Effect of analysts' optimism on estimates of the expected rate of return implied by earnings forecasts

Peter D. Easton
University of Notre Dame

and

Gregory A. Sommers
Southern Methodist University

August 2006

The comments of Ashiq Ali, Robert Battalio, Sung Chung, Somnath Das, Gus DeFranco, John Lyon, Hai Lu, Paul Healy, Rick Mendenhall, Krishna Palepu, Gord Richardson, Scott Richardson, Steven Rock, Cathy Schrand, Lisa Sedor, Margaret Shackell-Dowel, Pervin Shroff, Philip Stocken, Phil Shane, Tom Stober, Rex Thompson, Jenny Tucker, Kent Womack, Tzachi Zach, Paul Zarowin, and workshop participants at the 2006 American Accounting Association annual meeting in Washington, DC, Dartmouth College, Drexel University, the 2006 London Business School Accounting Symposium, the 2006 Lone Star Accounting Research Conference, Harvard University, New York University, Pennsylvania State University, Southern Methodist University, Tilburg University, the University of Colorado, the University of Illinois, the University of Melbourne, the University of Minnesota, the University of Notre Dame, and the University of Toronto are greatly appreciated. The paper reflects many long conversations with Mark Zmijewski. We thank Lorie Marsh for her assistance with the preparation of this paper.

Abstract

Recent literature has used analysts' earnings forecasts, which are known to be optimistic, to estimate expected rates of return; yielding upwardly biased estimates. We find a bias of 2.84 percent computed as the difference between the estimates of the expected rate of return based on analysts' earnings forecasts and estimates based on current earnings realizations. The importance of this bias is illustrated by the fact that studies using the biased estimates of the expected rate of return suggest an equity premium in the vicinity of 3 percent. Further analyses show that use of value-weighted, rather than equally-weighted, estimates reduces the bias and yields more reasonable estimates of the equity premium. We also show that analysts recommend "buy" ("sell") when they expect the future return to be high (low) regardless of market expectations and that bias is present for all recommendation types.

1. Introduction

A large and expanding body of literature uses analysts' forecasts of earnings to determine the expected rate of return implied by these forecasts, current book values, and current prices. These implied expected rates of return are often used as estimates of the market's expected rate of return and/or as estimates of the cost of capital.[1] Yet the earnings forecasts are optimistic; and they are made by sell-side analysts who are in the business of making buy/hold/sell recommendations which are, presumably, based on the difference between their expectation of the future rate of return and the market expectation of this rate of return. If these earnings forecasts are optimistically biased, the expected rates of return implied by these forecasts will be upward biased. We estimate the extent of this bias.[2]

We show that, consistent with the extant evidence that forecasts (particularly longer-run forecasts) are optimistic, the difference between the expected rate of return implied by analysts' earnings forecasts and the expected rate of return implied by current earnings is statistically and economically significantly positive. In other words, *ceteris paribus*, studies that use the expected rate of return implied by current prices and these forecasts of earnings have estimates of the cost of capital that may be too high.[3]

The extant literature on analysts' optimism/pessimism generally compares forecasts of earnings with realizations of the earnings that are forecasted. This is an ex post measure of optimism and one that pervades the extant literature. Most of our analysis is a comparison of the expected rate of return implied by analysts' earnings forecasts and the expected rate of return

[1] Cost of capital is an equilibrium concept that relies on the no arbitrage assumption. In the absence of arbitrage opportunities, the markets expected rate of return is equal to the cost of capital.
[2] Claus and Thomas (2001) observe that the optimistic bias in analysts' forecasts will bias their estimate of the equity premium upward.
[3] Examples include Gebhardt, Lee, and Swaminathan (2001), Claus and Thomas (2001), and Easton, Taylor, Shroff, and Sougiannis (2002).

implied by current earnings. This is an ex ante measure of optimism/pessimism. We are primarily interested in this ex ante comparison for two reasons. First, our goal is to determine the bias in estimates of expected rates of return implied by analysts' forecasts at the time that these forecasts are made. Second, this comparison provides an indication of optimism/pessimism that is not affected by events that occur between the forecast date and the time of the earnings realization.[4]

All of our analyses are based on two methods for simultaneously estimating the expected rate of return and the expected growth rate for a portfolio/group of stocks. The estimate of the expected growth rate is not important in and of itself in our study; but estimating it simultaneously with the estimation of the expected rate of return avoids the introduction of error which will almost inevitably arise when the expected growth rate is assumed. Any assumed growth rate will almost invariably differ from the growth rate implied by the data.[5]

The method we use for estimating the expected rate of return that is implied by prices and current accounting data is an adaptation of the method that O'Hanlon and Steele (2000) use to estimate the expected market equity premium for the U.K. The method we use for estimating the expected rate of return that is implied by prices, current book values, and forecasts of earnings is an adaptation of the method that Easton, Taylor, Shroff, and Sougiannis (2002) use to estimate the equity premium in the U.S.

Literature that reverse-engineers valuation models to obtain estimates of the expected rate of return on equity investment is very new. These models include the dividend capitalization model in Botosan (1997); the residual income valuation model in O'Hanlon and Steele (2000),

[4] An obvious recent example of such an event is the tragedy of the terrorist attack of September 11, 2001. This event, which was not foreseen by analysts, would almost certainly have made their forecasts overly optimistic with the benefit of hindsight. We will return to this example.
[5] See Easton (2005) for a detailed discussion of this source of error.

Gebhardt, Lee, and Swaminathan (2001), Claus and Thomas (2001), Easton, Taylor, Shroff, and Sougiannis (2002), and Baginski and Wahlen (2003); and the abnormal growth in earnings model in Gode and Mohanram (2003) and Easton (2004). Literature using these estimates to test hypotheses regarding factors that may affect the expected rate of return developed almost simultaneously; for example, see Daske (2006); Dhaliwal, Krull, Li, and Moser (2005); Francis, Khurana, and Periera (2005); Francis, LaFond, Olsson, and Schipper (2004); Hail and Leuz (2006); Hribar and Jenkins (2004); and Lee, Myers, and Swaminathan (1999). This development took place despite the fact that (1) some of these methods were not designed to provide firm-specific estimates; see, in particular, Claus and Thomas (2001), Easton, Taylor, Shroff, and Sougiannis (2002), and Easton (2004); and (2) there is very little evidence regarding the empirical validity of these methods.

The conclusion from the very recent studies that examine the validity of firm-specific estimates of expected rate of return derived from these reverse-engineering exercises (see, Botosan and Plumlee, 2005; Guay, Kothari and Shu, 2005; and Easton and Monahan, 2005), is that these estimates are poor, indeed. None of these studies addressed the issue of the difference between the market expectation of the rate of return, which these studies purport to measure, and rates implied by analysts' forecasts. Nevertheless, it is possible that the difference is a correlated omitted variable, which could affect the results in studies comparing estimates of the implied expected rate of return on equity capital. For example, it is possible that analysts' forecasts for firms under one accounting regime (say, accounting based on international accounting standards) may be more optimistic than analysts' forecasts for firms under a different accounting regime (say, accounting based on domestic standards). These optimistic forecasts will bias the estimate of the expected rate of return upward, potentially leading to the (possibly erroneous) conclusion that the cost of capital is higher for these firms.

In light of analysts' tendency to be optimistic, estimates of the expected rate of return based on analysts' forecasts are likely to be higher than the cost of capital. Williams (2004) makes this point in his discussion of Botosan, Plumlee, and Xie (2004). This effect of analysts' optimism is exacerbated by the fact that all studies using analysts' forecasts to calculate an implied expected rate of return are based on forecasts made well in advance (usually at least a year ahead) of the earnings announcement. These forecasts tend to be much more optimistic than those made closer to the earnings announcement; see Richardson, Teoh, and Wysocki (2004).

All of our analyses are based on I/B/E/S forecasts of earnings and recommendations for the years 1993 to 2004 and actual prices and accounting data for 1992 to 2004. Consistent with the extant literature, the forecasts tend to be optimistic. We show that, on average, the estimate of the expected rate of return based on analysts' forecasts is 2.84 percent higher than the estimate that is based on current accounting data. An implication of the observation that analysts tend to make optimistic forecasts is that caution should be taken when interpreting the meaning of the expected rate of return implied by analysts' earnings forecasts; it may not be, as the literature generally claims, an estimate of the cost of capital.

The observation that the optimism bias in analysts' forecasts may imply a 2.84 percent upward bias in the estimate of the implied expected rate of return is troublesome. Comparing this bias with the estimates of the expected equity premium based on these data (3 percent or less in Claus and Thomas (2001); between 2 and 3 percent in Gebhardt, Lee, and Swaminathan (1999); and 4.8 percent in Easton, Taylor, Shroff, and Sougiannis (2002)) suggests that there may be no premium at all! It is important to note, however, that each of these papers attributes equal weight to all stocks that are used in the calculation of the mean or median estimate of the market expected rate of return in Claus and Thomas (2001) and Gebhardt, Lee, and Swaminathan (1999), and in the regression in Easton, Taylor, Shroff, and Sougiannis (2002).

This equal-weighting has two potential effects. First, small stocks have an undue effect on the estimate of the market return. Second, stocks with low or negative earnings, which are somewhat meaningless as summary valuation metrics, potentially have an influence that is similar to the influence of large stable firms where earnings are a much more meaningful valuation metric. In order to avoid these undue influences, we repeat all of the analyses weighting each of the observations by market capitalization.

Our estimate of the implied expected rate of return on the market from the value-weighted regression, after removing the effect of bias in analysts' forecasts, is 9.67 percent with an implied equity premium of 4.43 percent. Of course, this estimate of the equity premium is more reasonable than that obtained when all observations have equal weight. We also find that the extent of analysts' optimism decreases as firm size increases. The effect of analysts' bias on the estimate of the implied expected rate of return on the market that is based on the value-weighted regression is lower than the estimate from the equally-weighted regression; 1.60 percent compared with 2.84 percent.

Studies such as Michaely and Womack (1999); Boni and Womack (2002); Eames, Glover, and Kennedy (2002); and Bradshaw (2004) show that analysts generally make "strong buy" and "buy" recommendations. They sometimes recommend "hold", and rarely recommend "sell". It seems reasonable to expect that buy recommendations will be associated with ex ante optimistic forecasts. In other words, the pervasiveness of buy recommendations may explain the optimistic bias in forecasts and in expected rates of return based on analysts' forecasts.

To examine this issue further, we repeat the analyses for sub-samples formed on the basis of number of analysts comprising the consensus who recommend "buy". Contrary to our expectations, we show that the consensus analyst forecast is optimistic even when less than 30 percent of analysts' comprising the consensus recommend "buy".[6] Estimates of the implied expected rate of return are biased upward even for these sub-samples. Interestingly, we show that the implied expected rate of return declines monotonically as the percentage of analysts recommending "buy" declines. In other words, analysts' recommendations appear to be based on expected rates of return rather than the difference between the analysts' expectations and the market expectation. This evidence is consistent with the observation in Groysberg, Healy, Chapman, and Gui (2006) that analysts' salary increases and bonuses are based on stock returns subsequent to their recommendations adjusted for the return on the S&P 500 index.

The remainder of the paper proceeds as follows. In section 2, we outline the methods used in estimating the expected rate of return implied by market prices, current book value of equity, and current and forecasted accounting earnings. Section 3 describes the data used in our analyses. In section 4, we document the ex post and the ex ante bias in consensus analysts' forecasts and discuss the implications for cost of capital estimates in extant accounting research, which are generally based on equal weighting of observations from the entire sample of firms followed by analysts. In section 5, we repeat the analyses using value-weighting of firms to show that the estimate of the bias is lower and the estimate of the expected equity risk premium is more reasonable than that obtained in extant studies. Sub-samples based on percentage of

[6] While it is reasonable to expect that the level of the analyst's recommendation should be associated with *expected* abnormal returns, it should be noted that Bradshaw (2004) finds analysts' recommendations uncorrelated with future *realized* abnormal returns.

analysts recommending buy are analyzed in section 6. Section 7 concludes with a summary of implications for future research.

2. Methods of estimating the implied expected rate of return

We develop three methods for estimating the implied expected rate of return. These estimates, which are based on (1) I/B/E/S earnings forecasts, (2) realized earnings, and (3) perfect foresight forecasts of earnings, lead to two determinations of the bias when estimates of the market expected rate of return are based on analysts' forecasts of earnings. Each of these methods determines bias as the difference between estimates based on forecasts of earnings and estimates based on earnings realizations.

We refer to the primary measure as the *ex ante* measure of bias because it relies on information available at the time of the earnings forecast. This measure compares the estimates of the implied expected rate of return based on analysts' forecasts with estimates based on current earnings realizations. The other measure compares estimates formed using analysts' forecasts with estimates based on perfect foresight of next-period earnings realizations. We refer to this as the *ex post* measure. We note there may be factors other than analysts' optimism affecting each of these measures of bias; but, since other factors affecting the ex ante measure would not affect the ex post measure (and vice-versa), obtaining similar results based on both measures suggests that the effect of other factors is minimal. We elaborate on this point in section 2.3.

2.1. Ex ante determination of the effect of bias

Each of the methods for estimating the implied expected rate of return are derived from the residual income valuation model which may be written as follows:

$$v_{jt} \equiv bps_{jt} + \sum_{\tau=1}^{\infty} \frac{eps_{jt+\tau} - r_j \times bps_{jt+\tau-1}}{\left(1 + r_j\right)^{\tau}} \tag{1}$$

where v_{jt} is the intrinsic value per share of firm j at time t, bps_{jt} is the book value per share of common equity of firm j at time t, eps_{jt} is the earnings per share of firm j at time t and r_j is the cost of capital for firm j.[7] Easton, Taylor, Shroff, and Sougiannis (2002) rely on the following finite horizon version of this model:

$$p_{jt} \equiv bps_{jt} + \frac{eps_{jt+1}^{IBES} - r_j \times bps_{jt}}{\left(r_j - g_j\right)} \tag{2}$$

where p_{jt} is price per share for firm j at time t, eps_{jt+1}^{IBES} is an I/B/E/S forecast of earnings for period t+1, and g_j is the expected rate of growth in residual income beyond period $t+1$ required to equate $(p_{jt} - bps_{jt})$ and the present value of an infinite residual income stream.[8, 9]

Easton, Taylor, Shroff, and Sougiannis (2002), like many other studies, implicitly use analysts' forecasts of earnings as a proxy for market expectations of next period earnings. Optimistic bias in analysts' forecasts implies a bias in this proxy. In this paper we use a modification of the method in O'Hanlon and Steele (2000) to determine, ex ante, the effect of the forecast error on the estimate of the expected rate of return. This method provides an estimate of the expected rate of return implied by current realized accounting earnings; we compare this with

---

[7] Derivation of this model requires the no arbitrage assumption, which is necessary to derive the dividend capitalization formula, and that earnings are comprehensive – in other words, the articulation of earnings and book value is clean surplus.

[8] Price in this relation replaces intrinsic value. This form of the residual income model does not rely on the no-arbitrage assumption – rather it is simply based on the definition of the expected rate of return (the difference between current price and expected cum-dividend end-of-year price divided by current price).

[9] In Easton, Taylor, Shroff, and Sougiannis (2002) the period t to t+1 is 4 years so that eps_{jt+1} is aggregate expected cum-dividend earnings for the four years after date t. We use a one-year forecast horizon instead of four years in order to facilitate more effective use of the data on analysts' recommendations. Easton, Taylor, Shroff, and Sougiannis (2002) note that estimates of the expected rate of return based on just one year of forecasts are very similar to those based on four years of forecasts.

the estimate implied by analysts' earnings forecasts from Easton, Taylor, Shroff, and Sougiannis (2002).

The method adapted from O'Hanlon and Steele (2000) is based on the following form of the residual income valuation model:

$$p_{jt} \equiv bps_{jt} + \frac{(eps_{jt} - r_j \times bps_{jt-1})(1 + g'_j)}{(r_j - g'_j)} \tag{3}$$

The difference between this form of the model and the form used by Easton, Taylor, Shroff, and Sougiannis (2002) is that g'_j is the perpetual growth rate starting from *current residual income* (that is, at time t) that implies a residual income stream such that the present value of this stream is equal to the difference between price and book value; in Easton, Taylor, Shroff, and Sougiannis (2002), g_j is the perpetual growth rate starting from *next-period residual income* (that is, time $t+1$). Since eps_{jt} (that is, realized earnings) is the only pay-off used in estimating the implied expected rate of return based on equation (3), this estimate is not affected by analysts' optimism unless that optimism is shared by the market and captured in p_{jt}.[10] Therefore, the estimate based on current accounting data can serve as an estimate of market expectations. It follows that the difference between the estimate of the expected rate of return based on analysts' forecasts in equation (2) and the estimate based on current earnings in equation (3) is an ex ante estimate of bias introduced when analysts' forecasts are used to estimate the markets' expected rate of return.

2.2. Ex post determination of the effect of bias

Optimistic bias in analysts' earnings forecasts is well-established in the literature; see, for example, O'Brien (1988); Mendenhall (1991); Brown (1993); Dugar and Nathan (1995); and

[10] Our empirical evidence is consistent with the maintained hypothesis that the analysts' optimism is not shared by the market.

Das, Levine, and Sivaramakrishnan (1998). Each of these studies estimates the ex post bias by comparing earnings forecasts with realizations of these forecasted earnings. We obtain an ex post measure of the bias in the estimate of the expected rate of return by comparing the estimate of the expected rate of return based on I/B/E/S analysts' forecasts using the method in Easton, Taylor, Shroff, and Sougiannis (2002) with the expected rate of return based on (perfect foresight forecasts of) earnings realizations; that is, we replace eps_{jt+1}^{IBES} in equation (2) with earnings realizations for period t+1, denoted eps_{jt+1}^{PF}. Of course, this ex post comparison, like the studies of bias in analysts' forecasts, will be affected by events having an effect on earnings, which happen between the time of the forecast and the date of the earnings announcement.

2.3. Ex ante and ex post comparisons

In the ex post comparison of expected rates of return, unforeseen events are *omitted* from the market price, which is used as the basis for estimating the expected rate of return. On the other hand, in the ex ante comparison, expectations of future events impounded in market expectations of earnings are not included in the current accounting earnings but are implicitly *included* in the market price, which is used as the basis for estimating the expected rate of return. Since there is no obvious reason to expect a correlation between the information omitted from price in the analyses based on equation (2) and the information included in price but excluded from earnings in the analyses based on equation (3), we use the results from both methods to gain alternative, independent estimates of the bias. As expected our results are similar using either method.

Our maintained hypothesis in the ex ante comparison of implied expected rates of return is that the market at time *t* sees through (un-does) the optimistic bias in the analysts' forecasts.

The observation that the implied expected rates of return based on current earnings and on realized future earnings are the same, suggests that this maintained hypothesis is reasonable.

2.4. Estimation based on prices, book value, and earnings forecasts

Easton, Taylor, Shroff, and Sougiannis (2002) transform equation (2) to form the following regression relation:

$$\frac{eps_{jt+1}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p_{jt}}{bps_{jt}} + \mu_{jt} \tag{4}$$

where $\gamma_0 = g$, $\gamma_1 = r - g$.[11] This regression may be estimated for any group/portfolio of stocks to obtain an estimate of the implied expected rate of return, *r,* and the implied expected growth rate, *g*, for the portfolio. Easton, Taylor, Shroff, and Sougiannis (2002) run this regression for a sample of U.S. stocks to obtain an estimate of the expected rate of return on the U.S. equity market and hence an estimate of the equity premium for that market. In the empirical implementation of this model, eps_{jt+1} is the I/B/E/S forecast of earnings. Since this is the only pay-off which is used in the estimation of implied expected rate of return, any bias in the forecast will lead to a bias in the estimate of the expected rate of return.

---

[11] At the firm-specific level, the following relation between the regression variables: $\frac{eps_{jt+1}}{bps_{jt}} = \gamma_{0j} + \gamma_{1j} \frac{p_{jt}}{bps_{jt}}$, is readily obtained by rearranging the identity shown in equation (2). In the re-expression of this relation for a group of observations (as in equation (4)) as a regression relation, the coefficients γ_0 and γ_1 represent an average of the firm-specific γ_{0j} and γ_{1j} coefficients and the cross-sectional variation in these coefficients creates the regression residual. Easton, Taylor, Shroff, and Sougiannis (2002) describe this regression in more detail pointing out that it involves the implicit assumption that it has the properties of a random coefficient regression. It is, of course, possible that the γ_{0j} and γ_{1j} are correlated in cross-section with either (or both) the dependent or the independent variable and this correlation may introduce bias into the estimates of the regression coefficients (and, hence, into the estimates of the implied expected rates of return). It seems reasonable to assume, however, that this bias will be very similar for the regressions based on analysts' earnings forecasts (eps^{IBES}_{jt+1}) and for those based on perfect foresight forecast of earnings (eps^{PF}_{jt+1}). Also, we can think of no reason why the effect of the bias in the analyses based regression (4) will be the same as the effect for the analyses based on current accounting earnings (regression (5)). In other words, similar results from the analysis based on perfect foresight forecasts and from the analyses based on current accounting data support the conclusion that this bias does not unduly affect our estimates.

2.5. Estimation based on current accounting data

The analyses in O'Hanlon and Steele (2000) are based on realized earnings rather than earnings forecasts. Following the essence of the idea in O'Hanlon and Steele (2000), which is summarized in equation (3), we transform this equation to form the following regression relation:[12]

$$\frac{eps_{jt}}{bps_{jt-1}} = \delta_0 + \delta_1 \frac{p_{jt} - bps_{jt}}{bps_{jt-1}} + \zeta_{jt} \tag{5}$$

where $\delta_0 = r$, $\delta_1 = (r - g')/(1 + g')$. This regression may be estimated for any group/portfolio of stocks to obtain an estimate of the expected rate of return, *r,* and the expected growth rate, g', for the portfolio. O'Hanlon and Steele (2000) run a regression similar to (5) for a sample of U.K. stocks to obtain an estimate of the expected rate of return on the U.K. equity market; and hence an estimate of the equity premium for that market. In the empirical implementation of regression (5), eps_{jt} is realized earnings. Since this is the only pay-off used in estimating the implied expected rate of return, this estimate is not affected by analysts' optimism unless that optimism is shared by the market and captured in p_{jt}. It follows that the difference between the estimate of the expected rate of return obtained via regression (4) and the estimate based on regression (5) is an ex ante estimate of the bias when analysts' forecasts are used to estimate expected rates of return.

---

[12] We attribute this model to O'Hanlon and Steele (2000) because they capture its essential elements. The similarity to their model may not, however, be immediately apparent. Since the derivation in O'Hanlon and Steele (2000) is based on Ohlson (1989), the observation that the regression intercept is an estimate of the implied expected rate of return is not evident and O'Hanlon and Steele (2000) do not use it in this way. Rather, they estimate the implied expected rate of return at the firm-specific level by applying their model to time-series data and then measuring the risk premium as the slope of the Securities Market Line estimated from a regression of these firm-specific rates of return on corresponding beta estimates. Notice that, in addition to requiring earnings to be clean surplus in all future periods, this form of the residual income model also requires that the relation between earnings for period *t* and book value for periods *t* and *t*-1 follows the clean surplus relation.

2.6. The relation between prices, actual earnings, and forecasts of earnings

In order to ensure that we obtain an estimate of the expected rate of return implied by analysts' forecasts we must use prices in regression (4) that reflect analysts' forecasts. Similarly, in regression (5) we must use prices that reflect earnings realizations to obtain an estimate of the markets' expected rate of return. The alignment of price-dates, earnings announcement dates, and analysts' forecast-dates is described in this sub-section and summarized in figure 1.

We choose the first consensus forecast announced at least 14 days after the date of the earnings announcement.[13] In the analyses based on these forecasts, we use the price at the close of trade one day after the earnings announcement. Consistent with numerous studies of the information content of earnings, it seems reasonable to assume that this price incorporates the information in realized earnings. Further, we implicitly assume that this price was known to analysts at the time they formed their earnings forecasts. In view of the fact that the forecasts comprising the consensus are formed at various points in time, this assumption may be invalid; some of the forecasts comprising the consensus may precede the earnings announcement date or they may have been issued a considerable time after this date. We examine the sensitivity of the results to this assumption by varying the price-date from the day after the earnings announcement to one day after the consensus forecast is measured. This latter measurement date for price allows for the incorporation of the information in the analysts' forecasts in price. The results are not sensitive to this choice. We will return to this point.

The residual income valuation model underlying regressions (4) and (5) describes the value of a stock at the fiscal period end-date. Our analyses are based on prices after this date. To accommodate this difference, we replace price (p_{jt}) in equations (4) and (5) with price at the

[13] Use of the first forecast made after the earnings announcement from the I/B/E/S Detail History database does not alter any results.

dates described above discounted by the expected rate of return ($\hat{r}$) back to the fiscal year end; that is, $p_{jt+\tau} / (1+\hat{r})^{\tau/365}$, where τ is the number of days between the fiscal year end and the price-date. Since the discounting of price requires the expected rate of return we are attempting to estimate in equations (4) and (5), we use an iterative method as used in Easton, Taylor, Shroff, and Sougiannis (2002). We begin these iterations by assuming a discount rate for prices of 12 percent. We run each regression and obtain estimates of the expected rate of return which we then use as the new rate for discounting prices. We then re-run the regressions to re-estimate equation (4) and/or equation (5) and provide another estimate of expected return. This procedure is repeated until the estimate of the expected return and the rate used in discounting price converge.[14]

3. Description of the data

All earnings forecast and recommendation data are obtained from the I/B/E/S unadjusted research databases. We use the first median consensus forecast of earnings for year t+1 released 14 days or more after the announcement of earnings for year t. This forecast is released on the third Thursday of each month. These data are obtained from the I/B/E/S Summary database. "Actual" earnings are also obtained from this database. The first year of our analyses uses forecasts and recommendations for 1993 in order to ensure the dates of the individual analysts' forecasts are reliable.[15] Book value of common equity and common shares outstanding are

[14] This iterative process is repeated until none of the annual estimates changes by more than 0.00001%. In our samples, the annual estimates usually converged in 5-6 iterations. This iterative procedure is not sensitive to choices of beginning discount rates between five and 20 percent.

[15] Zitzewitz [2002, p. 16] describes the importance of not relying on forecast dates in the I/B/E/S database prior to 1993 as follows:

> "I/B/E/S dates forecasts using the date it was entered into the I/B/E/S system. It has been well documented (e.g., by O'Brien, 1988) that the lags between a forecast becoming public and its entry into the I/B/E/S system were substantial in the 1980s (i.e., up to a month). In the 1980s, analysts mailed their forecasts,

obtained from the CRSP/COMPUSTAT annual merged database.[16] Prices are obtained from the CRSP daily price file.

We delete firms with non-December fiscal-year end so that the market implied discount rate and growth rate are estimated at the same point in time for each firm-year observation. For each set of tests, firms with any of the dependent or independent variables for that year in the top or bottom two percent of observations are removed to reduce the effects of outliers. Dropping between one and five percent of observations does not affect the conclusions of the study. For December 1999, in particular, removal of only one percent of observations has a large effect on that year's results in the value-weighted analyses; this is due to the extremely high price-to-book ratios of some internet firms prior to the market crash in 2000.

4. Ex post and ex ante bias in analysts' consensus forecasts

We begin by documenting the accuracy (that is, the mean/median *absolute* earnings forecast error) and the ex post bias (that is, the mean/median earnings forecast error) in the earnings forecasts for the entire sample of stocks. We then compare the estimate of the expected rate of return implied by prices, book values, and analysts' forecasts of earnings with the

---

often in monthly batches, to I/B/E/S where they were hand entered into the system. Since 1991-92, however, almost all analysts have entered their forecasts directly into the I/B/E/S system on the day they wish to make their forecast widely available (Kutsoati and Bernhardt, 1999). Current practice for analysts is now usually to publicly release forecasts within 24 hours of providing them to clients. I/B/E/S analysts have real-time access to each other's forecasts through this system, so an analyst entering a forecast into the system on Wednesday knows about forecasts entered on Tuesday and could potentially revise her forecast to incorporate their information. An additional advantage of the post-92 data is the shift from retrospective data entry by a specialist to real-time data entry by either the analyst or her employee should have considerably reduced data-entry related measurement error."

[16] In order to ensure that the clean-surplus assumption required for the derivation of the residual income valuation model holds in the data for fiscal year *t*, contemporaneous book value in regression (5) – that is, b_{jt} – is calculated as Compustat book value of common equity minus Compustat net income plus I/B/E/S actual income. That is, we use the book value number that would have been reported if the (corresponding) income statement had been based on I/B/E/S actual earnings. We also remove year *t* dirty surplus items from Compustat book value. These adjustments are unnecessary for the book value variable in regression (4) because the clean-surplus assumption only refers to future income statements and balance sheets.

estimate obtained from prices, book values, and actual current earnings. This is an estimate of ex ante bias in the estimates of the expected rate of return reported in the extant literature.

4.1. Accuracy and bias in the analysts' forecasts of earnings

Table 1 summarizes the accuracy and the ex post measure of bias in the I/B/E/S consensus forecast of earnings at the end of each of the years 1992 to 2003. We use the mean and the median absolute forecast error as the measure of accuracy. The mean absolute forecast error ranges from $0.427 in 1994 to $1.394 in 2000; the median absolute forecast error ranges from $0.160 in 2002 to $0.310 in 2000. We also present the mean and the median absolute forecast error deflated by end-of-year price in order to give an indication of the scale of these errors. The mean absolute price-deflated forecast error ranges from 0.019 in 2003 to 0.052 in 2000; the median absolute price-deflated forecast error ranges from 0.008 in 2003 to 0.018 in 2000.

We use the mean (median) forecast error as the measure of the ex post bias in the analysts' forecasts. The mean forecast error ranges from -$1.257 in 2000 to $0.119 in 2002. The median forecast error ranges from -$0.240 in 2000 to -$0.010 in 2003. The mean price-deflated forecast error ranges from -0.041 in 2000 to -0.003 in 2003. The median price-deflated forecast error ranges from -0.012 in 2000 to 0.000 in 2003.

These predominantly negative forecast errors are consistent with the prior literature, which concludes that analysts' forecasts, particularly long-run forecasts, tend to be optimistic; see, for example, O'Brien (1993); Lin (1994); and Richardson, Teoh, and Wysocki (2004). As noted earlier, these forecast errors compare forecasts with ex post realizations.

4.2 Description of regression variables

The number of observations we use to estimate the annual regressions ranges from 1,418 at December 1992 to 2,137 at December 1997. As shown in table 2, the mean price-to-book ratio, which is the independent variable in regression (4), ranges from 1.945 at December 2002 to 3.398 at December 1999; the median price-to-book ratio ranges from 1.625 at December 2002 to 2.409 at December 1997. Regression (4) is run with the forecasted return-on-equity based on the I/B/E/S consensus forecast as the dependent variable. The mean forecasted return-on-equity ranges from 0.079 at December 2001 to 0.146 at December 1994; the median forecasted return-on-equity ranges from 0.111 at December 2001 to 0.145 at December 1994.

The annual mean and median current return-on-equity, which is the dependent variable in regression (5), is generally a little less than the corresponding mean and median forecasted return-on-equity. The mean current return-on-equity ranges from 0.077 at December 2001 to 0.122 at December 1995; the median current return-on-equity ranges from 0.010 at December 2001 to 0.132 at December 1995. The mean of the independent variable in this regression, the difference between price and current book value deflated by lagged book value, ranges from 1.007 at December 2002 to 2.699 at December 1999; the median ranges from 0.662 at December 2002 to 1.491 at December 1997.

4.3. Comparison of implied expected rates of return based on I/B/E/S forecasts of earnings with implied expected rate of return based on current accounting data

In this section, we compare the estimates of the implied expected rates of return based on the method in Easton, Taylor, Shroff, and Sougiannis (2002), which uses one-year ahead I/B/E/S consensus forecasts of earnings in regression (4), with the estimates obtained from the method adapted from O'Hanlon and Steele (2000), which uses current earnings and current and lagged book value in regression (5). We also compare the estimates based on analysts' forecasts to those implied by future earnings realizations; that is, by perfect foresight forecasts.

4.3.1. The expected rate of return implied by analysts' earnings forecasts

The summary statistics from regression (4), where the dependent variable is I/B/E/S forecasted return-on-equity, are included in panel A of table 3. We provide year-by-year estimates of the regression coefficients and t-statistics for tests of their difference from zero. These t-statistics may be over-stated due to the possibility of correlated residuals; so we present the mean coefficient estimates and the related Fama and MacBeth (1973) t-statistics. The regression adjusted r-square ranges from 0.73 percent at December 1999, to 36.60 percent at December 1992.[17] The mean estimate of the intercept coefficient γ_0, an estimate of the implied growth in residual income beyond the one-year forecast horizon, is 0.074 with a t-statistic of 8.50. The mean estimate of the slope coefficient γ_1, an estimate of the difference between the implied expected rate of return and the implied growth in residual income beyond the one-year forecast horizon, is 0.020 with a t-statistic of 5.86.

The estimates of the implied expected rate of return obtained from the estimates of the regression (4) coefficients, where the dependent variable is analysts' forecasts of return-on-equity, are in panel A of table 3. These estimates range from 4.93 percent at December 2001, to 13.29 percent at December 1999; with a mean (t-statistic) of 9.43 percent (14.16).

[17] We note the very low r-square in some of these regressions. As a result we performed several analyses of the effects of outliers including more severe outlier removal – for example, removing up to the top and bottom 20 percent of observations or by eliminating all observations with an R-student statistic greater than 2 -- the regression r-square increases but none of our inferences based on the resulting estimates of the implied expected rate of return change. We also perform all analyses on the sub-set of observations for which analysts forecast positive earnings. Again we obtain much higher r-squares but inferences remain unchanged. These further analyses of outliers are also performed on all subsequent regressions and, in all cases, our inferences are unchanged.

4.3.2. The expected rate of return implied by current accounting data

The summary statistics from regression (5) are included in panel A of table 3. The regression adjusted r-square ranges from 0.34 percent at December 1999 to 27.09 percent at December 1992. The mean estimate of the intercept coefficient $\delta_{0,}$ which is an estimate of the implied expected rate of return, is 0.066 (t-statistic of 10.50); and the mean estimate of the slope coefficient $\delta_{1,}$ which is a function of the expected rate of return and the expected growth in residual income, is 0.022 (t-statistic of 5.51). The estimates of the implied expected rate of return are also included in panel A of table 3. These estimates range from 2.82 percent at December 2001 to 9.97 percent at December 1999; with a mean (t-statistic) of 6.59 percent (10.50).

4.3.3. The ex ante difference between the estimate of the expected rate of return based on analysts' earnings forecasts and the estimate of the expected rate of return based on current accounting data

Differences between the estimates of expected rate of return based on regressions (4) and (5) are included in the last column of panel A of table 3. On average, the difference between the estimate of the expected rate of return based on analysts' earnings forecasts and the estimate of the expected rate of return based on earnings realizations is 2.84 percent (t-statistic of 12.33). There are some years when the difference is quite large; for example, for the sample of stocks at December 1994, the difference is 3.83 percent. These results are not surprising in view of the fact that analysts' forecasts are known to be optimistic.

An implication of the observation that expected rates of return based on analysts' forecasts tend to be higher is that caution should be taken when interpreting the meaning of the rate of return that is implied by analysts' earnings forecasts; if, as is often the case in the extant literature, it is used as an estimate of the cost of capital, it is likely upward biased.

4.3.4. Estimates of the expected rate of return based on perfect foresight forecasts

The results in section 4.3.3 are roughly consistent with the results in Table 1. For example, we saw, in Table 1 that the mean deflated forecast error is -0.020. A crude PE valuation model, which relies on full payout and earnings following a random walk, suggests that the price-to-forward-earnings ratio is equal to the inverse of the expected rate of return. Thus a deflated forecast error of -0.020 implies an error in the expected rate of return of 2 percent. Allowing for the conservative nature of accounting, as in the models used in the ex ante indicators of optimism in panel A of table 3, leads to the conclusion that these estimates are at least "in the same ball-park".

Alternatively, the ex post forecast error can be re-parameterized as an error in the implied expected rate of return. This error may be estimated as the difference between the implied expected rate of return based on regression (4) where expected earnings are I/B/E/S forecasts (as in panel A of table 3) and the implied expected rate of return when these expected earnings are replaced in this regression with realized earnings for year t+1. The results of estimating the implied expected rate of return using realized earnings as "perfect foresight" forecasts are reported in panel B of table 3. Using perfect foresight earnings, the estimates of expected rate of return range from 3.13 percent at December 2001 to 9.79 percent at December 1999; with a mean (t-statistic) of 6.68 percent (10.79). Comparing the perfect foresight forecast to the consensus forecasts, the mean bias is 2.75 percent (t-statistic of 7.13).

4.3.5. Comparison of the estimates of the expected rate of return

The two estimates of expected rate of return that are not expected to contain bias, that is, those based on perfect foresight earnings and those based on current accounting data are very similar. The difference of -0.09 percent between these estimates is not significantly different from zero with a t-statistic of -0.19. It follows that our estimates of the bias are similar using either method. That is, both methods yield alternative, independent estimates of the bias that do not differ significantly; this observation supports the maintained hypothesis that the market sees through the optimistic bias in the analysts' forecasts.

Further evidence consistent with the notion that the market sees through the optimistic bias is the fact that, consistent with Richardson, Teoh, and Wysocki (2004), the forecast error declines almost monotonically as the forecast horizon decreases from approximately 12 months as in the analyses in panel C of table 3 to shortly before the earnings announcement date for year t+1. The un-tabulated associated implied expected rate of return based on these forecast and prices immediately following these forecasts also decreases almost monotonically to 6.47 percent for the consensus forecasts (of t+1 earnings) made in January of year t+1. That is, the expected rate of return implied by analysts' forecasts declines to the expected rate of return implied by the ex ante estimate of the expected rate of return implied by accounting earnings at date t. Again these results suggest that the market at date t sees through the optimistic bias in the analysts' forecasts of earnings for period t+1.

4.3.6. Effects of altering the timing of price measurement

As mentioned in section 2.3, we use price measured after the release of the prior year earnings but before analysts' forecast revisions in our primary analyses. Panel C of table 3 summarizes the results of the analysis summarized in panels A and B of table 3, but using prices measured at close of trade on the day after the consensus forecast is measured. This price is at least 14 days and could be a month and a half after the price used in panels A and B. We assume that this price reflects the information in the analysts' forecasts. Comparison of panels A and C reveals that the measurement of price at differing points; and, therefore, differing periods for discounting of price back to fiscal year-end; has no statistically or economically significant effect. The primary result from panel A of table 3 of an average 2.84 percent difference between the analysts' and market's expected rate of return is virtually unchanged at 2.93, with an un-tabulated t-statistic of 14.69, when price is measured at the day after the consensus forecast is measured.[18]

5. Value-weighted estimates of the implied expected rate of return

The analyses in section 4 examine the average effect of bias in analysts' forecasts of earnings on estimates of the implied expected rate of return. All observations are given equal weight in the analyses. Such weighting will be appropriate in some studies. Easton, Sommers, and Zmijewski (2006), for example, compare the difference between the expected rate of return implied by analysts' forecasts and the expected rate of return implied by current earnings for firms subject to litigation under section 10b-5.[19] Since the focus of their study is on average differences, they give each observation equal weight; value-weighting would lead to results that were dominated by cases associated with WorldCom and Enron.

Value-weighting will be more appropriate in many studies. Perhaps the best example is the estimation of the equity risk premium, which is a central part of three well-known studies based on analysts' earnings forecasts by Gebhardt, Lee, and Swaminathan (2001); Claus and Thomas (2001); and Easton, Taylor, Shroff, and Sougiannis (2002). These studies give equal weighting to all stocks. Yet, estimating the risk premium from investing in the equity market is more meaningful if stocks are weighted by their market capitalization. In the equally-weighted

[18] The results are virtually identical if we use prices taken from any date ranging from one day after the earnings announcement date to one day after the forecast announcement date (the set of *s* price-dates shown in Figure 1).
[19] Under Rule 10b-5, a firm and its officials can be held liable for damages to investors who bought and sold the firm's securities if the damages are attributable to investors' reliance on misleading statements or omission of material facts.

analyses in the papers referred to above, small stocks will have an undue effect on the estimate of the market return. Further, stocks with low or negative earnings, which are somewhat meaningless as summary valuation metrics, potentially have an influence that is similar to the influence of large stable firms where earnings are a much more meaningful valuation metric. In order to avoid these undue influences, and to provide an estimate of the equity risk premium that is (1) not affected by analysts' optimism; and (2) more representative of the risk premium for the market portfolio; we repeat all of the analyses weighting each of the observations by market capitalization.

In order to provide a sense of the likely effect of value weighting, we begin by describing the way that analysts' optimism differs with firm size. We also document the relation between firm size and the variables used in regressions (4) and (5). Central to our analyses is the observation, documented in panel A of table 4, that the mean scaled absolute forecast error declines in a monotonic manner from 0.102 for the decile of smallest firms to 0.012 for the decile of largest firms. Similarly, the median absolute scaled forecast error declines in a monotonic manner from 0.042 to 0.006.

Analysts' optimism, measured by the mean (median) forecast error, declines almost monotonically from -0.116 (-0.023) for the decile of smallest firms to -0.086 (-0.002) for the decile of largest firms. The differences in optimistic bias across these size deciles illustrate the point that difference in bias across samples of observations may explain a significant portion of the difference in the implied expected rates of return across these samples; in other words, differences in bias across samples may lead to spurious inferences.

Consistent with prior literature, see, for example, Fama and French (1992), the price-to-book ratio increases with firm size from a mean of 1.707 for the decile of smallest firms to a mean of 3.593 for the decile of largest firms. The forecasted and the realized return-on-equity also increase with firm size, suggesting that the smaller firms tend to be firms with higher expected earnings growth.[20]

The results from the estimation of value-weighted regressions (4) and (5) are summarized in panel B of table 4. A notable difference between these value-weighted regression results and the results for equally-weighted regressions (see panels A and B of table 3) is the higher adjusted r-square for the value-weighted regressions. For example, the average adjusted r-square for regression (4) based on analysts' consensus forecasts is 47.16 percent for the value-weighted regression; whereas it is 9.58 percent for the equally-weighted regression. As expected, t-statistics on the coefficient estimates in these value-weighted regressions are also higher.

The mean estimates (t-statistic) of the expected rate of return, also reported in panel B of table 4, are 11.27 percent (21.20) using analysts' forecasts and 9.67 percent (13.90) using current accounting data.[21] The un-tabulated minimum expected rate of return estimated using current accounting data is 6.22 percent at December 1992. The average of 9.67 percent yields a more reasonable estimate of the risk premium than the equal-weighted sample; 4.43 percent using 5-year treasuries as a proxy for the risk free rate. Differences between the estimates are also reported in panel B of table 4. The difference, though smaller in the value-weighted analyses than in the equally-weighted analyses, 1.60 percent compared with 2.84 percent, is still significantly positive (t-statistic of 4.90).

---

[20] The firms in the deciles of smaller firms also tend to have a much greater proportion of losses (the proportion of losses decreases monotonically from 17.64 percent for the decile of smallest firms to 1.65 percent for the decile of largest firms).

[21] The mean estimate (t-statistic) of the expected rate of return based on perfect foresight forecasts is 10.63 percent (14.35).

6. Variation in the implied expected rate of return with changes in the percentage of analysts making "buy" recommendations

Having documented a bias in the estimates of the expected rate of return based on analysts' forecasts of earnings, we now examine how the bias varies across analysts' recommendations. It is well-known that analysts seldom issue "sell" recommendations. To the extent that our samples examined thus far contain a majority of firms with "buy" recommendations, the observed positive bias in the expected rate of return using analysts' forecasts may be capturing the analysts' expectation of the abnormal returns, which can be earned from these stocks. To examine this notion, we compare estimates of the expected rates of return for stocks where the consensus forecast is comprised of analysts with varying recommendation types.

6.1 Sample description

I/B/E/S provides data on the percentage of analysts whose forecasts comprise the consensus who also make either a "strong buy" or a "buy" recommendation. We repeat the analyses in section 4.3 for sub-samples with various percentages of these types of recommendations. Descriptive statistics are provided in table 5, panel A. The choice of the five partitions of the data is based on a desire to maintain a sufficient number of observations to provide reasonable confidence in the regression output in each year. We restrict the sample to those consensus forecasts which are comprised of at least 5 analysts so that it is possible for a firm to appear in any of the partitions.[22]

The mean and median forecast error is always negative; that is, analysts are optimistic, regardless of the percentage of "buy" recommendations in the consensus. For example, the median deflated forecast error is -0.004 when the percentage of buy recommendations is greater

[22] Our findings and conclusions are unchanged when firms with consensus forecasts comprised of less than 5 analysts are included.

than 90 percent, between 30 and 50 percent, and when the percentage of "buy" recommendations is less than 30 percent.

Both the return-on-equity and the price-to-book ratio tend to be higher for the observations where there are more "buy" recommendations comprising the consensus. For example, the median forecasted return-on-equity for the sub-samples where greater than 90 percent of the analysts recommend "buy" and where between 70 and 90 percent recommend "buy" is 0.157 and 0.162 while median forecasted return-on-equity for the sub-sample where less than 30 percent of the analysts recommend "buy" is 0.112. The median price-to-book ratio for the sub-samples where greater that 90 percent of the analysts recommend "buy" and where between 70 and 90 percent recommend "buy" is 3.011 and 2.686 while median price-to-book ratio for the sub-samples where less than 30 percent of the analysts recommend "buy" is 1.649.

6.2. Estimates of implied expected rates of return

The results from the estimation of regression (4) based on price, I/B/E/S forecasts of earnings, and current book value and from the estimation of regression (5) based on price and current accounting data and are summarized in table 5, panel B. We focus our discussion on the estimates of the implied expected rates of return obtained from these regression parameters. These estimates are also included in panel B.

The estimates of the expected rates of return implied by I/B/E/S analysts' forecasts decline almost monotonically with the percentage of "buy" recommendations associated with the forecasts of earnings comprising the consensus; the means of these estimates are 11.20 percent, 11.84 percent, 10.82 percent, 9.18 percent, and 6.86 percent, suggesting that analysts' recommendations are, indeed, consistent with the implied expectations of rates of return. The estimates of the expected rates of return based on prices and current accounting data show a pattern that is very similar to that of those based on analysts' forecasts. The mean estimates of the expected rate of return for each of the groups of data decline monotonically with the percentage of "buy" recommendations associated with the forecasts of earnings comprising the consensus; the means of these estimates are 10.94 percent, 10.22 percent, 8.90 percent, 7.23 percent, and 4.60 percent.

Differences between the estimates of expected rate of return based on percentage of "buy" recommendations are included in table 5, panel C. Comparing the expected rates of return based on prices and current accounting data with the estimates based on analysts' forecasts reveals that even when the analysts are not to recommending "buy" their forecasts imply a rate of return that is higher than expectations based on current accounting data; these mean differences between the estimates based on analysts' forecasts and estimates based on current accounting data are 0.26 percent, 1.61 percent, 1.92 percent, 1.95 percent, and 2.27 percent. Four of these differences are significant. This pervasive optimism in the expected return measured by comparing analysts' return expectations with return expectations based on current accounting data is, interestingly, quite similar to the pervasive optimism observed when comparing expectations of future earnings with actual realizations of earnings; see table 5, panel A.

6.3. Summary

To summarize the analyses in this section, we observe that analysts' recommendations are consistent with their expectations of returns; that is, there is a monotonic decrease in expected rate of return as the percentage of "buy" recommendations declines.[23] Analysts' expected rates of return are higher than expectations based on current accounting data regardless of their recommendation. An interpretation of this result is that analysts are always optimistic;

[23] Our findings and conclusions are unchanged when the analysis is repeated using a value-weighted analysis similar to section 5.

even when they are not issuing "buy" recommendations.[24] The bias in expected rates of return based on analysts' forecasts is not the result of analysts' expectations of positive abnormal returns isolated in firms with "buy" or "strong buy" recommendations.

7. Summary and conclusions

We show that, on average, the difference between the estimate of the expected rate of return based on analysts' earnings forecasts and the estimate of based on current earnings realizations is 2.84 percent. An implication of the observation that rates of return based on analysts' forecasts are higher than market expectations is that caution should be taken when interpreting the meaning of the rate of return that is implied by analysts' earnings forecasts; it may not be, as the literature generally claims, an estimate of the cost of capital.

When estimates of the expected rate of return in the extant literature are adjusted to remove the effect of optimism bias in analysts' forecasts, the estimate of the equity risk premium appears to be approximately zero. We show, however, when estimates are based on value-weighted analyses, the bias in the estimate of the expected rate of return is lower and the estimate of the expected equity premium is more reasonable; 4.43 percent.

Results from sub-samples formed on the basis of percentage of analysts comprising the consensus recommending "buy" show that the estimate of the expected rate of return, based on both analysts' forecasts of earnings and on current earnings, declines in a monotonic manner as the percentage of analysts recommending "buy" declines. A comparison of the estimates of the expected rate of return based on the analysts' forecasts, with estimates based on earnings realizations, suggests that analysts tend to be more optimistic than the market even when they are

[24] This result is consistent with Barber, Lehavy, McNicholls, and Trueman (2001) who show that analysts' recommendations (in their case, those summarized in the Zach's database) can not be used to form profitable trading strategies.

not making "buy" recommendations. That is, analysts recommend "buy" when they expect the future return to be high and "sell" when they expect the return to be low regardless of market expectations.

Our paper has two key implications for future research which uses market price, book value of equity, and accounting earnings to obtain estimates of the implied expected rate of return for a portfolio of stocks. First, since analysts' forecasts are pervasively optimistic, estimates of the implied expected rate of return formed using forecasts will be pervasively and significantly upward biased. This bias may be avoided by estimating the rate of return implied by price, book values, and *realized* earnings rather than biased earnings *forecasts*. Second, value-weighted analyses may be more appropriate in addressing certain issues such as estimating the equity premium, than equal-weighted analyses. The value-weighted analyses may provide more realistic estimates of the expected rate of return than are implied by equally-weighted analyses; which may be unnecessarily affected by less representative observations, such as penny stocks, and stocks making losses.

When coupled with results from the papers that demonstrate the troublesome effects of measurement error in firm-specific estimates of the expected rate of return, the results in this study suggest that the extant measures of implied expected rate of return should be used with considerable caution. The challenge is to find means of reducing the measurement error and to mitigate the effects of bias. Easton and Monahan (2005) suggest focusing on sub-samples where the measurement error is likely to be small. Our paper suggests that methods based on realized earnings rather than earnings forecasts may be a possible means of avoiding the effects of bias in analysts' forecasts. Another possible avenue might be to attempt to un-do the bias; following, for example, the ideas in Frankel and Lee (1998).

Figure 1: Alignment of Price-Dates, Earnings Announcement Dates, and Analysts' Forecast-Dates

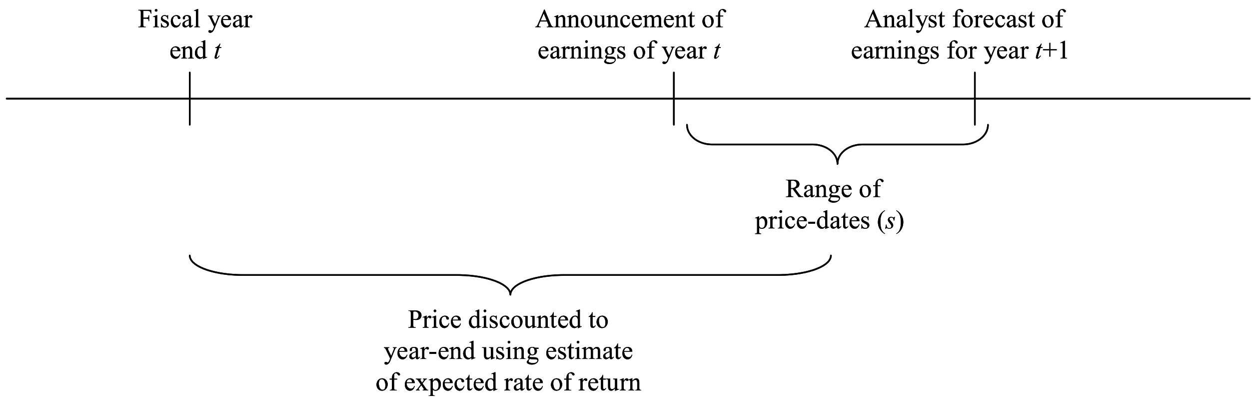


Table 1: Descriptive statistics on forecast errors for the consensus sample

		Accuracy of forecasts				Bias in forecasts			
		$\lvert FE_{jt+1}\rvert$		$\lvert FE_{jt+1}\rvert / p_{jt}$		FE_{jt+1}		FE_{jt+1} / p_{jt}	
t	N	Mean	Median	Mean	Median	Mean	Median	Mean	Median
12/92	1,418	0.594	0.280	0.030	0.014	-0.241	-0.150	-0.017	-0.007
12/93	1,544	0.461	0.190	0.028	0.009	-0.228	-0.070	-0.019	-0.003
12/94	1,781	0.427	0.220	0.030	0.012	-0.206	-0.080	-0.019	-0.004
12/95	1,939	0.451	0.210	0.028	0.011	-0.261	-0.070	-0.019	-0.004
12/96	2,006	0.518	0.210	0.027	0.010	-0.187	-0.100	-0.018	-0.005
12/97	2,137	0.606	0.270	0.031	0.013	-0.376	-0.200	-0.024	-0.009
12/98	2,044	0.718	0.215	0.040	0.012	-0.515	-0.080	-0.025	-0.004
12/99	1,854	0.668	0.230	0.046	0.012	-0.399	-0.090	-0.028	-0.004
12/00	1,729	1.394	0.310	0.052	0.018	-1.257	-0.240	-0.041	-0.012
12/01	1,809	0.705	0.200	0.033	0.011	0.063	-0.060	-0.018	-0.003
12/02	1,825	0.570	0.160	0.031	0.011	0.119	-0.030	-0.012	-0.002
12/03	2,000	0.650	0.170	0.019	0.008	-0.251	-0.010	-0.003	0.000
Means	1,841	0.647	0.222	0.033	0.012	-0.312	-0.098	-0.020	-0.005

Notes to Table 1:

FE_{jt+1} is actual earnings per share for year *t*+1 as reported by I/B/E/S less the first median consensus forecast of earnings per share for year t+1 released at least 14 days after the announcement of year *t* earnings

p_{jt} is price per share as of the end of fiscal year *t*

Table 2: Summary statistics for regression variables

t	N	$\frac{eps^{Cons}_{jt+1}}{bps_{jt}}$ Equation (4) dependent variable		$\frac{eps_{jt}}{bps_{jt-1}}$ Equation (5) dependent variable		$\frac{p'_{jt}}{bps_{jt}}$ Equation (4) independent variable		$\frac{p'_{jt} - bps^*_{jt}}{bps_{jt-1}}$ Equation (5) independent variable	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
12/92	1,418	0.138	0.132	0.104	0.110	2.193	1.792	1.265	0.854
12/93	1,544	0.138	0.138	0.113	0.122	2.374	1.929	1.505	0.994
12/94	1,781	0.146	0.145	0.121	0.126	2.114	1.706	1.334	0.834
12/95	1,939	0.145	0.142	0.122	0.132	2.454	1.906	1.679	1.060
12/96	2,006	0.135	0.139	0.108	0.126	2.654	2.114	1.851	1.228
12/97	2,137	0.125	0.140	0.102	0.125	2.998	2.409	2.132	1.491
12/98	2,044	0.118	0.134	0.093	0.116	2.728	1.974	1.810	0.959
12/99	1,854	0.126	0.141	0.094	0.124	3.398	1.883	2.699	0.996
12/00	1,729	0.116	0.136	0.100	0.130	2.749	1.964	2.022	1.109
12/01	1,809	0.079	0.111	0.068	0.100	2.457	1.928	1.548	0.989
12/02	1,825	0.093	0.117	0.077	0.102	1.945	1.625	1.007	0.662
12/03	2,000	0.106	0.121	0.090	0.111	2.883	2.314	2.198	1.450
Means	1,841	0.122	0.133	0.099	0.119	2.579	1.962	1.754	1.052

Notes to Table 2:

eps^{Cons}_{jt+1} is the first median consensus forecast of earnings per share for firm *j* for year *t*+1 released at least 14 days after the announcement of year *t* earnings

eps_{jt} is the I/B/E/S actual earnings per share for firm *j* for year *t*

bps_{jt} is common book value of equity per share for firm *j* at time *t*

$p'_{jt} = \frac{p_{jt+\tau}}{(1+\hat{r})^{\tau/365}}$ is the price per share for firm *j* at time t+τ (one day after the earnings announcement date), $p_{jt+\tau}$, adjusted for stock splits and stock dividends since the end of the fiscal year, discounted to year end using the estimated discount rate

bps^*_{jt} is the common book value of equity per share for firm *j* at time *t* less net income for firm *j* for year *t* plus I/B/E/S actual earnings per share for firm *j* for year *t*

Table 3: Comparison of implied expected rates of return based on I/B/E/S forecasts of earnings with implied expected rate of return based on current accounting data

Panel A: Estimates of expected rate of return based on analysts' forecasts and current accounting data

$$\frac{eps_{jt+1}^{Cons}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p'_{jt}}{bps_{jt}} + \mu_{jt} \quad (4)$$

$$\frac{eps_{jt}}{bps_{jt-1}} = \delta_0 + \delta_1 \frac{p'_{jt} - bps^*_{jt}}{bps_{jt-1}} + \zeta_{jt} \quad (5)$$

		Analysts' consensus earnings forecasts				**Current accounting data**				**Difference in expected rate of return**
T	N	γ_0	γ_1	Adj R^2	$\hat{r} = \gamma_0 + \gamma_1$	δ_0	δ_1	Adj R^2	$\hat{r} = \delta_0$	
12/92	1,418	0.057	0.037	36.60%	9.39%	0.057	0.037	27.09%	5.67%	3.72%
		(17.71)	(28.62)			(18.96)	(22.97)			
12/93	1,544	0.073	0.027	15.59%	10.08%	0.068	0.030	15.32%	6.83%	3.25%
		(16.53)	(16.91)			(18.37)	(16.74)			
12/94	1,781	0.073	0.035	16.81%	10.73%	0.069	0.039	24.00%	6.90%	3.83%
		(16.25)	(18.99)			(21.01)	(23.73)			
12/95	1,939	0.095	0.021	10.83%	11.53%	0.092	0.018	6.55%	9.22%	2.31%
		(23.47)	(15.38)			(23.40)	(11.70)			
12/96	2,006	0.089	0.018	6.66%	10.61%	0.073	0.019	6.77%	7.26%	3.35%
		(18.91)	(12.00)			(16.79)	(12.11)			
12/97	2,137	0.082	0.014	3.71%	9.64%	0.066	0.017	5.60%	6.62%	3.02%
		(14.64)	(9.13)			(14.61)	(11.30)			
12/98	2,044	0.082	0.013	3.50%	9.50%	0.065	0.016	6.43%	6.49%	3.01%
		(15.23)	(8.67)			(15.86)	(11.89)			
12/99	1,854	0.136	-0.003	0.73%	13.29%	0.100	-0.002	0.34%	9.97%	3.32%
		(32.67)	(-3.83)			(22.54)	(-2.71)			
12/00	1,729	0.084	0.012	3.38%	9.57%	0.086	0.007	1.00%	8.61%	0.96%
		(15.42)	(7.84)			(16.02)	(4.30)			
12/01	1,809	0.029	0.020	4.63%	4.93%	0.028	0.026	9.99%	2.82%	2.11%
		(4.64)	(9.42)			(6.30)	(14.20)			
12/02	1,825	0.019	0.038	9.83%	5.70%	0.030	0.047	21.13%	2.96%	2.74%
		(3.12)	(14.14)			(7.98)	(22.13)			
12/03	2,000	0.069	0.013	2.72%	8.18%	0.057	0.015	4.35%	5.74%	2.44%
		(11.65)	(7.55)			(11.55)	(9.59)			
Means	1,841	0.074	0.020	9.58%	9.43%	0.066	0.022	10.71%	6.59%	2.84%
t-Statistics		(8.50)	(5.86)		(14.16)	(10.50)	(5.51)		(10.50)	(12.33)

Table 3: Continued

Panel B: Estimates of expected rate of return based on future realized earnings

$$\frac{eps_{jt+1}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p'_{jt}}{bps_{jt}} + \mu_{jt} \quad (4)$$

	Perfect foresight earnings forecasts				Analysts' Forecasts Less Perfect Foresight	Current Accounting Data Less Perfect Foresight
t	γ_0	γ_1	Adj R^2	$\hat{r} = \gamma_0 + \gamma_1$		
12/92	0.037	0.031	14.10%	6.77%	2.62%	-1.10%
	(7.09)	(15.31)				
12/93	0.049	0.026	7.97%	7.45%	2.63%	-0.62%
	(8.10)	(11.61)				
12/94	0.046	0.031	8.33%	7.71%	3.02%	-0.81%
	(7.56)	(12.77)				
12/95	0.076	0.013	2.22%	8.87%	2.66%	0.35%
	(13.29)	(6.69)				
12/96	0.082	0.004	0.12%	8.56%	2.05%	-1.30%
	(12.01)	(1.83)				
12/97	0.040	0.009	0.77%	4.89%	4.75%	1.73%
	(5.14)	(4.18)				
12/98	0.057	0.006	0.44%	6.27%	3.23%	0.22%
	(8.28)	(3.15)				
12/99	0.105	-0.007	1.87%	9.79%	3.50%	0.18%
	(17.73)	(-6.01)				
12/00	0.043	0.004	0.18%	4.70%	4.87%	3.91%
	(6.16)	(2.05)				
12/01	0.018	0.013	1.40%	3.13%	1.80%	-0.31%
	(2.47)	(5.16)				
12/02	-0.003	0.041	9.16%	3.77%	1.93%	-0.81%
	(-0.48)	(13.60)				
12/03	0.075	0.007	0.64%	8.28%	-0.10%	-2.54%
	(11.02)	(3.71)				
Means	0.052	0.015	3.93%	6.68%	2.75%	-0.09%
t-Statistics	(6.12)	(3.63)		(10.79)	(7.13)	(-0.19)

Table 3: Continued

Panel C: Comparison of implied expected rates of return based on I/B/E/S forecasts of earnings with implied expected rate of return based on current accounting data and on future realized earnings using prices measured the day after the consensus forecast

$$\frac{eps^{Cons}_{jt+1}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p'_{jt}}{bps_{jt}} + \mu_{jt} \quad (4)$$

Analysts' consensus earnings forecasts

	N	γ_0	γ_1	Adj R^2	$\hat{r} = \gamma_0 + \gamma_1$
Means	1,841	0.072	0.021	10.07%	9.34%
t-Statistics		(8.04)	(5.93)		(13.68)

$$\frac{eps_{jt}}{bps_{jt-1}} = \delta_0 + \delta_1 \frac{p'_{jt} - bps^*_{jt}}{bps_{jt-1}} + \zeta_{jt} \quad (5)$$

Current accounting data

	N	δ_0	δ_1	Adj R^2	$\hat{r} = \delta_0$
Means	1,841	0.064	0.023	11.36%	6.41%
t-Statistics		(10.13)	(5.86)		(10.13)

$$\frac{eps^{PF}_{jt+1}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p'_{jt}}{bps_{jt}} + \mu_{jt} \quad (4)$$

Perfect foresight earnings forecasts

	N	γ_0	γ_1	Adj R^2	$\hat{r} = \gamma_0 + \gamma_1$
Means	1,841	0.049	0.016	4.42%	6.50%
t-Statistics		(5.36)	(3.84)		(9.72)

Notes to Table 3:

Panel A of the table reports the results of estimating regression (4) using I/B/E/S consensus forecasts and regression (5) using current accounting data cross-sectionally using all available observations. Panel B reports the results of estimating regression (4) using subsequent earnings realizations as perfect foresight forecasts. Observations with any of the dependent or independent variables in the top and bottom two percent observations are removed to reduce the effects of outliers. The variables are as defined in the notes to Tables 1 and 2. Summary means across the annual regressions and the related Fama and MacBeth (1973) t-statistics are provided. The last column of Panel A contains the difference between estimates of expected return from the estimation of regression (4) using I/B/E/S consensus forecasts and regression (5) using current accounting data. The last two columns of Panel B contain the differences between perfect foresight estimates and the estimates of expected return from the estimation of regression (4) using I/B/E/S consensus forecasts and regression (5) using current accounting data. Panel C repeats the analysis performed in Panels A and B using an alternative definition of price. Instead of measuring price at trade close the day after the earnings announcement, price is measured at trade close the day following the consensus forecast. This results in a price variable measured 14 days to a month and a half later. All other variables remain unchanged.

Table 4: Value-weighting observations, results of comparison of implied expected rates of return based on I/B/E/S forecasts of earnings, based on current accounting data and based on future realizations of earnings

Panel A: Descriptive statistics

	Decile of market capitalization at time t									
Mean of annual means	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$\lvert FE_{jt+1}\rvert$	0.419	0.397	0.398	0.443	0.428	0.455	0.466	0.488	0.579	2.369
$\lvert FE_{jt+1}\rvert / p_{jt}$	0.102	0.053	0.040	0.034	0.026	0.023	0.018	0.017	0.015	0.012
FE_{jt+1}	-0.284	-0.235	-0.242	-0.266	-0.233	-0.237	-0.214	-0.246	-0.273	-0.890
FE_{jt+1}/p_{jt}	-0.075	-0.033	-0.025	-0.021	-0.015	-0.013	-0.009	-0.009	-0.007	-0.005
$eps^{Cons}_{jt+1} / bps_{jt}$	0.065	0.081	0.093	0.095	0.113	0.128	0.140	0.149	0.160	0.186
eps_{jt} / bps_{jt-1}	0.002	0.050	0.066	0.075	0.095	0.113	0.126	0.134	0.145	0.168
p'_{jt} / bps_{jt}	1.707	1.954	2.188	2.362	2.482	2.676	2.794	2.895	2.941	3.593
$(p'_{jt} - bps^{*}_{jt}) / bps_{jt-1}$	0.641	1.000	1.275	1.533	1.752	1.958	2.083	2.142	2.146	2.732

	Decile of market capitalization at time t									
Mean of annual medians	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$\lvert FE_{jt+1}\rvert$	0.218	0.200	0.211	0.225	0.225	0.221	0.238	0.223	0.242	0.246
$\lvert FE_{jt+1}\rvert / p_{jt}$	0.042	0.024	0.018	0.016	0.012	0.010	0.009	0.008	0.007	0.006
FE_{jt+1}	-0.116	-0.106	-0.108	-0.116	-0.098	-0.092	-0.092	-0.090	-0.075	-0.086
FE_{jt+1}/p_{jt}	-0.023	-0.012	-0.009	-0.007	-0.005	-0.004	-0.004	-0.003	-0.002	-0.002
$eps^{Cons}_{jt+1} / bps_{jt}$	0.095	0.110	0.115	0.118	0.126	0.134	0.143	0.148	0.155	0.176
eps_{jt} / bps_{jt-1}	0.052	0.086	0.097	0.104	0.114	0.125	0.131	0.136	0.142	0.160
p'_{jt} / bps_{jt}	1.316	1.577	1.748	1.836	1.926	2.060	2.183	2.221	2.304	2.829
$(p'_{jt} - bps^{*}_{jt}) / bps_{jt-1}$	0.259	0.605	0.818	0.944	1.017	1.220	1.327	1.313	1.439	1.934

Table 4: Continued

Panel B: Value-weighted estimates of expected rate of return based on analysts' forecasts and current accounting data

$$\frac{eps^{Cons}_{jt+1}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p'_{jt}}{bps_{jt}} + \mu_{jt} \quad (4) \qquad \frac{eps_{jt}}{bps_{jt-1}} = \delta_0 + \delta_1 \frac{p'_{jt} - bps^*_{jt}}{bps_{jt-1}} + \zeta_{jt} \quad (5)$$

		Analysts' consensus earnings forecasts				**Current accounting data**				**Difference in expected rate of return**
T	N	γ_0	γ_1	Adj R^2	$\hat{r} = \gamma_0 + \gamma_1$	δ_0	δ_1	Adj R^2	$\hat{r} = \delta_0$	
12/92	1,418	0.047	0.047	57.76%	9.35%	0.062	0.044	46.89%	6.22%	3.13%
		(14.73)	(44.03)			(23.49)	(35.38)			
12/93	1,544	0.052	0.047	51.76%	9.82%	0.079	0.042	46.23%	7.87%	1.95%
		(14.70)	(40.70)			(29.00)	(36.43)			
12/94	1,781	0.072	0.049	52.03%	12.15%	0.084	0.050	57.05%	8.39%	3.76%
		(22.46)	(43.95)			(34.82)	(48.64)			
12/95	1,938	0.092	0.036	46.89%	12.76%	0.127	0.028	32.37%	12.65%	0.11%
		(26.96)	(41.36)			(41.25)	(30.46)			
12/96	2,006	0.081	0.034	51.09%	11.53%	0.106	0.029	44.72%	10.64%	0.89%
		(25.50)	(45.77)			(38.36)	(40.29)			
12/97	2,137	0.094	0.026	44.60%	12.01%	0.106	0.023	39.89%	10.58%	1.43%
		(28.17)	(41.48)			(41.10)	(37.67)			
12/98	2,044	0.093	0.022	47.17%	11.49%	0.090	0.022	49.99%	8.97%	2.52%
		(28.30)	(42.72)			(33.70)	(45.20)			
12/99	1,855	0.147	0.010	23.55%	15.69%	0.147	0.004	4.00%	14.66%	1.03%
		(35.74)	(23.92)			(36.07)	(8.85)			
12/00	1,729	0.091	0.022	43.02%	11.26%	0.110	0.021	33.61%	11.04%	0.22%
		(22.09)	(36.13)			(28.77)	(29.60)			
12/01	1,808	0.059	0.031	44.84%	8.98%	0.070	0.030	47.31%	6.98%	2.00%
		(15.74)	(38.34)			(22.45)	(40.29)			
12/02	1,825	0.055	0.043	59.95%	9.76%	0.083	0.041	61.56%	8.26%	1.50%
		(18.77)	(52.26)			(34.75)	(54.05)			
12/03	2,000	0.072	0.032	43.22%	10.41%	0.098	0.031	40.17%	9.76%	0.65%
		(21.58)	(39.02)			(27.36)	(36.65)			
Means	1,841	0.079	0.033	47.16%	11.27%	0.097	0.030	41.98%	9.67%	1.60%
t-Statistics		(10.09)	(9.62)		(21.20)	(13.90)	(8.38)		(13.90)	(4.91)

Notes to Table 4:

Panel A of the table reports the summary statistics from repeating the analysis performed in Tables 1 and 2 by annual decile of market capitalization at time *t*. Panel B repeats the analysis in Table 3 using weighted least squares regression with regression weights equal to market capitalization at time *t*.

Table 5: Variation in the implied expected rate of return with changes in the percentage of analysts' making "buy" recommendation – minimum of five analysts following firm

Panel A: Descriptive statistics by percent of buy recommendations

	90 ≤ % Buy ≤ 100		70 ≤ % Buy ≤ 90		50 ≤ % Buy < 70		30 ≤ % Buy < 50		0 ≤ % Buy < 30	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
$\lvert FE_{jt+1}\rvert$	0.437	0.218	0.932	0.232	0.497	0.220	0.540	0.235	0.536	0.229
$\lvert FE_{jt+1}\rvert / p_{jt}$	0.017	0.008	0.017	0.008	0.019	0.008	0.026	0.010	0.041	0.011
FE_{jt+1}	-0.268	-0.101	-0.725	-0.103	-0.251	-0.083	-0.271	-0.089	-0.287	-0.082
FE_{jt+1}/p_{jt}	-0.010	-0.004	-0.009	-0.003	-0.010	-0.003	-0.016	-0.004	-0.027	-0.004
$eps^{Cons}_{jt+1}/bps_{jt}$	0.140	0.157	0.164	0.162	0.159	0.153	0.134	0.131	0.108	0.112
eps_{jt}/bps_{jt-1}	0.125	0.150	0.152	0.151	0.143	0.140	0.120	0.120	0.091	0.101
p'_{jt}/bps_{jt}	3.860	3.011	3.435	2.686	2.848	2.305	2.371	1.921	2.029	1.649
$(p'_{jt} - bps^{*}_{jt})/bps_{jt-1}$	3.649	2.313	2.844	1.948	2.005	1.438	1.485	1.016	1.032	0.704
# of observations	135		227		263		176		154	

Table 5: Continued

Panel B: Summary of results of estimation by percent of buy recommendations

$$\frac{eps^{Cons}_{jt+1}}{bps_{jt}} = \gamma_0 + \gamma_1 \frac{p'_{jt}}{bps_{jt}} + \mu_{jt} \quad (4)$$

$$\frac{eps_{jt}}{bps_{jt-1}} = \delta_0 + \delta_1 \frac{p'_{jt} - bps^*_{jt}}{bps_{jt-1}} + \zeta_{jt} \quad (5)$$

		Analysts' consensus earnings forecasts				**Current accounting data**			
Recommendation	N	γ_0	γ_1	Adj R^2	$\hat{r} = \gamma_0 + \gamma_1$	δ_0	δ_1	Adj R^2	$\hat{r} = \delta_0$
90 ≤ % Buy ≤ 100	135	0.100	0.012	7.90%	11.20%	0.109	0.012	18.18%	10.94%
		(7.93)	(3.32)		(9.93)	(5.12)	(1.46)		(5.12)
70 ≤ % Buy ≤ 90	227	0.098	0.021	16.82%	11.84%	0.102	0.020	17.42%	10.22%
		(9.87)	(7.73)		(14.29)	(10.23)	(5.88)		(10.23)
50 ≤ % Buy < 70	263	0.080	0.029	34.28%	10.82%	0.089	0.028	30.29%	8.90%
		(13.67)	(12.69)		(20.84)	(18.09)	(10.96)		(18.09)
30 ≤ % Buy < 50	176	0.060	0.031	28.31%	9.18%	0.072	0.033	26.85%	7.23%
		(7.04)	(6.80)		(16.25)	(13.25)	(8.38)		(13.25)
0 ≤ % Buy < 30	154	0.032	0.037	32.00%	6.86%	0.046	0.044	30.09%	4.60%
		(3.13)	(9.60)		(8.85)	(5.60)	(9.67)		(5.60)

Table 5: Continued

Panel C: Mean differences in (t-statistics for) estimates of expected rate of return

		Analysts' expected rate of return					**Expected rate of return based on current accounting data**			
		90 ≤ % ≤ 100	70 ≤ % ≤ 90	50 ≤ % < 70	30 ≤ % < 50	0 ≤ % < 30	90 ≤ % ≤ 100	70 ≤ % ≤ 90	50 ≤ % < 70	30 ≤ % < 50
Analysts' expected rate of return	70 ≤ % ≤ 90	-0.64% (-0.79)								
	50 ≤ % < 70	0.38% (0.50)	1.02% (2.11)							
	30 ≤ % < 50	2.02% (2.50)	2.66% (4.76)	1.64% (3.96)						
	0 ≤ % < 30	4.34% (5.46)	4.97% (9.01)	3.96% (8.90)	2.31% (5.04)					
Expected rate of return based on current accounting data	90 ≤ % ≤ 100	0.26% (0.15)								
	70 ≤ % ≤ 90		1.61% (3.14)				0.72% (0.30)			
	50 ≤ % < 70			1.92% (5.04)			2.04% (1.03)	1.32% (1.81)		
	30 ≤ % < 50				1.95% (6.38)		3.72% (1.82)	3.00% (4.77)	1.68% (3.96)	
	0 ≤ % < 30					2.27% (7.15)	6.35% (3.15)	5.63% (8.25)	4.31% (7.40)	2.63% (5.29)

Table 5: Continued

Notes to Table 5:

Using the median consensus analysts' forecast and the percent of buy recommendations from the summary I/B/E/S database, we estimate expected rate of return by percentage of buy recommendations for all firms with at least five analysts included in the consensus. Panel A reports descriptive statistics by percentage of buy recommendations. The variables are as defined in the notes to Tables 1 and 2. Panel B reports the results of estimating regression (4) using I/B/E/S consensus forecasts and regression (5) using current accounting data cross-sectionally using all available observations of that percentage of buy recommendations. Within the percentage of buy recommendations, observations with any of the dependent or independent variables in the top and bottom two percent observations are removed to reduce the effects of outliers. The reported numbers are the summary means across the annual regressions and the related Fama and Macbeth (1973) t-statistics. The last column for each regression in Panel B reports the annual estimates of expected rate of return by percentage of buy recommendations. Panel C reports summary means of the differences in estimates across the annual regressions and the related Fama and Macbeth (1973) t-statistics.

REFERENCES

Baginski, S. and J. Wahlen. 2003. Residual income, risk, intrinsic values, and share prices. *The Accounting Review* 78: 327-351.

Barber, B, R. Lehavy, M. McNicholls, and B. Trueman. 2001. Can investors profit from the prophets? Security analyst recommendations and stock returns. *Journal of Finance* 56: 531-563.

Boni, L. and K. Womack. 2002. Wall Street's credibility problem: misaligned incentive and dubious fixes. *Wharton Financial Institutions Center.*

Botosan, C. 1997. Disclosure level and the cost of equity capital. *The Accounting Review* 72: 323-349.

Botosan, C. and M. Plumlee. 2005. Assessing alternative proxies for the expected risk premium. The Accounting Review 80: 21-54.

Botosan, C., M. Plumlee, Y. Xie. 2004. The role of information precision in determining the cost of equity capital. *Review of Accounting Studies* 9: 233-259.

Bradshaw, M. 2004. How do analysts use their earnings forecasts in generating stock recommendations? *The Accounting Review* 79: 25-50.

Brown, L. 1993. Earnings forecasting research: Its implications for capital markets research. *International Journal of Forecasting* 9: 295-320.

Claus, J. and J. Thomas. 2001. Equity risk premium as low as three percent? Evidence from analysts' earnings forecasts for domestic and international stocks. *Journal of Finance* 56: 1629-1666.

Das, S., B. Levine, and K. Sivaramankrishnan. 1998. Earnings predictability and bias in analysts' earnings forecasts. *The Accounting Review* 73: 277-294.

Daske, H. 2006. Economic benefits of adopting IFRS or US-GAAP – Have the expected costs of equity capital really decreased? *Journal of Business, Finance, and Accounting.* Forthcoming.

Dhaliwal, D., L. Krull, O. Li, and W. Moser. 2005. Dividend taxes and implied cost of capital. *Journal of Accounting Research.* 43: 675-715.

Dugar, A., and S. Nathan. 1995. The effect of banking relationships on financial analysts' earnings investment recommendations. *Contemporary Accounting Research* 12: 131-160.

Eames, M., S. Glover, and J. Kennedy. 2002. The association between broker recommendations and broker-analysts' earnings forecasts. *Journal of Accounting Research* 40: 85-104.

Easton, P. 2004. PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital. *The Accounting Review* 79: 73-96.

Easton, P. 2006. Use of forecasts of earnings to estimate and compare cost of capital across regimes. *Journal of Business, Finance, and Accounting* 33: 374-394.

Easton, P, and S. Monahan. 2005. An evaluation of accounting-based measures of expected returns. *The Accounting Review* 80: 501-538.

Easton, P., G. Sommers, and M. Zmijewski. 2006. Effects of fraud on expectations of returns on equity investment and growth. University of Notre Dame. Working paper.

Easton, P., G. Taylor, P. Shroff, and T. Sougiannis. 2002. Using forecasts of earnings to simultaneously estimate growth and the rate of return on equity investment. *Journal of Accounting Research* 40: 657-676.

Fama, E. and K, French. 1992. The cross-section of expected returns. *Journal of Finance* 47: 427-465.

Fama, E. and J. MacBeth. 1973. Risk, return and equilibrium – Empirical tests. *The Journal of Political Economy* 81: 607-636.

Francis, J., I. Khurana, and R. Periera. 2005. Disclosure incentives and effects on cost of capital around the world. *Accounting Review* 80: 1125-1163.

Francis, J., R. LaFond, P. Olsson and K. Schipper. 2004. Costs of equity and earnings attributes. *Accounting Review* 79: 967-1011.

Frankel, R. and C. Lee. 1998. Accounting valuation, market expectation, and cross-sectional stock returns. *Journal of Accounting and Economics* 25: 283-319.

Gebhardt, W., C. Lee, and B. Swaminathan. 2001. Towards an ex-ante cost of capital. *Journal of Accounting Research* 39: 135-176.

Gode, D. and P. Mohanram. 2003. Inferring the cost of capital using the Ohlson-Juettner model. *Review of Accounting Studies* 8: 399-431.

Groysberg, B., P. Healy, C. Chapman, and Y. Gui. 2006. Do buy-side analysts out-perform the sell-side. *Journal of Accounting and Economics*. Forthcoming.

Guay, W., S. Kothari, S. Shu. 2005. Properties of implied cost of capital using analysts' forecasts. University of Pennsylvania, Wharton School. Working paper.

Hail, L. and C. Leuz. 2006. International differences in the cost of equity capital: Do legal institutions and securities regulation matter? *Journal of Accounting Research*. Forthcoming.

Hribar, P. and N. Jenkins. 2004. The effect of accounting restatements on earnings revisions and the estimated cost of capital. *Review of Accounting Studies* 9: 337-356.

Kutsoati, E. and D. Bernhardt. 1999. Can relative performance evaluation explain analysts' forecasts of earnings. Tufts University. Working paper.

Lee, C., J. Myers, and B. Swaminathan. 1999. What is the intrinsic value of the Dow? *Journal of Finance* Volume 54 Issue 5: 1693-1741.

Lin, H. 1994. Security analysts' investment recommendations. Stanford University. Ph.D. dissertation.

Mendenhall, R. 1991. Evidence on the possible underweighting of earnings information. *Journal of Accounting Research* 29: 170-179.

Michaely, R and K. Womack. 1999. Conflict of interest and the credibility of underwriter analyst recommendations. *Review of Financial Studies* 12: 653-686.

O'Brien, P. 1988. Analysts' forecasts as earnings recommendations. *Journal of Accounting and Economics* 10: 53-83.

O'Brien, P. 1993. Earnings forecasts and the macroeconomy. University of Michigan. Working Paper.

O'Hanlon, J. and A. Steele. 2000. Estimating the equity risk premium using accounting fundamentals. *Journal of Business Finance and Accounting* 27: 1051-1084.

Ohlson, J. 1989. Accounting earnings, book value and dividends: the theory of the clean surplus equation (part I). Reproduced in R. Brief and K. Peasnell (eds.) *Clean Surplus: A Link Between Accounting and Finance* (Garland), 167-227.

Richardson, S., S. Teoh, and P. Wysocki. 2004. The walk-down to beatable analyst forecasts: the role of equity issuances and insider trading incentives. *Contemporary Accounting Research*, 21, 885-924.

Williams, M. 2004. Discussion of "The role of information precision in determining the cost of equity capital." *Review of Accounting Studies* 9: 261-264.

Zitzewitz, E. 2002. Regulation fair disclosure and the private information of analysts. Stanford University. Working paper.

EQUITY RISK PREMIUM FORUM

NOVEMBER 8, 2001

Forum Participants

Martin L. Leibowitz (*Forum Chair*)

Robert D. Arnott
Clifford S. Asness
Ravi Bansal
John Y. Campbell
Peng Chen, CFA
Bradford Cornell
William N. Goetzmann
Brett Hammond
Campbell R. Harvey
Roger G. Ibbotson
Rajnish Mehra
Thomas K. Philips
William Reichenstein, CFA
Stephen Ross
Robert J. Shiller
Jeremy Siegel
Kevin Terhaar, CFA
Richard H. Thaler
J. Peter Williamson

Editorial Staff

Kathryn Dixon Jost, CFA
Editor

Bette Collins
Book Editor

Christine E. Kemper
Assistant Editor

Jaynee M. Dudley
Production Manager

Kathryn L. Dagostino
Production Coordinator

Kelly T. Bruton
Lois A. Carrier
Composition

EQUITY RISK PREMIUM FORUM, NOVEMBER 8, 2001

Biographies

ROBERT D. ARNOTT is managing partner and CEO at First Quadrant, LP. Previously, he served as equity strategist at Salomon Brothers and as president and chief investment officer at TSA Capital Management. Mr. Arnott co-edited the first and second editions of *Active Asset Allocation* and *Style Management* and is the author of numerous articles. He has received four Graham and Dodd Awards of Excellence for articles published in the *Financial Analysts Journal* and is a member of the editorial boards of the *Journal of Portfolio Management, Journal of Investing,* and *Journal of Wealth Management*. Mr. Arnott holds degrees in economics, applied mathematics, and computer science from the University of California.

CLIFFORD S. ASNESS is president and managing principal at AQR Capital Management, LLC. Previously, he was a managing director and director of quantitative research at Goldman, Sachs & Company. Mr. Asness's articles on a variety of financial topics have appeared in many journals, including the *Journal of Portfolio Management*, *Financial Analysts Journal*, and *Journal of Banking & Finance*. In 2000, he received a Graham and Dodd Award of Excellence from the *Financial Analysts Journal*. Mr. Asness serves on the editorial board of the *Journal of Portfolio Management* and on the governing board of the Courant Institute of Mathematical Finance. He holds a B.S. in economics from The Wharton School at the University of Pennsylvania, a B.S. in engineering from the Moore School of Electrical Engineering, and an M.B.A. and a Ph.D. from the University of Chicago.

RAVI BANSAL is associate professor of finance at Fuqua School of Business at Duke University. Professor Bansal has published numerous articles in such finance journals as the *Journal of Finance*, *Review of Financial Studies*, and *Journal of Econometrics*. He is associate editor of the *Journal of Financial Econometrics* and *Journal of Securities Markets*. He holds an M.S and a Ph.D from the Carnegie Mellon University Graduate School of Industrial Administration and a B.A. and an M.A. in economics from the Delhi School of Economics at the University of Delhi, India.

JOHN Y. CAMPBELL is Otto Eckstein Professor of Applied Economics at Harvard University. Previously, he was Class of 1926 Professor of Economics and Public Affairs at Princeton University. He is the author of numerous articles in financial journals and was awarded the Smith Breeden Prize from the *Journal of Finance*, the Roger F. Murray Prize from the Institute for Quantitative Research in Finance and the Paul A. Samuelson Certificate of Excellence from TIAA-CREF. He holds a B.A. from Corpus Christi College at the University of Oxford and a Ph.D. and an M.Phil. from Yale University.

PENG CHEN, CFA, is vice president and director of research at Ibbotson Associates. He conducts research projects on asset allocation, portfolio risk measurement, nontraditional assets, and global financial markets. His writings have appeared in various journals, including the *Journal of Portfolio Management*, *Journal of Association of American Individual Investors*, and *Consumer Interest Annual*. Mr. Chen holds a bachelor's degree in industrial management engineering from Harbin Institute of Technology and master's and doctorate degrees in consumer economics from Ohio State University.

BRADFORD CORNELL is professor of financial economics at the Anderson Graduate School of Management at the University of California at Los Angeles and president of FinEcon. Previously, Professor Cornell was vice president and director of the Securities Litigation Group at Economic Analysis Corporation. He has also taught at the California Institute of Technology, the University of Southern California, and the University of Arizona. Professor Cornell has served as an associate editor for a variety of scholarly and business journals and is the author of several books and numerous articles published in various finance journals. Professor Cornell holds an A.B. in physics, philosophy, and psychology, an M.S. in statistics, and a Ph.D. in financial economics from Stanford University.

WILLIAM N. GOETZMANN is Edwin J. Beinecke Professor of Finance and Management Studies and director of the International Center for Finance at the Yale School of Management. Previously, he was associate professor of finance at Yale School of Management, assistant professor of finance at Columbia Business School, and a lecturer at Ibbotson Associates. Professor Goetzmann has also served as director of the Museum of Western Art and as a writer and producer of PBS documentaries. He is the author or co-author of numerous articles on finance and real estate and is co-editor or editorial board member for several journals. Professor Goetzmann holds a B.A., an M.A., and an M.Phil. from Yale College, an M.P.P.M. from Yale School of Management, and a Ph.D. in operations research with a specialty in finance from Yale University.

BRETT HAMMOND is director of corporate projects at TIAA-CREF Investment Management, LLC.

CAMPBELL R. HARVEY is J. Paul Sticht Professor of International Business at the Fuqua School of Business at Duke University and a research associate for the National Bureau of Economic Research. Professor Harvey is an internationally recognized expert in portfolio management and global risk management. His work on the implications of changing risk and the dynamics of risk premiums for tactical asset allocation has been published in the top academic and practitioner journals. He is editor of the *Review of Financial Studies*, co-editor of the *Emerging Markets Review*, and an associate editor for a number of journals. Professor Harvey received the 1993–1994 Batterymarch Fellowship and has received four Graham and Dodd Awards for Excellence in financial writing from the *Financial Analysts Journal*. He holds a B.A. from Trinity College at the University of Toronto, an M.B.A. from York University, and a Ph.D. from the University of Chicago.

ROGER G. IBBOTSON is chair and founder of Ibbotson Associates and the author of numerous books and articles, including the annual *Stocks, Bonds, Bills, and Inflation Yearbook*. Mr. Ibbotson is a frequent lecturer at universities, academic conferences, business conferences, and other forums. He is associate editor of the *Journal of Applied Corporate Finance* and a member of the editorial board of the *Financial Analysts Journal*. He received a *Financial Analysts Journal* Graham and Dodd Award of Excellence in 1980, 1982, 1984 and 2000. Mr. Ibbotson holds a bachelor's degree in mathematics from Purdue University, a master's degree in finance from Indiana University, and a Ph.D. in finance and economics from the University of Chicago Graduate School of Business, where he taught for more than 10 years and served as executive director of the Center for Research in Security Prices.

MARTIN L. LEIBOWITZ is vice chair and chief investment officer at TIAA-CREF Investment Management, LLC, where he is responsible for the overall management of all TIAA-CREF investments. Previously, he was a managing director, director of research, and member of the executive committee with Salomon Brothers. Mr. Leibowitz has authored several books and more than 130 articles, 9 of which have received a *Financial Analysts Journal* Graham and Dodd Award of Excellence. He was the recipient of AIMR's Nicholas Molodovsky Award in 1995 and the James R. Vertin Award in 1998. In 1995, he received the Distinguished Public Service Award from the Public Securities Association and became the first inductee into the Fixed Income Analysts Society's Hall of Fame. Mr. Leibowitz is a trustee of the Carnegie Corporation, the Institute for Advanced Study at Princeton, and the Research Foundation of AIMR. He holds a B.A. and an M.S. from the University of Chicago and a Ph.D. in mathematics from the Courant Institute of New York University.

RAJNISH MEHRA is professor of finance at the University of California at Santa Barbara and visiting professor of finance at the University of Chicago Graduate School of Business. Previously, he was visiting professor of finance at the Sloan School of Management at the Massachusetts Institute of Technology and assistant and associate professor at the Graduate School of Business at Columbia University. He is the author of numerous articles published in such journals as *Econometrica*, the *Review of Economic Studies*, and the *Journal of Monetary Economics*, and his writings have been included in several books. He holds a B.Tech. in electrical engineering from the Indian Institute of Technology in Kanpur, India, an M.S. in computer science from Rice University, and an M.S. in industrial administration and a Ph.D. in finance from the Graduate School of Industrial Administration at Carnegie-Mellon University.

THOMAS K. PHILIPS is chief investment officer at Paradigm Asset Management Company, where he is responsible for all aspects of the investment process, including the development of new products and the enhancement of existing ones. Previously, he was managing director at RogersCasey and worked at IBM Corporation in research and active equity management for the IBM Thomas J. Watson Research Center and the IBM Retirement Fund. Mr. Philips is the author of several articles and book chapters on topics in finance, engineering, and mathematics. He holds an M.S. and a Ph.D. in electrical and computer engineering from the University of Massachusetts at Amherst.

WILLIAM REICHENSTEIN, CFA, holds the Pat and Thomas R. Powers Chair in Investment Management at Baylor University and is a consultant to TIAA-CREF. He is an associate editor of the *Journal of Investing*, on the editorial board of *Journal of Financial Education*, on the editorial review board of the *Journal of Financial Planning*, and on the editorial advisory board of the *Journal of Applied Business*

Research. Professor Reichenstein has written more than 50 articles for professional and academic journals and is a frequent contributor to the *Financial Analysts Journal, Journal of Portfolio Management*, and *Journal of Investing*. His work has been discussed in the *Wall Street Journal, Barron's, Forbes, Smart Money*, and elsewhere, and he is frequently quoted in newspapers throughout the United States. Professor Reichenstein holds a B.A. in mathematics from St. Edward's University and a Ph.D. in economics from the University of Notre Dame.

STEPHEN ROSS is Franco Modigliani Professor of Financial Economics at the Sloan School of Management at the Massachusetts Institute of Technology. He is also a principal of Roll and Ross Asset Management Corporation. Professor Ross, a widely published author in finance and economics, is best known as the inventor of Arbitrage Pricing Theory and the Economic Theory of Agency and as the co-discoverer of risk-neutral pricing and the binomial model for pricing derivatives. He is the author of *Corporate Finance*, which is in its fourth edition.

ROBERT J. SHILLER is Stanley B. Resor Professor of Economics at the Cowles Foundation for Research in Economics at Yale University. He is co-founder of Case Shiller Weiss, an economics research and information firm, and also a co-founder of Macro Securities Research, a firm that promotes securitization of unusual risks. Professor Shiller is the author of numerous articles on financial markets, behavioral economics, macroeconomics, real estate, statistical methods, and public attitudes, opinions, and moral judgments regarding markets. He is the author of *Market Volatility*, a mathematical and behavioral analysis of price fluctuations in speculative markets, and *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks*, which won the 1996 Paul A. Samuelson Award from TIAA-CREF. Professor Shiller's recent book, *Irrational Exuberance*, won the Commonfund Prize for 2000. He holds a Ph.D. in economics from the Massachusetts Institute of Technology.

JEREMY SIEGEL is Russell E. Palmer Professor of Finance at The Wharton School of the University of Pennsylvania, where he has been a member of the faculty since 1976. Previously, he taught at the University of Chicago Graduate School of Business. Professor Siegel has received many awards and citations for his research and excellence in teaching, including a Graham and Dodd Award of Excellence from the *Financial Analysts Journal* and the 2000 Peter Bernstein and Frank Fabozzi Award from the *Journal of Portfolio Management*. In 1994, he received the highest teaching rating in a worldwide ranking of business school professors conducted by *BusinessWeek*. Professor Siegel has published articles in numerous finance journals and is the author of the book *Stocks for the Long Run* and co-author of *Revolution on Wall Street*. He holds a B.A. from Columbia University and a Ph.D. from the Massachusetts Institute of Technology.

KEVIN TERHAAR, CFA, is director of risk management and specialized investments at Brinson Partners. Previously, Mr. Terhaar was manager of investments for a trust office, where his responsibilities included asset allocation and investment analysis. He has published articles on a number of investment topics and is the co-author of "Maintaining Consistent Global Asset Views," which appeared in the *Financial Analysts Journal* in 1998. Mr. Terhaar holds a B.A. and an M.A. from the University of Virginia.

RICHARD H. THALER is Robert P. Gwinn Professor of Behavioral Science and Economics and director of the Center for Decision Research at the University of Chicago Graduate School of Business. He is also a research associate at the National Bureau of Economic Research and co-director, with Robert Shiller of the Behavioral Economics Project, funded by the Russell Sage Foundation. He has published articles on finance in such journals as the *Journal of Economic Perspectives*, *Journal of Finance*, *Journal of Portfolio Management*, and *American Economic Review*. Professor Thaler holds a B.A. from Case Western Reserve University and an M.A. and a Ph.D. from the University of Rochester.

J. PETER WILLIAMSON is the Laurence F. Whittemore Professor of Finance, Emeritus, at the Amos Tuck School of Business Administration at Dartmouth College, where he has been a member of the faculty since 1961. He is the author of more than a dozen books and monographs and numerous articles. Professor Williamson has served as a consultant and as an expert witness on cost of capital and capital structure in approximately 100 federal and state cases. He has prepared for publication summaries of all the presentations made at the semi-annual seminars of the Institute for Quantitative Research in Finance for 26 years. Professor Williamson holds a B.A. from the University of Toronto and an M.B.A., an LL.B., and a D.B.A. from Harvard University.

INTRODUCTION

Martin L. Leibowitz (*Forum Chair*)
TIAA-CREF
New York City

Our goal here today is to foster a very candid discussion of the many facets of the equity risk premium. Generally, the risk premium is thought of as the incremental return of certain equity market components relative to certain fixed-income components. Even when these two measures are clarified, however, which they often are not, considerable ambiguity can remain as to just what we're talking about when we talk about the risk premium. Are we talking about a premium that has been historically achieved, a premium that is the ongoing expectation of market participants, an analytically determined forecast for the market, or a threshold measure of required return to compensate for a perceived level of risk? All of these measures can be further parsed out as reflections of the broad market consensus, the opinions of a particular individual or institution, or the views of various market cohorts looking at specific and very different time horizons.

As for the issue of the risk premium as uncertainty, we often see the risk premium defined as an extrapolation of historical volatility and then treated as some sort of stable parameter over time. A more comprehensive (and more difficult) approach might be to view the risk premium as a sufficient statistic unto itself, a central value that is tightly embedded in an overall distribution of incremental returns. From this vantage point, we would then look at the entire risk premium distribution as an integrated dynamic, one that continually reshapes itself as the market evolves.

With the enormous variety of definitions and interpretations, the risk premium may seem to be the ultimate "multicultural" parameter and our forum today may have the character of a masked ball within the Tower of Babel. However, every one of us here does know and understand the particular aspect of the risk premium that we are addressing in our work. And I hope that we can communicate that clarity even as we tackle the many thorny questions that surround this subject. The risk premium is a concept that is so central to our field of endeavor that it might properly be called the financial equivalent of a cosmological concept.

Theoretical Foundations I

Richard H. Thaler

Graduate School of Business
University of Chicago
Chicago

One of the puzzles about the equity risk premium is that in the U.S. market, the premium has historically been much greater than standard finance theory would predict. The cause may lie in the mismatch between the actual asset allocation decisions of investors and their forecasts for the equity risk premium. In this review of the theoretical explanations for this puzzle, two questions are paramount: (1) How well does the explanatory theory explain the data? (2) Are the behavioral assumptions consistent with experimental and other evidence about actual behavior? The answers to both questions support the theory of "myopic loss aversion"—in which investors are excessively concerned about short-term losses and exhibit willingness to bear risk based on their most recent market experiences.

A good place to start consideration of what the equity risk premium should theoretically be is a discussion of the risk premium puzzle: The equity risk premium in the U.S. market has historically been much bigger than standard finance theory would predict. Based on the familiar Ibbotson Associates (2001) data of the long-term historical return to U.S. stocks, T-bonds, and T-bills, if you had invested \$1 in the stock market at the end of 1925 (with dividends reinvested), you would now have more than \$2,500; if you had put \$1 in T-bonds, you would have about \$49; and if you had put \$1 in T-bills, you would have only \$17. These differences are much too large to be explained by any reasonable level of risk aversion.

The Puzzle

The formal puzzle, which was posed by Mehra and Prescott (1985), is that, on the one hand, if you ask, "How big a risk premium should we expect?" the standard economic model (assuming expected-utility-maximizing investors with standard additively separable preferences and constant relative risk aversion, A) provides a much smaller number than is historically true, but if you ask, "How risk averse would investors have to be to demand the equity risk premium we have seen?" (that is, how large does A have to be to explain the historical equity premium), the answer is a very large number—about 30. Mehra and Prescott's response was that 30 is too large a number to be plausible.

Why? What does a coefficient of relative risk aversion of 30 mean? If I proposed to you a gamble in which you have a 50 percent chance that your wealth will double and a 50 percent chance that your wealth will fall by half, how much would you pay to avoid the chance that you will lose half your wealth? If you have a coefficient of relative risk aversion equal to 30, you would pay 49 percent of your wealth to avoid a chance of losing half your wealth, which is ridiculous. And that is why I believe that investors do not have a coefficient of relative risk aversion of 30.

Another way to think about this puzzle is that for reasonable parameters (and theorists argue about what those are), we would expect an annual risk premium for stocks over bonds of 0.1 percent (10 basis points).

In the Mehra–Prescott model, the coefficient of relative risk aversion, A, is also the inverse of the elasticity of intertemporal substitution, so a high value of A implies an extreme unwillingness to substitute consumption tomorrow for consumption today, which implies a long regime of high interest rates. We have not, however, observed high interest rates for extended periods of time. Historically, the risk-free rate has been low, barely positive for much of the 20th century. Therefore, part of the risk premium puzzle is the "risk-free-rate puzzle": Why do we not see very high interest rates if investors are so risk averse?

How do we resolve these puzzles? One answer is to "blame the data"—for example, survivorship bias. The returns in the U.S. equity market have been particularly favorable, which may be simply the product of good luck. In other words, some markets have collapsed and disappeared. So, we should not focus all our attention on one market in one period; one market can go awry.

My view is that if we can worry about stock markets going awry, we had better also worry about bond markets going awry. For example, over the long run, bond investors have experienced bad periods of hyperinflation. Bond investors have been wiped out by hyperinflation just as stock investors have been wiped out by crashes. So, if we are going to consider the effect of survivorship bias on the data, we need to look at both sides of the equation—stock and bond returns—which brings us back to a puzzle. If you adjust *both* returns for risk, you still end up with a puzzle.

The part of the puzzle that I want to stress is the contrast between investor investments and investor expectations. I am a behaviorist, and the behavior I find puzzling is how investor expectations fit with their investments.

Throughout the 1980s and 1990s, investors had expectations of a big equity premium, typically in the range of 4 percent to 7 percent. **Table 1** provides the results of a survey of fund managers on their forecasts for U.S. security returns at two points in time almost 10 years apart. Note that investor estimates of the equity risk premium fall into the 4–6 percent range in both years.

Other evidence comes from surveys of forecasts of the 10-year equity risk premium over the last decade (for example, Welch's 2000 survey of economists); again, the estimates are substantial. A problem with such surveys, of course, is that we never know the question the people were really answering. For example, most respondents, including economists, do not know the difference between the arithmetic and the geometric return, and this confusion can skew the results. So, we cannot know precisely what such surveys show, but we can know that the estimates of the equity risk premium are big numbers compared with an estimate of 0.1 percent.

Table 1. Forecasted Returns: Survey of Fund Managers (N = 395)

Fund/Premium	1989	1997
90-day T-bills	7.4%	4.7%
Bonds	9.2	6.9
S&P 500	11.5	10.4
S&P 500 – T-bills	4.1	5.7

Source: Greenwich Associates.

Thaler's Equity Premium Puzzle

The real puzzle is a mismatch between the allocations of investors and their forecasts for the equity risk premium. Many long-term investors—individuals saving for retirement, endowments, and pension fund managers—think the long-term equity risk premium is 4–5 percent or higher yet still invest 40 percent of their wealth in bonds. This phenomenon is the real puzzle.

One version of this puzzle is "Leibowitz's Lament." In a former life, Marty Leibowitz was a bond guy at Salomon Brothers. As a bond guy, his job was to give investors a reason to buy bonds. The numbers Marty was crunching in 1989 for the wealth produced by $1 in stocks versus the wealth produced by $1 invested in bonds could have been those from the Ibbotson Associates studies. The historical risk premium was 6.8 percent, which made the return numbers ridiculous. Marty's analysis showed that if we assume investors may lever, the correct asset allocation at that time would have been at least 150 percent in equities. The puzzle is that investors did not invest this way then and do not do so now.

Theoretical Explanations

Many explanations for the puzzle have been offered, and all the theoretical explanations so far proposed are behavioral—in the sense that they build on the Mehra–Prescott model and then make some inference about investor preferences. In most of these models, the investors make rational choices but their preferences are still slightly different from ones traditionally considered normal.

Epstein and Zin (1989) broke the link that A is equal to the coefficient of relative risk aversion and the elasticity of intertemporal substitution. With their approach, the standard assumptions of expected utility maximization are destroyed.

Constantinides (1990) introduced the theory of habit formation based on the following postulate: If I'm rich today, then I'm more miserable being poor tomorrow than if I'd always been poor. A similar theory of habit formation, the approach of Abel (1990), is based on the concept of "keeping up with the Joneses." Perhaps the leading model at the moment, however, is that of Campbell and Cochrane (1995, 1999), which combines the idea of habit formation with high levels of risk aversion. Together, these behavioral theories appear to explain some, but not all, of the data—including the risk-free-rate puzzle.

Benartzi and I (1995) suggested the theory of loss aversion, which is the idea that investors are more sensitive to market changes that are negative than to those that are positive, and the idea of mental accounting, which adds that investors are more sensitive when they are given frequent market evaluations. Combined, loss aversion and mental accounting produce what we called "myopic loss aversion." We explicitly modeled investors as being myopic, in that they think about and care most strongly about the market changes that occur over short periods, such as a year.

Barberis, Huang, and Santos (1996) used the myopic loss aversion model and added another behavioral phenomenon, the "house money effect" (that is, loss aversion is reduced following recent gains), in an equilibrium model. When people are ahead in whatever game they are playing, they seem to be more willing to take risks. I also documented this effect in some experimental work about 10 years ago. I discovered this phenomenon playing poker. If you're playing with people who have won a lot of money earlier in the game, there is no point in trying to bluff them. They are in that hand to stay.

So, we have a long list of possible behavioral explanations for the equity risk premium. How do we choose from them? We should concentrate on two factors. The first factor is how well the models fit the data. The second factor, and it is a little unusual in economics, is evidence that investors actually behave the way the modeler claims they are behaving. On both counts, the myopic loss aversion arguments that Benartzi and I (1995) proposed do well.

First, all the consumption-based models have trouble explaining the behavior of two important groups of investors, namely, pension funds and endowments. And these two groups hold a huge amount of the equity market in the United States.

Second, I do not understand why habit formation would apply to a pension-fund manager or the manager of the Rockefeller Foundation.

Third, explanations based on high levels of risk aversion do not fit the following situation: Consider these gambles. Gamble 1: You have a 50 percent chance to win $110 and a 50 percent chance to lose $100. Gamble 2: You have a 50 percent chance to win $20 million and a 50 percent chance to lose $10,000. Most people reject Gamble 1 and accept Gamble 2. Now, those two preferences are not consistent with expected utility theory. To be consistent with expected utility theory, if you reject the first gamble, you must also reject the second gamble. This inconsistency between behavior and utility theory is a problem for all the models except those that incorporate loss aversion and "narrow framing." In narrow framing, people treat gambles one at a time.

In Thaler, Tversky, Kahneman, and Schwartz (1997), we reported on some experiments to determine whether investors actually behave the way our myopic loss aversion model says they do. In the first experiment, we sat participants down at a terminal and told them, "You are a portfolio manager, and you get to choose between two investments, A and B." One choice was stocks, and the other was bonds, but they were not told that. They were simply shown each investment's returns for the investment period just completed. At the end of every period, the pseudo portfolio managers were instructed to invest their money for the upcoming period based only on the prior-period returns for A and for B. So, they made an asset allocation decision every period. The participants were paid based on the amount of wealth their portfolio had earned at the end of the experiment.

To test the effect of how often investors receive feedback, in various runs of the experiment, we manipulated "how often" the participants were able to look at the return data. In the learning period, the participants learned about the risk and returns of the investments over time. One group of participants received feedback the equivalent of every six weeks, which led to a lot of decision making. Another group made decisions only once a year. So, the first group was working in a condition of frequent evaluation, whereas the second group was receiving exactly the same random feedback as the first one but the returns for the first eight periods were collapsed into a single return. A third group was given a five-year condition. We also had an "inflated monthly" condition in which we increased returns by a constant over the 25-year period that was sufficient to create periods with never any losses. Over the 25 years, 200 decisions were being made in the most frequent condition and 5 in the least frequent condition.

When that part of the experiment was completed and the participants had enjoyed plenty of opportunity to learn the distribution patterns, we instructed them to make one final decision for the next 40 years. Outcomes were "yoked" to assure that all manipulations had the same investment experience.

Our hypotheses were, first, that more frequent reports would induce more risk aversion, resulting in an increased allocation to bonds and, second, that shifting the returns of both assets up to eliminate losses would make stocks relatively more attractive. **Table 2** presents the results.

Table 2. Effect of Frequency of Feedback: Allocation to Bonds

Feedback Group	Number	Mean
A. Final decisions		
Monthly	21	59.1%
Yearly	22	30.4
Five year	22	33.8
Inflated monthly	21	27.6
B. Decisions during the last five "years"		
Monthly	840	55.0%
Yearly	110	30.7
Five year	22	28.6
Inflated monthly	840	39.9

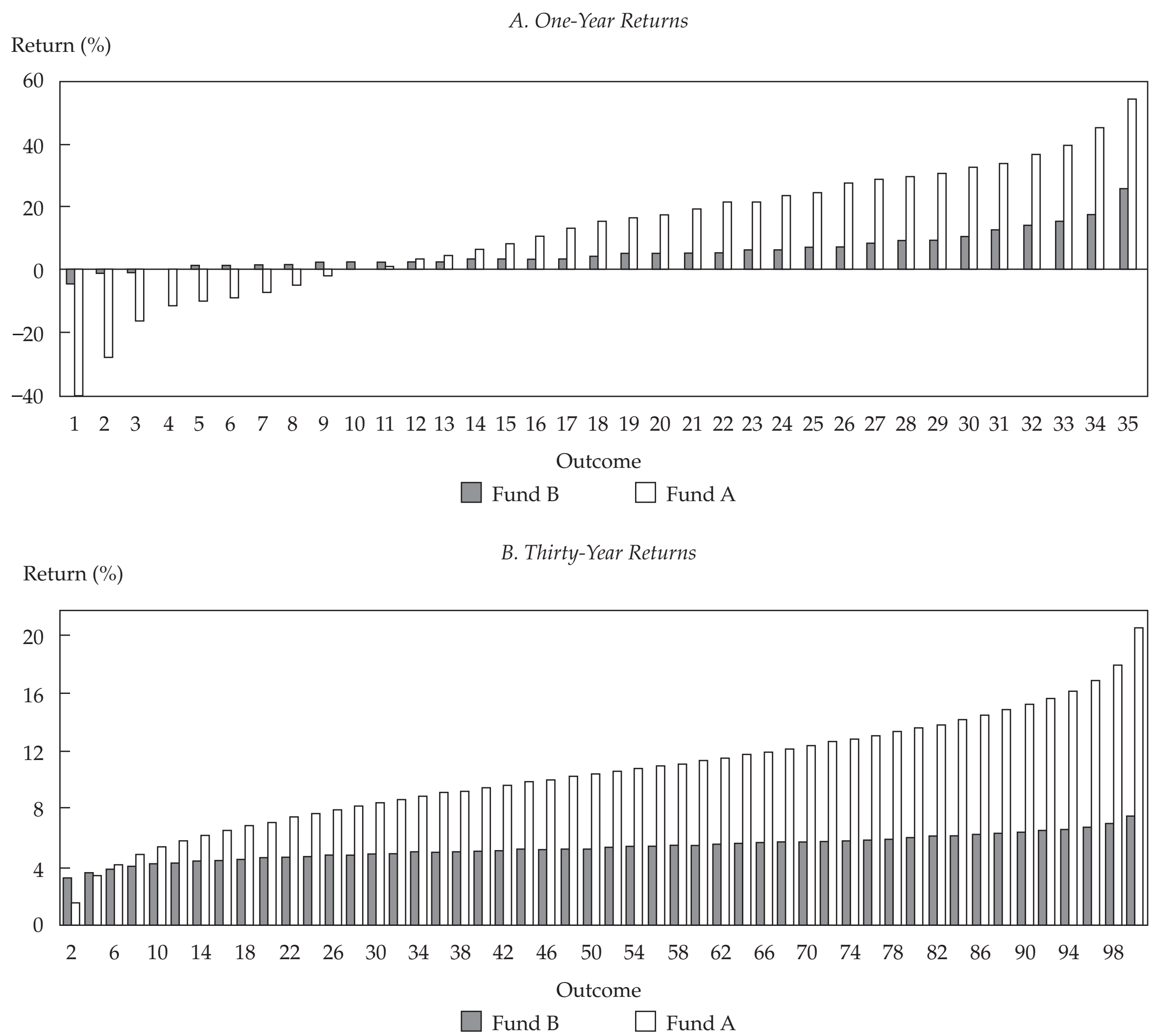
As you can see, participants involved in the monthly condition (the most frequent decision-making condition), on average, chose to invest 60 percent of their money in bonds. Participants in the yearly condition chose to invest only 30 percent in bonds. The participants made the most money if they chose 100 percent stocks every period.

We concluded that the more often investors look at the market, the more risk averse they become, which is exactly what our theory suggests. Loss aversion can be mitigated by forced aggregation (to avoid narrow framing), and learning may be improved by less frequent feedback.

Another set of experiments on myopic loss aversion involved 401(k) participants—specifically, staff among University of Southern California employees who had become eligible for the program in the past year. They were shown return data for Fund A (providing higher returns than Fund B but riskier, equivalent to stocks) and Fund B (equivalent to bonds) and then asked how they would allocate their money. One group was given one-year returns and one group was given 30-year returns. **Figure 1** contains the charts presented in which the historical equity risk premium was used. The figure shows the distribution of periodic rates of return that were drawn from the full sample. That is, if this is the distribution you're picking from, what allocations would you make? Possible outcomes are ranked from worst on the left to best on the right. When we showed the participants the distribution of 1-year rates of return for each asset category (Panel A), the average choice was to invest about 40 percent in stocks. Stocks seemed a bit risky to participants under this scenario. When we showed exactly the same data as compounded annual rates of return for a 30-year investment (Panel B), the participants chose to put 90 percent of their money in stocks. The data are the same in both charts, but the information is presented in a different way. Again, we concluded that the amount investors are willing to invest in stocks depends on how often they look at periodic performance.

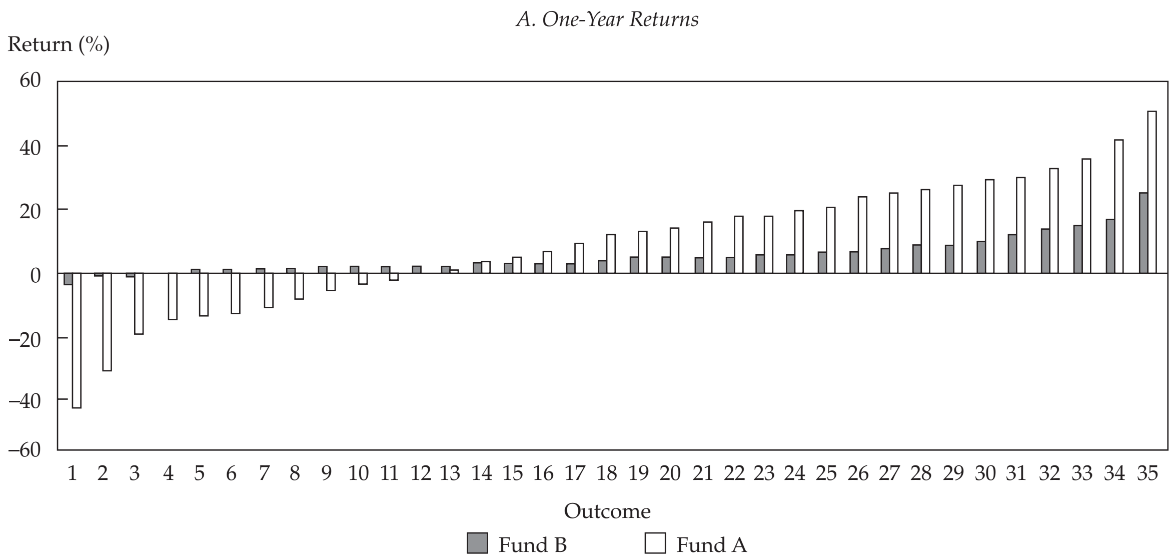
Finally, we showed participants the data with a lower risk premium. As **Figure 2** shows, we divided the equity premium in half. Again, Panel A shows the revised return data for the 1-year periods, and Panel B shows the revised return data for the 30-year period. In this experiment, the participants liked stocks equally well either way they viewed the data. They chose to put about 70 percent of their money in stocks in either scenario. We call this situation a "framing equilibrium." If the equity premium were a number such as 3 percent, investors would put about the same amount of money into the stock market whether they had a long-term perspective or not.

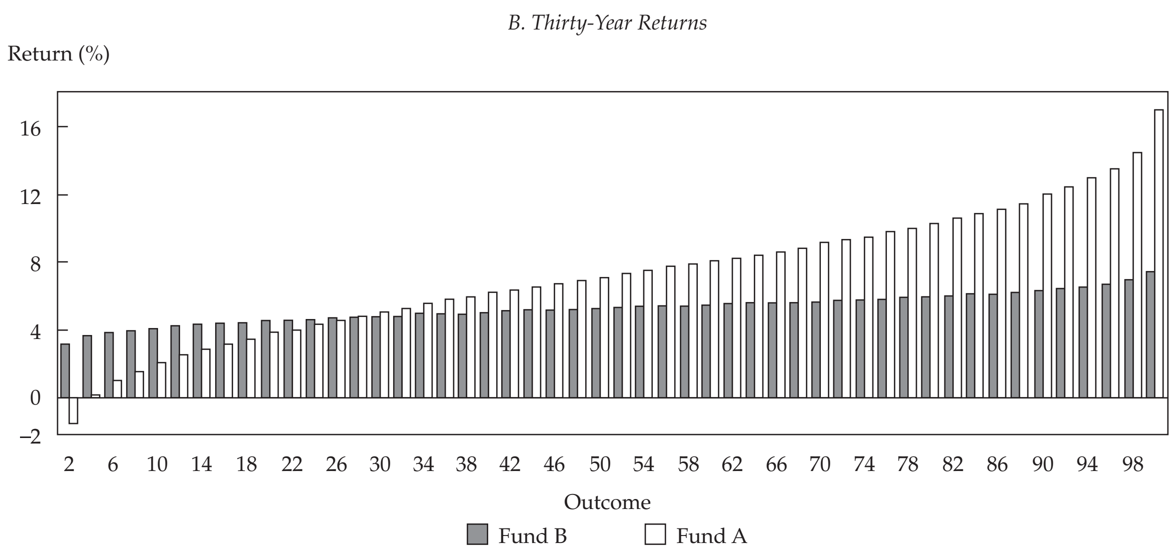
Figure 1. Charts Constructed with Historical Risk Premium of Equity over Five-Year T-Bonds



Notes: Fund A was constructed from the historical returns on the NYSE value-weighted index, and Fund B was constructed from the historical returns on five-year U.S. T-bonds.

Figure 2. Charts Constructed with Half the Historical Risk Premium of Equity over Five-Year T-Bonds





Notes: Fund A was constructed from the historical returns on the NYSE value-weighted index, but 3 percentage points were deducted from the historical annual rates of return on stocks. Fund B was constructed from the historical returns on five-year U.S. T-bonds.

EQUITY RISK PREMIUM FORUM, NOVEMBER 8, 2001

Theoretical Foundations I

Richard H. Thaler

Graduate School of Business
University of Chicago
Chicago

SUMMARY

by Peter Williamson

Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

Richard Thaler was the first to speak to the group and the only one dealing essentially with behavioral finance aspects of the equity risk premium puzzle.

He started by discussing the now familiar Ibbotson Associates data from the *2000 Yearbook*,[1] showing the cumulative value of a dollar invested at the end of 1925 in U.S. stocks, T-bonds, and T-bills, with the stock investment (with reinvested dividends) growing to more than $2,500 while a dollar invested in T-bonds grew to about $49 and one invested in T-bills to only $17 by the year 2000. The difference, he said, is much too large to be explained by any reasonable level of risk aversion. Thaler described analysis showing that a 0.1 percent (10 basis point) per year premium for stocks over bonds would be a reasonable equilibrium risk premium; the actual excess return, however, has been more than 7 percent.

In the Mehra–Prescott (1985) model, the constant relative risk aversion, which would have to be 30 to explain the actual historical excess return of stocks, is also the inverse of the elasticity of intertemporal substitution. A value of 30 is very high and implies very high interest rates. But interest rates since 1925 have not been high enough to justify that risk aversion.

What, then, is the explanation for the high historical excess return on stocks? One possibility is high risk coupled with good luck investing in the U.S. stock market. But bond markets are risky too, and if both stock and bond returns are adjusted for high risk, we are still left with an extraordinary gap in historical returns. Furthermore, most surveys in the 1980s and 1990s of "expert" opinion indicated a high expected equity premium, on the order of 4–6 percent. And current surveys give consistent results. Thaler's observation is that many long-term investors who think that the long-term equity premium is 4–5 percent, or higher, still invest 40 percent in bonds, something that is not easily explained. A firm belief in such a premium should have led to at least a 100 percent allocation to stocks. The size of the historical excess equity return versus the size of the expected equity premium present a puzzle.

Most attempts to explain the puzzle focus on behavioral deviations from the standard assumptions of expected utility maximization. Epstein and Zin (1989) broke the link between the coefficient of relative risk aversion and the elasticity of intertemporal substitution. Constantinides (1990) incorporated "habit formation" to posit rising risk aversion with high returns. Others see further reasons for very high risk aversion; they include Benartzi and Thaler (1995) in their myopic risk aversion model.

Thaler put forward a test for choosing among explanations in the form of two questions: (1) How well does the explanatory theory explain the data? (2) Are the behavioral assumptions consistent with experimental and other evidence about actual behavior?

The answers to both questions, he said, support the myopic loss aversion theory. All the consumption-based models have trouble explaining the behavior of pension funds and endowments. A number of experiments presenting people with choices of different gambles have argued against the high-risk-aversion theory. At the same time, experiments posing a problem of allocating funds between stocks and T-bonds have supported myopic loss aversion. Participants in these experiments were asked to allocate money between stocks and bonds after receiving periodic reports on the investment performance of the two classes. It was found that providing more frequent performance feedback induces greater risk aversion and hence reduces commitment to stocks. Shifting

[1] See Ibbotson Associates (2001).

upward and equally the reported returns for both asset classes such that there were no losses for either led to greater investment in stocks.

A further experiment asking subjects to divide retirement funds between stocks and bonds on the basis of the historical excess return on stocks led to a median 40 percent investment in stocks when the subjects were shown distributions of one-year returns and to a median 90 percent investment in stocks when the distributions shown were of 30-year returns.

When the reported excess return on stocks was cut in half from its historical level and the experiment was repeated, the median allocation to stocks was about 70 percent for the annual and for the 30-year distributions. Thaler referred to this condition as "framing equilibrium." The expected risk premium was now such as to remove the influence of the time period of the performance results studied. The equilibrium was reached at an equity premium of about 3 percent.

His three final conclusions were as follows:

- The historical excess return on equities has been surprisingly high.
- Part of the explanation seems to be that investors are excessively concerned about short-term losses.
- Part may be that willingness to bear risk depends on recent experience, both because past gains provide a psychological cushion against future losses and because high returns can create unrealistic expectations about the future.

Theoretical Foundations II

Clifford S. Asness
AQR Capital Management, LLC
New York City

Historically, high P/Es have led to low returns and low P/Es have led to high returns. So, with today's market at historically high P/Es, there is a real need for rescue. This discussion examines three possible ways in which the market might be saved from decline: high and sustained real earnings growth (which is highly unlikely), low interest rates (which help only in the short term), and investor acceptance of lower future rates of return. The last possibility boils down to a choice between low long-term returns forever and very low (crash-type) returns followed by more historically normal returns. The research presented here found some support for the prescription that investors should accept a 6–7 percent nominal stock return, but evidence indicates that investors do not actually think they are facing such low returns.

My talk does not fit neatly into the category of "theoretical foundations," which makes sense; after all, someone who runs a hedge fund is not going to have much to add to the theoretical foundations that underlie our musings about the equity risk premium, certainly not in this crowd!

My first set of data is intended to be an icebreaker. As a beginning, **Figure 1** plots the S&P 500 Index's P/E from 1881 to 2001. From those data, I created seven P/E buckets, or ranges, covering the 1927–2001 period. For each of the buckets, I calculated the median real annualized stock market return for the following decade and the worst return for any decade. **Table 1** provides the results for each range. We can argue about statistical significance, but these numbers are pretty striking. The infallibility of stocks is typically drawn from a 20-year horizon, so I have cheated by using a 10-year horizon. But the infallibility still exists when stocks are bought at low valuation ratios.

The note "Here Be Dragons" is a caution about what might happen with those P/Es of 32.6 to 45.0. It is a saying (similar to "Terra Incognita") once used on old maps for areas not yet visited. The highest P/E, about 45, was reached in 2000. We don't know what the next 10 years will bring. We still have another eight and a half years to go, but for the one and a half years we have recently visited, the return realization is fitting the chart nicely.

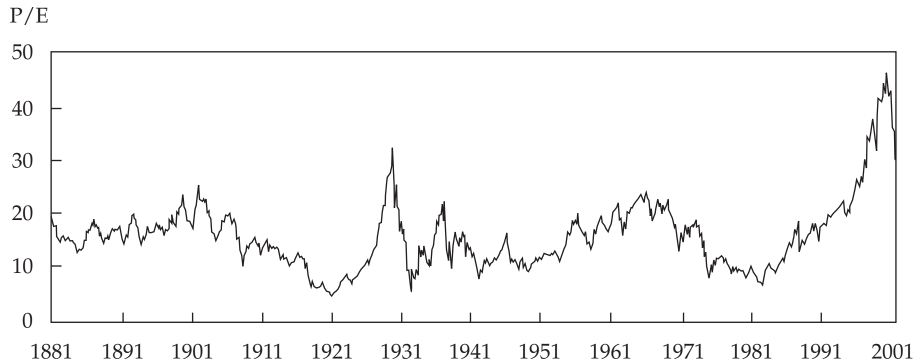
The relationship between starting P/E and subsequent return is potentially exaggerated because much of the strong relationship comes from P/E reversion. What if P/Es did not change?

Figure 2 presents some input into the relationship if P/Es were constant. In the figure, trailing 20-year real S&P earnings growth is plotted for the past 110 years. For this period, annualized real earnings growth averaged 1.5–2.0 percent fairly consistently. Those people who actually still assume 10 percent nominal returns on stocks should recognize that such a return would require 5–6 percent real earnings growth over the next 10–20 years. Such growth has happened only a few times in history, and it has happened only after very depressed market conditions, which we are not really experiencing now, certainly based on the last 10 years. With a 2 percent real earnings growth forecasted, a long-term buy-and-hold investor in the S&P 500 can expect to earn 6–7 percent nominal returns.

What Can Save the Stock Market?

I envision a bad 1920s-type serial in which the villain has tied the stock market to the railroad tracks and a

Figure 1. Historical P/E of the S&P 500, 1881–2001

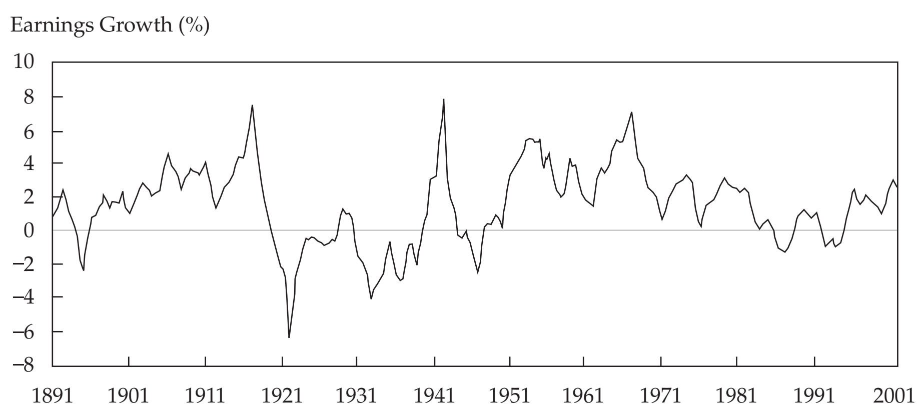


Note: P/E was calculated as the current price divided by the average of earnings for the past 10 years adjusted for inflation.

Table 1. Real Stock Market Return in the Next 10 Years for Historical P/E Ranges of the S&P 500, 1927–2001 Data

P/E Range (low to high)	Median Return (annualized)	Worst Return (total)
5.6 to 10.0	11.0%	46.1%
10.0 to 11.7	10.6	37.3
11.7 to 14.1	10.0	4.1
14.1 to 16.7	9.0	–19.9
16.7 to 19.4	5.4	–23.1
19.4 to 32.6	–0.4	–35.5
32.6 to 45.0	Here Be Dragons!	

Figure 2. S&P 500 Trailing 20-Year Real Earnings Growth, 1891–2001



Note: Earnings growth is annualized.

voice-over is pleading, "What can save stocks?" This question is going to be the organizing principle for my presentation today. I am going to concentrate on three things that could save stocks, although other answers may be possible. One is sustained high real earnings growth—"high" meaning better than the historical average. The second, a Wall Street favorite, is the so-called Fed model, in which the U.S. Federal Reserve lowers interest rates and supports high P/Es. The third is a simple hero—investor acceptance of lower future rates of return in the long term.

HIGH EARNINGS GROWTH. First, something we all probably know: Only if the future brings extra-special, super-high earnings growth are very high starting P/Es justified. For each level of P/E at the start of a 10-year period except very low P/Es (when returns are always on average strong), decades with stronger earnings growth also experienced stronger average stock returns, and even when P/Es were high, if earnings growth came in very high, returns were on average strong. This analysis, however, gives us an *ex post*—not a predictive—measure. If we see extraordinarily high growth in real earnings after 2001, we will probably see high real equity returns. However, the question is: What reason do we now have to be optimistic that such abnormally high earnings growth will occur?

One reason is that higher productivity and technological advancement could create high earnings growth. I think this development is unlikely. Historically, most productivity benefits accrue to workers and consumers, not necessarily to earnings:

> Optimists frequently cite higher growth of real output and enhanced productivity, enabled by the technological and communications revolution, as the source of this higher growth. Yet the long-run relationship between the growth of real output and *per share* earnings growth is quite weak on both theoretical and empirical grounds. (Siegel 1999, pp. 14–15)

So, the first hurdle to believing in high earnings growth is to believe the productivity numbers, and the second is to believe earnings will benefit.

Now, let's look at the empirical data. In **Table 2**, I show the historical relationship between P/E at the beginning of a period and subsequent average 10-year real earnings growth for 1927–2001. The numbers in the 16 quadrants, or 16 buckets, are actual realized real earnings growth over rolling 10-year periods. Each number corresponds to a range of starting P/Es and a range of starting earnings retention rates. Historically, when both the starting P/E and the retention rate are high, the real earnings growth rate is low. On May 30, 2001, the P/E of the S&P 500 was 27.3 and the retention rate was 65.3 percent, which today puts us in the bottom right bucket, so the dragons are off to the right. This position is not promising for saving stocks.

We can interpret Table 2 further. The second way stocks could experience future high earnings growth is through market efficiency. The idea is that in an efficient market, high current P/Es will lead to higher earnings growth because the market must be right. I like this approach. I wish it were the case, but I don't think the data support it well. Table 2 shows no relationship between starting P/E and future earnings growth. In fact, P/E does a lousy job of predicting earnings growth. I will go further. It does no job. In fact, the data show that higher P/Es have not led to higher real earnings growth going forward and lower P/Es have not led to lower growth. The joint hypothesis of constant expected returns and market efficiency should lead to P/Es predicting growth, but the hypothesis doesn't hold, at least in the data.

Finally, Table 2 sheds light on the third reason we might now expect high earnings growth: the idea that high cash retention (low payout ratios) leads to strong growth. Table 2 indicates, however, that the retention rate at the beginning of a period has been *inversely* related to the subsequent 10-year growth in earnings. The impact of the retention rate is incredibly, astronomically backward. Rob Arnott and I have struggled with this phenomenon. We haven't found this impact to be intuitive—it is not a forecasted result—but we do have a few *ex post* theories as to why higher retention rates might lead to lower real growth rates. I'll share three of them quickly.

The first reason relates to company managers. The general idea is that companies retain a lot of cash

Table 2. Average 10-Year Real Earnings Growth, 1927–2001 Data

Starting P/E	Retention Rate (%): Negative to 37.7	37.7 to 44.4	44.4 to 50.3	50.3 to 63.9	63.9 →
5.9 to 10.4	4.1%	2.5%	2.2%	–0.3%	
10.4 to 13.8	4.3	2.5	2.4	0.6	
13.8 to 17.2	3.3	2.5	1.7	–0.4	
17.2 to 26.3	4.3	2.7	0.8	–0.6	
26.3 →					The Dragons Are Here!

to finance projects for behavioral reasons such as empire building. If the cash is for projects, managers are not doing a good job with the cash; they tend to pursue and overinvest in marginal projects, which is reflected in the future lowered growth rates of the company. If this is the explanation, the telecom boom in the late 1990s is going to be the poster child for empire building for all eternity.

Another theory, less plausible in my opinion, is that managers have information that the market doesn't have. It is generally accepted that companies are loath to cut dividends. So, the theory goes that when a company's managers pay high dividends, the market perceives that those managers must have such positive information about the company's prospects that they know they will not have to cut dividends in the future. When managers pay high dividends, they are optimistic because they have information unknown in the market. When managers do not pay high dividends, they must be nervous. So, retention of earnings may reflect a desire by managers to smooth dividends.

The third explanation is that Rob and I are doing something wrong. We have each double-checked our approach and the data repeatedly, but when you get a wacky result, for intellectual honesty, you still have to admit the possibility. That is why I mentioned the dragons, because we are off the charts and into uncharted territory.

If history repeats and higher P/Es and higher retention rates lead to lower real earnings growth and if Rob and I are not making an error, the future does not bode well for real earnings growth.

LOW INTEREST RATES. The second possible way stocks can be saved is low interest rates. **Figure 3** compares the P/E (or the "absolute" value of the S&P 500) with the earnings yield on the S&P 500, E/P, minus the 30-year U.S. T-bond yield, Y (or the "relative" value of the S&P 500); Panel A graphs these indicators for the past 20 years. As you can see, P/E has certainly fallen from its peak in 1999 but is still at the high end of the 20-year range. The equity yield minus the bond yield is one version of the Fed model. In that model, a high value is an indication of good news for the equity market, but for P/E, a high value indicates bad news for the market. Using the Fed model, the situation does not look that bad in 2001; the market is above average on earnings yield minus bond yield.

The same information, but stretching back to 1927, is presented in Panel B of Figure 3. The line for earnings yield minus bond yield is pretty lackluster over the period. When stocks were far cheaper in relation to bonds, stocks used to be bought for their dividend yield; this chart uses earnings yield, but the difference is not really important. As Panel B shows, if Wall Street had a little bit longer perspective, such as looking back to 1927 rather than just 20 years, even the Fed model, or the relative value of the equity market, does not look great.

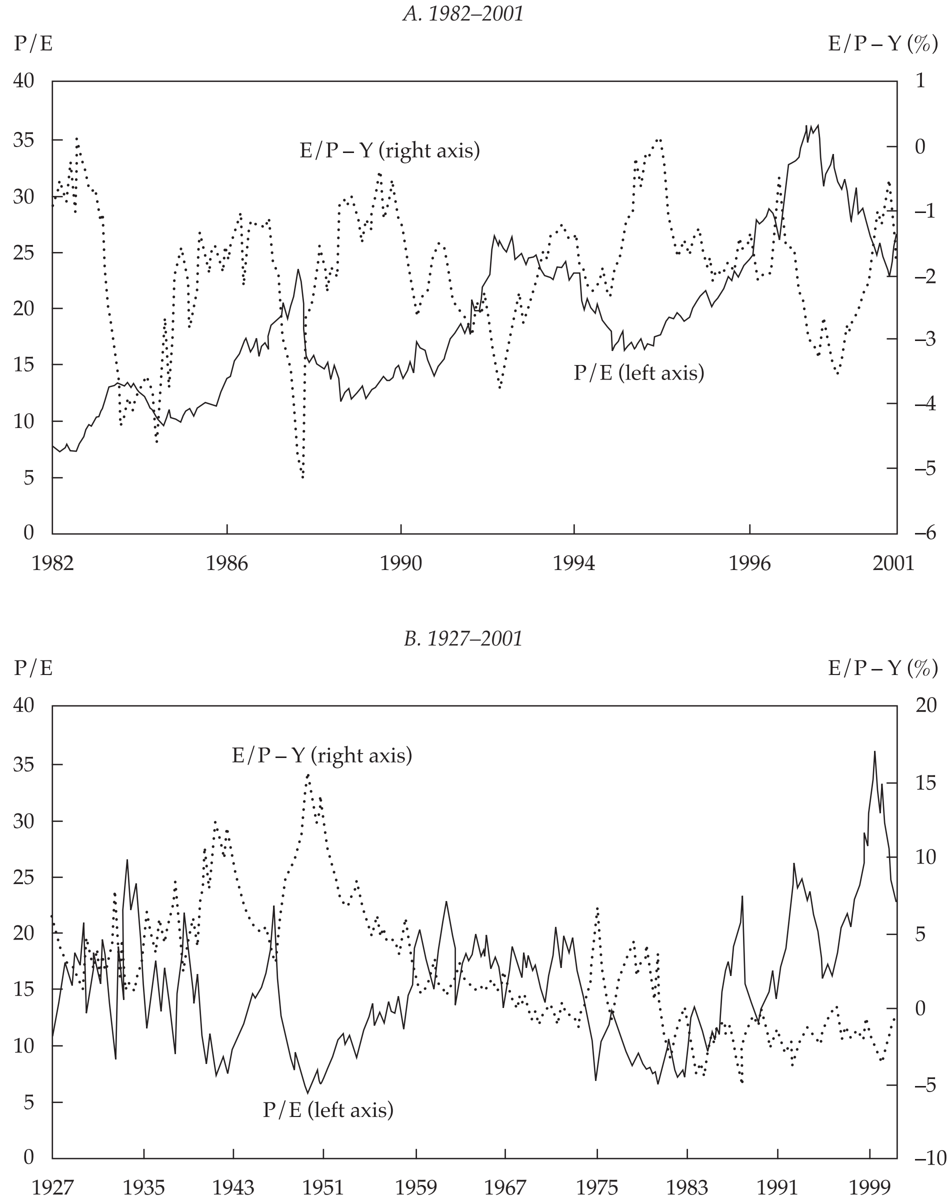
Forgetting the data, note that the Fed model has little theoretical standing. Nominal earnings growth does correlate nicely with expected inflation over time. A lot of confounding biases, such as depreciation methods, accounting choices, and different inflationary environments, affect the P/E calculation (see Siegel 1998). But by and large, the net of those biases is not clear. What does appear fairly clear, however, is that the market does not seem to understand that if you write down the expected return of a stock (dividend yield plus earnings growth), then if inflation and interest rates fall and earnings growth drops along with them, the P/E does not have to change. I think you understand the concept, but it is an idea I have to explain to most people, and I encourage you to do the same. People believe P/Es have to move with interest rates, and they are probably wrong, or at least overstating the relationship.

Figure 4 shows a plot of the S&P 500's realized 20-year volatility divided by the bond market's 20-year realized volatility against the relative yield of the stock market for 1950 to 2001.[1] I chose 20 years because I think of 20 years as a generation, so the ratio plotted from the *x*-axis reflects what a generation thinks in terms of how risky stocks are versus bonds. This ratio is a very robust indicator for each five-year period, up to 30 years. The *y*-axis is the earnings yield on the S&P 500 minus the 10-year bond yield. Whenever you look at long-term autocorrelated relationships like this, you have to carry out many, many robustness tests. This ratio survived every test we came up with.

Note that the *y*-axis is not stock yields; it is stock yields *minus* nominal bond yields. The market clearly does trade on interest rates in the short term. Not many models have a high R^2 at forecasting short-term (less than a one-year horizon) market performance. One indicator that is less pathetic than most in this regard is deviation from the fitted [linear (normal)] line in Figure 4. However, for longer horizons, such as forecasting the next 10-year real stock return, neither the bond yield nor the volatility measures matter. P/E alone forecasts the real stock return. So, an investor with a short horizon cares a lot about this line, but an investor with a long horizon doesn't.

[1] Figure 4 is similar to Figures 7 and 8 in Asness (2000b). In that article, Figure 7 goes back to 1871 and forward to mid-1998 and Figure 8 goes back to 1881 and forward to mid-1998.

Figure 3. S&P 500 "Absolute" and "Relative" Value



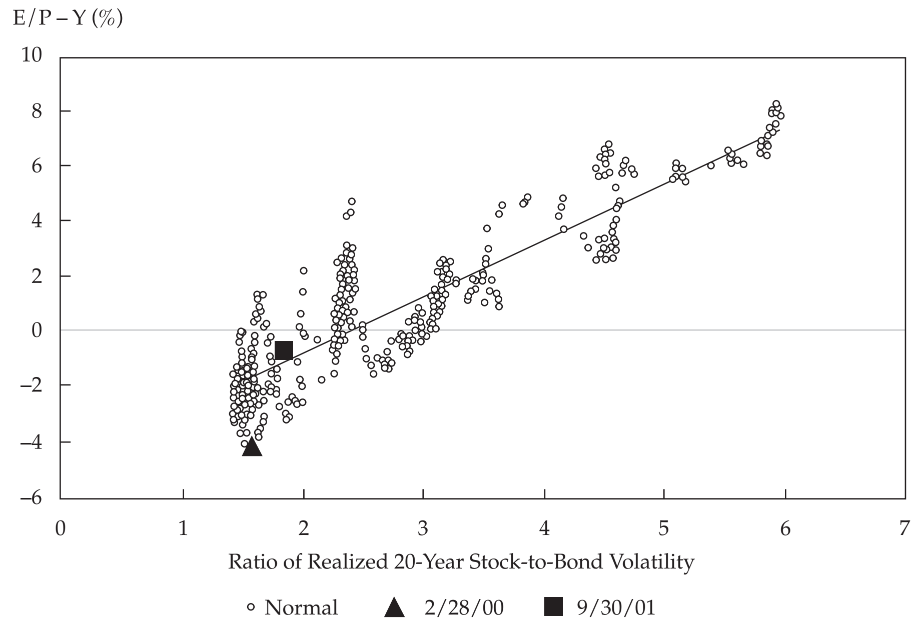
Note: S&P 500 P/E and E/P; 10-year T-bond yield.

I have marked on Figure 4 where we were on February 28, 2000, and on September 30, 2001. On February 28, 2000, short-term traders could not be saved by anything; the solid triangle is well under the line. Stocks were yielding much less than they had historically—even given unusually low volatility and unusually low interest rates relative to the historical average.

The September 2001 mark in Figure 4 indicates that stock performance doesn't look too bad over the very short term. Short-term investors tend to trade on this relationship—that is, trade on the idea that eventually the market moves back to the line for behavioral reasons. Note that this relationship is behavioral because it is based on errors—which does not change what the equity risk premium is in the long term. Over the short term, it is the deviation of E/P from the line that counts; over the long term, it is only the actual E/P that counts.

ACCEPTANCE OF LOW RETURNS. Now for the third possible hero that might save the stock

Figure 4. Stock versus Bond Valuation, 1950–2001



Note: S&P 500 E/P; 10-year T-bond yield.

market: Are investors willing to accept low stock returns? Have they understood the idea that future returns will be low, as so many of us have discussed. A ton of "strategists" will give explanations of why high P/Es are supportable, but then they will follow the explanations with the expectation of 10–12 percent stock returns anyway. That reasoning is questionable to say the least. The first part is believable; no one can say that a 1–2 percentage point return over bonds is bad. But you cannot have your cake and eat it too. Or as I like to say when it comes to Wall Street investors, they cannot have their cake and eat yours too.

What if investors haven't yet realized the conundrum of expectations versus reality? Surveys exist—Campbell Harvey is going to present his survey data [see the "Implications for Asset Allocation, Portfolio Management, and Future Research" session]—that indicate respondents are expecting very high equity returns. Survey data are not always the most reliable, but the data report that the high return expectations are out there. I talk to a lot of pension plans, and not many of them are using assumptions as low as 6–7 percent nominal returns or a 1 percent real equity return over bonds. And investors who plan to retire at 38 because they expect to get a 5 percent equity risk premium and 7 percent real stock returns forever are going to wake up at 62 out of money.

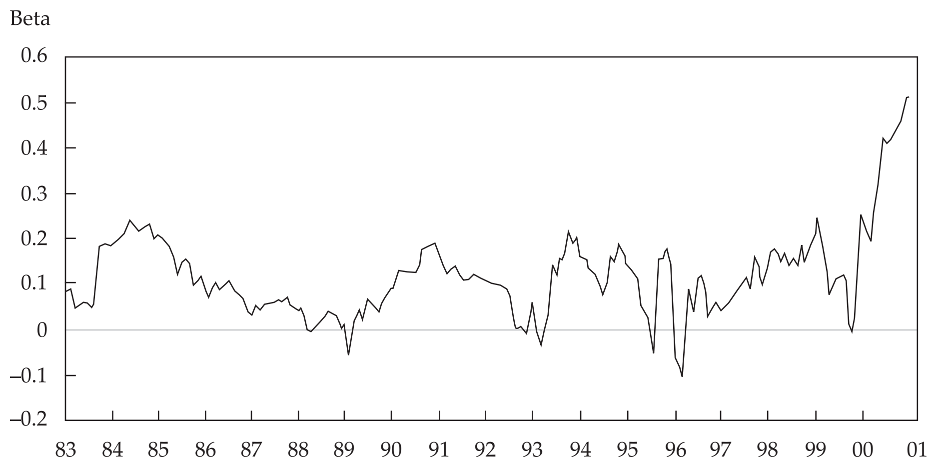
Are investors rationally accepting the low equity risk premium, or are a lot of people still trying to buy lottery tickets?[2] Many have shown that Wall Street's growth expectations are ridiculously optimistic, but investors seem to still believe them. So, Rob and I examined a strategy based on these expectations. We formed a portfolio for a 20-year period that was long high-growth stocks and short low-growth stocks (based on Wall Street's estimates). **Figure 5** shows the rolling 24-month beta of that long–short portfolio from December 1983 to September 2001. For a long time, the beta was mildly positive, but for the past few years, it has been massively positive. It is a dollar long, dollar short 0.5 beta. Figure 5 says that every rally for the past several years has occurred because the high-expected-growth stocks were crushing the low-expected growth stocks. And every market sell-off has been a result of the opposite occurring. Does this pattern indicate rational acceptance of the low equity risk premium or the buying of lottery tickets?

Conclusion

Broad stock market prices are still well above those of most recorded history (and of all history excluding 1999–2000 and just before the crash of 1929). Unless a miracle happens, we must prepare for very low returns as compared with history. In the end, the market offers two choices: low long-term expected

[2] See Statman (2002).

Figure 5. Rolling 24-Month Beta of Long–Short Portfolio, December 1983–September 2001



Note: Except for 2001, dates are as of December.

returns in perpetuity or very bad short-term returns with higher, more normal expected returns in the long run. My personal opinion: Do the events of 1999–2001 strike anyone as a group of rational investors embracing and accepting a permanently low risk premium? If so, I missed it on CNBC.

Theoretical Foundations II

Clifford S. Asness

AQR Capital Management, LLC
New York City

SUMMARY

by Peter Williamson

Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

Clifford Asness made the second presentation of the day, beginning with a graph (**Figure 1**) showing the record of the S&P 500 Index's P/E (current price divided by the average of the preceding 10 years' real earnings) for 1881 to 2001. The highest P/E, about 45, was reached in 2000. **Table 1** reports for each of six ranges of P/E the median real stock market return in the next 10 years and the return for the worst decade. In general, high P/Es led to low subsequent returns and to the worst of the worst decades and low P/Es led to high returns and to the best of the worst decades.

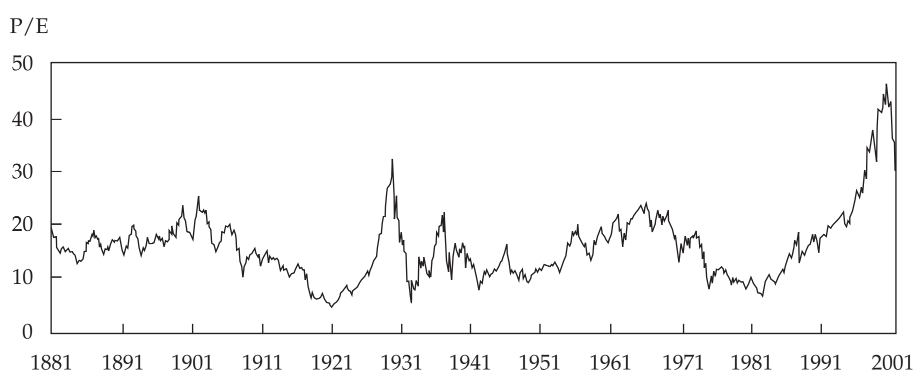
Asness observed that much of what Table 1 shows in terms of consequences of P/E levels comes from P/E reversion. Some would ask: What happens if the ratios do not revert? **Figure 2**, showing S&P 500 trailing 20-year real earnings growth (annualized) helps to answer the question.

Asness next examined three possible ways in which the market might be saved from decline. One is high and sustained real earnings growth. A second (the Wall Street solution) is low interest rates. This is the so-called Fed model. The third way is based on investor acceptance of lower future rates of return. This answer would mean no imminent crash but a less attractive long-term return.

Would high earnings growth work? **Table 2** shows the historical relationship between P/E at the beginning of a period and subsequent average 10-year real earnings growth for 1927–2001. The numbers in the 16 quadrants, or 16 buckets, are actual realized real earnings growth over rolling 10-year periods. Each number corresponds to a range of starting P/Es and a range of starting earnings retention rates. Historically, when both the starting P/E and the retention rate are high, the real earnings growth rate is low.

Why might we expect high earnings growth? Some might say because of increasing productivity and technological advancement. But the relationship between growth of real output and *per share earnings*

Figure 1. Historical P/E of the S&P 500, 1881–2001

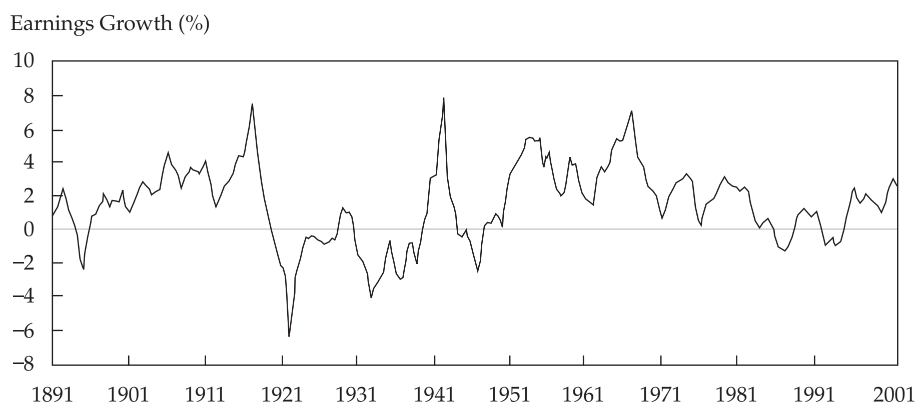


Note: P/E was calculated as the current price divided by the average of earnings for the past 10 years adjusted for inflation.

Table 1. Real Stock Market Return in the Next 10 Years for Historical P/E Ranges of the S&P 500, 1927–2001 Data

P/E Range (low to high)	Median Return (annualized)	Worst Return (total)
5.6 to 10.0	11.0%	46.1%
10.0 to 11.7	10.6	37.3
11.7 to 14.1	10.0	4.1
14.1 to 16.7	9.0	–19.9
16.7 to 19.4	5.4	–23.1
19.4 to 32.6	–0.4	–35.5
32.6 to 45.0	Here Be Dragons!	

Figure 2. S&P 500 Trailing 20-Year Real Earnings Growth, 1891–2001



Note: Earnings growth is annualized.

Table 2. Average 10-Year Real Earnings Growth, 1927–2001 Data

	Retention Rate (%)				
Starting P/E	Negative to 37.7	37.7 to 44.4	44.4 to 50.3	50.3 to 63.9	63.9 →
5.9 to 10.4	4.1%	2.5%	2.2%	–0.3%	
10.4 to 13.8	4.3	2.5	2.4	0.6	
13.8 to 17.2	3.3	2.5	1.7	–0.4	
17.2 to 26.3	4.3	2.7	0.8	–0.6	
26.3 →					The Dragons Are Here!

has been weak. Some would argue that in an efficient market, the current P/E simply *must* be justified by high earnings expectations. Asness thinks the data do not provide much support for this proposition.

A third reason might be that high cash retention leads to above-normal growth. But referring to Table 2, he pointed out that the current retention rate has been significant in relation to real earnings growth and the retention at the beginning of a 10-year period is *inversely* related to the subsequent 10-year growth in earnings! Why should this be? One answer is empire building. Retention of earnings is simply not productive. A second is a desire on the part of managers to smooth dividends. In any case, the current retention rate is about 65 percent, and Table 2 is not encouraging for the future of the stock market.

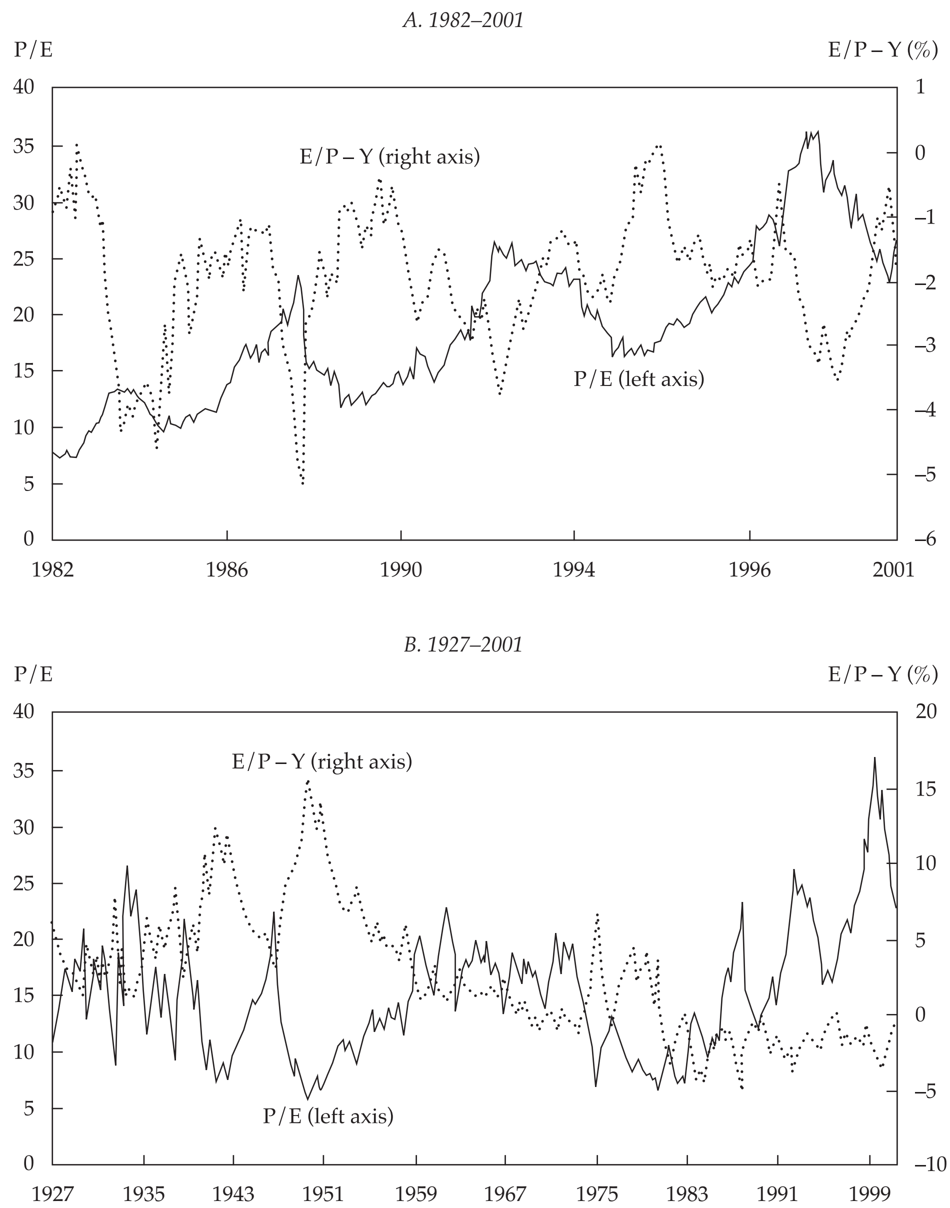
A second way in which the market might be saved is through low interest rates. Can low interest rates save stocks? Panel A of **Figure 3** is encouraging: Interest rates below about 3 percent are very helpful.

But Panel B shows that over a longer historical period, the news is not so good. The indicator seems to be the earnings yield, E/P, less the bond yield, Y. There is evidence that nominal earnings growth is correlated with inflation. The P/E, however, is mostly a real entity, and comparing it with nominal bond yields cannot be expected to have much long-term forecasting power.

Finally, the willingness of investors to accept low stock returns might save the market. Are investors willing to accept low stock returns? Declining volatility may be justifying high P/Es and low returns. **Figure 4** provides support for this idea, although the vertically plotted E/P minus Y mixes real and nominal data.

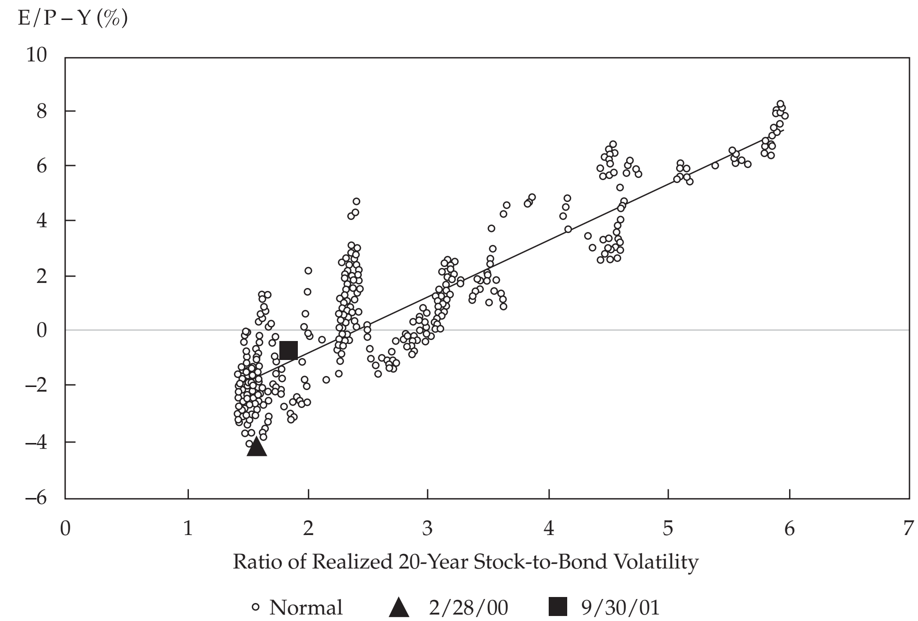
Figure 4 seems to work for the short term. The point on the graph for September 30, 2001, represents a high P/E coupled with a low ratio of realized 20-year stock-to-bond volatility. For the longer term, the E/P is a better guide to real stock returns.

Figure 3. S&P 500 "Absolute" and "Relative" Value



Note: S&P 500 P/E and E/P; 10-year T-bond yield.

Figure 4. Stock versus Bond Valuation, 1950–2001

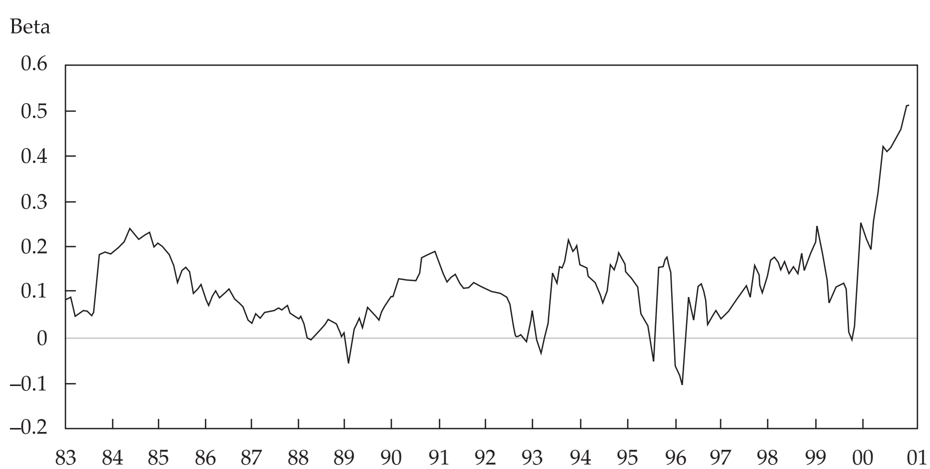


Note: S&P 500 E/P; 10-year T-bond yield.

Acceptance of a 6–7 percent nominal stock return appears not unreasonable. But Asness went on to present evidence that investors do not actually think they are facing such low returns. In this case, when they realize the true prospects, then short- to medium-term returns will be low. To raise the expected return on the S&P 500 by 2 percentage points, the price must fall about 50 percent.

Figure 5 shows the results of forming long–short portfolios (based on Wall Street growth forecasts) in which the portfolios were long the high growers and short the low growers. The rolling 24-month beta of the portfolios has been consistently positive and, in recent years, has been massively positive. Every rally has seen the high-expected-growth stocks crushing the low-expected-growth stocks. Asness thought this

Figure 5. Rolling 24-Month Beta of Long–Short Portfolio, December 1983–September 2001



Note: Except for 2001, dates are as of December.

was not a picture of investors willing to accept lower equity premiums.

In conclusion, he said:

- Broad stock market prices are still well above the levels of most recorded history (and of all history excluding 1999–2000 and just before the crash of 1929). Unless a miracle happens, we must prepare for very low returns as compared with history.
- The choice is between low long-term returns forever and very low (crash type) returns followed by more historically normal returns.

Finally, he offered the following reflection: Do the events of 1999–2001 strike anyone as a picture of rational investors accepting a permanently low risk premium? Answer: No.

Theoretical Foundations: Discussion

Stephen Ross (*Moderator*)
Robert Arnott
Clifford Asness
Ravi Bansal
John Campbell
Bradford Cornell
William Goetzmann
Roger Ibbotson
Martin Leibowitz
Rajnish Mehra
Thomas Philips
Robert Shiller
Richard Thaler

STEPHEN ROSS (Moderator)

I have a few brief comments. They will be brief for two reasons. First, I am confused. Second, even in my confusion, I am in the uncommon position of not having a lot to say. Let me turn first to Cliff Asness's presentation.

What is puzzling to me about Cliff's presentation is that the discussions about P/Es and other broad descriptors of the market seem to me to be discussions that we could have held 100 years ago. The vocabulary would have been a little different, but in fact, not only could we have held the discussion, I suspect these discussions *were* held 100 years ago. So, I don't think we are saying many things differently now than we said back then.

What is troubling to me is that we are supposed to be making progress in the theory. To the contrary, the theory seems to me to be in a wasteland, not just regarding the risk premium but, more generally, in much of finance. We are in a period of time, a phase, in which data and empirical results are just outrunning our ability to explain them from a theoretical perspective. This position is a very tough one for a theorist who used to dine high on the hog when we had derivatives pricing, where theory worked wonderfully. Now, we are interested in theory to explain the problems, which is not working quite so wonderfully.

It seems to me that the issues involving P/Es are issues involving whether or not these processes are mean reverting. Obviously, something like the P/E has to revert to the mean; it is only a yield. Jonathan Ingersoll made a wonderful comment about interest rates and whether interest rates revert or not. He noted that interest rates existed 4,000 years ago in Egypt and if interest rates didn't mean-revert, they would be 11,000 percent today. So, they have to revert.

We know P/Es revert, but they seem to revert very slowly, and we are able to measure the reversion only with great difficulty. Our efforts to measure, for example, stock returns—not actual returns but expected returns—have basically been futile.

I also have some comments about Richard Thaler's presentation. I am often characterized as a defender of the neoclassical faith. I know I am because often I am asked to debate Richard. Sometimes, however, I am characterized as a shill of the neoclassical school. So, it is not clear to me which position I am supposed to represent in the minds of market pundits. But I will say that I feel a bit like one of those physicians with a gravely ill patient to whom I would like to suggest the possible benefits of herbs and acupuncture—alternative medicine. I call for "alternative finance," not behavioral finance as the alternative approach, but an alternative that may offer a little bit of hope.

What I actually think is that our prey, called the equity risk premium, is extremely elusive. We cannot observe the expected return on stocks even with stationarity in time-series data because volatility and the short periods of time we are able to analyze give us little hope of actually pinning down a result. The best hope, from the empirical perspective, seems to lie in cross-sectional analysis, which is not what we are talking about here; we are talking mostly about *time series*, for which we do not have many observations. Cross-sectional analysis says that the excess returns should be the risk premium times the beta. If we could find some way to spread excess returns, maybe through P/Es of individual stocks, then we'd have a better chance of measuring expected return at each point in time—no matter what theory we decide to pin our hopes on.

The theory itself is a myth, and in this case, Richard and I are in complete agreement. Any hope of tickling, or torturing, some reasonable measure of the risk premium out of consumption data is forlorn. It resides in the hope that somehow people are rational.

I love old studies. For example, in one study on consumption data that was done mostly in Holland, the researchers observed shoppers in supermarkets to see what happened when the price of soap was higher than the price of bread. These shoppers did not adjust their marginal rates of substitution to the prices of consumer goods at a single point in time, let alone in the presence of uncertainty and over time. But consumption theory has always said that people would adjust their marginal rates of substitution for prices that evolve over time in a stochastic world.

I am not at all surprised, nor am I troubled, by the fact that we do not find any meaningful correlations between something that we may or may not be able to measure, such as expected return and consumption, and the interplay between them. So, I applaud Richard's view that we ought to consider other reasons to explain why people do what they do.

The real puzzle may be: Why do investors behave the way they do based on what the premiums actually are? And here too, I have to say that even though neoclassical theory is not up to the task of explaining this behavior, and it is not doing a good job, I am not sure that behavioral theory has much more to say to us.

Behavioral anecdotes and observations are intriguing. Behavioral survey work is empirically fortified. But behavioral theory does not seem to have a lot of content yet. In interpreting the study that Richard mentioned about the incompatibility of two gambles, one has to be very careful. Those gambles are incompatible if they are assumed to hold over the entire range of the preference structure. But there is no reason to believe that the gamble holds over the entire range of the preference structure. We do not believe that if the guy wins $20 million he won't take the 110 to 100 gamble. The uniformity requirements in that assumption bend the question. A lot of curious things are going on in those kinds of analyses of behavioral assumptions. And even the richer models, such as those of DeLong and Shleifer (1990), have their own problems.

In summary, I am a theorist and I am confused. I would like theory to make progress, and I would like for us to be able to address some of these issues successfully. I do not really care whether we do so from a neoclassical or another perspective, but I find myself facing an enormous, complicated array of phenomena that come under the heading of "the equity risk premium puzzle" and I'm completely unable to explain any of it.

RAJNISH MEHRA: One thing that Richard Thaler missed was that most of these models do not incorporate labor income. Constantinides, Donaldson, and I (1998) have been doing work in this area for the last couple of years. We have been analyzing the implications of the changes in the characteristics of labor income over the life cycle for asset pricing. The idea is simple: The attractiveness of equity as an asset depends on the correlation between consumption and equity income, and as the correlation of equity income with consumption *changes* over the life cycle of an individual, so does the attractiveness of equity as an asset. Consumption can be decomposed into the sum of wages and equity income. A young person looking forward in his or her life has uncertain future wage *and* equity income; furthermore, the correlation of equity income with consumption will not be particularly high as long as stock income and wage income are not highly correlated. This is empirically the case. Equity will thus be a hedge against fluctuations in wages and a "desirable" asset to hold as far as the young are concerned.

Equity has a very different characteristic for the middle-aged. Their wage uncertainty has largely been resolved. Their future retirement wage income is either zero or fixed, and the fluctuations in their consumption occur from fluctuations in equity income. At this stage of the life cycle, equity income is highly correlated with consumption. Consumption is high when equity income is high, and equity is no longer a hedge against fluctuations in consumption; hence, for this group, equity requires a higher rate of return. The way Constantinides, Donaldson, and I approach this issue is as follows: We model an economy as consisting of three overlapping generations—the young, the middle-aged, and the old—where each cohort, by the members' consumption and investment decisions, affect the demand for, and thus the prices of, assets in the economy. We argue that the young, who should be holding equity, are effectively shut out of this market because of borrowing constraints. In the presence of borrowing constraints, equity is thus exclusively priced by the middle-aged investors, and we observe a high equity premium. We show that if there were no constraints on young people participating in the equity markets, the equity premium would be small.

So, I feel that life-cycle issues are crucial to any discussion of the equity premium.

JOHN CAMPBELL: I want to follow up on the point Rajnish Mehra made because one part of Richard Thaler's talk was normative analysis—the claim that if the equity risk premium is as much as 4–5 percent, long-term investors should obviously hold their money in stocks or even leverage a position to hold their money in stocks. I think that, as a normative statement, that prescription is simply wrong.

I am going to take as a benchmark a model with constant relative risk aversion at some reasonable, traditional low number. The simple formula for the share you should put into stocks if you are living off your financial wealth alone and if returns are distributed identically every period is as follows: the risk premium divided by risk aversion times variance. Suppose the risk premium is 4 percent and the standard deviation of stocks is 20 percent; square that and you get 4 percent. Now, you have 4 percent divided by risk aversion times 4 percent. So, if your risk aversion is anything above 1—say, 3 or 4—you should be putting a third of your money in stocks or a quarter of your money in stocks. It is just not true that with low risk aversion and a risk premium of 4–5 percent you should put all your money in stocks.

So, what's happened to the puzzle? Why don't I get an equity risk premium puzzle when I look at it from this point of view? Well, the key assumption I made is that *you are living off your financial wealth entirely.* It follows then that your consumption is going to be volatile because it will be driven by the returns on your financial wealth. The only way to get an equity risk premium puzzle is that when you look at the smoothness of consumption, you see that it is much smoother than the returns on the wealth portfolio. Why is that?

Rajnish's point is that other components of wealth, such as human capital, are smoother, which is keeping down the total risk of one's position. If you have these other, much smoother human assets, then of course, stocks look very attractive. But I think it's important not to assert that a risk premium of 4 percent should induce aggressive equity investment.

I am reminded of Paul Samuelson's crusade over many years to get people to use utility theory seriously, as a normative concept. He was always trying to combat the view that you should just maximize the expected growth rate of wealth. He got so frustrated by his inability to convince people of this that he finally wrote an article called, "Why We Should Not Make Mean Log of Wealth Big Though Years to Act Are Long" (1979). It is a wonderful article, and the last paragraph says, "No need to say more, I've made my point and but for the last word, I've done so in words of but one syllable." And every word in the article is a one-syllable word except for the last word. It is almost impossible to read, of course, but the point is important: We may not want to use standard utility theory as a positive theory, but we should try to use it as a normative theory, in my view.

ROSS: If you are going to use it as a normative theory, though, you do not have to place your attention entirely on the constant relative-risk-aversion utility function. The broader class of linear risk-tolerance models has exactly the same function (with the addition of deterministic parts to the income stream), except they work in the opposite direction. So, if someone has a linear risk tolerance with a high threshold for that risk tolerance, then the equity risk premium puzzle reappears because the desire to invest is huge even when the risk premium is relatively low.

RICHARD THALER: Let me respond briefly. You have all these models that are based on consumption, and it is true (and I appreciate John Campbell's clarification) that to really understand this puzzle, you need to emphasize consumption smoothing. Otherwise, you get precisely the result that John suggested.

But the puzzle I was informally identifying before refers to other investors that I think have been neglected in much of this theoretical research. Those simulations that Marty Leibowitz was doing were mostly for defined-benefit pension funds, and I did some similar simulations for a foundation that I've been associated with over the years. Foundations have 5 percent mandatory spending rules. Now, if you crunch the numbers and you are investing in bonds, basically you are certain to be out of business in the near future unless you can find some bonds providing a 5 percent real rate of return. With TIPS we were getting close for a while.[1] But if the real interest rate is 2 percent and you have to spend 5 percent, you are soon going to be out of business. One question I have for the theorists, of which I am not one, is: What's the normative model we want to apply for those investors and what does it tell us about the kind of risk premium we should expect?

BRADFORD CORNELL: I have one question: Most of you are involved in one way or another with investment firms, and it is almost a mystery to me that you read academic papers where you see things like "consumption process," "labor income," "risk aversion," and so on, and then you attend an actual investment meeting—where none of these concepts are even remotely talked about. So, how do you bridge the gap between the supposed driving factors of the models and equilibrium returns and the way people who are actually making decisions make them? Is there a way to tie all of it together?

ROSS: There does seem to be a disconnect between the two areas and the two literatures. It is, actually, a fundamental theoretical disconnect. In these markets, with their many institutional players, the institutions are typically run by managers under some type of agency structure. So, there must be some sort of agency model for the people who run the pension funds and other institutions. They are the ones who

[1] Treasury Inflation-Protected Securities; these securities are now called Treasury Inflation-Indexed Securities.

make investment decisions. In the theoretical structures we build that include consumption, we seem to have the view, or maybe just the wishful thinking, that whatever the underlying forces in the economy are, these institutions will simply be transparent intermediaries of those forces, so the agents who are representing these institutions will simply be players in people's desire to allocate consumption across time or will be dealing with the life-cycle problems of people. Some take a Modigliani view that the *people* will adjust their actions around whatever the agents do. The net result is that the actions of the agents and the people coincide, which seems to me overly hopeful. I don't believe it is the case.

CLIFFORD ASNESS: Is it more complicated than saying the description Richard Thaler presented works better for what actually happens in a boardroom than any of the theory? Behavior like myopic loss aversion is true. Many of us have behaved that way. The fact that people make choices in the ways that they do does not have to be proven by a survey. As a manager who has gotten way too much money after a good year and too many redemptions after a bad year, I can tell you people focus on the short term.

I have one comment about Steve Ross's initial response. I don't think anyone would argue about the fact that P/Es are mean reverting. But that is not the exciting part of the puzzle. The exciting part, which is incredibly challenging, is that if we all accept that P/Es are mean reverting to an unconditional mean, what we are disagreeing about is what that unconditional mean either should be, in theory, or is. Mean reversion is a pull toward something, and the open issue is not mean reversion but whether the "right" (meaning unconditional mean) P/E is 15. If it is and we are in the high 20s, then mean reversion is not going to work as a good model for the next year. But the pull was downward for a long time, so I do not think my comments were trying to be insightful about P/Es being mean reverting. They have to be, or else they are unbounded in some direction.

MARTIN LEIBOWITZ: This is just strictly an observational comment, not a theoretical one, and it has to do with the comment about myopic loss aversion or myopic return attraction, which is the other side of the coin. As Cliff Asness said, there's clearly some pain in the short term and also some joy in the short term, depending on your outcomes. But I think what actually happens is that people incorporate a kind of Bayesian revision, that the prospects for the future are based on what have been the most immediate short-term returns.[2] We see it in terms of the flow of funds into, for example, TIPS—a wonderful instrument with a great yield, a +4 percent real rate. We couldn't get anyone to invest in them until, suddenly, we had a 12.76 percent return year in the equity market, at which point, of course, the real return on equities was a lot lower than it had been and money started flowing into TIPS big time. Short-term return is a very powerful force.

THALER: Aren't you too Bayesian, then, to be sarcastic?

LEIBOWITZ: Yes, Bayes would recoil because in the fixed-income area, this short-term focus is clearly, you know, a kind of nuttiness, although there's something to it. It does show that real rates can decline. I think some people were thinking: Why were we stuck with real rates in the area of +4 percent? So, myopic loss aversion is not totally irrational, even in the fixed-income area. In the equity area, where the risk premium is so elusive and unmeasurable, I think that investors do place a lot of weight on these myopic results, and not just in the short term; they are interested in what the data say about the long term.

ASNESS: Can we call it Bayesian without priors?

LEIBOWITZ: I think there are priors. I think there really is a Bayesian division going on.

THALER: I want to explain that in the study by Marty Leibowitz, which I so meanly presented, one of the conclusions he reached is that those 20-year numbers look really, really good but that the plan sponsors, the target audience of Marty's study, were going to have to answer some difficult questions over the next two or three years. This problem is an agency problem. The investment committee or whoever is making the investment decisions will get a lot of heat if lots of losses occur on their watch. Typically, the manager running the pension plan is going to be in that job for only two or three years and will then rotate into another job.

ROSS: That agency problem exacerbates this issue even further. With the distinction between the real economy (represented by Rajnish Mehra and John Campbell) and the financial markets, the transmission

[2] Bayes' Law determines a conditional probability (for example, the probability that a person is in a certain occupation conditional on some information about that person's personality) in terms of other probabilities, including the base-rate (prior) probabilities (for example, the unconditional probability that a person is in an occupation and the unconditional probability that the person has a certain personality).

mechanism through institutions becomes even more difficult to explain. Are those who run institutions subject to a variety of psychological vagaries of this sort? Why, if this is an agency problem, has it been so poorly solved to date? It seems to throw up even more theoretical puzzles for us.

LEIBOWITZ: Just a real quick response. That research of mine that Dick Thaler mentioned actually spurred a whole series of papers in which we looked at all kinds of reasons why people would not be 100 percent in stocks. We looked at it from all kinds of different angles—both theoretical and empirical—and we always kept getting this kind of lognormal type of distribution with nice, beautiful tails; it was pretty weird never to see underperformance over long periods of time.

The only conclusion we could finally come to was that, basically, as people peer into the future, they see risk. They are not talking about something with volatility characteristics. They are not talking about return that behaves in a linear fashion. But they see something out there that, basically, fundamentally, scares them. They can't articulate it, but it keeps them from being 100 percent in stocks.

CAMPBELL: I want to defend the relevance of consumption, even in a world with both behavioral biases and agency problems. It would be ludicrous to deny the importance of those phenomena, but even in a world with those phenomena playing a major role, consumption should have a central role in our thinking about risk in financial markets. In the long run, consumption drives the standard of living, which matters to people. So, consumption is a very influential force in investors' decisions.

Can consumption models be applied to endowments, to long-term institutions? I argue that they can, and I have some knowledge of this issue from talking to the managers of the Harvard endowment. Harvard's new president, Lawrence Summers, is trying to make sense of Harvard's spending decisions, which have always been made on an *ad hoc* basis. The endowment maintains very stable spending for a number of years, and then spending rises periodically. Now, in many universities, endowments generally have a smoothed spending rule, so spending levels are linked to past spending levels and the recent performance of the endowment. This rule makes perfect sense if you think that universities get utility from spending but also have some sort of habit formation. It is internal as related to their own history: They hate to cut the budget because it is really painful, the faculty are up in arms, and the students are screaming. And it is related to external situations: They hate to fall behind their competitors. I know that the Harvard endowment managers look very carefully at the management of the Yale endowment, because there's nothing worse than having Yale outperform Harvard. So, habit formation and consumption spending are extremely relevant to endowments. The relationship may be a little more complicated than just saying, "Oh, they have power utility," but you can make sense of the way they think by reference to spending, not only at the micro level but also in terms of the aggregate consumption in the economy.

In the long term, the correlation between consumption growth and the stock market has been quite strong—in the United States and in other countries. And it makes sense. We know that when the economy does well, the stock market does well, and vice versa. There is a link, a correlation, and it represents a form of risk over the longer run.

Aggregate consumption is also an amazingly accurate measure of the sustainable long-term position of the economy. We know that consumption, financial wealth, and labor income are all held together by budget constraints. You can't let your consumption grow indefinitely without some reference to the resources that are available to support it. So, no matter what the behavioral influence is, there is still a budget constraint that is bound to hold consumption, wealth, and income together. You can ask the empirical question when you look at the data: What adjusts to what? If you have a behaviorist's view, you might think that consumption would adjust to the harsh realities of the budget constraint over time. Instead, what seems to happen is that consumption follows a random walk—as if it is set to the level that is sustainable at each point in time. When wealth gets out of line or income gets out of line, they adjust to consumption. So, there's short-term volatility in the financial markets, but when financial wealth is very high relative to consumption, what tends to happen is financial wealth falls. That is just a fact, it does not suggest a particular model, but I think it does suggest the relevance of consumption—together with agency problems and very interesting and important behavioral phenomena—in thinking about the markets.

CORNELL: If consumption is relevant, what type of information would you expect to see flowing through the pipeline of an organization such as TIAA-CREF? How would you expect to see information flowing from the ultimate clients, who are the consumers, into the organization so that the organization can act as the agent on their behalf?

CAMPBELL: Well, TIAA-CREF is running a defined-contribution pension plan. So that, in a sense, information does not have to flow into it. But it seems to me the way to think about defined-benefit pension plans is that they have evolved over a long period of time to reflect the conservatism of the ultimate clients. For example, labor unions negotiate pension arrangements to give their members very stable income in retirement. And even if we accept that agency problems introduce imperfections, it seems to me that the liabilities defined-benefit pension plans have are very stable because of an expressed preference for stable consumption streams.

THALER: The residual claimant to those plans is the company, and the company is supposed to be virtually risk neutral. So, I think the model John Campbell described, which is sort of a habit-formation model, has some plausibility to it as applied to endowments. What is more difficult is to try to use that model in explaining the behavior of the typical plan sponsor of a defined-benefit pension plan.

ROBERT SHILLER: The general public of investors does not, of course, have an economic model like those produced by economists. They do, however, know the definition of stocks and bonds. They know that bondholders get paid first and stockholders are the residual claimants after the bondholders are paid. They know that. The original idea for a stock market was that stockholders are the people who can bear risk and that buying stocks is designed to be a risky contract—which, I think, is very much on investors' minds. So, if we tell them, "Well, in this last century, we were really lucky. Nothing really went wrong. We had five consecutive 20-year periods in which stockholders did really well," I believe that investors then think, rationally, that what we are telling them about low risk for stocks is pretty unconvincing. Investing in stocks is still investing in an asset that was designed for people who can take a lot of risk. There are no promises, and the government isn't going to bail you out if the stock market collapses. The government is perfectly free to throw on a big corporate profits tax; they've moved it up and down. And the shareholder gets no sympathy when the government does so. So, people are rational to be wary, to require a high expected return to take that risk.

ROBERT ARNOTT: I think in this whole discussion of risk premiums we have to be very careful of definitions. In terms of expected returns on stock, there is the huge gap between rational expectation based on a rational evaluation of the sources of return, current market levels, and so forth, versus hope. The investors out there are not investing because they expect to earn TIPS plus 1 percentage point.

And we have a semantic or definitional problem in terms of past *observed* risk premiums, exemplified by the Ibbotson data, between a *normal or unconditional* risk premium, which a lot of the discussion so far seems to have centered on, and the *conditional* risk premium based on current prospects. So, one of the things that we have to be very careful of is that we clarify what we're talking about—past observed risk premiums, normal (unconditional) risk premiums, or conditional premiums based on current prospects.

ROGER IBBOTSON: We have talked mostly about either the behavioral perspective or the classical (or neoclassical) perspective. The classical approach can be interpreted or reinterpreted in many ways as we get more and more sophisticated in our understanding of what the risk aversion might be for the predominant people in the market. And we can put behavioral overlays on classical theory. Ultimately, I think this topic is a rich land for research, and I encourage it, but we are not very close now to getting a fix on an estimate for the risk premium. At first, it appeared that theory suggested low risk premiums, as per Mehra and Prescott (1985), but I think at this stage of the game, using classical theory with behavioral overlays, we can't pinpoint the answer.

THOMAS PHILIPS: An idea that ties together many of the discussions associated with the risk premium is the notion of how to estimate something if you don't have a model or if you're not sure what you are doing. The typical answer is to take the historical average or the sample mean. If we stop to consider why investors buy TIPS at certain times and pull out of hedge funds at other times, we find, more often than not, that the answer is grounded in their use (and abuse!) of the sample mean of the historical returns of that asset class. The trouble is that the sample mean is a terrible estimator. It is easy to show that the sample mean can have huge biases; you just have to vary the risk premium a little bit, for example, or have slightly different economic assumptions, and the estimate and reality diverge sharply. But the sample mean does seem to be the driving force behind most people's behavior. What you observe at cocktail parties or working with clients is this enormous drive toward investing in the asset class with the highest historical return. And I believe it is a fundamentally bad way to think about the problem.

MEHRA: I want to say a couple of things in defense of neoclassical economics. First, for psychological vagaries and other behavioral phenomena to affect prices, the effect has to be systematic. Unless these phenomena occur in a systematic way, the behavior will not show up in prices. So, one has to be very careful about saying, "This is how I behave so I should model market behavior that way." Many of our idiosyncrasies may well cancel out in the aggregate.

Second, most of our economic intuition is actually based on neoclassical models. Ideally, new paradigms must meet the criteria of cross-model verification. Not only must the model be more useful for organizing and interpreting observations under consideration, but it must not be grossly inconsistent with other observations in growth theory, business cycle theory, labor market behavior, and so on. So, I think we should guard against this tendency of model proliferation in which one postulates a new model to explain each phenomenon without regard to cross-model verification. A model that is going to explain one part of reality but then is completely inconsistent with everything else does not make much progress. That is my biggest concern.

ROSS: It seems to me also that there is a vocabulary issue at work here. We have heard the phrase "habit formation" used by many people to mean many different things. On the one hand, the term is used by the behavioralists as though it is some kind of psychological phenomenon. On the other hand, John Campbell uses it as a description of the way universities behave. In either case, it is difficult to tell the difference between whether some fundamental underlying costs that universities face produce a behavioral pattern that looks like habit formation on the preference side but might have nothing to do with it or whether the universities' preferences are perfectly independent across time, are intertemporally independent, but the basic cost structure induces a net behavior that looks like they're concerned about what they did in the past or they are concerned about preserving what they did in the past.

The same is true on the behavioral side. It could well be that there is some fundamental psychological underpinning that we can argue for in terms of habit formation. All you are really saying is that, on the preference side, people don't have adequately separable preferences all the time, that there is some induced link between preferences at one point in time and consumption at one point in time and consumption at another time. There may be some substitutability that we are not capturing in the additive case. So, I think that all of these phenomena have the funny and interesting property that both the neoclassical economist and a purely psychological economist, or behavioral economist (I don't know what the proper phrase is anymore), could wind up saying that the reduced form could be the same for both of them. They just have different ways of getting there.

SHILLER: I think the difference between behavioral economics and classical economics is totally a difference of emphasis. The behaviorists are more willing to look at experimental evidence, a broad array of evidence. Indeed, expected utility is a behavioral model; psychologists also talk about expected utility. So, I think the difference is somewhat methodological; it is not a subject matter difference. It is a question of how willing you are to experiment with different variations.

THALER: Well, habit formation is obviously to some extent a description of preferences. Nothing says it's irrational. The simple additive (and separable) model is the easiest to use, so we naturally started with that model. But you could add completely hypo-rational agents who have preferences that change from one period to another, and you could, of course, have agents who are making the so-called Bayesian forecasts that Marty Leibowitz referred to with those same preferences.

ROSS: There are some exceptions, though, like framing or path dependence. Those tend to be time inconsistent, and time consistency is required in what we typically think of as rational models.

WILLIAM GOETZMANN: A lot of interesting theoretical work is going on, but I want to put in a plug for empirics. Theorists have looked at the price behavior of markets and of individual securities, but a lot of the models have this behavioral component, rational or otherwise, at their heart—whether in identifying the marginal investor or what have you. Yet, we have almost no information about how actual investors behave. Organizations have a lot of that information, but it may never see the light of day for our research purposes. We're beginning to see a little bit of this information cropping up here and there (and sometimes companies that allow us to have it are sorry they did). But imagine the ability to take hundreds of thousands of accounts, time series of accounts, identify the people who seem to exhibit myopic loss aversion, and then test to see whether their behavior has any influence on prices. That work would provide a way to identify whether pathologically behaved people have a short-term or a long-term influence on price behavior. In the long run, empirical study is how we are going to be able to answer some of these questions.

RAVI BANSAL: There is a lot of discussion about preferences, and many of the implementations of this theory lead to the result that asset price fluctuations are a result of cost-of-capital fluctuations. The models do not have much room for expected growth rates. The models build on a long-held belief in economics that consumption growth rates and dividend growth rates are very close to being identically and independently distributed (i.i.d.). It is the notion that most people have. I think we need to rethink that idea. A lot of hidden persistent components are in these growth processes; the realized growth process looks like an i.i.d. process, but if these growth rates have a small persistent component, the ramifications are huge. Small persistent components of any of these growth rates would have dramatic implications for how we think about what is causing asset prices to fluctuate. Statistically, there is actually some evidence to support the view that there are some persistent components in both consumption and growth rates. If such components are put into a model, the unforeseen components can explain equity premiums because consumption goes up at the same time dividends go up. News about consumption and dividend growth rates continuously affects perceptions about long-run expected growth rates, which leads to a lot of asset volatility. This channel is important for interpreting what goes on in asset markets.

Behavior is important, clearly, but understanding the dynamics of cash flows, of consumption, is equally, if not more, important. So, in a paper that Amir Yaron and I wrote (Bansal and Yaron 2000), we allowed for that possibility. And we actually show that when you rely on the Epstein–Zin (1989) preference structure and allow for intertemporal elasticity of substitution to be more than 1.0 (which makes intuitive sense to me), then you can actually get the result that during periods of high anticipated consumption growth rates, the wealth-to-consumption ratio rises. So, in terms of the asset markets, asset valuations will rise simply because of higher expected growth rates. When you require the intertemporal elasticity of substitution to be more than 1.0, then when people expect good times, they want to buy assets. I find this quite intuitive. When you allow for this possibility, you can explain through these neoclassical paradigms a lot of the equity premium and volatility in the market. So, focusing on aggregate output growth is a pretty important dimension.

Historical Results I

Jeremy J. Siegel

Wharton School of Business
Philadelphia

Analysis of the very long term in U.S. markets indicates that average real stock market returns have been about 7 percent and average real T-bond and T-bill returns have been about half that figure. Downward bias in the more recent bond returns and upward bias in recent valuations may be skewing the analysis. Valuations have been rising for three possible reasons: declining transaction costs, declining economic risks, and investors learning that stocks have been undervalued on average throughout history. An analysis of the historical relationships among real stock returns, P/Es, earnings growth, and dividend yields and an awareness of the biases justify a future P/E of 20 to 25, an economic growth rate of 3 percent, expected real returns for equities of 4.5–5.5 percent, and an equity risk premium of 2 percent (200 bps).

Table 1 shows historical returns and the equity risk premium (on a compounded and an arithmetic basis) for the U.S. markets from 1802 through September 30, 2001. The last columns display the equity risk premium based on a comparison with U.S. T-bonds and T-bills, which is just the difference between the real return for stocks and the real return for bonds and bills. I broke out these returns and premiums into the three major subperiods since 1802 and also into 20-year post-World War II periods.

When I wrote the book *Stocks for the Long Run* (Siegel 1998), I was struck by the fact that for all the very long periods (and the definition of "long" is more than 50 years), the average real annual stock market return is just about 7 percent a year, maybe a tad under. This return also holds true for the three subperiods 1802–1870, 1871–1925, and 1926–2001 and for the whole 1946–2001 post-WWII period. (By the way, almost all of the inflation the United States has suffered over the past 200 years has come since World War II, and as we economists should not find surprising, stocks—being real assets—were not at all adversely affected by post-WWII inflation). So, 7 percent appears to be a robust measure of the long-term annual real stock return.

For periods of several decades, however, the real return on stocks can deviate quite a bit from that 7 percent average. Some of those extreme periods since WWII include the bull market of 1946–1965, the bear market of 1966–1981, and the great bull market that lasted from 1982 to the end of 1999. From 1982 through 1999, the average real return on stocks was 13.6 percent, which is double the 200-year average.

That recent experience may color investors' estimates of the equity risk premium today. In the roundtable Discussion for the opening session ["Theoretical Foundations"], there was talk about Bayesian updating, and I do believe that investors place greater weight on the more recent past than we economists think they should. Perhaps investors believe that the underlying parameters of the system have shifted or the model or paradigm has changed or whatever, but I think some of the high expectations investors have for future returns have certainly come from the recent bull market. For many investors, their bull market experience is the only experience they have ever had with the markets, which could certainly pose a problem in the future if excess-return expectations are widespread and those expectations are frustrated.

Table 1. Historical Returns and Equity Premiums, 1802–September 2001

	Real Return						Stock Excess Return over			
	Stocks		Bonds		Bills		Bonds		Bills	
Period	Comp.	Arith.	Comp.	Arith.	Comp.	Arith.	Comp.	Arith.	Comp.	Arith.
1802–2001	6.8%	8.4%	3.5%	3.9%	2.9%	3.1%	3.4%	4.5%	3.9%	5.3%
1871–2001	6.8	8.5	2.8	3.2	1.7	1.8	3.9	5.3	5.0	6.6
Major subperiods										
1802–1870	7.0%	8.3%	4.8%	5.1%	5.1%	5.4%	2.2%	3.2%	1.9%	2.9%
1871–1925	6.6	7.9	3.7	3.9	3.2	3.3	2.9	4.0	3.5	4.7
1926–2001	6.9	8.9	2.2	2.7	0.7	0.8	4.7	6.2	6.1	8.0
Post World War II										
1946–2001	7.0%	8.5%	1.3%	1.9%	0.6%	0.7%	5.7%	6.6%	6.4%	7.8%
1946–1965	10.0	11.4	–1.2	–1.0	–0.8	–0.7	11.2	12.3	10.9	12.1
1966–1981	–0.4	1.4	–4.2	–3.9	–0.2	–0.1	3.8	5.2	–0.2	1.5
1982–1999	13.6	14.3	8.4	9.3	2.9	2.9	5.2	5.0	10.7	11.4
1982–2001	10.2	11.2	8.5	9.4	2.8	2.8	1.7	1.9	7.4	8.4

Note: Comp. = compound; Arith. = arithmetic.

Sources: Data for 1802–1871 are from Schwert (1990); data for 1871–1925 are from Cowles (1938); data for 1926–2001 are from the CRSP capitalization-weighted indexes of all NYSE, Amex, and Nasdaq stocks. Data through 2001 can be found in Siegel (2002).

The annual real bond returns provided in Table 1 show an interesting trend. From 1802 through September 30, 2001, the average annual real T-bond return was 3.5 percent, about half the equity return. In the major subperiods, this return has been trending decidedly downward. Beginning in the 19th century, it was nearly 5 percent; it then fell to 3.7 percent in the 1871–1925 period; it was 2.2 percent for the 1926–2001 period; and since the end of WWII, it has been only 1.3 percent. From 1982 onward, as interest rates and inflation have fallen, bonds have produced a much greater real return than average. When I was studying finance in the 1970s, we learned that both T-bill and T-bond real returns were close to zero. Yet, over the past 20 years, those real returns have definitely risen.

When TIPS were first issued, they were priced to yield a real return of 3.5 percent, which is close to the average 200-year long-term real return of bonds.[1] Investors rightfully ignored the low real returns on bonds of the past 75 years (the period made popular by Ibbotson and the standard benchmark for the profession) in determining the TIPS yield. In fact, in 2000, during the stock market boom, TIPS were priced to yield a real return of almost 4.5 percent. Currently, the long-term TIPS yields have fallen back to a 3.0–3.2 percent range, depending on the maturity.

The real returns on T-bills tell the same story as for bonds, although for bills, the return is generally a bit lower. Of course, bills do not generate the capital gains and losses that bonds do, so in the post-WWII period, bill returns have not fluctuated as much as bonds. Note that from 1982 forward, the annual real return for bills is 2.8 percent, far higher than the nearly zero average real return realized in the previous 55 years. In other words, periods as long as a half century can be quite misleading in terms of predicting future returns.

The problem is that while real stock returns were maintaining their long-term historical average real return of about 7 percent, real bond and bill returns were very low over the past 75 years, particularly up to 1980. Recognition of this phenomenon might help us understand why the equity premium has been so high in data from 1926 to the present.

The equity premium calculated for the past 75 years is biased downward for two reasons—bias in bond returns and bias in equity valuations.

Bias in Bond Returns

First, real historical government bond returns were biased downward over the 1926–2001 period. I say so because all the evidence points to the fact that bondholders simply did not anticipate the inflation of the late 1960s and 1970s. Investors would not have been buying corporate and government bonds of 30-year duration with 3.5 percent coupons (as they did in the 1960s) had they had any inkling of the inflation risk. I attribute part of that ill-fated confidence to the fact that few had a complete understanding of the inflationary implications of the shift from a gold-based to a paper monetary standard.

[1] TIPS are Treasury Inflation-Protected Securities; these securities are now called Treasury Inflation-Indexed Securities.

The gold standard was prevalent during the 19th century and much of the early 20th century when prices were stable over the long term. The United States (and most of the rest of the world) went off the gold standard in the early 1930s, but the effect was not immediately apparent. Although we had a pop of inflation following World War II, inflation was quite low up to the mid-1960s. So, in the 1960s, bond buyers were pricing 30-year bonds as if 30 years later their purchasing power would be nearly the same.

As inflation accelerated, bond buyers began to catch on. Bond yields rose, bond prices fell, and real bond returns were severely depressed. Table 1 shows that during the 15-year period from 1966 through 1981, the real return on bonds was a *negative* 4 percent. That period was long, and its effect is to bias downward the real return of bonds over the longer 1926–2001 period. I thus believe we should use higher real returns on fixed-income assets in our forecasting models, returns that are consistent with the real return on TIPS of 3–4 percent.

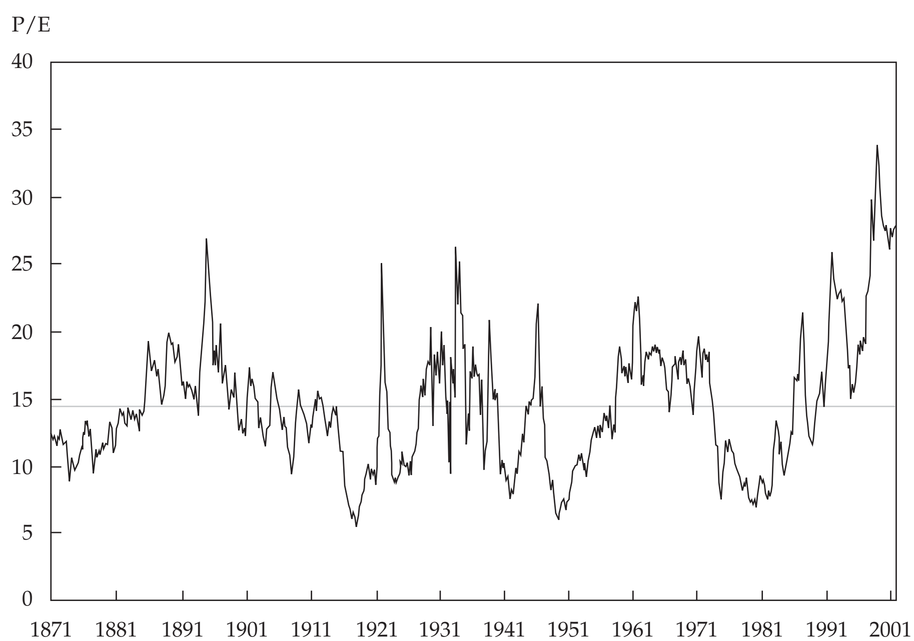
Bias in Equity Valuations

The second reason the equity risk premium is too high is that historical real stock returns are biased upward to some extent. **Figure 1** plots historical P/Es (defined here as current price of the S&P 500 Index divided by the last 12 months of *reported* earnings) from 1871 through September 2001. The straight line is the 130-year mean for the P/E, 14.5. The latest P/E is about 37, surpassing the high that was reached in late 1999 and early 2000. So, the collapse of earnings that we have experienced this year has now sent the P/E to an all-time high.

Let me add a warning here: Part of the incredibly high P/E that we have now is a result of the huge losses in a few technology companies. For instance, JDS Uniphase Corporation wrote down its investments $36 billion in the second quarter of 2001. The write-down was in reported earnings, not in operating earnings, and translates into a 5-point drop in the S&P 500 Index's valuation. So, approach these recent data on reported earnings with caution; $36 billion from just one company's write-down has a huge impact on the market. Some of the technology issues are now essentially out-of-the-money options. When we compute numbers like the P/E of the market, we are adding together all the earnings of all the companies and dividing that into the market value. Because one company has big losses, it sells at option value, but another company with positive earnings can sell at a more normal valuation level. Adding these together might lead to upward biases in P/Es.

Nevertheless, there is no question that P/Es have risen in the past 10 years. If the market's P/E were to return to the historical (since 1871) average of 14.5 tomorrow, the annual real return on equities would fall 50 bps. And if the P/E had always remained at its

Figure 1. Historical Market P/E, 1871–2001



Note: Ending month for 2001 is September.

historical average level but the dividends paid had been reinvested, the annual real return on equities would be 115 bps lower than where it is today. The reason is that much of the real return on equities comes from the times when stock prices are very depressed and the reinvested dividends are able to buy many more shares, boosting stock returns. Much of the historically high returns on stocks has come when the market was extremely undervalued and cash flows were reinvested at favorable prices.

I believe there are several reasons for rising valuation ratios.

- *Declining transaction costs.* One reason for rising valuations is the extensive decline in equity transaction costs. One-way transaction costs were more than 1 percent of the value of the transaction as late as 1975; costs are less than 0.2 percent today.[2] In the 19th and early 20th centuries, the (two-way) costs of maintaining a diversified portfolio could have been as high as 2 percent a year, whereas today indexed funds enable even small investors to be completely diversified at less than 0.2 percent a year.
- *Declining risk.* Another reason for rising valuations may be declining levels of real economic risk as the U.S. economy has become more stable. The increased stability of labor income has enabled workers to accept a higher level of risk in their savings.
- *Investor learning.* We cannot dismiss the fact that investors may have learned about the long-term risk and return characteristics of stocks. If investors have learned that stocks have been chronically undervalued on average, and in particular during recessions and crises, they will be less likely to let prices become undervalued, which leads to higher average valuations.
- *Taxes.* Tax law has become increasingly favorable to equities. And low inflation, because the capital gains tax is not indexed, causes after-tax returns to rise. There has also been a proliferation of tax-deferred savings accounts, although it is not clear whether the taxable or tax-deferred investor sets stock prices at the margin.

[2] Charles Jones of Columbia University discussed declining transaction costs in "A Century of Stock Market Liquidity and Trading Costs" (2001).

Historical Growth Rates

As **Table 2** shows, the real return on stocks has been 7 percent for the 1871–2001 period and is almost exactly the inverse of the P/E. If you divide this period into two subperiods—before World War II and after World War II—the real return for stocks remains roughly 7 percent but the dividend yield drops significantly from the first subperiod to the second, as does the payout ratio, and earnings growth rises.

In his presentation, Cliff Asness mentioned that he could not find in the data an increase in earnings growth when the payout ratio decreased [see "Theoretical Foundations" session]. But his findings are inconclusive because of the confusion between cyclical and long-term trends. In a recession, because dividends remain relatively constant as earnings plummet, payout ratios rise and earnings fall. In the subsequent economic recovery, earnings growth is higher and appears to follow a high dividend payout ratio. But this phenomenon is purely cyclical. Over long periods, a drop in the payout ratio and a drop in the dividend yield are matched almost one-to-one with an increased growth rate of real earnings. I find this relationship comforting because it is what finance theory tells us should happen over long periods of time.

Projecting Real Equity Returns

The link between the P/E and real returns is given by the following equation:

$$\text{Expected future real returns} = \frac{E}{P} + g\left(1 - \frac{RC}{MV}\right),$$

where

E/P = earnings yield, the inverse of the P/E
g = real growth
RC = replacement cost of capital
MV = market value of capital
RC/MV = book-to-market value, or 1/Tobin's q

I will call it the "Tom Philips equation" for projecting the real return of equity (Philips 1999). (I modified the formula somewhat.) According to this equation, if replacement cost does not equal market value, then the link between the P/E and future real returns must be modified. If Tobin's q is not 1, you have to correct

Table 2. Historical Growth Rates, 1871–September 2001

Period	Real Stock Return	Average P/E	Inverse of Average P/E	Real Earnings Growth	Dividend Yield	Real Dividend Growth	Real Capital Gains	Average Payout Ratio
1871–2001	7.06%	14.45	6.92%	1.27%	4.66%	1.09%	2.17%	62.24%
1871–1945	6.81	13.83	7.23	0.66	5.31	0.74	1.32	70.81
1946–2001	7.38	15.30	6.54	2.08	3.78	1.57	3.32	50.75

the earnings yield for the growth rate in the real economy to find expected future real returns. According to the equation, when the market value of equity exceeds the replacement cost of capital, as is the case today, the earnings yield *underestimates* future returns. The reason is that higher equity prices allow companies to fund capital expenditures by floating less equity, thereby reducing the dilution that this investment entails.

How much downward is the earnings yield biased? The Tobin's q on the latest data that I have is about 1.2. It was about 1.5, or even higher, in 2000. With long-run real growth at 3 percent, the last term, $g[1 - (RC/MV)]$, adds about 50 bps to the forecast of real return going forward. It added more in 2000 because Tobin's q was higher. So, if the P/E settles down to 20 (and I believe that a future P/E should not be back at 14 or 15 but that a higher P/E is justified for the reasons I listed previously) and we emerge from the recession, then in terms of a long-term trend, E/P will be about 5 percent. Add the half a percentage point for the cheaper investment to maintain capital and you get a 5.5 percent expected real rate of return for equities. If the P/E is 25 in the future, with 1/25 = 4 percent, adding the growth correction produces an expected real return for equities of 4.5 percent.

Keep in mind that TIPS are now priced to yield a real return of about 3 percent. So, because I believe that the long-run P/E in the market will settle between 20 and 25, the real future equity return is about 5 percent and the equity risk premium will be 2 percent (200 bps).

Historical Results I

Jeremy J. Siegel
Wharton School of Business
Philadelphia

SUMMARY

by Peter Williamson
Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

Jeremy Siegel began his presentation with a table of U.S. market historical returns and excess equity returns for five time periods. **Table 1** provides returns for two very long periods, from the 1800s to September 30, 2001, for three subperiods making up the long periods, and for five post-World War II periods. What is most noteworthy in Table 1 is the geometric (compounded) average real return on stocks of close to 7 percent for the long periods, for both of the major subperiods, and for the 1946–2001 period. Equally significant are the wide deviations above and below 7 percent over quite long periods after World War II, especially since 1982. The geometric average for 1982–1999 was 13.6 percent, and Siegel concluded that this high average return has influenced the high expectations of today's investors, many of whom have little experience of the pre-1982 period.

Table 1 indicates that average real U.S. T-bond returns fell over the years until the post-1982 period, when very high returns resulted from a decline in interest rates. The 1926–2001 period produced a 2.2 percent average real bond return, biased downward by unexpected inflation in the 1960s and 1970s. Siegel observed that TIPS were priced originally in 1997 at about 3.375 percent, with the yield later rising to about 4 percent, and are now down to about 3 percent.[1] This pricing is close to the 200-year average real return on bonds.

[1] TIPS are Treasury Inflation-Protected Securities; these securities are now called Treasury Inflation-Indexed Securities.

Table 1. Historical Returns and Equity Premiums, 1802–September 2001

	Real Return						Stock Excess Return over			
	Stocks		Bonds		Bills		Bonds		Bills	
Period	Comp.	Arith.	Comp.	Arith.	Comp.	Arith.	Comp.	Arith.	Comp.	Arith.
1802–2001	6.8%	8.4%	3.5%	3.9%	2.9%	3.1%	3.4%	4.5%	3.9%	5.3%
1871–2001	6.8	8.5	2.8	3.2	1.7	1.8	3.9	5.3	5.0	6.6
Major subperiods										
1802–1870	7.0%	8.3%	4.8%	5.1%	5.1%	5.4%	2.2%	3.2%	1.9%	2.9%
1871–1925	6.6	7.9	3.7	3.9	3.2	3.3	2.9	4.0	3.5	4.7
1926–2001	6.9	8.9	2.2	2.7	0.7	0.8	4.7	6.2	6.1	8.0
Post World War II										
1946–2001	7.0%	8.5%	1.3%	1.9%	0.6%	0.7%	5.7%	6.6%	6.4%	7.8%
1946–1965	10.0	11.4	–1.2	–1.0	–0.8	–0.7	11.2	12.3	10.9	12.1
1966–1981	–0.4	1.4	–4.2	–3.9	–0.2	–0.1	3.8	5.2	–0.2	1.5
1982–1999	13.6	14.3	8.4	9.3	2.9	2.9	5.2	5.0	10.7	11.4
1982–2001	10.2	11.2	8.5	9.4	2.8	2.8	1.7	1.9	7.4	8.4

Note: Comp. = compound; Arith. = arithmetic.

Sources: Data for 1802–1871 are from Schwert (1990); data for 1871–1925 are from Cowles (1938); data for 1926–2001 are from the CRSP capitalization-weighted indexes of all NYSE, Amex, and Nasdaq stocks. Data through 2001 can be found in Siegel (2002).

Real returns on T-bills averaged 2.8 percent from 1982 to September 30, 2001—a surprisingly high return for those who were accustomed to the popular position a few years ago that bills offered a zero real rate.

The equity excess return, over both bonds and bills, from 1982 to 1999 and from 1926 to 2001 was much higher than it had been for the long periods, and Siegel commented that the 3–4 percent range that characterized the longer periods was probably reasonable for the long term.

Figure 1 shows the historical P/E of the equity market (calculated from the current price and the last 12 months of reported earnings) for 1871 through September 2001. The collapse of earnings recently pushed the ratio up to 37, past the high of 1999. The average P/E over 130 years was only 14.5. Siegel noted that huge losses in only a few technology companies accounted for a lot of this valuation change. Real stock returns have been biased upward with the rise in P/Es. If the market's P/E were to return to the historical (since 1871) average overnight, the real return on equities would fall 50 bps. And if the P/E had always remained at its average level, without reinvestment of the dividends that actually were paid, real returns would be 115 bps lower than where they are today.

Siegel offered three reasons for rising P/E multiples. First is declining transaction costs, which could have accounted for 2 percent a year in the 19th and early 20th centuries and are presently perhaps as low as 0.2 percent for a one-way trade. Second is declining real economic risk. And third is investors learning more about the long-term risk characteristics of common stocks, especially investors realizing that there are periods of significant undervaluation.

Table 2 shows the relationships among real stock returns, P/Es, earnings growth, and dividend yields. For 130 years, the real stock return, averaging 7 percent, has been almost exactly the earnings yield (reciprocal of the P/E). The periods before and after World War II show close to the same 7 percent. Faster post-WWII earnings growth matches the decline in the dividend yield and the rise in retained earnings. Siegel noted that this long-term relationship between payout and growth is in accord with theory, but over short periods, the change in earnings growth does not always accompany a change in dividend yield.

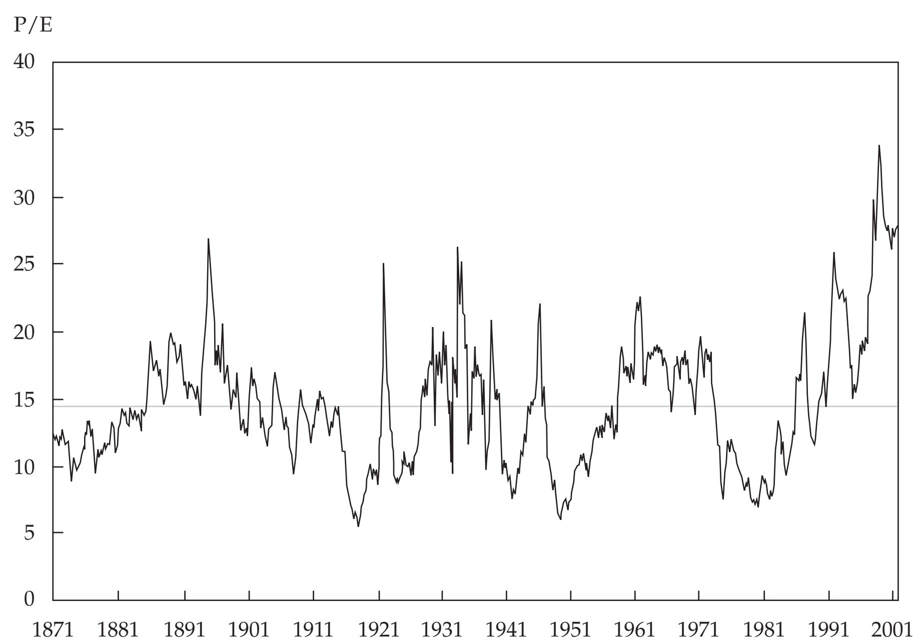
The link between P/E and real returns is given by

$$\text{Expected future real returns} = \frac{E}{P} + g\left(1 - \frac{RC}{MV}\right),$$

where

E/P = earnings yield, the inverse of the P/E
g = real growth
RC = replacement cost of capital
MV = market value of capital
RC/MV = book-to-market value, or 1/Tobin's q

Figure 1. Historical Market P/E, 1871–2001



Note: Ending month for 2001 is September.

Table 2. Historical Growth Rates, 1871–September 2001

Period	Real Stock Return	Average P/E	Inverse of Average P/E	Real Earnings Growth	Dividend Yield	Real Dividend Growth	Real Capital Gains	Average Payout Ratio
1871–2001	7.06%	14.45	6.92%	1.27%	4.66%	1.09%	2.17%	62.24%
1871–1945	6.81	13.83	7.23	0.66	5.31	0.74	1.32	70.81
1946–2001	7.38	15.30	6.54	2.08	3.78	1.57	3.32	50.75

Tobin's q is currently about 1.2, and the long-run growth rate, g, is about 3 percent, so the term $g[1 - (RC/MV)]$ adds about 0.5 percentage point to the E/P term. At a P/E of 20, appropriate for today, the expected real return is about 5.5 percent. At a P/E of 25, it is 4.5 percent. With the TIPS return at about 3 percent and a P/E of 20 to 25, Siegel's equity risk premium is about 2 percent (200 bps).

Historical Results II

Bradford Cornell
University of California
Los Angeles

The basic investment and constant-growth models, used with some justifiable simplifying assumptions about the U.S. market, indicate that the earnings growth rate cannot be greater than the GNP growth rate because of political forces and that the expected return, or cost of capital, in the long run should unconditionally be about 1.5 times the dividend-to-price ratio plus GNP growth. Adding reasonable assumptions about inflation produces a finding that equity risk premiums cannot be more than 3 percent (300 bps) because earnings growth is constrained by the real growth rate of the economy, which has been in the 1.5–3.0 percent range. In a consideration of today's market valuation, three reasons for the high market valuations seem possible: (1) stocks are simply seen as less risky, (2) valuation of equities is fundamentally determined by taxation, or (3) equity prices today are simply a mistake. A research question that remains and is of primary interest is the relationship between aggregate stock market earnings and GNP.

The very basic investment and constant-growth models from introductory finance courses can be used to interpret the long-run unconditional historical data on returns. So, let's begin with the basic model:

$$\frac{E_{t+1}}{E_t} = 1 + [(b)(ROE)],$$

where

E = earnings
b = the retention rate
ROE = return on equity

So that, with investment at time t denoted by I_t,

$$ROE = \frac{E_{t+1} - E_t}{I_t}$$

and

$$b = \frac{I_t}{E_t};$$

therefore, the growth rate of earnings is

$$(b)(ROE) = \frac{E_{t+1} - E_t}{E_t}.$$

This model implies that the growth rate in earnings is the retention rate times the return on equity, $(b)(ROE)$. In discussing the models, I would like to stress an important point: If you are interpreting the growth in earnings as being the retention rate times the return on equity, you have to be very careful when you are working with historical data. For example, does the retention rate apply only to dividends or to dividends and other payouts, such as share repurchases? The distinction is important because those proportions change in the more recent period. And if you make that distinction, you have to make a distinction between aggregate dividends and per share dividends because the per share numbers and the aggregate numbers will diverge. In working with the historical data, I have attempted to correct for that aspect.

What simplifying assumptions can be made to work with the unconditional data? I have made some relatively innocuous simplifying assumptions. First, that b should adjust until the cost of capital equals the ROE at the margin. To be very conservative, therefore, I will assume that the ROE equals the cost of capital, or expected returns, in the aggregate. The problem that arises is: What if the retention rate times the cost of capital (that is, the minimal expected return on equity), bk, is greater than GNP growth? The second assumption deals with this possibility: I assume bk cannot be greater than GNP growth because political forces will come into play that will limit the ROE if earnings start to rise as a fraction of GNP.

The relationship between aggregate earnings and GNP is one of the research questions that I have been unable to find interesting papers on—perhaps because I have not searched well enough—but I want to bring up the subject to this group. It seems to me that if aggregate earnings start to rise, and Robert Shiller mentioned several reasons why it can happen [see the "Current Estimates and Prospects for Change" session], then tax rates can change, antitrust regulation can change (one of Microsoft's problems probably was that it was making a great deal of money, which is an indication that some type of regulation may be necessary), labor regulation can change, and so forth. And these variables can change *ex post* as well as *ex ante*. So, once a company starts making superior returns using a particular technology, the government may step in *ex post* and limit those returns. The critical research question is how earnings relate to GNP.

The constant-growth model is

$$P = \frac{D}{k-g}$$

or

$$k = \frac{D}{p} + g,$$

where

P = price
D = dividends
k = cost of capital
g = growth rate

What I am going to do is just an approximation because I am going to work with aggregate, not per share, data. I am going to assume that total payouts are 1.5 times dividends.[1] Payouts will probably be lower in the future, but if I work with aggregate payouts, then g should be the growth rate in aggregate potential payouts, which I will characterize as earnings.

One of the implications of the simplifying assumptions I have made, and it relates to the data that Jeremy Siegel just produced ["Historical Results I"], is that the expected returns on stocks should be equal to the earnings-to-price ratio. (In the more complicated equations, you have situations in which the ROE is not exactly equal to expected returns, but for my long-run data, the simplifying assumption that earnings yield equals the expected ROE is fine.) So, with these assumptions,

$$\begin{aligned} P &= \frac{D}{k-g} \\ &= \frac{D}{k-bk} \\ &= 1-(b)\left(\frac{E}{1-b}\right)(k) \\ &= \frac{E}{k} \end{aligned}$$

or

$$k = \frac{E}{P}.$$

A further implication is that if g is constrained to be close to the growth of GNP, then it is reasonable to substitute GNP growth for g in the constant-growth model. The implication of this conclusion is that the expected return, or cost of capital, in the long run should unconditionally be about 1.5 times the dividend-to-price ratio plus GNP growth:

$$k = 1.5\frac{D}{P} + \text{GNP growth}.$$

With this background, we can now look at some of the data.

Earnings and GNP

Figure 1 allows a comparison of dividends/GNP and (after-tax) earnings/GNP for 1950 through July 2001.[2] The data begin in 1950 because Fama believed that the data before then were unreliable. Figure 1 shows that, historically, earnings have declined as a fraction of GNP in this period. My assumption that earnings keep up with GNP works from about 1970 on, but I am looking at the picture in Figure 1 in order to make that conclusion. The ratio of earnings to GNP depends on a lot of things: the productivity of labor, capital, the labor-to-capital ratio, taxes, and (as I said earlier) a host of political forces. Figure 1 shows that earnings have, at best, kept up with GNP.

[1] This choice is based on recent findings by Jagannathan, Stephens, and Weisbach (2000) that we are seeing significant payouts today.

[2] These data were provided by Eugene Fama, who attributed them to Robert Shiller.

Figure 1. S&P 500 Earnings and Dividends to GNP, 1950–July 2001

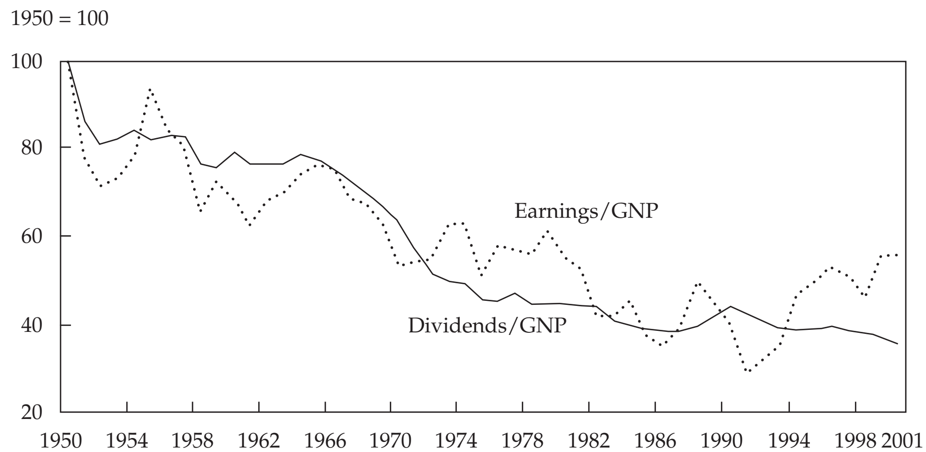


Table 1 gives the arithmetic average data for growth rates in GNP, earnings, and dividends for two periods: 1951–2000 and 1972–2000. (I used the 1972–2000 period because it mirrors the same period shown in Figure 1.) The earnings growth rates are so much more volatile than the dividend growth rates. And because of the volatility effect on arithmetic averages, GNP and earnings exhibit very similar growth rates from the early 1970s to the present. Dividends (and Table 1 shows the growth rate of actual dividends, not payouts) have grown much less than earnings for two reasons: First, dividends are less volatile, and second, dividend substitution is occurring. Corporations are not providing shareholders the same constant fraction of earnings (in the form of dividends) that they were in the past.

Despite the 1972–2000 data, it seems to me that earnings are not going to grow as fast as or faster than GNP in the future. This notion seems to be consistent with long-term historical data, and it fits my view of how politics works on the economy. If you accept that notion, it has immediate implications for the future.

Table 1. Historical Growth Rates of GNP, Earnings, and Dividends: Two Modern Periods

Period/Measure	GNP	Earnings	Dividends
1951–2000			
Mean	3.21%	2.85%	1.07%
Standard deviation	2.89	14.29	4.13
1972–2000			
Mean	2.62%	3.79%	0.96%
Standard deviation	2.94	15.72	3.58

Note: Growth rates for earnings and dividends are based on aggregate data.

First, under any reasonable underlying assumptions about inflation, equity risk premiums cannot be much more than 3 percent (300 bps) because the earnings growth rate is constrained unconditionally in the long run by the real growth rate of the economy, which has been in the range of 1.5–3.0 percent. Second, as **Table 2** shows, for an S&P level of about 1,000, you simply cannot have an equity risk premium any higher than 2 percent, 2.5 percent, or (at most) 3 percent.

Table 2. Value of the S&P 500 Index Given Various Real (Earnings or GNP) Growth Rates and Equity Risk Premiums

Real Growth Rate	Equity Risk Premium						
	2.0%	2.5%	3.0%	4.0%	5.0%	6.0%	7.0%
1.5%	845	724	634	507	423	362	317
2.0%	1,014	845	724	563	461	390	338
2.5%	1,268	1,014	845	634	507	423	362
3.0%	1,690	1,268	1,014	724	563	461	390

Assumptions: Inflation = 3 percent; long-term risk-free rate = 5.5 percent; payout = 1.5(S&P 500 dividend). The S&P 500 dividend used in the calculation was $16.90, so $P = 1.5(\$16.90)/(k - g)$, where k = 5.5 percent (the risk-free rate minus 3 percent inflation plus the risk premium) and g = real growth rate.

Valuation

Why is the market so high? As an aside, and this concern is not directed toward our topic today of the equity risk premium, but I think it is an interesting question: Why is the market where it is today relative to where it was on September 10 or September 9 or just before the events of September 11, 2001? The market then and now is at about the same level. Almost every economist and analyst has said that the September 11 attacks accelerated a recession, that they changed perceptions of risk, and so forth. It is curious to me that such a situation does not seem to be reflected in market prices.

But in general, why is the market so high? I believe three possible explanations exist. One idea, and I consider it a "rational" theory, is that stocks are simply seen as less risky than in the past. I do not know whether the behavioral theories are rational or not, in the sense that prices are high because of behavioral phenomena that are real and are going to persist. If so, then those phenomena—as identified by Jeremy Siegel and Richard Thaler [see the "Theoretical Foundations" session]—are also rational. In that case, the market is not "too high"; it is not, in a sense, a mistake. It is simply reflecting characteristics of human beings that are not fully explained by economic theories.

Another rational explanation has been given less attention but is the subject of a recent paper by McGrattan and Prescott (2001). It is that the valuation of equities is fundamentally determined by taxation. McGrattan and Prescott argue that the move toward holding equities in nontaxable accounts has led to a drop in the relative tax rate on dividends. Therefore, stock prices should rise relative to the valuation of the underlying capital and expected returns should fall. This effect is a rational tax effect.

Both this theory and the theory that stocks are now seen as less risky say that the market is high because it should be high and that, looking ahead, equities are going to have low expected returns, or low risk premiums—about 2 percent—but that investors have nothing to worry about.

The final explanation, which I attribute to John Campbell and Robert Shiller, focuses on the view that equity prices today are simply a mistake. (I suppose mistakes are a behavioral phenomenon, but presumably, they are not as persistent as an underlying psychological condition.) Now, when people realize they have made a mistake, they attempt to correct the behavior. And those corrections imply a period of *negative* returns from the U.S. equity market before the risk premium can return to a more normal level.

Closing

To close, I want to repeat that, to me, the fundamental historical piece of data that needs more explanation is the relationship between the aggregate behavior of earnings and GNP—what it has been in the past and what it can reasonably be going forward. This relationship is interesting, and I look forward to hearing what all of you have to say about it. In my view, it is the key to unlocking the mystery of the equity risk premium's behavior.

EQUITY RISK PREMIUM FORUM, NOVEMBER 8, 2001

Historical Results II

Bradford Cornell
University of California
Los Angeles

SUMMARY

by Peter Williamson
Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

To interpret long-run unconditional features of historical returns, Bradford Cornell began with the following basic model:

$$\text{Earnings growth} = (b)(ROE),$$

where b is the rate at which earnings are retained and ROE is return earned on equity. He noted that we have to be careful when working with historical data in this model. For example, does payout apply only to dividends or to dividends and other payouts, such as share repurchases? And we need to distinguish between aggregate dividends and per share dividends. The two have been diverging.

Now, b should adjust until ROE at the margin equals k, the cost of capital. Cornell assumed that $k = ROE$ in the aggregate, but a critical question is how earnings relate to GNP (see **Figure 1**). What if bk is greater than GNP growth? Cornell assumed that political forces—such as taxation, antitrust laws, and labor regulations—would affect *ex ante* and *ex post* returns in such a way as to bring about

$$(b)(ROE) = bk \leq \text{GNP growth}.$$

The constant-growth model is

$$P = \frac{D}{k-g}$$

or

$$k = \frac{D}{P} + g$$

where

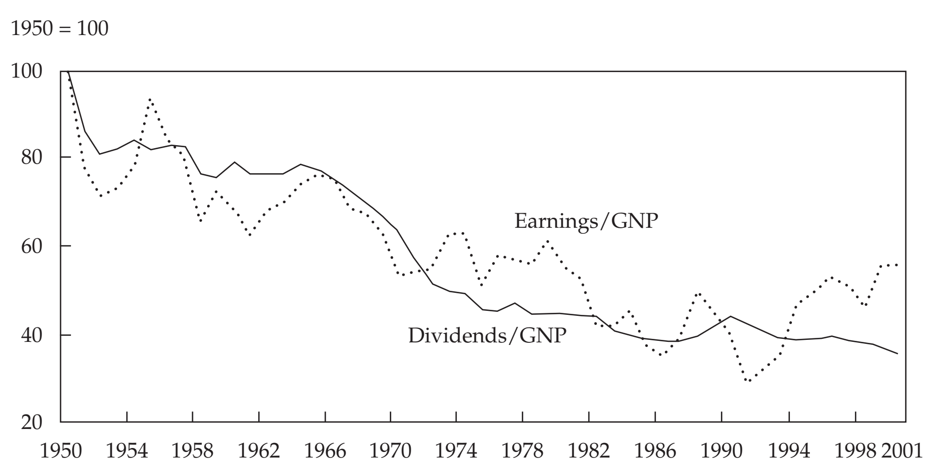
P = price
D = dividends
k = cost of capital
g = growth rate

Because D is equal to $E(1 - b)$ and g is equal to bk, the constant-growth model becomes, in real terms,

$$P = \frac{E}{k}$$

or

Figure 1. S&P 500 Earnings and Dividends to GNP, 1950–July 2001



$$k = \frac{E}{P}.$$

Cornell had so far been working with aggregates, but share repurchases and other nondividend cash flows between companies and their shareholders should be considered. So, he assumed that the total of cash distributions is approximately 1.5*D*.

Finally, if g is constrained to be close to GNP growth, then $k = 1.5(D/P) + \text{GNP growth}$.

Table 1 shows that since 1950, aggregate S&P 500 Index earnings and dividends have both grown less than GNP, although from 1972 to 2000, earnings actually grew faster. (Earnings may appear to have kept up with or even exceeded GNP because of the high volatility of the earnings, which leads to high arithmetic average rates of growth for the same geometric averages.) The dividend growth rates have been lower because of falling payout ratios. The picture conveyed to Cornell is that earnings growth will not exceed GNP growth in the future. (The relationship of earnings to GNP is an interesting measure having to do with, among other things, the productivity of labor and capital.)

Table 1. Historical Growth Rates of GNP, Earnings, and Dividends: Two Modern Periods

Period/Measure	GNP	Earnings	Dividends
1951–2000			
Mean	3.21%	2.85%	1.07%
Standard deviation	2.89	14.29	4.13
1972–2000			
Mean	2.62%	3.79%	0.96%
Standard deviation	2.94	15.72	3.58

Note: Growth rates for earnings and dividends are based on aggregate data.

Finally, putting together an inflation assumption of 3 percent, a long-term nominal risk-free rate of 5.5 percent, and the relationships developed previously produces **Table 2**. An example of the calculations for Table 2 under the assumptions given in the table is as follows: At real growth of 3 percent and with a risk premium of 2.5 percent, $P = [1.5(\$16.90)]/(0.055 - 0.03 + 0.025 - 0.03) = \$1{,}268$. What Table 2 indicates is that as long as g is limited by GNP growth of 1.5–3.0 percent, the equity risk premium must be no more than about 3 percent to be consistent with an S&P 500 of about 1,000.

Cornell asked why, in general, is the market so high? (In particular, he questioned why the market is currently at the level of pre-September 11, 2001, if, as so many say, the events of that date accelerated a recession and changed perceptions of risk.) One explanation is that investors see the market generally as less risky than in the past. Cornell found that explanation rational. Another rational explanation is that the value of equities is fundamentally determined by taxation. Perhaps the market's level is explained by human behavior that is rational but for which we have no explanation. Both propositions imply that there is nothing wrong with current prices. Still, another explanation is that equity prices are a mistake and that a downward correction will produce negative returns before a normal risk premium prevails.

A key subject on which we might focus is the relationships among aggregate earnings, GNP, and other economic variables.

Table 2. Value of the S&P 500 Index Given Various Real (Earnings or GNP) Growth Rates and Equity Risk Premiums

Real Growth Rate	Equity Risk Premium						
	2.0%	2.5%	3.0%	4.0%	5.0%	6.0%	7.0%
1.5%	845	724	634	507	423	362	317
2.0%	1,014	845	724	563	461	390	338
2.5%	1,268	1,014	845	634	507	423	362
3.0%	1,690	1,268	1,014	724	563	461	390

Assumptions: Inflation = 3 percent; long-term risk-free rate = 5.5 percent; payout = 1.5(S&P 500 dividend). The S&P 500 dividend used in the calculation was \$16.90, so $P = 1.5(\$16.90)/(k - g)$, where k = 5.5 percent (the risk-free rate minus 3 percent inflation plus the risk premium) and g = real growth rate.

Historical Results: Discussion

Ravi Bansal (*Moderator*)
Robert Arnott
Clifford Asness
John Campbell
Peng Chen, CFA
Bradford Cornell
William Goetzmann
Campbell Harvey
Roger Ibbotson
Martin Leibowitz
Rajnish Mehra
Thomas Philips
William Reichenstein, CFA
Stephen Ross
Robert Shiller
Jeremy Siegel
Kevin Terhaar, CFA
Richard Thaler

RAVI BANSAL (Moderator)

I would like to make a couple of observations. One aspect that we could consider is the time-series evidence on aggregate consumption volatility. I am thinking of consumption as a way to measure economic uncertainty in the data, but it can be done by other means as well. The time-series evidence suggests that a decline in conditional volatility has without doubt occurred over the past 40 years or so. This reduced volatility suggests that there should be some decline in risk premiums. Another aspect that could be considered, which Steve Ross mentioned earlier, is that much of the risk premium discussion draws on the cross-sectional evidence. It is where a lot of the bodies are buried in terms of understanding where risks are coming from.

We heard some debate in the first session ["Theoretical Foundations"] about whether consumption models are plausible or not, and my view is that consumption data are not in a usable form for explaining the cross-sectional differences, although there may be new evidence in this regard. The consumption models can actually go a long way, however, in explaining the difference in the risk premiums on different assets. In fact, in "Consumption, Dividends, and the Cross-Section of Equity Returns" (Bansal, Dittmar, and Lundblad 2001), we show that if you take the earnings growth or the dividend growth of different portfolios and regress actual growth on historical (say, the past 25–30 years) consumption growth smoothed for 12 or 14 quarters, and if you consider (what has almost become the industry benchmark) 10 portfolios composed on the basis of size, 10 on momentum, and 10 on the book-to-market ratio, you will see that the regression coefficient almost entirely lines up with the *ex post* excess returns on these different assets. So, for example, the regression coefficient of extreme "loser" momentum portfolios is negative and that of "winner" portfolios is strongly positive. The value stocks have a very high exposure to the consumption growth rate, and what I call the loser value stocks—that is, the growth stocks—have a low exposure, which maps the differences in equity premiums also. So, there is a link between consumption and risk premiums, which creates a *prima facie* case for aggregate economic uncertainty, defined as consumption, being a very useful measure.

The cross-sectional evidence also highlights that what determines the risk premium on an asset is "low-frequency" movements (long-run growth prospects) and the exposure of different portfolios to them. Long-run growth prospects are the key source of risk in the economy.

Still, a puzzle remains because the equity market risk premiums have decreased—to 2 percent, 2.5 percent, or so on—and of course, people disagree about what the risk premium is. It seems to me that the right way to approach the equity risk premium puzzle is through the Sharpe ratio on the market. If we argue that the risk premium has fallen, then the Sharpe ratio is quite likely to have fallen also.

CLIFFORD ASNESS: If I understood correctly, Jeremy Siegel was saying that Rob Arnott and I were picking up a short-term mean-reversion effect that is not relevant over the long term. I would like to make two points: First, we were forecasting over several decades and found a pretty strong negative relationship between the retention rate and real earnings growth. So, Jeremy, if this relationship reverses itself in the longer term, we should find a very, very strong positive relationship later. Yes? Second, in the draft of our paper (Arnott and Asness 2002), which has only been seen by Rob, me, and a few people we trusted not to laugh at us, we tested the relationship against other proxies for pure, univariate mean reversion in earnings growth—prior growth, growth versus a 20-year average—added to the equation. We still found over a 10-year horizon (we would like to have used a longer horizon but were trying to avoid having too few periods) that the relationship is very negative. Therefore, I have a hard time believing that over longer periods the relationship is going to be very positive. We did find that simple measures of mean reversion and earnings do not knock out the relationship. I am curious about the data you were using and what you are citing in the longer term. Maybe we can reconcile the apparent differences.

JEREMY SIEGEL: Well, I did not run the tests that you did. I just know that there is very strong evidence from cycles. In recessions, the payout ratio goes very high because companies choose to maintain the same level of dividends they were paying before the recession, and earnings drop. Then, subsequent growth in real earnings is very high because it is happening relative to the slow or negative growth experienced during the recession. The same phenomenon, but in the opposite direction, occurs during and after an economic boom. For these reasons, I found in the two long periods, 1871–1945 and then 1946–2000, that the decrease in the dividend yield during each period was matched by an increase in real earnings growth [see Siegel's Table 2]. The result is the same approximate 7 percent real return in the later period as in the earlier period, which is comforting from a theoretical point of view. Otherwise, we would have to turn to such theories as that "companies that retain more earnings must be totally wasting them because the companies do worse after the earnings retention." That theory is very much a concern.

JOHN CAMPBELL: I want to focus attention on an issue that is in Jeremy Siegel's tables but which he didn't talk about in his presentation—the geometric versus the arithmetic average. This issue is one that causes people's eyes to glaze over. It seems a pedantic thing, like worrying about split infinitives—the sort of thing that pedantic professors do but other people shouldn't bother about. But it is actually an important issue for risky assets because the difference between the arithmetic and the geometric average is on the order of about half the variance, which for stocks, is about 1.5–2.0 percent. That's a big difference, and it shows up in Jeremy's tables very clearly. So, when we're bandying about estimates of the equity premium and we say, "Maybe it's 2 percent; maybe it's 3 percent," clearly the difference between these two averages is large relative to those estimates.

Which is the right concept, arithmetic or geometric? Well, if you believe that the world is identically and independently distributed and that returns are drawn from the same distribution every period, the theoretically correct answer is that you should use the arithmetic average. Even if you're interested in a long-term forecast, take the arithmetic average and compound it over the appropriate horizon. However, if you think the world isn't i.i.d., the arithmetic average may not be the right answer.

As an illustration, think about a two-lane highway to an airport. Suppose that to increase traffic capacity, you repaint the highway so that it has three, narrower lanes. Traffic capacity is thus increased by 50 percent. But suppose the lanes are now too narrow, causing many accidents, so you repaint the highway with only two lanes. Arithmetically, the end result appears to be a great success because the net effect is an increase in capacity. A 50 percent increase in capacity has been followed by only a 33.3 percent decrease. The arithmetic average of the changes is +8.5 percent. So, even though you're back to your starting point, you delivered, on average, an 8.5 percent increase in traffic capacity. Obviously, that's absurd. In this case, the geometric average is the right measure. The geometric average calculates a change in capacity to be zero, which is the correct answer; nothing has been accomplished with the lane rearrangement and reversal.

The difference between the i.i.d. case and the highway story is that in the highway story, you have extreme negative serial correlation. You could get to –33.3 percent in the end only by having had the +50 percent and –33.3 percent occur on a higher base than +50 percent. So, the geometric average is the correct measure to use in an extreme situation like the highway illustration.

I think the world has some mean reversion. It isn't as extreme as in the highway example, but whenever any mean reversion is observed, using the arithmetic average makes you too optimistic. Thus, a measure somewhere between the geometric and the arithmetic averages would be the appropriate measure.

BRADFORD CORNELL: You see that difference in the GNP and earnings data. Although the ratio of earnings to GNP is falling from 1972 on [see Cornell's Table 1], the growth rate of earnings is higher as an *arithmetic* mean precisely for the reason you suggest.

CAMPBELL: Right, right. Mean reversion has the effect of lowering the variance over long horizons, which is, of course, a major theme of Jeremy Siegel's work. And you could imagine taking the geometric average and then adding half of long-term variance to get an appropriate long-term average.

SIEGEL: That's a good point. You discussed in your new book with Lewis Viceira (Campbell and Viceira 2002) whether we should use the arithmetic or the geometric average and that when mean reversion occurs, we perhaps have more reason to use the geometric average. I've found in my data that at 30-year horizons, the standard deviation is about half the number that i.i.d., random walk theory would predict. So, you can actually add half the variance to the geometric average and use that number as the appropriate arithmetic risk premium on long horizons.

CAMPBELL: It was striking that you did focus your presentation on the geometric average. A lot of the other calculations that have been presented here today evolve out of these deterministic models in which no distinction is made between geometric and arithmetic calculations. But I think that when you face randomness, as we do in the world, you have to think about this issue.

ROBERT ARNOTT: I had just a quick follow-up to Cliff Asness's question about the link between payout ratios and earnings growth. I think one possible source of the difference that we're seeing is not the time horizon but that, in Jeremy Siegel's work, if I understand correctly, he is looking at the *concurrent* payout ratio versus earnings growth. Cliff Asness and I are looking at *leading* payout ratio versus *subsequent* earnings growth; in effect, we're using the payout ratio as a predictor of earnings growth.

ASNESS: I'll add one thing to that: What Jeremy Siegel is saying is that a high and falling dividend yield is replaced by increased earnings growth over that period. What Rob Arnott and I are saying is that perhaps there is mean reversion but if you look at the start of that period, the high dividend yield was leading to a high payout ratio, which tended to forecast the declining actual earnings growth. So, I think we're actually saying the same thing. That's a limb I'm going to go out on.

CAMPBELL HARVEY: One thing that completely baffles me is the TIPS yield right now. The breakeven inflation rate for 10 years is about 1.2 percent. Brad Cornell showed that valuation table [Cornell's Table 2] with a reasonable assumption of inflation at 3 percent. And Jeremy Siegel's Table 1 showed the historical data in terms of real bond return, which was significantly higher on average than 1.5 percent. It just seems there's something going on with TIPS that I don't understand. For me, an inflation rate of 1.2 percent over 10 years doesn't seem reasonable.

PENG CHEN: It depends on how you define the equity risk premium. Some define the equity risk premium in relation to the real return earned on TIPS. It's a good observation, but TIPS is a new asset class, started just several years ago. The TIPS market is still immature; the market size is relatively small. So, I'm not sure how much inference you should draw by just looking at the current yield. A current yield of 3 percent doesn't mean that the real interest rate is 3 percent. If you had followed the TIPS market for a while, you probably would have heard rumors that the U.S. Treasury Department is going to suspend issuing TIPS—which would have a huge impact on how TIPS behave in the marketplace. So, we need to be careful when using TIPS as part of the benchmark in trying to calculate the actual risk premium.

SIEGEL: On that issue, I think there is a liquidity issue with TIPS, but it's not that great. I think there's $70, $80, $90 billion worth of TIPS in the market. You can do a trade of fairly decent size at narrow bid–ask spreads. My opinion of what's going on right now is that nominal bonds are seen as a hedge. I think there is fear of deflation in the market. And as in 1929, 1930, and 1931, investors were thinking that if the world markets, such as Japan, were going to be in a bad state, in a deflationary sense, holding nominal assets was the thing to do. So, as a result, the demand for nominal bonds is rising as a hedge against deflation, which will be bad for the economy and for real assets. The difference between TIPS and nominal bonds doesn't measure unbiased expected inflation; there's a negative risk premium in the picture. It is not what we think of as "there's inflation risk so nominal bonds should sell at a higher-than-expected return." I think right now the premium is a negative risk premium as investors use nominal bonds as a hedge against deflationary circumstances in the economy.

STEPHEN ROSS: In all of these computations of the equity risk premium on the stock market, does anyone take into account the leverage inherent in the stock market and the volatility premium that you would get from it? I don't have a clue about the empirical size of that premium. Can someone help me?

MARTIN LEIBOWITZ: I can. If you take the formulas that have been discussed today and translate them to assume a particular risk premium on unlevered assets, you can see how that premium translates into the typical level of leverage in the equity markets. You find that it is exactly what you'd expect. The risk premium that you actually see in the market reflects the leverage that is endemic in the equity market, and if you back out that premium to find the risk premium on unlevered assets, you find that the premium on unlevered assets is less.

RAJNISH MEHRA: The Sharpe ratio won't change. It's invariant to leverage.

LEIBOWITZ: It's exactly linear.

ROBERT SHILLER: Let's remember correctly the McGrattan and Prescott article (2001) that Brad Cornell mentioned. They use a representative agent model, and they compare the late 1950s and early 1960s with a recent year. And they say that because of 401(k)s and similar vehicles, the tax rate on dividends for a representative agent has fallen—from 50 percent in 1950–1962 to 9 percent in 1987–1999. That fall seems to me like an awfully big drop, and I question whether there could have been such a big drop for the representative investor. I wonder if anyone here has looked carefully at their model? Are they right?

SIEGEL: They use the average investor; they don't use the marginal investor. They say that X percent of assets are in a 401(k), and they equate that amount with the marginal rate. My major criticism of the McGrattan–Prescott paper is that we don't know whether the marginal investor is a taxable investor, which would change their results dramatically.

CORNELL: That criticism doesn't mean their results are wrong. We simply don't know.

SIEGEL: We don't know. But I have a feeling that the marginal investor has a much higher tax rate than the marginal investor used to have.

ROSS: Yes, James Poterba told me that his calculations indicate that 401(k)s have far less tax advantage at the margin than one might think. Because of the tax rate "upon withdrawals," those vehicles can be dramatically attacked from a tax perspective. If you make a simple presumption that 401(k)s are simply a way of avoiding taxes, you're missing the point.

THOMAS PHILIPS: I'd like to go back to the equation for expected future real returns that Jeremy Siegel attributes to me: Expected future real returns = Earnings yield + $g \times$ [1 – (Book value/Market value)]. It really is an expression for the expected future *nominal* return. When I derived that equation, I derived it in *nominal* terms. In particular, the growth term, g, is nominal, not real, growth (Philips 1999). When you subtract inflation, you have Expected future real returns = Earnings yield + Nominal growth × [(1 – Book value/Market value) – Inflation]; the last two terms go to approximately zero. You're left with the earnings yield being approximately the real expected return.

In the special case that Brad Cornell talked about, in which the cost of capital and the return on capital are the same, the second term disappears because the book-to-market ratio becomes 1. In that case, the earnings yield is actually the *nominal* expected return. The truth, in practice, lies somewhere in between the two results because some of these quantities will vary with inflation, real interest rates, and the economywide degree of leverage.

The approximation that Brad used is biased up or down depending on where inflation, growth, and the cost of capital relative to the return on capital lie. It's a great first-order approximation, a great historical approximation, but you can be talking about the nominal rate of return instead of the real rate of return when the cost of capital starts coming very close to the return on capital.

SIEGEL: Well, I disagree with you. In your slides, the earnings yield—if you're in equilibrium and book value equals market value equals replacement cost—is an estimate of the real return, not the nominal return. Your equation is extraordinarily useful, but I think we do have to interpret it as the real return.

ROGER IBBOTSON: I'd like to say something about Brad Cornell using aggregate calculations to get an estimate of the equity risk premium. I did some work on aggregate calculations in a paper I wrote with Jeffrey Diermeier and Laurence Siegel in 1984. Relating to merger and acquisition activities, we looked at how best to use cash: For example, do you use cash for dividends or share repurchases? (You could take the same approach for investing in projects.) When you look at which data to use in the context of cash mergers or acquisitions, you can see that the per share estimates are going to be very different from the aggregate estimates because you're buying other companies on a per share basis. Thus, EPS can grow much faster than aggregate corporate earnings.

CORNELL: That's why I like looking at aggregate earnings; it's the whole pot, and you're not as concerned about how things are moving around within the pot or being paid out to shareholders. But even looking at aggregate earnings, and this is based on Bob Shiller's data series going back to 1872, the earnings don't keep up with GNP, despite the greater volatility of earnings; even the arithmetic averages are less. Can you explain that phenomenon? What does it imply for the future?

SHILLER: The national income and product account (NIPA) earnings keep up a lot better. So, it's probably because earnings in the market indexes are not representing the new companies that come into the economy and existing companies' earnings are growing at a slower rate.

SIEGEL: I looked at it very closely. The trend in the ratio of NIPA profits to GDP is virtually zero, the mean being 6.7 percent. You can do a linear regression—any regression—and you get a trend of absolutely zero: The ratio of NIPA profits to GDP has remained constant. Aggregate S&P 500 Index profits have slipped because the S&P 500 back in the 1950s and 1960s represented a much higher percentage of the market's value than it does today. You can look at both aggregate S&P 500 profits and aggregate NIPA profits and see the trends.

MEHRA: I found the same thing in my 1998 paper. The ratio of aggregate cash flows to national income (NI) is essentially trendless. In the afternoon, I'll be talking about the difference when you look at stock market valuation relative to national income [see the "Current Estimates and Prospects for Change" session]. That ratio fluctuates from about 2 × NI to about 0.5 × NI, whereas cash flows, which are the input for all these valuation models, are trendless relative to NI.

KEVIN TERHAAR: I want to go back to the representative investor or the marginal investor and Brad Cornell's first "rational" reason that the market might be high—that stocks are seen as less risky. One thing that hasn't been brought up is that all the discussions so far have focused primarily on the U.S. equity market. To the extent that the marginal investor looks at U.S. equities in the context of a broader portfolio (as opposed to looking at them only in a segmented market), the price of risk (or the aggregate Sharpe ratio) can stay the same while the equity premium for *U.S.* equities can fall. As the behavior of investors becomes less segmented—as they become less apt to view assets in a narrow or isolated manner—the riskiness of the assets can decline. Risk becomes systematic rather than total, and as a result, the compensation for risk falls commensurately.

WILLIAM GOETZMANN: I have a related comment in reference to Brad Cornell's presentation. An interesting aspect was his reference to changes in diversification of individual investors. There's not much empirical evidence on this issue, but it's interesting because we did have a boom in mutual funds through the 1980s and 1990s, with investors becoming more diversified. And the result was that the volatility of their equity portfolios dropped. We saw a similar trend in the 1920s, at least in the United States, through much growth in the investment trusts.[1] We think of trusts as these terrible entities that we clamped down on in the 1930s, but nevertheless, they did provide diversification for individual investors. So, maybe there is some relationship between the average investor's level of diversification and valuation measures of the equity premium.

It's hard to squeeze much more information out of the time-series data because we don't have many booms like I just described. But we might get something from cross-sectional studies—looking internationally—because we have such differences in the potential for investors in each country to diversify—different costs associated with diversification and so forth. So, maybe we could find out something from international cross-sectional data.[2]

CAMPBELL: On the diversification issue, I have a couple of cautionary notes. First, I think that diversification on the part of individual investors probably is part of this story, but what matters for pricing ought not to be the diversification of investors with investors equally weighted but with investors *value weighted*. Presumably, the wealthy have always been far more diversified than the small investor. So, if small investors succeed in diversifying a bit more, it may not have much effect on the equity premium.

Second, you mentioned the trend toward increased diversification in recent years. There has also been a trend toward increased idiosyncratic risk in recent years. So, although marketwide volatility has not trended up, there has been a very powerful upward trend since the 1960s in the volatility of a typical, randomly selected stock. So, you *need* to be more diversified now in order to have the same level of idiosyncratic risk exposure as before 1960. It's not clear to me whether the increase in diversification of portfolios has outstripped that other trend or merely kept pace with it.

ROSS: It's not at all obvious to me that the wealthy are more diversified. The old results from estate tax data I found are really quite striking. Keep in mind that the data contain survivorship bias and that the rich got wealthy by owning a company that did well, but as I remember, the mean holding of the wealthy is about four stocks, which is really quite small. Conversely, if you look at the less wealthy investor, many of their assets are tied up in pension plans,

[1] Investment trusts existed solely to hold stock in other companies, which frequently held stock in yet other companies.
[2] For a discussion of long-term equity risk premiums in 16 countries, see Dimson, Marsh, and Staunton (2001).

where the diversification—even in defined-benefit plans—is subtle and not easy to detect. The same can be said for Social Security.

SIEGEL: I think we should also keep in mind the absolutely dramatic reduction in the cost of buying and selling stocks. Bid–ask spreads are sometimes pennies for substantial amounts of stocks, and transaction costs have decreased virtually to zero. I would think that, even with the increase in idiosyncratic risk, if individual investors *want* to diversify (leaving aside the question of whether they want to diversify or pick stocks), they can do so at a much lower cost today than they could, say, 20 or 30 years ago.

BANSAL: So, your argument for the falling equity premium would be that the costs have gone down more for equities than for bonds?

SIEGEL: Yes.

ASNESS: We still see many investors with tremendously undiversified portfolios. There are psychological biases and errors that can lead to a lack of diversification; we haven't had a rush to the Wilshire 5000 Total Market Index.

RICHARD THALER: To follow up, I want to point out that research on the prevalence of ownership of company stock in 401(k) plans indicates that it's quite high—in some companies, shockingly high. At Coca-Cola, for example, at one time, more than 90 percent of the pension assets were in Coca-Cola stock. The same pattern was common in the technology companies. Talk about investments being undiversified *and* positively correlated with human capital! These situations are very risky.

ASNESS: Have you ever tried to convince an endowment started by one family that what they should really do is diversify?

THALER: Right, right.

ASNESS: You never succeed.

THALER: Research on the founders of companies indicates that they hold portfolios with very low returns and very high idiosyncratic risk.

ASNESS: But they had *had* very high returns at some point.

THALER: Right.

PHILIPS: I'd like to re-explore the earnings versus GDP question. Rob Arnott and Peter Bernstein (2002) find that per share earnings grow more slowly than the economy for a very simple reason: A large chunk of the growth of the economy is derived from new enterprises, and therefore, the growth in earnings per dollar of capital will be inherently lower than the growth of earnings in the entire economy. Their empirical result is that per share earnings grow at roughly the same rate as per capita GDP. Let's call that the rate of growth of productivity. I, on the other hand, am much more comfortable with the notion of EPS growing at roughly the same rate as the economy as a whole. Why? Because the old economy spins off dividends that it cannot reinvest internally. Those dividends, in turn, can be invested in the new economy, which allows you to capture the growth in the new economy. In effect, you have a higher growth rate and a lower dividend yield, and your per share earnings keep growing at roughly the same rate as the economy as a whole. Do you have a take on that, Jeremy? Do you have an instinctive feel for whether we're missing something here or not?

SIEGEL: If companies paid out all their earnings as dividends (with no reinvestment or buying back of shares) and because (based on the long-run-growth literature) the capital output ratio is constant, then EPS would not grow at all. You would have new shares as the economy grew, through technology or population growth, because companies would have to float more shares over time to absorb new capital. But EPS wouldn't really grow at all. What happens, of course, is that the companies withhold some of their earnings for reinvestment or buyback of shares, which pushes EPS upward. If the earnings growth also happens to be the rate of productivity growth or GDP growth, I think it's coincidental, not intrinsic.

IBBOTSON: I have done work on the same subject, and I agree.

WILLIAM REICHENSTEIN: I have a concern. If you're buying back shares, EPS grow (corporate earnings don't necessarily grow, but earnings per share do). The argument that when companies reinvest their earnings rather than paying out their earnings to shareholders they must be wasting some of that money just doesn't jibe with the reality that the price-to-book ratio on the market today is about 4 to 1. If the market is willing to pay $4.00 for the $1.00 equity that is being reinvested, companies cannot be wasting the reinvested money.

SIEGEL: The confusing thing is that the price-to-book ratio for the S&P 500 or the DJIA is about 4 or 5 to 1 but the Tobin's q-ratio—which uses book value adjusted for inflation and replacement costs—is nowhere near that amount. I think it could be very misleading to use historical market-to-book ratios.

LEIBOWITZ: Still, whether you use the market-to-book ratio or not, the idea of having high P/Es in an environment where monies are reinvested at less than the cost of capital produces the same inconsistency. Something doesn't compute.

IBBOTSON: The burden is on the people who are challenging the Miller–Modigliani theorem. M&M said that dividends and retention of earnings have the same effect so which number is used doesn't matter; you're saying it does matter.

ARNOTT: I believe the Miller–Modigliani theorem is an elegant formula that should work. But it doesn't match 130 years' worth of historical data.

IBBOTSON: We'll investigate that!

PHILIPS: In part, the difference may be something already mentioned: NIPA (which covers all businesses) versus the set of publicly traded securities (which is a subset of NIPA). Examining both groups separately might provide us some answers to the reinvestment question. Another angle on reinvestment is: Suppose we idealize the world so that businesses reinvest only what they need for their growth (so, it's a rational reinvestment, not empire building). What is our view now of how EPS should be growing? Is there a consensus? Rob Arnott has some very strong numbers showing that per share earnings grow more slowly than the economy. Will you be putting up that graph this afternoon, Rob?

ARNOTT: Yes, that's why I'm not saying anything.

SIEGEL: What's interesting is that growth has occurred over time in the marketable value of securities versus what would be implied by the NIPA profits. Many more companies are now public than used to be. A lot of partnerships have gone public in the past 10–20 years. A lot of small companies, private companies, have gone public recently. Part of the reason could be the good stock market, and part could be a long-term trend. At any rate, in NIPA, a very big decline has occurred in "proprietors' income," which is derived from partnerships and individual owners, and an increase has occurred in corporate income as these private companies and partnerships went public. You have to be aware of this trend if you are using long-term data. It is one reason I think there is an upward trend in market value versus GDP. I'm not saying the ownership change alone explains the market value trend, or that it explains the whole amount, but changes between corporate income and noncorporate income are important.

IBBOTSON: So, as I've just said, either go to per share data to do this type of analysis or make sure you make all these adjustments to the aggregate data. See Diermeier, Ibbotson, and Siegel (1984) if you want to see how to make the adjustments.

TERHAAR: For the per share data, however, most people use the S&P 500, and the S&P 500 isn't really passive. It's a fairly actively managed index, particularly in recent years; the managers at Standard & Poor's have a habit of adding "hot" stocks, such as their July 2000 inclusion of JDS Uniphase. These substitutions have effects on the per share earnings and the growth rate that would not be present in a broader index or in the NIPA index.

SIEGEL: That's a very important point. Whenever the S&P 500 adds a company that has a higher P/E than the average company in the index, which has been very much the case in the past three years, the result is a dollar bias in the growth rate of earnings as the index is recomputed to make it continuous. My calculations show that the bias could be 1–2 percent a year in recent years as companies with extraordinarily high P/Es were added.

Current Estimates and Prospects for Change I

Robert J. Shiller

Yale University
New Haven, Connecticut

The equity premium puzzle and the foundations of behavioral finance are inseparable. The equity premium puzzle is a puzzle only if we assume that people's expectations are consistent with past historical averages, that expectations are rational. But behavioral finance has shown repeatedly the weakness of the assumption that rational expectations consistently drive financial markets. This presentation explores, in the context of recent stock market behavior, a number of reasons to doubt that rational expectations always find their way appropriately into stock prices. The reasons stressed have to do with psychological factors: (1) the difficulty that committees, groups, and bureaucracies have in changing direction, (2) the inordinate influence of the recent past on decisions, (3) the tendency (perhaps the need) to rely on "conventional wisdom," and (4) group pressure that keeps individuals from expressing dissent.

I will discuss here some issues in behavioral finance related to the so-called equity premium puzzle. The academic literature on the puzzle is based on the assumption that people are perfectly rational and consistent in their financial decision making and that their expectations for future returns are at all times in line with facts about past historical returns. The term "equity premium puzzle" refers to the fact that the performance of the stock market in the United States has just been too strong relative to other assets to make sense from the standpoint of such rationality. But behavioral finance research has provided strong evidence against the very assumptions of rationality, at least against the idea that the rationality is consistent and responsive to relevant information and only relevant information. The equity premium puzzle and the foundations of behavioral finance are inseparable.

People's expectations cannot be equated with mathematical expectations, as the equity premium literature assumes. Expectations for future economic variables, to the extent that people even have expectations, are determined in a psychological nexus. I want to describe, in the context of recent experience in the stock market, some of the psychology that plays a role in forming these expectations. Considering recent experience will help provide concreteness to our treatment of expectations. The U.S. equity market became increasingly overpriced through the 1990s, reaching a phenomenal degree of overpricing by early 2000.[1] This event is a good case study for examining expectations in general.

I will be following here some arguments I presented in my 2000 book *Irrational Exuberance*, and I will also develop some themes that I covered in my 2002 paper, "Bubbles, Human Judgment, and Expert Opinion," which concentrated attention on the behavior of institutional investors—particularly, college endowment funds and nonprofit organizations (see Shiller 2002).

The theme of "Bubbles, Human Judgment, and Expert Opinion" is that even committees of experts can be grossly biased when it comes to actions like those that are taken in financial markets.

A lot of behavioral finance depicts rather stupid things going on in the market, but (presumably) trustees and endowment managers are pretty intelligent people. Yet, they, as a group, have not been

[1] See the testimony by John Y. Campbell and Robert J. Shiller before the Federal Reserve Board on December 3, 1996. Summarized in Campbell and Shiller (1998).

betting against the market during this recent bubble. They seem to be going right along with it. One of the biggest arguments for market efficiency has been that if the market is inefficient, why are the smart people still investing in the market. So, the question of how expert opinion can be biased will be one of the focal points of this talk.

The Recent Market Bubble

Figure 1 is the Nasdaq Composite Index in real terms from October 1984 to October 2001. Anyone who is thinking about the equity premium puzzle ought to reflect on what an event like the recent bubble we have had implies about the models of human rationality that underlie the equity premium puzzle. There has never been a more beautiful picture of a speculative bubble and its burst than in the Figure 1 chart of the Nasdaq; the price increase appears to continue at an ever increasing rate until March 2000; then, there is a sudden and catastrophic break, and the index loses a great deal of its value. We will have to reflect on what could have driven such an event before we can be comfortable with the economic models that imply a high degree of investor consistency and rationality.

Figure 2 shows the same speculative bubble from 1999 to late 2000 in the monthly real price and earnings of the S&P Composite Index since 1871. This bubble is almost unique; the only other one like it for the S&P Composite occurred in the 1920s; we could perhaps add the period just before the mid-1970s as a similar event. So, because we have a record of only two (possibly three) such episodes in history, a lot of short-run historical analysis may be misleading. We are in very unusual times, and this circumstance is obvious when we look at Figure 2.

The bubble that was seen in the late 1990s was not entirely confined to the stock market. Real estate prices also went up rapidly then. Karl Case[2] and I have devised what we call the "Case–Shiller Home Price Indexes" for many cities in the United States. **Figure 3** is our Los Angeles index on a quarterly basis from the fourth quarter of 1975 to the second quarter of 2001. (The smoothness in price change is not an artifact; real estate price movements tend to be smooth through time. The real estate market is different from the stock market.) Figure 3 tells an interesting and amazingly simple story. The two recessions over the period—1981–1982 and 1990–1991—are easy to see. Los Angeles single-family home prices were trending up when the 1981–82 recession hit. Then, although nominal home prices did not go down, prices did drop in real terms. After that recession, prices moved up again, only to fall again in the 1990–91 recession. Following that recession, prices soared back up. In the fall of 2001, we are again entering a recession. So, our prediction is that home

[2] Of Wellesley College, Massachusetts, and the real estate research firm of Case Shiller Weiss, Inc.

Figure 1. Real Nasdaq Composite, October 1984–October 2001

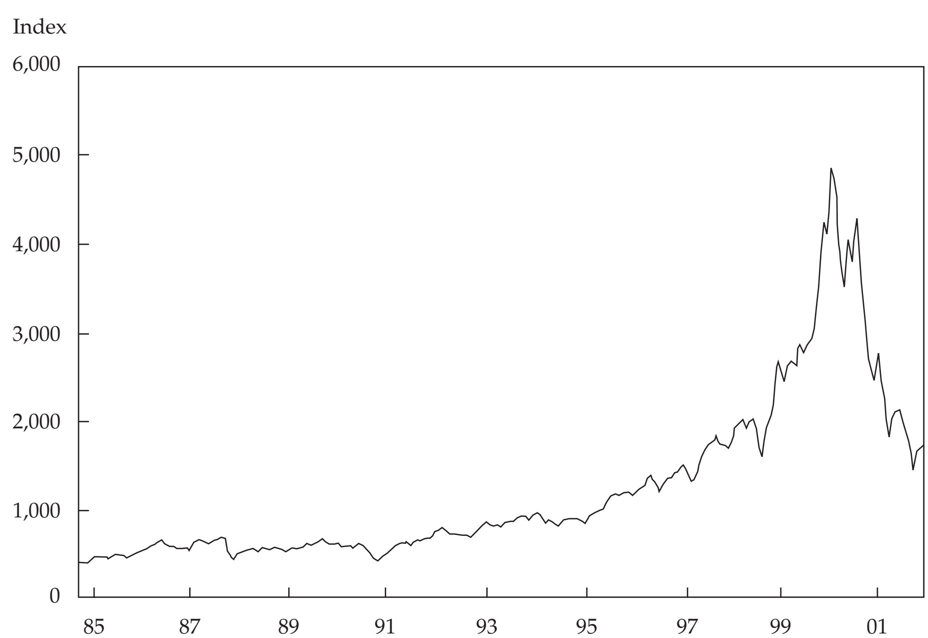
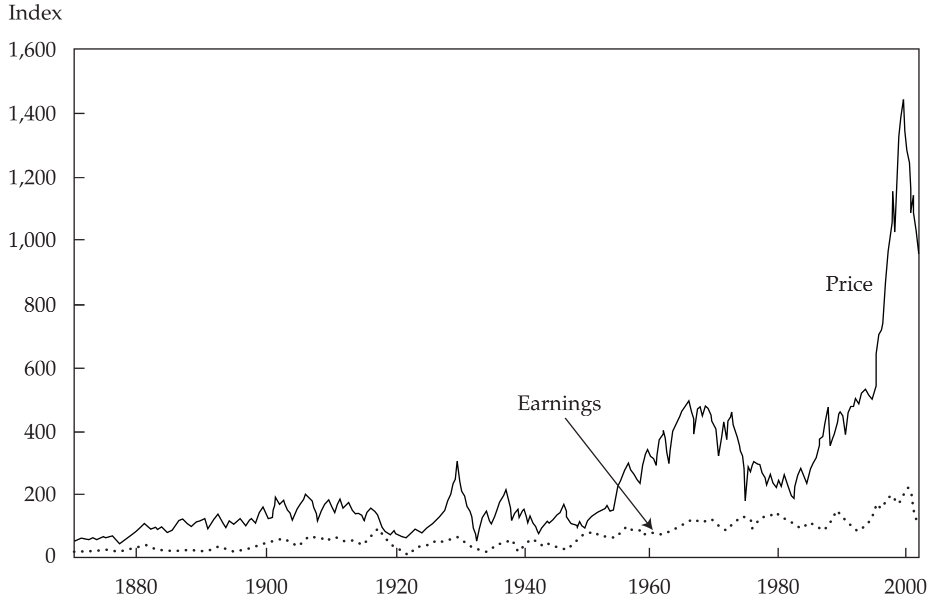
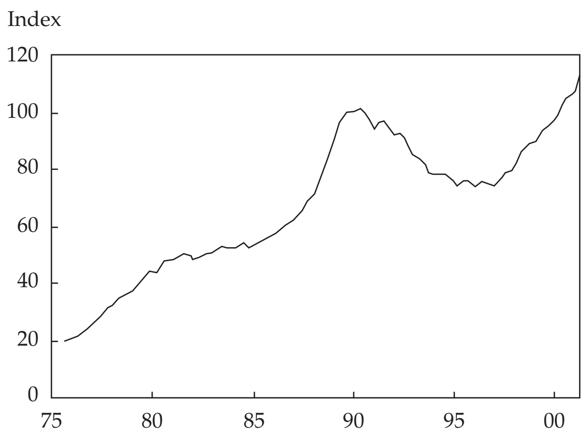


Figure 2. S&P Composite: Real Price and Earnings, January 1871–2001



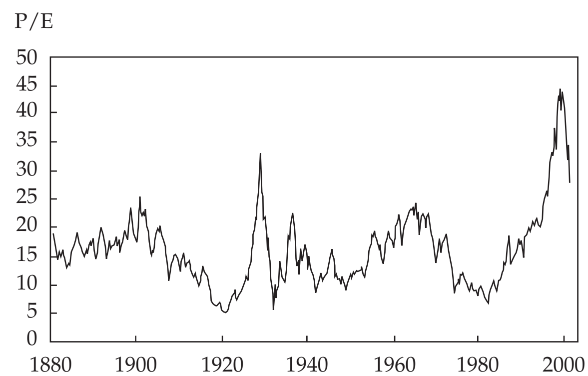
Note: Measured monthly.

Figure 3. Case–Shiller Home Price Index: Los Angeles Single-Family Home Prices, Fourth Quarter 1975 to Second Quarter 2001



Note: Measured quarterly.

Figure 4. P/E for the S&P Composite, January 1881–October 2001



Note: P/E calculated as price over 10-year lagging earnings (a calculation recommended by Graham and Dodd in 1934).

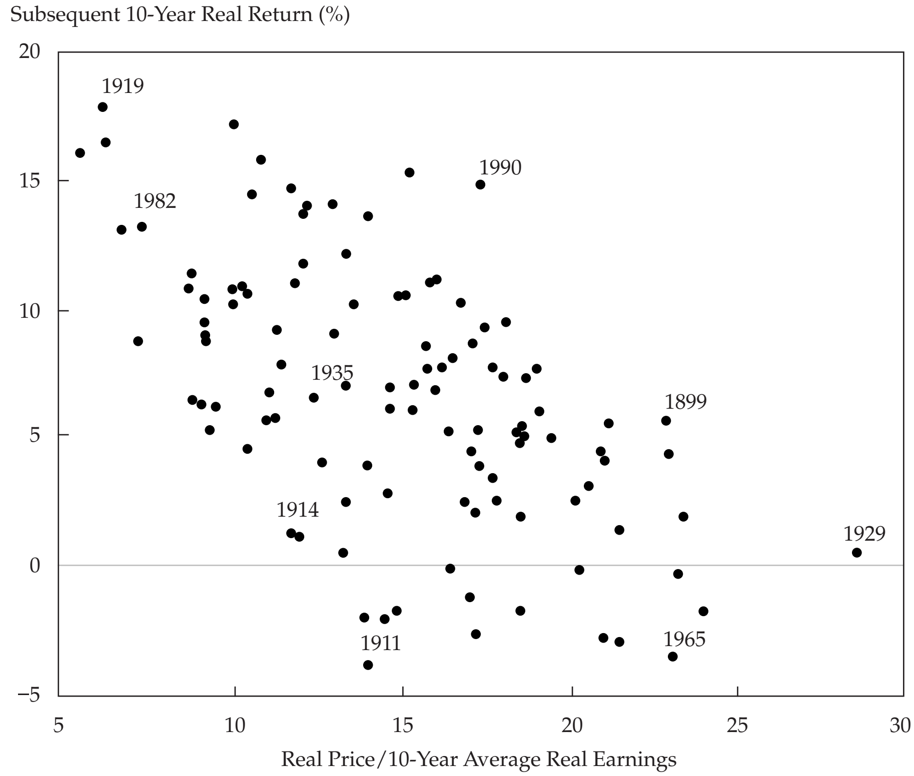
prices may trend lower as a result. We do not expect to see in the market for homes a sharp bubble and burst pattern such as we saw in the Nasdaq, but we might well see some substantial price declines.

Figure 4, the S&P Composite P/E for 1881 to 2001, shows once again the dramatic behavior in the stock market recently, behavior matched only by the market of the late 1920s and (to a lesser extent) around 1900 and the 1960s.

Figure 5 is a scatter diagram, which John Campbell and I devised, depicting the historical negative correlation between P/Es and subsequent 10-year returns. Figure 5 shows how the S&P Composite P/E predicts future S&P Composite returns. The P/E is now around the 1929 level, which suggests that high valuation is the dominant issue in judging the equity premium at this time.

It seems there is sufficient evidence in these markets, not only in their outward patterns but also in their correlation with each other and with other events, to feel pretty safe in concluding that we have seen a speculative bubble here. I know that there are

Figure 5. P/E for the S&P Composite in Relation to Subsequent 10-Year Real Composite Returns



Notes: P/E for 1881–1990; average real returns for 1891–2000. A similar scattergram was used in the Campbell–Shiller presentation to Congress in 1996 (see Campbell and Shiller 1998) .

some academics who still apparently believe that there are no such things as speculative bubbles.[3] But these academics are increasingly in the minority in the profession.

Why Speculative Bubbles?

In *Irrational Exuberance*, I begin by showing the historical data that I just reviewed with you. The question that I addressed in the book is why we have speculative bubbles. I take three behavioral approaches to answering the question. In the first part, I consider structural factors—precipitating factors and amplification mechanisms—that encourage people to buy more stocks. The second part deals with cultural factors, such as the news media and "new era" theories. The third part deals with psychological factors, which include overconfidence, anchoring, and attention anomalies.

[3] For example, Peter Garber, in his recent (2000) book *Famous First Bubbles: The Fundamentals of Early Manias*, argues that even the tulipmania in Holland in the 1600s was essentially rational. He concludes, "The wonderful tales from the tulipmania are catnip irresistible to those with a taste for crying bubble, even when the stories are obviously untrue" (p. 83).

I have not heard many of these factors mentioned at our meeting today. It is puzzling to me that economists rarely seem to express an appreciation of the news media as important transmitters of speculative bubbles and of the idea that we are in a new era. Every time a speculative bubble occurs, many people who work in the media churn out stories that we are in a new era. I documented this phenomenon in my book by looking at a number of different cases in which the stock markets in various countries rose over a brief period, and I was able to find in each of them a new era theory in the newspaper.

Expert Theories

"Bubbles, Human Judgment, and Expert Opinion" was written to be of interest to practitioners. The objective was to observe how investors react to a market bubble and then try to interpret that phenomenon.

During the book tour for *Irrational Exuberance* in 2000 and 2001, I was often speaking to investment professionals, and although I had the sense that many times I was engaging their interest, I often did not have the sense that I was really connecting with them.

In many cases, they were not a really receptive audience. There was a sense of momentum or inertia among many of these people. They appeared to be of two minds—the one of an interested book reader and the other of a more rigid committee member or bureaucrat. I wanted to talk about that type of behavior in the "Bubbles" paper.

Why would that behavior be happening? What evidence would help us understand it? The reason I set forth in the paper is that the market is like a supertanker that cannot make sudden changes in course: Even if people like me present a case that the market is overpriced and is going to fall and even if people like me convince investment professionals that the market outlook is not so good, the professionals will not really make substantive changes in their portfolios. They may well continue to hold the 55 percent of their portfolios in U.S. equities and 11 percent in non-U.S. equities. University portfolio managers and other institutional investors were not withdrawing from the market in 1999.

In the paper, I discuss the *feedback* theory of bubbles that Andrei Shleifer and Nicholas Barberis (2000), I (1990), and others have talked about. In the feedback theory, demand for shares is modeled as a distributed lag of past returns plus the effect of precipitating factors. When returns have been high for a while, investors become more optimistic and bid up share prices, which amplifies the effects of precipitating factors. I consider this behavior to be an inconstancy in judgment, not naive extrapolation; for portfolio managers to respond naively to past returns seems implausible. Inconstancy in judgments arises because committees and their members find it difficult to respond accurately and incrementally to evidence, especially when the evidence is ambiguous, qualitative rather than quantitative, and ill defined. Ultimately, recent past returns have an impact on the decisions committee members make, even if they never change their conscious calculations. This feedback behavior thus amplifies the effect on the market of any precipitating factors that might initiate a speculative bubble.

The critical point is that the problem faced by institutional investors in deciding how much to put in the stock market is extremely complex; it has an infinite number of aspects that cannot possibly be completely analyzed. In such situations, people may fall into a pattern of behavior given by the "representative heuristic"—a psychological principle described by Kahneman and Tversky (1974, 1979) in which people tend to make decisions or judge information based on familiar patterns, preconceived categories or stereotypes of a situation. We tend to not take an objective outlook but to observe the similarity of a current pattern to a familiar, salient image in our minds and assume that the future will be like that familiar pattern.

Part of the problem that institutional investors face is the impossibility of processing all the available information. Ultimately, the decision whether to invest heavily in the stock market is a question of historical judgment. There are so many pieces of information that no one person can process all of them.

Therefore, institutional investment managers must rely on "conventional wisdom." They make decisions based on what they perceive is the generally accepted expert opinion. A problem with that approach is that one cannot know how much information others had in reaching the judgments laid out in conventional wisdom. In addition, investors do not know whether others were even relying on information or were, for their part, just using their judgment.

These kinds of errors that professionals make are analogous to the errors we sometimes make when, for example, we walk out of a conference and cross the street as a group. We may be talking about something interesting, so each person in the group assumes that someone else is looking at oncoming traffic. Sometimes, nobody is.

The tendency to follow conventional wisdom is increased by the strange standard we have called "the prudent person rule," part of fiduciary responsibility that is even written into ERISA. It is a strange standard because what it's really saying is not clear. As set forth in the ERISA regulations adopted in 1974, the prudent person rule states that investments must be made with

> the care, skill, and diligence, under the circumstances then prevailing, that a prudent man acting in a like capacity and familiar with such matters would use in the conduct of an enterprise with like character and like aims.

I interpret the statement to mean that an investment manager or plan sponsor must make judgments based on what is considered conventional at the time, not independent judgments.

The prudent person rule is a delicate attempt to legislate against stupidity, but the way the problem is addressed basically instructs the trustee or sponsor to be conventional. "Conventional" is exactly how I would describe what I think has happened to institutional investors and the way they approach the market. In 2000, many institutional investors believed they should not be so exposed to the market, but they could not justify to their organizations, within the confines of the prudent person rule, cutting back equity exposure. This dilemma is a serious problem.

Another problem that managers of institutional investments have can be described as "groupthink," a term coined in a wonderful book of the same name by the psychologist Irving Janis (1982). In the book, Janis gives case studies of committees or groups of highly intelligent people making big mistakes. In particular, he discusses the mistakes that arise because of group pressures individuals feel to conform. Janis points out that people who participate in erroneous decisions often find themselves censoring their statements because they believe, "If I express my dissenting view too often, I will be marginalized in the group and I will not be important." He uses the term "effectiveness trap" to describe this thinking. Dissenters, although they may be correct in their opinions, fear that they are likely to see their influence reduced if they express their opinions. Janis describes, for example, responses in the Lyndon Johnson administration to a Vietnam bombing fiasco. When Johnson wrote about this episode in his memoirs, he did not mention any substantial dissent. Yet, those involved remember having dissenting views. Evidently, they did not express their views in such a way that Johnson remembered the dissent after the fact.

As economists, we talk a great deal about models, which concretize the factors in decisions, but when you are making a judgment about how to manage a portfolio, you face real-world situations. The real world is fundamentally uncertain. And fundamental uncertainty is what Knight talks about in *Risk, Uncertainty and Profit* (1964): How do we react in committees or as groups or as individuals within groups?

An argument Shafir, Simonson, and Tversky (2000) recently made that they applied to individual decisions is, I think, even more applicable to group decisions. The authors stated that when we are making what seems like a portentous decision, our minds seek a *personalized* way to justify the decision; we do not simply consider what to do. They asked people to make hypothetical custody decisions about divorcing couples. They described the two parents and then asked each participant to choose which parent would get custody of the child. They framed the question in two different ways. One question was, "Which parent would you give the child to?" And the other was, "Which parent would you deny custody to?" Of course, the question is the same either way it is framed. Nevertheless, the authors found systematic differences in the responses. When the parents were described, one person was described in bland terms and the other person in very vivid terms—both good extremes and bad extremes. Participants tended to point their decisions to the more salient person (the more vividly described person) in the couple. For example, when the question was framed for awarding custody, participants tended to award custody to the person who was vividly described—even though the description included bad things. And when the question was framed for denying custody, participants tended to deny custody to the person who was vividly described—even though the description included good things.

This research points to a fundamental reason for inertia in organizations: Institutions have to have a very good reason to change any long-standing policy, but the kinds of arguments that would provide that good reason are too complicated (not salient enough) to be persuasive.

Conclusion

My talk has taken us a little bit away from the abstract issue of the long-run equity premium that has been talked about so much at this forum. I have described a shorter-run phenomenon, the recent stock market bubble, and I have described some particular psychological principles that must be borne in mind if we are to understand this recent behavior. But we cannot see the weaknesses of faulty abstract principles unless we focus on particular applications of the principles. I hope that my discussion today has raised issues relevant to understanding whether we ought to consider the markets efficient, whether we ought to be "puzzled" by the past equity premium, and whether we should expect this historical premium to continue in the future.

Current Estimates and Prospects for Change I

Robert J. Shiller
Yale University
New Haven, Connecticut

SUMMARY

by Peter Williamson
Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

Robert Shiller described the equity premium puzzle as inseparable from the foundations of behavioral finance. The three bases of his presentation were

- Campbell and Shiller, testimony before the Federal Reserve Board on December 3, 1996,[1]
- *Irrational Exuberance* (published in April 2000; see Shiller 2000), and
- "Bubbles, Human Judgment, and Expert Opinion" (Shiller 2002).

[1] Summarized in Campbell and Shiller (1998).

The third publication was aimed at (nonprofit) practitioners (particularly, those at U.S. educational endowments). Much behavioral finance describes apparently foolish behavior in the market, but trustees are, presumably, intelligent people. Yet, even they have not been betting against the market during the recent bubble. Despite warnings, intelligent people have not lost faith in the stock market. Why is expert opinion so biased?

Shiller's **Figure 1** showed the real Nasdaq Composite Index from October 1984 to October 2001. It provided clear evidence of a perfect bubble from 1999 to late 2000. The same could be seen in his **Figure 2** of the S&P Composite Index from 1871 to 2001. Two other, lesser bubbles appeared—in the late 1920s and the late 1960s. Similarly, the **Figure 3** graph of real estate prices in Los Angeles, California, showed a clear bubble (although it was smoother than the market bubble) around 1990. **Figure 4**, of the S&P

Figure 1. Real Nasdaq Composite, October 1984–October 2001

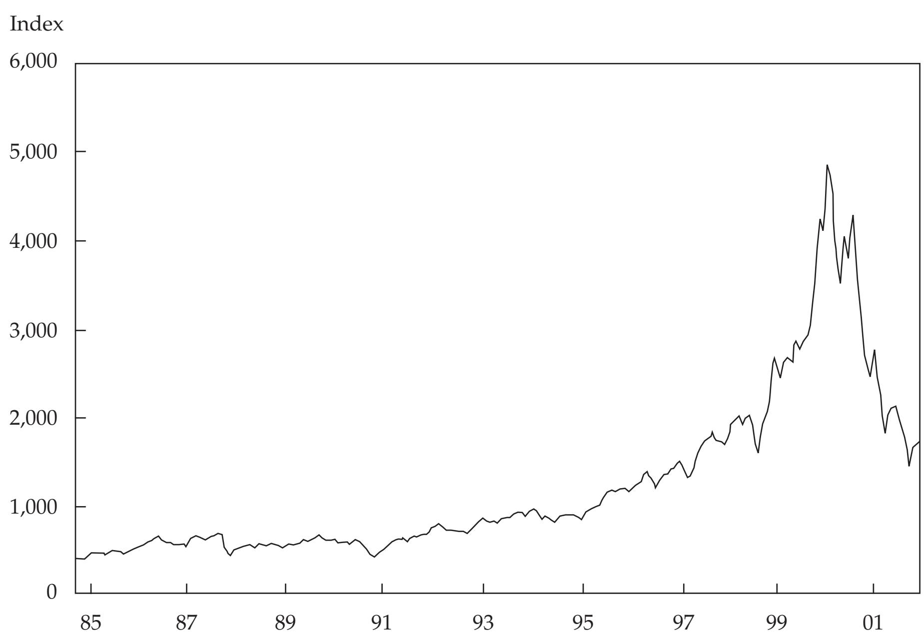
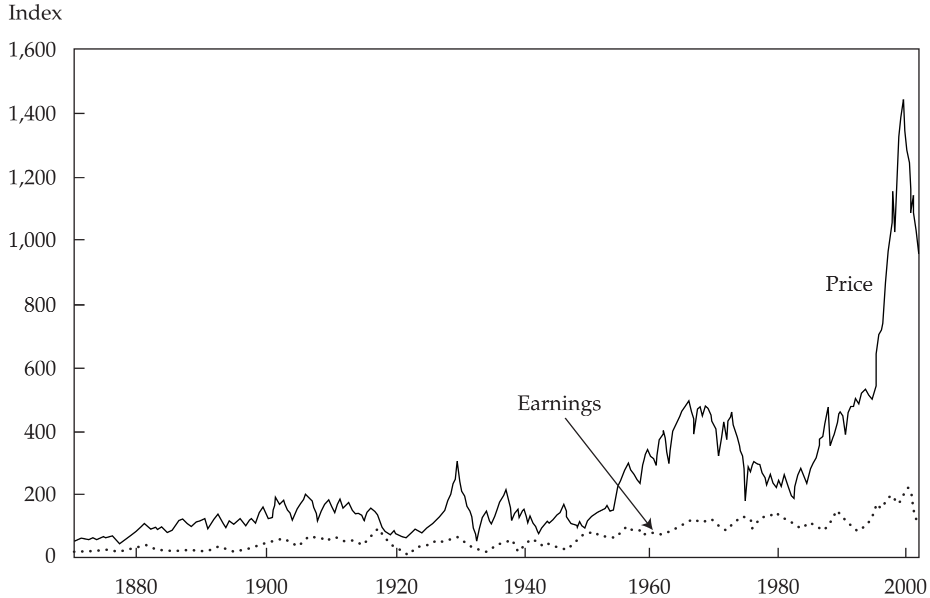
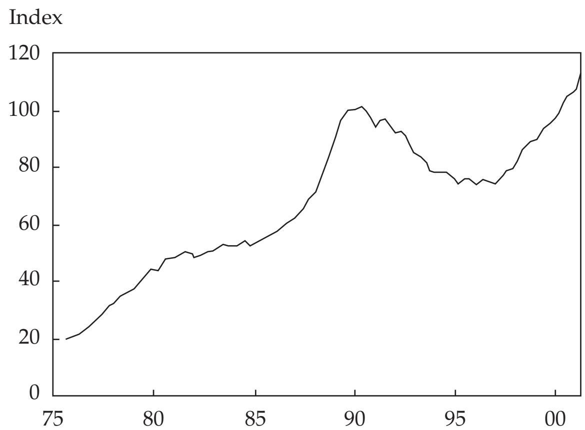


Figure 2. S&P Composite: Real Price and Earnings, January 1871–2001



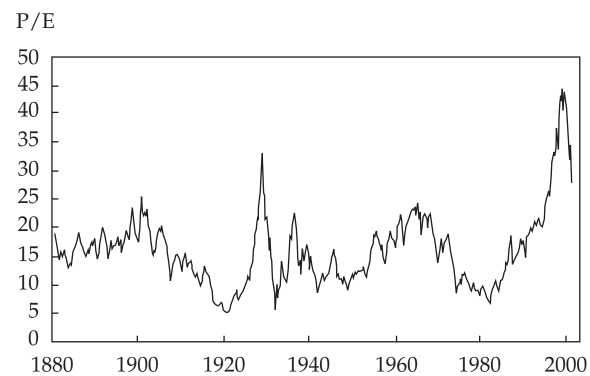
Note: Measured monthly.

Figure 3. Case–Shiller Home Price Index: Los Angeles Single-Family Home Prices, Fourth Quarter 1975 to Second Quarter 2001



Note: Measured quarterly.

Figure 4. P/E for the S&P Composite, January 1881–October 2001



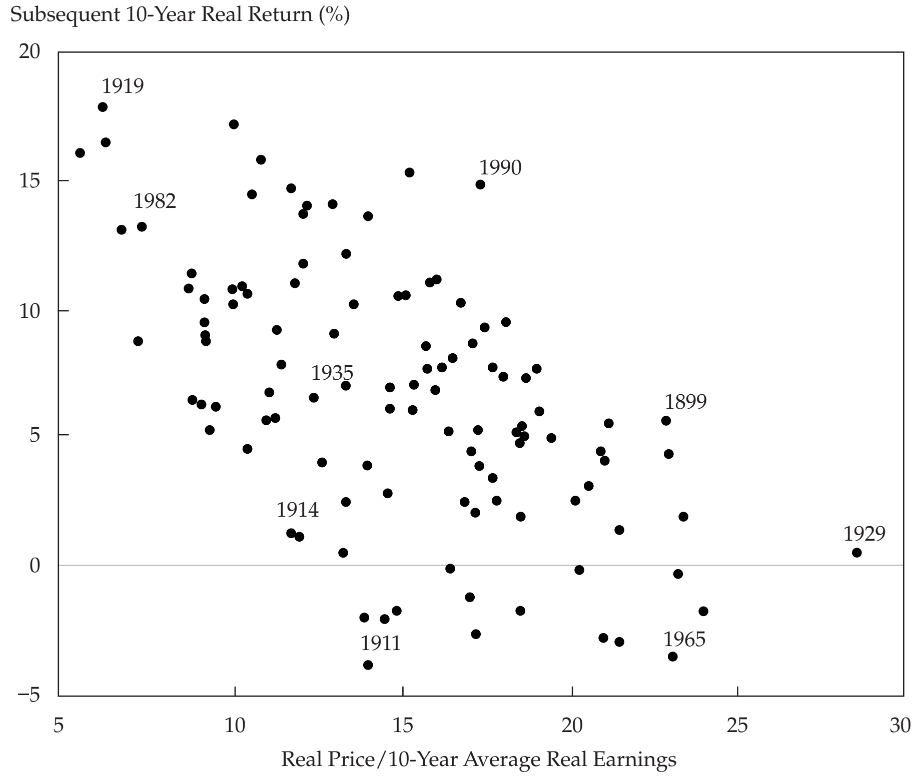
Note: P/E calculated as price over 10-year lagging earnings (a calculation recommended by Graham and Dodd in 1934).

Composite P/E (real price divided by average real earnings over the preceding 10 years) from 1881 to 2001, showed bubbles recently, in the late 1920s, around 1900 (to a lesser extent), in the late 1930s, and in the 1960s.

Figure 5 is a scattergram showing how the S&P Composite P/E predicts future S&P Composite returns. The P/E is now around the 1929 level, which suggests that valuation is the dominant issue in terms of the equity premium at this time.

In his book *Irrational Exuberance*, Shiller dealt with three types of factors leading to excessive valuations: structural, cultural, and psychological. Cultural factors included the news media and "new era" theories. The news media are important transmitters of speculative bubbles, and every bubble is accompanied by a new era theory to explain the rise in prices. Among psychological factors are overconfidence, anchoring, and attention anomalies.

Figure 5. P/E for the S&P Composite in Relation to Subsequent 10-Year Real Composite Returns



Notes: P/E for 1881–1990; average real returns for 1891–2000. A similar scattergram was used in the Campbell–Shiller presentation to Congress in 1996 (see Campbell and Shiller 1998) .

Turning to the subject of his "Bubbles" paper, Shiller discussed a number of aspects of behavioral finance behind the behavior of investment professionals that drove equity prices up. The most important factor is the inertia of a bureaucratic process. No matter how convincing the evidence that stock prices are too high, institutional committees do not change their asset allocations, which were generally about 60 percent in U.S. and non-U.S. equities in 1999.

The influence of recent past returns is powerful. Reliance on recent returns might be thought of as naive extrapolation, but Shiller prefers to think of it as inconstancy in judgment. It is difficult for committees to maintain the same judgment at all times when the evidence is ambiguous and complicated. The tendency is to assume that the future will be like the past.

The impossibility of processing all available information leads to reliance on conventional wisdom. Institutional investors have a tendency to trust the opinions of others without knowing what information those others are making use of. Moreover, the "prudent person rule" is, unfortunately, to "do what is conventional."

Shiller also cited examples of the "effectiveness trap"—the group pressure to conform—described in *Groupthink* (Janis 1982). Dissenters, although they may be correct in their opinions, fear that they are likely to see their influence reduced if they express their opinions. Other references Shiller made dealt with the difficulty of getting organizations to change long-standing policy. Committees need a *very* good reason to change a policy.

Shiller's conclusions included the following:

- Bubble behavior and the equity risk premium are tied up with many issues of human cognition and judgment.
- Institutional investors have generally been too slow to react to the negative equity premium today.

Current Estimates and Prospects for Change II

Rajnish Mehra
Professor of Finance
University of California, Santa Barbara
National Bureau of Economic Research and Vega Asset Management

Analysts have more than 100 years of good, clean economic data on asset returns that support the persistence of a historical long-term U.S. equity risk premium over U.S. T-bills of 5–7 percent (500–700 bps)—but the expected equity risk premium an analyst might have forecasted at the beginning of this long period was about 2 percent. The puzzle is that stocks are not so much riskier than T-bills that a 5–7 percent difference in rates of return is justified. Analyses of the long series of data indicate that the relationship between *ex ante* and *ex post* premiums is inverse. The relationship between the market and the risk premium is also inverse: When the value of the market has been high, the mean equity risk premium has been low, and vice versa. Finally, investors and advisors need to realize that all conclusions about the equity risk premium are based on and apply only to the very long term. To predict next year's premium is as impossible as predicting next year's stock returns.

I took the topic of the equity risk premium literally and considered, given current valuation levels, what is the expected equity risk premium. I would argue that this question is an exercise in forecasting and has little to do with the academic debate on whether the historically observed equity risk premium has been a puzzle. Let me illustrate.

Table 1 shows the data available to us from various sources and research papers on U.S. equity returns (generally proxied by a broad-based stock index), returns to a relatively riskless security (typically a U.S. Treasury instrument), and the equity risk premium for various time periods since 1802. The equity premium can be different over the same time period, primarily because some researchers measure the premium relative to U.S. T-bonds and some measure it relative to T-bills. The original Mehra–Prescott paper (1985) measured the premium relative to T-bills. Capital comes in a continuum of risk types, but aggregate capital stock in the United States will give you a return of about 4 percent. If you combine the least risky part and the riskier part, such as stocks, their returns will be different but will average about 4 percent. I can, at any time, pry off a very risky slice of the capital risk continuum and compare its rate of return with another slice of the capital risk continuum that is not at all risky.

Table 1 provides results from a fairly long series of data—almost 200 years—and the premium exists even when the bull market between 1982 and 2000 is

Table 1. Real U.S. Equity Market and Riskless Security Returns and Equity Risk Premium, 1802–2000

Period	Mean Real Return on Market Index	Mean Real Return on Relatively Riskless Asset	Risk Premium
1802–1998	7.0%	2.9%	4.1%
1889–2000	7.9	1.0	6.9
1889–1978	7.0[a]	0.8	6.2[b]
1926–2000	8.7	0.7	8.0
1947–2000	8.4	0.6	7.8

[a]Not rounded, 6.98 percent.
[b]Not rounded, 6.18 percent.

Sources: Data for 1802–1998 are from Siegel (1998); for 1889–2000, from Mehra and Prescott (1985).

excluded. That bull market certainly contributed to the premium, but the premium is pretty much the same in all the periods. One comment on early-19th-century data: The reason Edward Prescott and I began at 1889 in our original study is that the earlier data are fairly unreliable. The distinction between debt and equity prior to 1889 is fuzzy. What was in a basket of stocks at that time? Would bonds actually be called risk free? Because the distinction between these types of capital was unclear, the equity premium for the 1802–1998 period appears to be lower in Table 1 than I believe it really was. As **Table 2** shows, the existence of an equity premium is consistent across developed countries—at least for the post-World War II period.

The puzzle is that, adjusted for inflation, the average annual return in the U.S. stock market over 110 years (1889–2000) has been a healthy 7.9 percent, compared with the 1 percent return on a relatively riskless security. Thus, the equity premium over that time period was a substantial 6.2 percent (620 basis points). One could dismiss this result as a statistical artifact, but those data are as good an economic time series as we have. And if we assume some stationarity in the world, we should take seriously numbers that show consistency for 110 years. If such results occurred only for a couple of years, that would be a different story.

Is the Premium for Bearing Risk?

This puzzle defies easy explanation in standard asset-pricing models. Why have stocks been such an attractive investment relative to bonds? Why has the rate of return on stocks been higher than on relatively risk-free assets? One intuitive answer is that because stocks are "riskier" than bonds, investors require a larger premium for bearing this additional risk; and indeed, the standard deviation of the returns to stocks (about 20 percent a year historically) is larger than that of the returns to T-bills (about 4 percent a year). So, obviously, stocks are considerably more risky than bills!

But are they?

Why do different assets yield different rates of return? Why would you expect stocks to give you a higher return? The deus ex machina of this theory is that assets are priced such that, *ex ante*, the loss in marginal utility incurred by sacrificing current consumption and buying an asset at a certain price is equal to the expected gain in marginal utility contingent on the anticipated increase in consumption when the asset pays off in the future.

The operative emphasis here is the *incremental loss or gain* of well-being resulting from consumption, which should be differentiated from incremental consumption because the same amount of consumption may result in different degrees of well-being at different times. (A five-course dinner after a heavy lunch yields considerably less satisfaction than a similar dinner when one is hungry!)

As a consequence, assets that pay off when times are good and consumption levels are high—that is, when the incremental value of additional consumption is low—are less desirable than those that pay off an equivalent amount when times are bad and additional consumption is both desirable and more highly valued.

Let me illustrate this principle in the context of a popular standard paradigm, the capital asset pricing model (CAPM). This model postulates a linear relationship between an asset's "beta" (a measure of systematic risk) and expected return. Thus, high-beta stocks yield a high expected rate of return. The reason is that in the CAPM, good times and bad times are captured by the return on the market. The performance of the market as captured by a broad-based index acts as a surrogate indicator for the relevant state of the economy. A high-beta security tends to pay off more when the market return is high, that is, when times are good and consumption is plentiful; as

Table 2. Real Equity and Riskless Security Returns and Equity Risk Premium: Selected Developed Markets, 1947–98

Country	Period	Mean Real Return on Market Index	Mean Real Return on Relatively Riskless Asset	Risk Premium
United Kingdom	1947–1999	5.7%	1.1%	4.6%
Japan	1970–1999	4.7	1.4	3.3
Germany	1978–1997	9.8	3.2	6.6
France	1973–1998	9.0	2.7	6.3

Sources: Data for the United Kingdom are from Siegel (1998); the remaining data are from Campbell (2002).

discussed earlier, such a security provides less incremental utility than a security that pays off when consumption is low, is less valuable to investors, and consequently, sells for less. Thus, assets that pay off in states of low marginal utility will sell for a lower price than similar assets that pay off in states of high marginal utility. Because rates of return are inversely proportional to asset prices, the latter class of assets will, on average, give a lower rate of return than the former.

Another perspective on asset pricing emphasizes that economic agents prefer to smooth patterns of consumption over time. Assets that pay off a relatively larger amount at times when consumption is already high "destabilize" these patterns of consumption, whereas assets that pay off when consumption levels are low "smooth" out consumption. Naturally, the latter are more valuable and thus require a lower rate of return to induce investors to hold them. (Insurance policies are a classic example of assets that smooth consumption. Individuals willingly purchase and hold them in spite of their very low rates of return.)

To return to the original question: Are stocks that much riskier than bills so as to justify a 7 percent differential in their rates of return?

What came as a surprise to many economists and researchers in finance was the conclusion of a research paper that Prescott and I wrote in 1979. Stocks and bonds pay off in approximately the same states of nature or economic scenarios; hence, as argued earlier, they should command approximately the same rate of return. In fact, using standard theory to estimate risk-adjusted returns, we found that stocks on average should command, at most, a 1 percent return premium over bills. Because for as long as we had reliable data (about 100 years), the mean premium on stocks over bills was considerably and consistently higher, we realized that we had a puzzle on our hands. It took us six more years to convince a skeptical profession and for our paper (the Mehra and Prescott 1985 paper) to be published.

Ex Post versus *Ex Ante*

Some academicians and professionals hold the view that at present, there is no equity premium and, by implication, no equity premium puzzle. To address these claims, we need to differentiate between two interpretations of the term "equity premium." One interpretation is the *ex post* or realized equity premium over long periods of time. It is the actual, historically observed difference between the return on the market, as captured by a stock index, and the risk-free rate, as proxied by the return on T-bills.

The other definition of the equity premium is the *ex ante* equity premium—a forward-looking measure. It is the equity premium that is *expected* to prevail in the future or the conditional equity premium given the current state of the economy. I would argue that it *must* be positive because all stocks must be held.

The relationship between *ex ante* and *ex post* premiums is inverse. After a bull market, when stock valuations are exceedingly high, the *ex ante* premium is likely to be low, and this is precisely the time when the *ex post* premium is likely to be high. After a major downward correction, the *ex ante* (expected) premium is likely to be high and the realized premium will be low. This relationship should not come as a surprise because returns to stock have been documented to be mean reverting. Over the long term, the high and low premiums will average out.

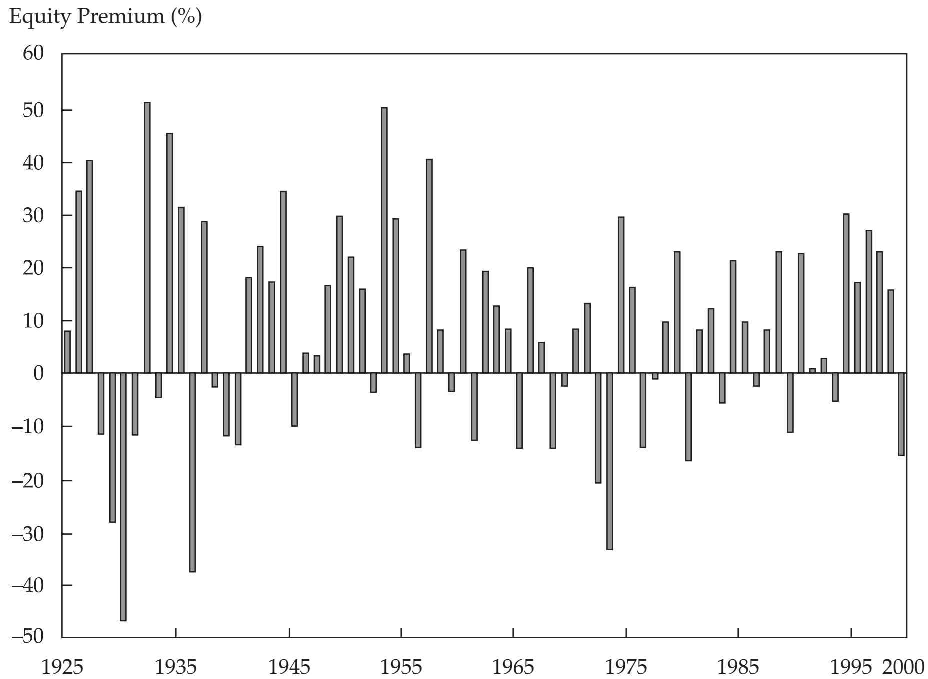
Which of these interpretations of the equity risk premium is relevant for an investment advisor? Clearly, the answer depends on the planning horizon.

The historical equity premium that Prescott and I addressed in 1985 is the premium for very long investment horizons, 50–100 years. And it has little—in fact, nothing—to do with what the premium is going to be over the next couple of years. Nobody can tell you that you are going to get a 7 percent or 3 percent or 0 percent premium next year.

The *ex post* equity premium is the realization of a stochastic process over a certain period, and as **Figure 1** shows, it has varied considerably over time. Furthermore, the variation depends on the time horizon over which it is measured. Over this 1926–2000 period, the realized equity risk premium has been positive and it has been negative; in fact, it has bounced all over the place. What else would you expect from a stochastic process in which the mean is 6 percent and the standard deviation is 20 percent? Now, note the pattern for 20-year holding periods in **Figure 2**. This pattern is more in tune with what Jeremy Siegel was talking about [see the "Historical Results" session]. You can see that over 20-year holding periods, there is a nice, decent premium.

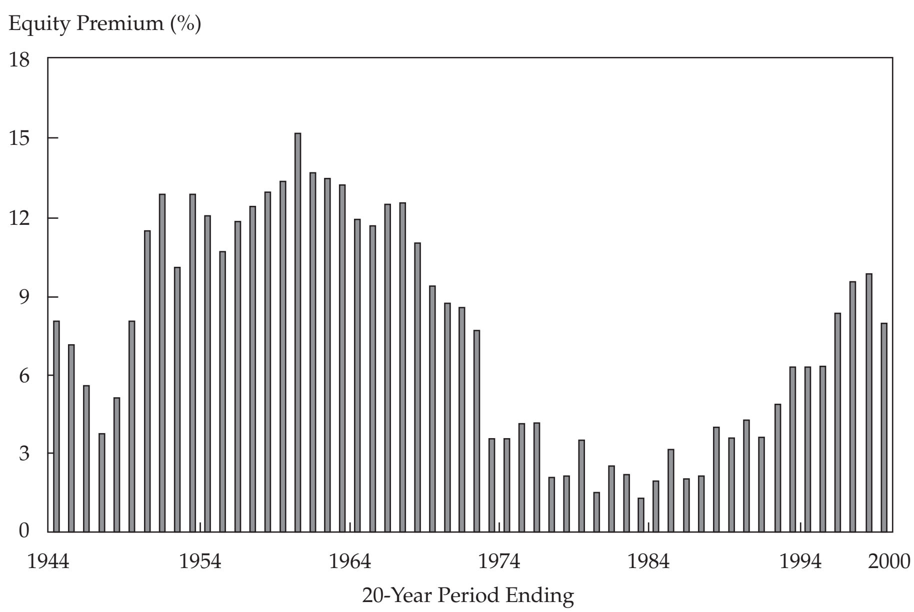
Figure 3 carries out exactly the exercise that Brad Cornell recommended [see the "Historical Results" session]: It looks at stock market value (MV)—that is, the value of all the equity in the United States—as a share of National Income (NI). These series are cointegrated, so when you divide one by the other, you get a stationary process. The ratio has been as high as approximately 2 times NI and as low as approximately 0.5 NI. The graph in Figure 3 represents risk. If you are looking for stock market risk, you are staring at it right here in Figure 3. This risk is low-frequency, persistent risk, not the year-to-year volatility in the market. This persistence defies easy

Figure 1. Realized Equity Risk Premium per Year, January 1926–January 2000



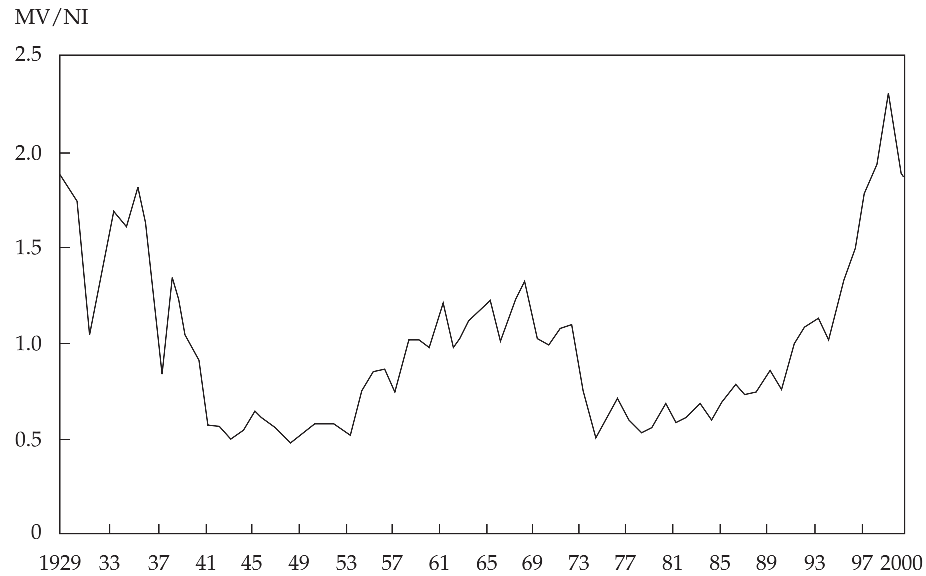
Source: Ibbotson Associates (2001).

Figure 2. Mean Equity Risk Premium by 20-Year Holding Periods, January 1926–January 2000



Source: Ibbotson Associates (2001).

Figure 3. U.S. Stock Market Value/National Income, January 1929–January 2000

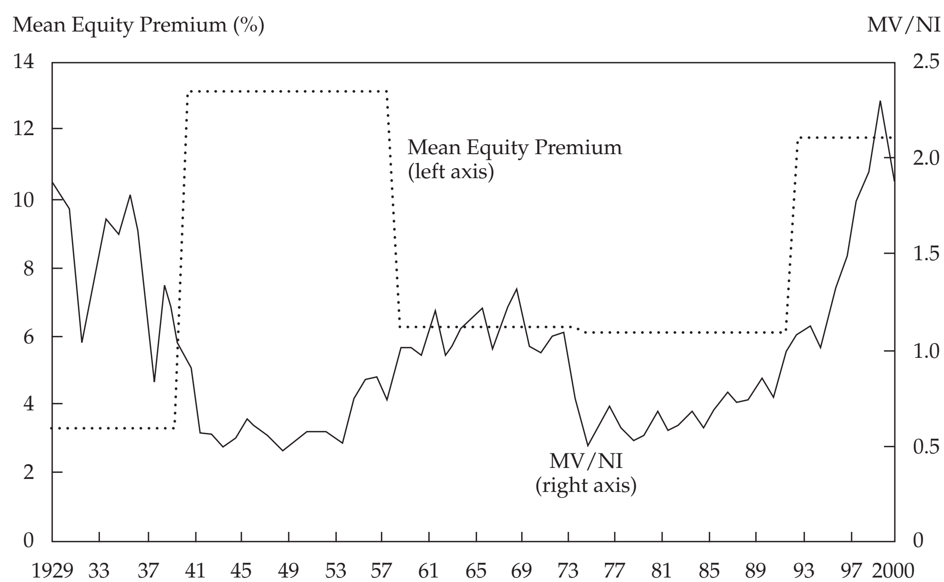


Source: Data updated from Mehra (1998).

explanation for the simple reason that if you look at cash flows over the same period of time relative to GDP, they are almost trendless. There are periods of relative overvaluation and periods of undervaluation, and they seem to persist over time.

When I plotted the contemporaneous equity risk premium over the same period, the graph I got was not very informative, so I arbitrarily broke up the data into periods when the market was more than 1 NI and when the market was below 1 NI. I averaged out all the wiggles in the equity premium graph, and **Figure 4** shows the smoothed line overlaid on the graph from Figure 3 of MV/NI. As you can see, when the market was high, the mean equity risk premium was low, and when the market was low, the premium was high.

Figure 4. Mean Equity Risk Premium and Market Value/National Income, January 1929–January 2000



The mean equity risk premium three years ahead is overlaid on the graph of market value to net income in **Figure 5**. (The premium corresponding to 1929 on the dotted line represents the mean equity risk premium averaged from 1929 to 1932. So, the premium line ends three years before 2001). You can clearly see that the mean equity risk premium is much higher when valuation levels are low.

I might add that the MV/NI graph is the basis of most of the work in finance on predicting returns based on price-to-dividends ratios and price-to-earnings ratios. Essentially, we have historical data for only about two cycles. Yet, a huge amount of research and literature is based on regressions run with only these data.

A scatter diagram of MV/NI versus the mean three-year-ahead equity risk premium is shown in **Figure 6**. Not much predictability exists, but the relationship is negative. (The graphs and scatter diagrams for a similar approach but with the equity risk premium five years ahead are similar).

Finally, **Figure 7** plots mean MV/NI versus the mean equity risk premium three years ahead, but I arbitrarily divided the time into periods when MV/NI was greater than 1 and periods when it was less than 1, and I averaged the premium over the periods. This approach shows, on average, some predictability: Returns are higher when markets are low relative to GDP. But if I try to predict the equity premium over a year, for example, the noise dominates the drift.

Operationally, because the volatility of market returns is 20 percent, you do not get much information from knowing that the mean equity premium is 2 percent rather than 6 percent. From an asset-allocation point of view, I doubt that such knowledge would make any difference over a short time horizon—the next one or two years. The only approach that makes sense in this type of analysis is to estimate the equity premium over the very long horizon. The problem of predicting the premium in the short run is as difficult as predicting equity returns in the short run. Even if the conditional equity premium given current market conditions is small (and the general consensus is that it is), that fact, in itself, does not imply either that the historical premium was too high or that the unconditional equity premium has diminished.

Looking into the Future

If this analysis had been done in 1928, what would an exercise similar to what Prescott and I did in 1985 have yielded? Suppose the analysis were done for the period from 1889 to 1928; in 1929, the mean real return on the S&P 500 was 8.52 percent, the mean real return on risk-free assets was 2.77 percent, and thus the observed mean equity premium would have been 5.75 percent. A theoretical analysis similar to Prescott's and mine would have yielded a 2 percent equity premium.

Figure 5. Mean Equity Risk Premium Three Years Ahead and Market Value/National Income, January 1929–January 2000

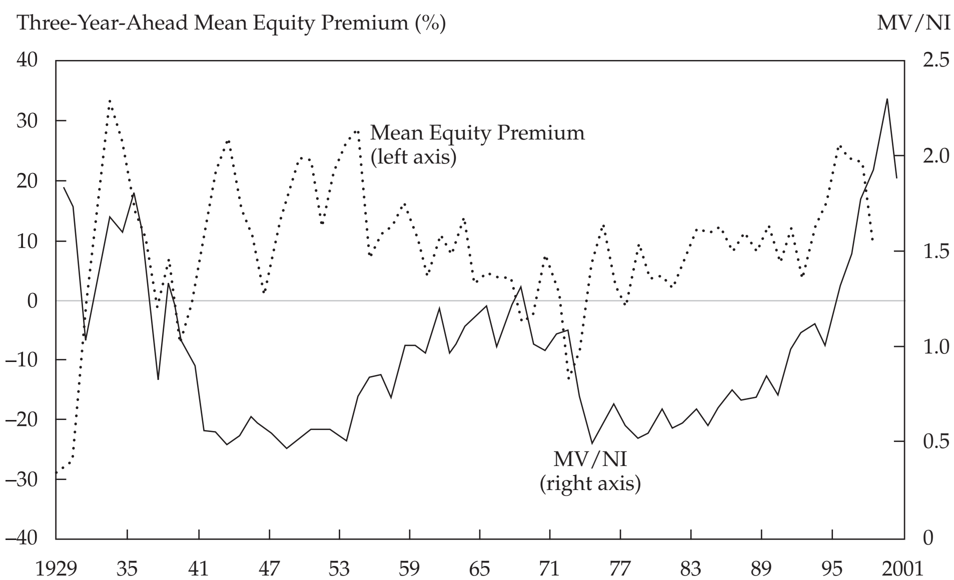
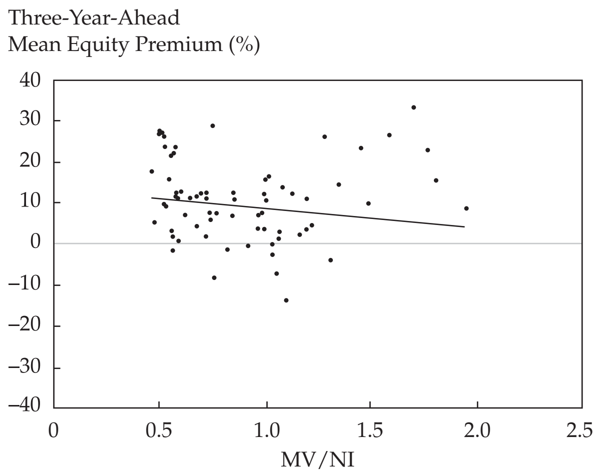


Figure 6. Scatter Diagram: Mean Equity Risk Premium Three Years Ahead versus Market Value/National Income, January 1929–January 2000 Data

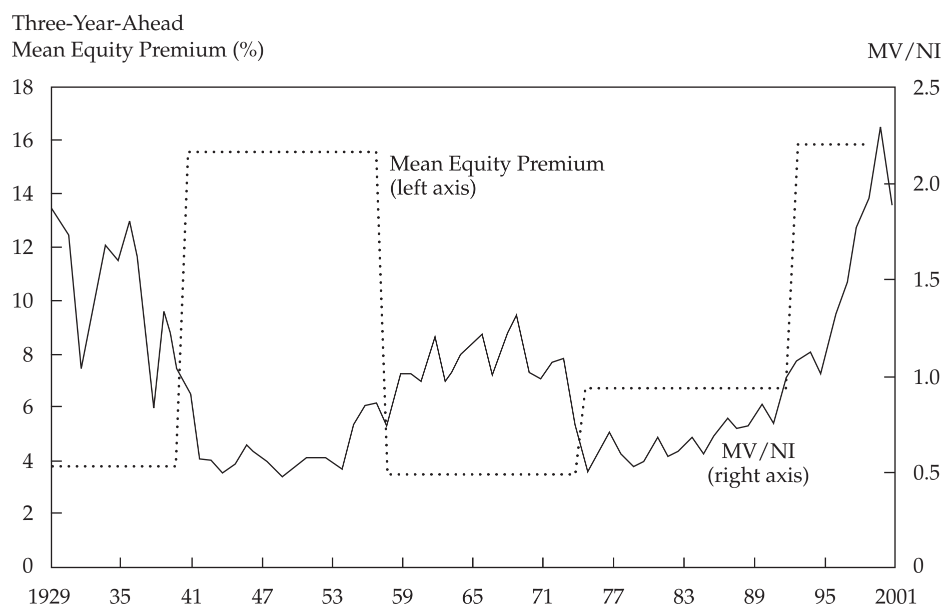


Note: $y = 4.7159x + 13.321$.

What could have been concluded from that information? The premium of 2 percent is the realization of a stochastic process with a large standard deviation. If the investor of 1928 saw any pattern in the stochastic process, optimizing agents would have endogenously changed the prices. That understanding makes it much more difficult to say we have a bubble. What we see is only one realization of a stochastic process. We would ideally like to see the realizations in many different, parallel universes and see how many times we actually came up with 2 percent and how many times we didn't. However, we are constrained by reality and observe only one realization!

The data used to document the equity premium are as good and clean as any economic data that I have seen. A hundred years of economic data is a long time series. Before we dismiss the equity premium, not only do we need to understand the observed phenomena (why an equity risk premium should exist), but we also need a plausible explanation as to why the future is likely to be different from the past. What factors may be important in determining the future premium? Life-cycle and demographic issues may be important, for example; the retirement of aging Baby Boomers may cause asset deflation. If so, then the *realized* equity premium will be low in 2010. But if asset valuations are expected to be low in 2010, why should the premium not be lower now? Perhaps what we are seeing in the current economy is the result of market efficiency taking the aging Baby Boomers into account. Either we will understand why a premium should exist (in which case, it will persist), or if it is a statistical artifact, it should disappear now that economic agents are aware of the phenomenon.

Figure 7. Mean Equity Risk Premium Three Years Ahead by Time Periods and Market Value/National Income, January 1929–January 2000



Note: The equity premium was averaged over time periods in which MV/NI > 1 and MV/NI < 1.

Current Estimates and Prospects for Change II

Rajnish Mehra

Professor of Finance
University of California, Santa Barbara
National Bureau of Economic Research and Vega Asset Management

SUMMARY

by Peter Williamson

Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

Rajnish Mehra proposed that analyzing the equity risk premium is an exercise in forecasting that has little to with the academic debate over whether the observed past excess return on equities presents a puzzle. Why is the equity premium a puzzle?

Table 1 shows real returns for long and not-so-long periods of time for the U.S. stock market, a relatively riskless asset, and the risk premium. A real return on equities of about 7 percent characterizes some long time periods, including 1889–1978, a period that did not incorporate the recent bull market. For the 1889–2000 period, the return was 7.9 percent. The standard deviation of annual returns was about 20 percent. Moreover, as **Table 2** shows, other countries have shown similar returns.

U.S. T-bills have returned about 1 percent with a 4 percent standard deviation. Why are the returns on T-bills so different from those on equity? We might say we are looking at an aberration, but this time series is the best evidence we have. The difference defies easy explanation by standard asset-pricing models. Is it explained by risk differences? The answer is not clear.

Table 1. Real U.S. Equity Market and Riskless Security Returns and Equity Risk Premium, 1802–2000

Period	Mean Real Return on Market Index	Mean Real Return on Relatively Riskless Asset	Risk Premium
1802–1998	7.0%	2.9%	4.1%
1889–2000	7.9	1.0	6.9
1889–1978	7.0[a]	0.8	6.2[b]
1926–2000	8.7	0.7	8.0
1947–2000	8.4	0.6	7.8

[a]Not rounded, 6.98 percent.
[b]Not rounded, 6.18 percent.

Sources: Data for 1802–1998 are from Siegel (1998); for 1889–2000, from Mehra and Prescott (1985).

Our theory tells us that assets are priced in such a way that, *ex ante*, the loss in marginal utility incurred by sacrificing current consumption to buy an asset at a certain price is equal to the expected gain in marginal utility contingent on the anticipated increase in consumption when the asset pays off in the future. The emphasis here is on *incremental loss or gain* of utility of consumption, which should be differentiated from incremental consumption because the same amount of consumption may result

Table 2. Real Equity and Riskless Security Returns and Equity Risk Premium: Selected Developed Markets, 1947–98

Country	Period	Mean Real Return on Market Index	Mean Real Return on Relatively Riskless Asset	Risk Premium
United Kingdom	1947–1999	5.7%	1.1%	4.6%
Japan	1970–1999	4.7	1.4	3.3
Germany	1978–1997	9.8	3.2	6.6
France	1973–1998	9.0	2.7	6.3

Sources: Data for the United Kingdom are from Siegel (1998); the remaining data are from Campbell (2002).

in different degrees of well-being at different times. As a consequence, assets that pay off when times are good and consumption levels are high—i.e., when the marginal utility of consumption is low—are less desirable than those that pay off an equivalent amount when times are bad and additional consumption is more highly valued.

This theory is readily illustrated in the context of the capital asset pricing model, in which good times and bad times are captured by the return on the market. Why do high-beta stocks yield a high expected rate of return? A high-beta security tends to pay off more when the market return is high—that is, when times are good and consumption is plentiful. Such a security provides less incremental utility than a security that pays off when consumption is low, is less valuable, and consequently, sells for less. Because rates of return are inversely proportional to asset prices, the former class of assets will, on average, give a higher rate of return than the latter.

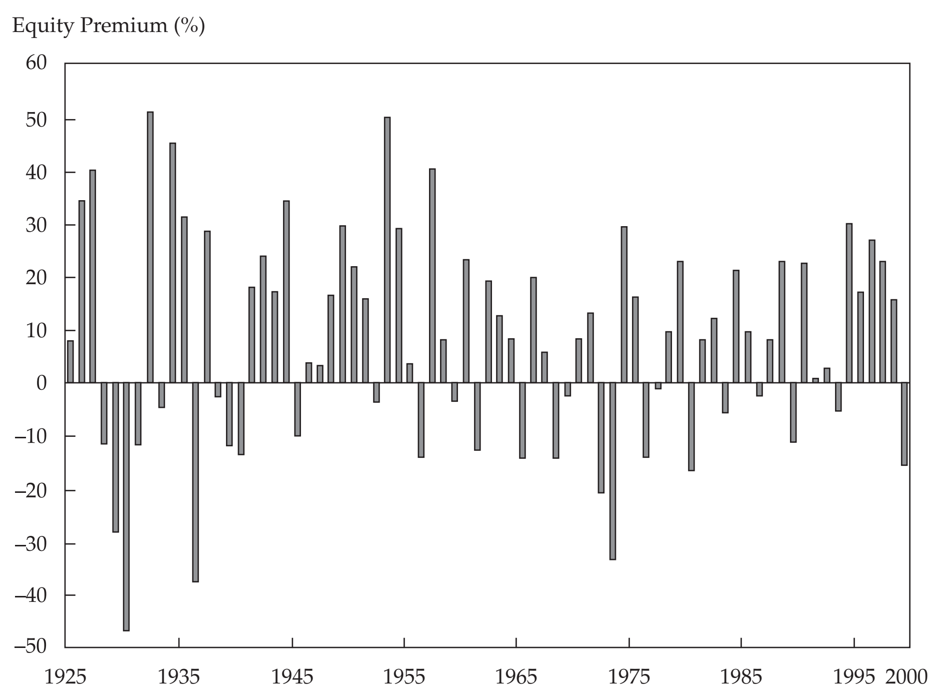
Another perspective emphasizes that economic agents prefer to smooth patterns of consumption over time. Assets that pay off a relatively larger amount at times when consumption is already high "destabilize" these patterns of consumption, whereas assets that pay off when consumption levels are low "smooth" out consumption. Naturally, the latter are more valuable and thus require a lower rate of return to induce investors to hold them. And such assets are purchased despite their very low expected rates of return. Insurance is an example.

What is surprising is that stocks and bonds *pay off in approximately the same states of nature* or economic scenarios. Hence, as Mehra argued earlier, they should command approximately the same rate of return. Using standard theory to estimate risk-adjusted returns, Mehra and Prescott (1985) showed that stocks, on average, should command, at most, a 1 percent (100 bps) return premium over bills. This finding presented a puzzle because the historically observed mean premium on stocks over bills was considerably and consistently higher.

The *ex post* excess return has varied a lot, which is not surprising. Graphs of the annual realized excess return in **Figure 1** and of the excess return for 20-year periods in **Figure 2** show dramatic differences.

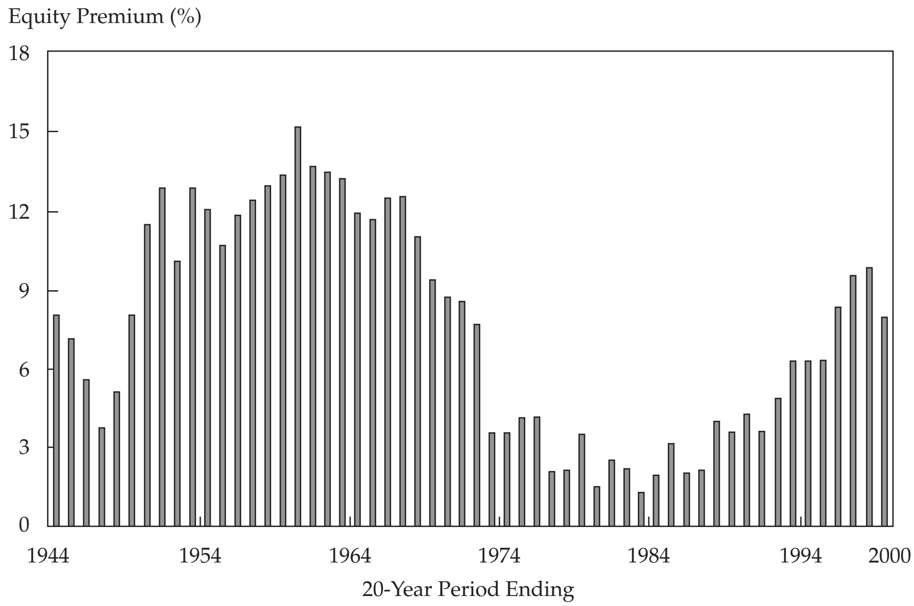
Mehra stressed that we need to distinguish the *ex post* excess return on equity from the *ex ante* risk premium. The expected equity premium *must* be positive. Following a bull market, the *ex post* will be high and the *ex ante* will be low. Over time, they will average out. A conclusion for the future depends on the planning horizon. Mehra was addressing the premium for the very long term—on the order of 50–100 years. In the short term, as in Figure 1, the variance in returns makes it quite impossible to come up with any reliable forecast. Figure 2 for 20-year periods, however, shows something more promising.

Figure 1. Realized Equity Risk Premium per Year, January 1926–January 2000



Source: Ibbotson Associates (2001).

Figure 2. Mean Equity Risk Premium by 20-Year Holding Periods, January 1926–January 2000

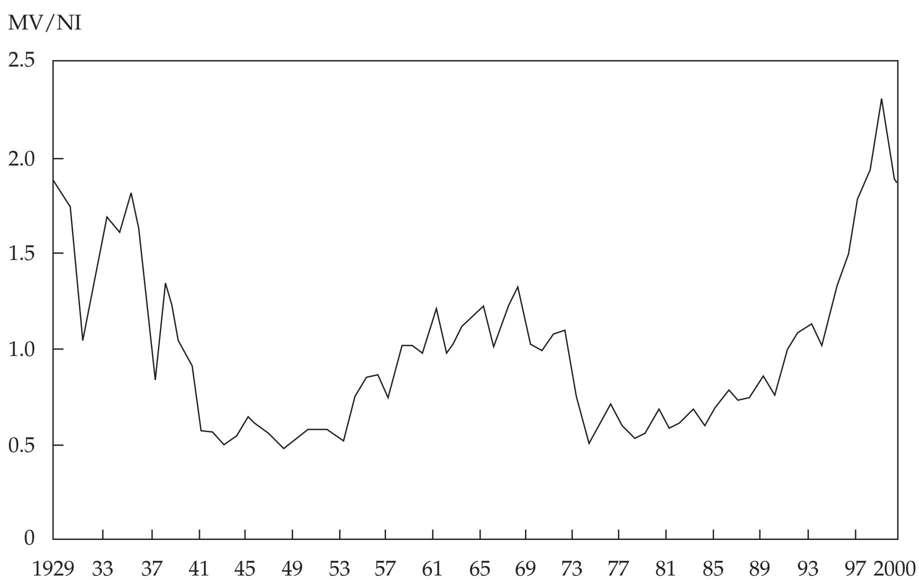


Source: Ibbotson Associates (2001).

Mehra's **Figure 3** showed the ratio of market value of equity (MV) to national income (NI) since 1929, and his **Figure 5** overlaid on that graph the three-year-ahead equity premium.[1] The ratio has ranged from $2 \times$ NI to $0.5 \times$ NI to $2.25 \times$ NI. In **Figure 7**, Mehra split the 1929–2000 period into subperiods—those in which MV as a ratio of NI was greater than 1 and those in which it was less than 1—and overlaid on that graph is the three-year-ahead mean equity premium. Figure 7 shows that we have had two and a half cycles since 1929, and they reveal some predictive ability: On average, when MV/NI is low, the risk premium is high, which is useful as a guide for the very long term.

[1] Table and figure numbers in each Summary correspond to the table and figure numbers in the full presentation.

Figure 3. U.S. Stock Market Value/National Income, January 1929–January 2000



Source: Data updated from Mehra (1998).

Figure 5. Mean Equity Risk Premium Three Years Ahead and Market Value/National Income, January 1929–January 2000

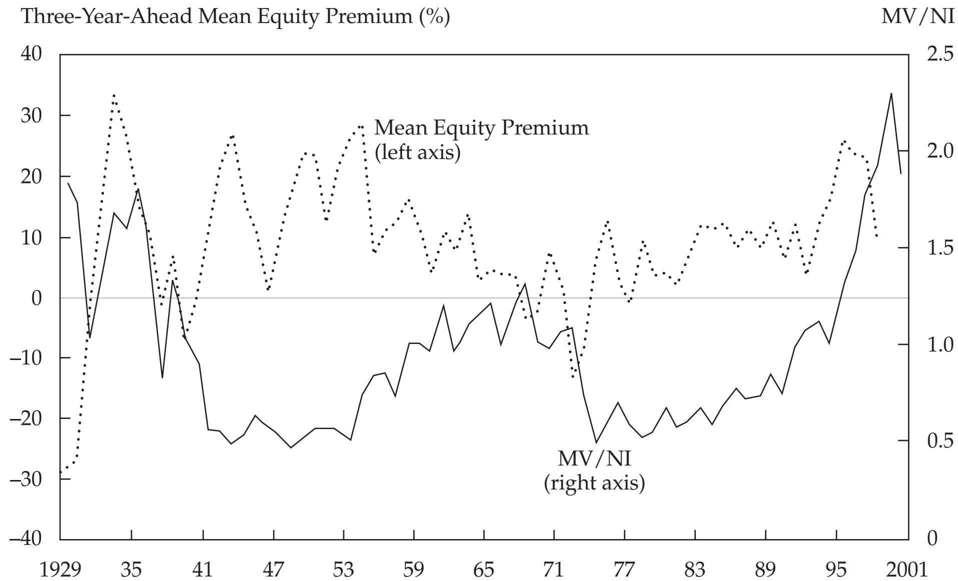
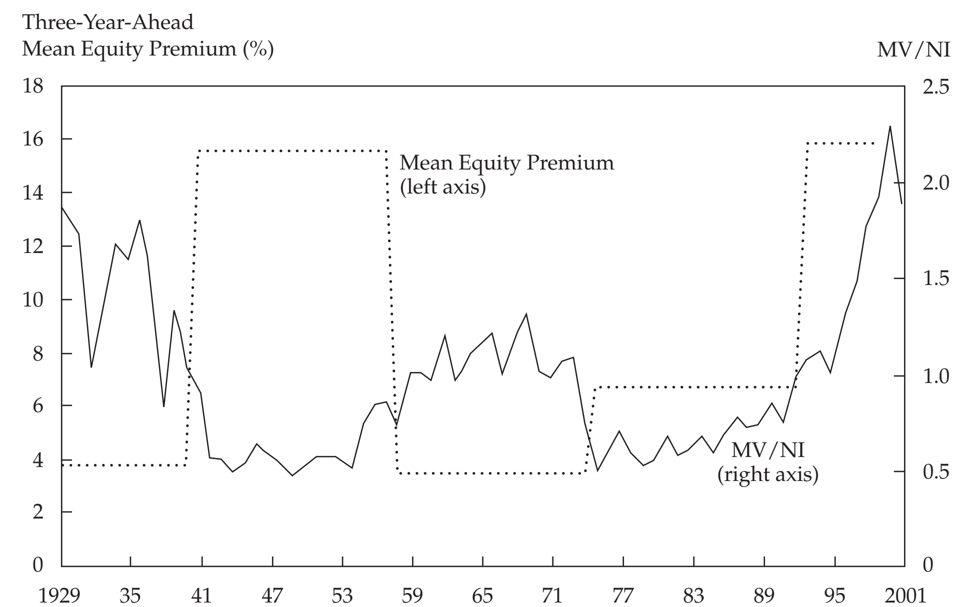


Figure 7. Mean Equity Risk Premium Three Years Ahead by Time Periods and Market Value/National Income, January 1929–January 2000



Note: The equity premium was averaged over time periods in which MV/NI > 1 and MV/NI < 1.

Mehra suggested that individuals who are interested in short-term investment planning will wish to project the conditional equity premium over their planning horizon. But doing so is by no means a simple task. It is isomorphic to forecasting equity returns. Because returns have a standard deviation of 20 percent, the noise dominates the drift. Operationally, how much information comes from knowing that the mean risk premium is 2 percent rather than 6 percent when the standard deviation is 20 percent?

In conclusion, Mehra considered how the world must have looked to an investor at the end of 1928.

The mean real return on the S&P 500 had been 8.52 percent for 1889–1928, and the mean real return on risk-free assets had been 2.77 percent, so the observed mean equity risk premium would have been 5.75 percent (575 bps). An analysis similar to the Mehra–Prescott (1985) analysis, however, would have indicated an *ex ante* premium of 2.02 percent.

Is the future likely to be different from the past? To decide, we need to focus on what factors might make the future different. Demographic changes, for example, could be very important. But, maybe, because of market efficiency, the market has already taken into account the likely changes.

Current Estimates and Prospects for Change: Discussion

John Campbell (*Moderator*)
Ravi Bansal
Bradford Cornell
William Goetzmann
Roger Ibbotson
Martin Leibowitz
Rajnish Mehra
Thomas Philips
William Reichenstein, CFA
Stephen Ross
Robert Shiller
Jeremy Siegel

JOHN CAMPBELL (Moderator)

I'll make a few remarks and then open the discussion. I would like to amplify a distinction that Raj Mehra was making between the *ex post*, realized premium over some past period and the *ex ante* premium that investors are expecting at a single point in time. Over the long run, these premiums have to average out to the same level if the market has any rationality at all, but in the short run, they can move quite differently. For example, a lot of Raj's graphs indicate that the *ex post* and *ex ante* risk premiums might move in opposite directions, and I think that concept is very important to keep in mind. If we go through a period when the *ex ante* premium falls (for whatever reason), that movement will tend to drive prices up for a given cash flow expectation, so we will see a high realized return during a period when the *ex ante* premium has actually fallen. That is the story of the 1990s—that average returns were high, particularly at the end of the decade, because investors were willing to take on more risk, so the required rate of return was declining. Thus, we had a decline in the *ex ante* equity premium at the same moment that we had very high average returns.

Of course, if the equity premium is estimated by use of historical average returns, even over a period as long as 100 years, a few good years can drive up the long-term average considerably. For example, over 100 years, a single good yearly return of 20 percent adds 20 bps to the 100-year average return. This is the problem with estimating the equity premium from historical average returns; there is so much noise, and the average will tend to move in the wrong direction if the true *ex ante* premium is moving.

As a result, the methodology used by many at this forum is to focus on valuation ratios at a single point in time and make adjustments for growth forecasts. The methodology can be applied simply or elaborately. You can simply look at the earnings yield, or you can try to adjust the yield for return on equity being greater than the discount rate equilibrium or Tobin's q being different from 1, which we discussed this morning [in the "Historical Results" session]. I think this approach is the right way to go. If you want to estimate the *ex ante* premium, you start with a valuation ratio that summarizes the current state of the market, make some adjustments based on your best judgment, and back out the *ex ante* premium.

The approach has two difficulties that one has to confront. They arise from the fact that the models we are using are steady-state models that give long-term forecasts in a deterministic setting. The problem with using a deterministic model is that you obliterate any distinction between different kinds of averages. In a random world, however, that distinction matters a lot. It matters to the tune of 1.5–2.0 percentage points.

The second problem is that a forecast from a valuation ratio is really the equivalent of the yield on a long-term bond. The valuation ratio produces an infinite discounted value of future returns. You don't necessarily know the sequence of predicted returns. You don't know the sequence of forward rates or the term structure; you just have a single measure of a long-term yield. So, it's very difficult to construct or generate a view about the actual path that returns might follow.

In my work with Bob Shiller, we argue that, given the level of prices, this long-term yield must be very low. But that argument is consistent with two different views about the time path. One view is that a correction is going to occur in the short or medium term, followed by a return to historical norms. If you hold this view, you have to be bearish in the short term but you are more optimistic about returns in future years. This outlook would be very pessimistic for an investor who has finished accumulating wealth and wants to cash out; it would be a more optimistic outlook for an investor who expects to accumulate assets over the next several decades.

The other view, which I think has some plausibility, is that we might see mediocre returns over the long term because of structural changes—structural changes in that transaction costs have come down, the costs of diversification have come down, investors have learned about the equity premium puzzle, and therefore, the *ex ante* premium is down and will be permanently down. This view is less bearish in the short term than the first view but also less optimistic in the long term.

I think Bob and I differ a little bit on this time-path issue in terms of how to chop up the long-term yield into a sequence of forecasts. Bob is probably closer to the view that returns will be very poor in the short term and then revert to historical norms, and I am closer to the view that there may have been a permanent structural change that will mean mediocre returns in the near term and the longer term.

It is hard for me to imagine a long-run equilibrium with an equity premium relative to U.S. T-bills less than about 1.5 percent geometric (2.5–3.0 percent arithmetic). And I think it may take a further price decline to reach that long-run equilibrium. In other words, we are in for a short period of even lower returns followed by a (geometric) premium of about 1.5 percent for the long term.

MARTIN LEIBOWITZ: One thing we have not talked much about is that if, over time, we have more data on earnings, price movements, and returns, what is going to be the catalyst for moving the risk premium to higher or lower levels—or to a point of acceptance? Of course, one of the really great things about the market is its ambiguity; even if you are earning dismal returns now, the market's volatility always allows you to look back at a recent period when you earned great returns. But what sequence of events and flow of information would wake up market participants to say, "Hey, a 2 percent equity risk premium? I'm not buying for 2 percent. Give me something else. Is there another market I can invest in? Is there another advisor out there?" This possibility is worth thinking about because if we make the rounds and tell our friends and professional colleagues, "Look, we've found out that the nominal, arithmetic equity risk premium is roughly only 3.0–3.5 percent, and that's going to be it, but I can give you some good news: Volatility will be relatively low, so you will really be getting a lot of return for the amount of risk you'll be taking," people will say, "Forget it!" I would not want to be invested in the equity market with that sort of outlook. People would just run away from the equity market. People are thinking, hoping, and dreaming of returns well over an equity premium of 3 percent; they are thinking of a risk premium greater than that. This kind of question is what we need to discuss.

RAJNISH MEHRA: This point is the reason that understanding *why* we have an equity premium is so important. On the one hand, if there is a rational reason for the equity premium—for instance, if investors are scared of recessions and actually demand a 6 percent equity premium, then I would expect a 6 percent premium in the future. On the other hand, if we find out that investors do not actually demand that premium for holding stocks—that they perceive stocks, in some sense, to be not much riskier than bonds—then, the premium will be lower. You seem to be saying that investors *do* perceive stocks to be much riskier than bonds and they *do* want a high premium, in which case they will get it. If investors refuse to own stocks when they get only a 2 percent premium, a repricing of assets will take place.

STEPHEN ROSS: One thing that we all agree on is that there is enormous estimation error in figuring out the risk premium. I find it ironic that the estimation error in the risk premium that we agree on plays no role whatsoever in the models that we use to infer the risk premium. It is somewhat like option pricing, where you assume you know the volatility. You look at the option price, and then you figure out what the volatility must be for that to be the option price. Then, you build models of what the option price should be. But estimating the risk premium is even more complicated, and estimation error is even more damaging.

The estimation error in estimating the risk premium is huge. Over a 100-year period, the standard error alone of the sample estimates is on the order of 2–3 percent. I am not convinced by John Campbell's argument that structural models, which are efforts to get conditional probability estimates and do a better job of conditioning, will improve the situation, because we have about the same volatility on our conditional estimates. I have a very pessimistic view of those models. They introduce other parameters, and where we had 2 percent standard errors on a few parameters, now we have 4 percent because we have more parameters. I'm not convinced that this approach will narrow down the estimate.

I am troubled by the fact that in this world of incredible volatility, and with no real confidence in our estimations of the risk premium, we still go ahead and advise people about what to do with their portfolios. As Rajnish Mehra said, we have a strange disconnect: The uncertainty that we all perceive in these models plays no role in the construction of the models. As a consequence, uncertainty plays no role in our ability to filter from the models better estimates. One of the things we have to think seriously about is estimation error in these models.

THOMAS PHILIPS: I share John Campbell's view that, barring an unforeseen surge in productivity, we are in for a prolonged period of lower returns prior to transaction costs and fees. However, the actual return that will be *realized* by investors net of transaction costs and fees is probably not very different from the return achieved in the past. Don't forget that index funds did not exist in 1926. In those days, transaction costs and fees subtracted 2–3 percent each year from returns; today, costs have fallen by 90 percent.

WILLIAM REICHENSTEIN: A number of models predict returns using a dividend model. In this model, long-run return is the current dividend yield plus long-run expected growth in dividends plus the percentage change in price divided by the dividend multiple, P/D. When predicting returns, analysts tend to drop the last term and predict the capital gains as the long-run growth in dividends. In the corresponding earnings model, predicted return is the current dividend yield plus the capital gains (the long-run growth in earnings) plus the percentage change in P/E. That has to hold; it is a mathematical certainty.

The reason I do not like the dividend model but like the earnings model is that we have no idea where the P/D multiple is going to go. Yet, the predictions from the dividend model assume it will remain constant. I can accept that there is some normal range for the P/E multiple, but I agree with Fisher Black that there is no normal range for the P/D multiple. Black looked at the various arguments to try to explain why companies pay dividends, and in the end, he threw up his hands and said we have no idea. If we have no theory or empirical evidence to explain dividend policy, then we have no reason to believe the P/D multiple is going to be stable. And we have no way of predicting it. That ratio could go to infinity. Therefore, any model that drops out that term, even for a long-run analysis, may be very, very wrong.

BRADFORD CORNELL: The dividend ratio may not be stable. In fact, we are seeing declining dividends, but you may have a constant payout ratio.

REICHENSTEIN: If we wanted to estimate the ending P/E after the next 50 years, whatever we came up with, we might feel reasonably confident it is going to be between 30 and 8.

ROSS: It is higher than 30 now!

REICHENSTEIN: Let's say that something will stop the P/E multiple from going too high or too low. But if you ask what the ending P/D multiple will be, well, if companies keep dropping dividends, it could be a billion.

CORNELL: That is why you might want to include payouts. Wouldn't you think that political pressures would arise to make sure shareholders got a certain fraction, on average, of corporate earnings? If shareholders do not get some share, they will become dissatisfied and companies will not be able to issue equity. Corporations cannot play the game of siphoning off all the earnings indefinitely for executives' perks and options and so forth.

ROGER IBBOTSON: You do not have to get your return through dividends. If the company is bought out, you can get your money out. You can get your money out in lots of ways other than dividends. Speaking for myself, if I had a choice, I would not want to get any of my money out in dividends.

MEHRA: Tandy Corporation, for instance, does not pay out any dividends. It was sued by the U.S. IRS, which charged that it was helping stockholders evade taxes. The company successfully won the case with an argument that it had a diverse group of stockholders and was not acting in the interest of any particular shareholder group. A rational approach would be for shareholders, instead of receiving a dividend payment, to sell shares and pay a capital gains tax when they want cash.

REICHENSTEIN: Yes, we do end up paying taxes. So, if you are only able to tell me that 50 years from now, the P/D multiple could be anywhere from infinity to something much, much lower, then that is a heck of an estimation error.

ROSS: The interesting question being raised is whether price to dividends is the variable you should be looking at or whether we should be asking: Is there stability in price divided by total payout, including stock repurchases, dividends, and Roger Ibbotson's suggestion that there is a constant probability that you will get a cash offer for the holding? So, the totality of all the payouts would be an interesting long-term variable to look at that may well be quite stable.

CORNELL: There are also some monies that go the other way, however, so the effective payout rate is very hard to compute.

REICHENSTEIN: But if you are using a model and put in the current dividend yield to project long-run growth and if dividends come from some historical average, then in a period like the past 20 years (in which we have had this dramatic fall in dividend payout rates and dividend yields), if you don't include repurchases, you have a problem. Past growth is going to be below future growth, and the dividend model predictions miss this point. I think Stephen Ross is saying that dividend payouts are unstable but might be stable if we added back in repurchases. In my view, the dividend model is a questionable framework.

RAVI BANSAL: Both Rajnish Mehra and Bob Shiller commented on the size of the premium but didn't comment on, or make predictions about, the underlying volatility of the market portfolio. From John Campbell's comment, if I am interpreting it correctly, he views the current scenario as a form of a drop in the Sharpe ratio. Has uncertainty fallen or risen? What is happening to the Sharpe ratio?

CAMPBELL: There haven't been any long-term trends in the volatility of the market as a whole. Certainly, marketwide volatility fluctuates. Volatility was unusually low in the mid-1990s and has risen a lot since then, but if you look over decades, you don't see any trend. The result is different when you look at the idiosyncratic volatility measure, however, because then you do see a trend over the last three decades. But looking marketwide, we do not see trends. Actually this lack of trend is a puzzle because of the evidence that the real economy has stabilized. GDP growth seems to be less volatile. So, some people claim that risk has fallen, which would justify the fall in the equity premium. Yet, we don't see that lower volatility when we look at short-term stock returns. The market does not appear to think that the world is any less risky.

JEREMY SIEGEL: Could I suggest something? Because real uncertainty has declined, companies can lever up more, generate higher P/Es. The result is maintenance of equity volatility, but it's because of an endogenous response to the increased real stability of the economy. So, greater leverage and higher P/Es could be generating the same equity volatility, which wouldn't be a puzzle even with the more stable real economy.

CAMPBELL: But if companies have levered up to maintain the same equity volatility, the equity premium should not fall as a result.

SIEGEL: Yes, if you don't take labor income being more stable into account as one of the factors that might determine risk preferences. In fact, some research shows that if there were more stability on the wage side (labor income), that stability would give people more incentive to buy equities.

WILLIAM GOETZMANN: Just a word on dividends: With all the studies that have looked at historical dividend yields, the problem is that we do not know very much about the dividends on which the studies were based. For data before 1926, we have the Cowles Commission (1938) information on dividends, but when you start reading Cowles' footnotes, you see he had a problem figuring out whether he was actually identifying all the dividends that were being paid by the companies.

ROBERT SHILLER: Have you solved this problem? We had the same problem.

GOETZMANN: Well, no, but we found it was a striking problem. We started from the Cowles period and worked back to see if we could collect information on dividends. We have the information back to the 1820s or so, but we could be missing dividends.

SHILLER: You're concerned that you don't have all the information, that you are missing a significant chunk of it?

GOETZMANN: Yes. You have a set of stocks that are similar to each other—their industrial characteristics are similar, for example. One stock may be paying 8 percent dividends for 10 years, but for another stock, you have no dividend information available. Are you to presume that the second stock did not pay any dividends or that your records simply do not show the dividend? So, what we have had to resort to is to report the high number and to report the low number. And we don't think anybody else has ever really been able to get any better information about dividends than we have. So, if we're going to talk about model uncertainty, let's also talk about data uncertainty—particularly as the records go back through time.

SHILLER: Do you think that companies sometimes reported dividends to commercial and financial chronicles and at other times, misreported them or didn't report them at all?

GOETZMANN: Yes, that could be true.

SHILLER: Wouldn't it have to happen on a big scale to affect the aggregate numbers?

IBBOTSON: As you go back in time, it is not clear who or what was getting the reports. For one period of time, there was an official source for the NYSE, but later, that source disappeared. It is hard enough to get actual stock price data, but it is much harder to find out who reported dividends to whom. Therefore, dividend information comes from all sorts of sources.

GOETZMANN: So, for what it's worth, sprinkle some more noise into this whole process. It's a real challenge to focus on valuation ratio regressions. We've been talking about valuation ratio regressions and statistics in one form or another for eight or nine years now, and we have all sorts of details about the econometrics, but the real issue to me is whether we really know what the payouts were as we push backward in time.

IBBOTSON: For the stock price data, we only needed to go to one (or possibly two or three) sources, but for the dividend data, we had to go to many sources, and even after going to many sources, we found we were getting only some of the data. However, when we found the data, companies paid all their earnings out in dividends. They had 100 percent payout ratios in the 19th century. But for the missing data—who knows.

ROSS: In this entire discussion, we are focusing entirely on the risk premium, and we have sort of ignored the other variable, volatility. What is interesting about volatility is that it is the one variable about which we do have confident expectations.

Volatility has two features that are curious. One feature is that we can actually measure volatility with a certain amount of precision; we know what volatility is. Volatility is a lot less ambiguous than the equity risk premium. We need to bring volatility to bear on such questions as long-run portfolio allocation problems. Someone who has great estimation error about the risk premium and cannot quite figure out what it is but who, nonetheless, is taking others' advice as to what to do, would perhaps be informed in this decision by observing that we do know a lot about the pattern of volatility, we have far less estimation error for it, we sort of know what volatility is today, and we have pretty good ability to predict it over fairly long horizons. At least this person should understand the volatility of volatility, which shows up as much in those allocation problems as does expected return.

The second curious feature of volatility is, it seems to me, that we can use this variable in some interesting ways. Implied volatilities have been around now for 20 years. I know that the week before the 1987 crash, implied volatilities went to an annualized rate of about 120 percent. Prior to the current crash, implied volatilities again rose substantially. The cynic would say, well, implied volatility was quite high, but people didn't know whether the market was going up 200 points or down 200 points the next day; they just knew it was going to be a big move. But my guess is that investors figured that the market wasn't going to go up much more; they really thought the market was going to go down. It would be nice for those who are doing the empirical work on the risk premium to have a variable that actually has expectation recorded in it. It might be fun to look at its empirical content for the puzzles we are talking about today.

SIEGEL: I would like to add something to that comment. I think we know short-run volatility because we can measure it using options, most of which are very short term. But the question of long-run volatility depends very much on the degree of mean reversion, which is very important for long-term investors and is, as we all know, subject to great debate.

ROSS: Actually, I suspect long-term volatility is subject to less debate than long-run returns. For short-run volatility, even for an option one year out, with pretty good liquidity, you can start to see reversion—pretty clear reversion—one year out.

SIEGEL: But we don't have 10-year, or 20-year, or 30-year options, which might be very important for longer-term investors.

ROSS: Volatility is a lot better measure than returns, for which we have nothing that tells us anything about the short term or the long term.

SHILLER: I want to remind you of the very interesting discussion in Dick Thaler's talk this morning about *perceived* volatility [See the "Theoretical Foundations" session]. We seem to be forgetting about the distinction between the actual and the perceived risk premium. When Marty Leibowitz was saying that people would not be interested in stocks with an equity premium of 1.5 percent, he may have been assuming that the perceived volatility was very high. Dick was saying that it is the *presentation* to the general public that affects the public's perception of volatility. His research disclosed a very striking result, which is that when you present investors with high-frequency data, they have a much different perception of what the data are saying than when you present them with less-frequent—say, annual—data. And the way the data are being presented is changing. When I walk down the street now, I can look up at a bank sign that alternates between time, temperature, and the Nasdaq.

LEIBOWITZ: I have a couple of comments. First, if you had a volatility estimate that you could live with and you had actual asset allocations that were stable and common—most asset allocations, at least by institutional investors, are surprisingly stable and common—you could (theoretically) clearly back out from those variables the implied risk premium. No big challenge. At least, you could back out mean–variance estimates. Of course, the question is: What kind of time horizon would you be looking at? The horizon would be the critical ingredient. If you were looking over a long enough time horizon, the risk premium could be 0.1 percent. If you were looking over a short horizon, the risk premium could be something enormous.

Robert Merton wanted me to introduce along these lines the Zvi Bodie construct.[1] Bodie says that the kind of option you would have to buy as you go out to very long horizons is very different, in terms of the Sharpe ratio, from a short-horizon option; it is a very expensive option. That reality has to tell you something.

The other thing that I want to mention is that the issue of equilibrium payout ratios is very important. The question is: When an equilibrium is reached, at which point earnings are growing at either the growth rate of the economy or near that rate (i.e., that rate is your stable equilibrium view), then in terms of dividends, how much of a company's aggregate earnings have to be put back into the company to sustain that growth? This is the critical question. All else would then follow from the answer. It's surprising that this issue has not been much addressed, as far as I know, even from a macro level.

PHILIPS: There is a pragmatic solution to the question that Stephen Ross and Jeremy Siegel raised. We have about 20 years of option data, so you might construct the volatility data going back 20 years, and you could explore the fact that as you sample faster and faster, the estimates of volatility get sharper and sharper. Just take a perfect-foresight model: Assume it's 1920, and you're going to assume that the world is rational and that the forecasted volatility would have been the volatility that was actually realized over 1921, or 1921–1925, or whatever years you want to use. From those data, you could impute a data series going back in time and then try to do the appropriate tests. Cliff Asness has a very nice paper in the *Financial Analysts Journal* that explores this approach (2000b). Cliff looks at historical volatility and then backs out future returns as a function of historical volatility.

[1] Robert Merton was invited to attend but could not.

Implications for Asset Allocation, Portfolio Management, and Future Research I

Robert D. Arnott

First Quadrant, L.P.
Pasadena, California

A practitioner's empirical approach to estimating prospective (expected) equity risk premiums does not bode well for finding alpha through conventional U.S. equity allocations. In the United States and the United Kingdom, real earnings and real dividends have been growing materially slower than real GDP. Based on empirical evidence, if today's dividend yield is 1.7 percent and growth in real dividends is about 2.0 percent, cumulative real return on stocks will be about 3.7 percent. With a 3.4 percent real yield on bonds available, the *ex ante* risk premium all but disappears. Perhaps most troubling in the empirical evidence is the 60 percent negative correlation between payout ratios and subsequent 10-year earnings growth. With current payout ratios close to 40 percent, the implication for earnings growth over the coming decade is a rate of about –2 percent. When an assumed negative earnings growth rate is combined with an assumed zero risk premium, we have a serious problem.

I have to begin by offering profuse apologies. You are seasoned, very capable academics, and I'm not. I'm just a practitioner and an empiricist. So, we're going to focus on practice and empiricism in this presentation and stay far away from the theory related to the equity risk premium.

History versus Expectations

First, I want to emphasize an observation that a number of speakers have made: Much of the dialogue about the risk premium is very confused because the same term, "risk premium," is used for two radically different concepts. One is the historical excess return of stocks relative to bonds or cash, and the other is the prospective risk premium for stocks relative to bonds on an *ex ante* basis, without any assumptions about changes in valuation levels. The two concepts are totally different, should be treated separately, and, I think, should carry separate labels. Excess returns measure past return differences. The risk premium measures prospective return differences. I wish the industry would migrate to using different terms for these two radically different concepts.

A quick observation: If you are a bond investor and you see bond yields drop from 10 percent to 5 percent, and in that context, you have earned a 20 percent return, do you look at those numbers and say, "My expectation of 10 percent was too low. I have to ratchet my expectation higher. I'll expect 12–15 percent"? Of course not. The reaction by the bond investor is, "Thank you very much for my 20 percent returns; now, I'll reduce my expectation to 5 percent." If the earnings yield on stocks falls from 10 percent to 5 percent, however, what is the investment community's response when they see the 20 percent return? They say, "Our expectations were too low! Let's raise our expectations for the future."

My impression of the discussion we have been having today is that the reaction in this room would be absolutely unanimous in saying the portion of return attributable to the drop in the earnings yield (earnings to price) or the drop in the dividend yield can and should be backed out of the historical return in shaping expectations. I haven't heard a lot of discussion of the fact—and I think it is a fact—that a drop in the earnings yield should have a second-stage impact. The first stage is to say 10 percentage points (pps) of the return came from falling earnings yields; therefore, let's back that out. The second stage is that the fall in the earnings yield should produce a haircut in future expectational returns. I don't hear this concept out in the marketplace, and I don't hear it much in the academic community either.

Strategic Implications of Lower Returns

Let's begin with the hypothesis that the risk premium, the forward-looking premium, on U.S. stocks is now zero. Please accept that supposition for the next few minutes. If the risk premium is zero, what is the implication for asset allocation policy? In the past, the policy allocation to stocks and fixed income was the king of asset management decisions. It was the number one decision faced by any U.S. institutional investor—indeed, any investor in general. The reason was that more stocks meant more risk and more return.

The fiduciary's number one job was to gauge the risk tolerance of the investment committee and to push the portfolio as far into stocks as that risk tolerance would permit. If that job was done correctly, the fiduciaries had succeeded in their primary responsibility. But if stock, bond, and cash real returns are similar, if the risk premium is approximately zero, then it doesn't matter whether you have a 20/80 equity/debt or an 80/20 equity/debt allocation. It does affect your risk and your year-by-year returns, but it doesn't affect your long-term returns. So, if the risk premium is zero, this fundamental policy decision is radically less important than it has ever been in the past.

As for rebalancing, the empirical data support the notion that rebalancing can produce alpha, but we do not have a lot of empirical data to support the notion that rebalancing adds value. History suggests that rebalancing boosts risk-adjusted returns, but it sometimes costs money. Rebalancing produces alpha by reducing risk, and in the long term, it typically adds some value in addition to risk reduction. Now, suppose we are in a world in which there is no risk premium and in which stocks and bonds have their own cycles, their own random behavior. If that behavior contains any pattern of reversion to any sort of mean, rebalancing suddenly can become a source not only of alpha but also of actual added value—spendable added value.

In the past, tactical asset allocation (TAA) provided large alpha during periods of episodic high returns but did not necessarily provide large added value. So, the actual, live experience of TAA in the choppy, see-saw market of the 1970s was awesome. In the choppy bull market of the 1980s, value added from TAA was not awesome but was still impressive. In the relentless bull market of the 1990s, the value added from TAA was nonexistent. Alpha was certainly still earned in the 1990s (a fact overlooked by many), but it came mostly from reduced risk. If we are moving into markets like those of the 1970s, then TAA certainly merits another look.

What about the strategic implications of lower returns for pension funds? If conventional returns lag actuarial returns, then funding ratios are not what they seem. I did a simple analysis of funding ratios for the Russell 3000 Index and found that for every 1 pp by which long-term returns fall short relative to actuarial returns, the true earnings of U.S. pension assets fall by $20 billion. If, as I believe is the case, long-term returns are going to be about 3 pps below long-term actuarial assumptions, pension fund earnings will be $60 billion less than what is being reported, and this shortfall will need to be made up at some later date.

In a world of lower returns, if you don't believe in efficient markets, alpha matters more than ever before. If you do believe in efficient markets, the avoidance of negative alpha by not playing the active management game matters more than ever.

Now, a truism would be that conventional portfolios will produce conventional returns. That is fine if conventional returns are 15 percent a year, as they were for the 18 years through 1999. In a market environment of 15 percent annual returns, another 1 pp in the quest for alpha doesn't matter that much to the board of directors, although it does make a material difference to the health of the fund. However, if the market environment is producing only 3–4 percent real returns for stocks *and* bonds, another 1 pp matters a lot.

What investments would be expected to consistently add value in a world of lower expected returns? "Conventional" alternative investments may or may not produce added value. Private equity and venture capital rely on a healthy equity market for exit strategies. They need a healthy equity market to issue their IPOs (initial public offerings). Without a healthy equity market, private equity and venture capital are merely high-beta equity portfolios that can suffer seriously in the event of any sort of reversion to the historical risk premium. International equities and bonds may have slightly better prospects than U.S. equities and bonds, but not much better.

Strategies well worth a look are the elimination of slippage, through the use of passive or tactical rebalancing, and cash equitization. If the equity risk premium is lost, then alternative assets whose returns are uncorrelated with the U.S. equity market will absolutely produce added value. Uncorrelated alternatives include TIPS,[1] real estate, REITs (real estate investment trusts), natural resources, and commodities. Absolute return strategies (market-neutral or long–short strategies and other hedge fund strategies) will also absolutely produce added value—if you can identify strategies that *ex ante* have an expectation of alpha. These approaches are, more than anything else, bets on skill and bets on inefficient markets. So, the investment strategies that will work in a world of lower returns differ greatly from the conventions that are driving most institutional investing today.

These reflections are from the vantage point of a practitioner. Much of what I've said makes the tacit assumption that markets are quite meaningfully inefficient, so these comments might be viewed with a jaundiced eye by a group that accepts market efficiency. Now, let's turn from practice to empiricism.

Empirical Experience

The Ibbotson data going back 75 years show about an 8 percent cumulative real return for stocks (see Ibbotson Associates 2001). Starting at the end of 1925 with a 5.4 percent dividend yield, the valuation attached to each dollar of dividends quadrupled in the 75-year span. That increase translated into nearly a 2 percent a year increase in the price/dividend valuation multiple—hence, 2 pp of the 8 percent real return. I think nearly everyone in this room would feel comfortable backing this number out of the returns in shaping expectations for the future. Over the 75-year period, real dividends grew at a rate of 1 percent a year. So, over the past 75 years, stocks produced an 8.1 percent real return. The real yield at the start of this period was 3.7 percent. (I say "real" yield because the United States was still on a gold standard in 1925; inflation expectations were thus zero. Bonds yielded 3.7 percent, and bond investors expected to earn that 3.7 percent in real terms.) Bonds depreciated as structural inflation came onto the scene. So, stocks earned a cumulative 4.7 percent real return in excess of the real return earned by bonds over the same period.

What does the future have in store for us from our vantage point now in the fall of 2001? **Table 1** contains the Ibbotson data and our analysis of the prospects from October 2001 forward. We'll start with a simple model to calculate real returns for stocks:

Real stock return = Dividend yield
+ Dividend growth
+ Changes in valuation levels.

In October 2001, the dividend yield is roughly 1.7 percent. If we assume that stock buybacks accelerate the past growth in real dividends, we can double the annual growth rate in real dividends observed over the past 75 years to 2 percent. Those two variables give us a 3.7 percent expected annual real return. TIPS are currently producing a 3.4 percent annual real return. Thus, the expected risk premium is, in this analysis, 0.3 pp, plus or minus an unspecified uncertainty, which I would argue is meaningful but not huge.

Why was the historical growth in real dividends (from 1926 through 2000) only 1 percent a year? Did dividends play less of a role in the economy? Were corporate managers incapable of building their companies in line with the economy? I don't believe either was the reason. The explanation hinges on the role of entrepreneurial capitalism as a diluting force in the growth of the underlying engines for valuation—that is, earnings and dividends of existing enterprises. The growth of the economy consists of growth in existing enterprises and the creation of new enterprises. A dollar invested in the former is not invested in the latter. **Figure 1** shows real GDP growth, real earnings per share (EPS) growth, and real dividends per share (DPS) growth since January 1970. Over the past 30 years, until the recent earnings downturn, real earnings have almost kept pace with real GDP

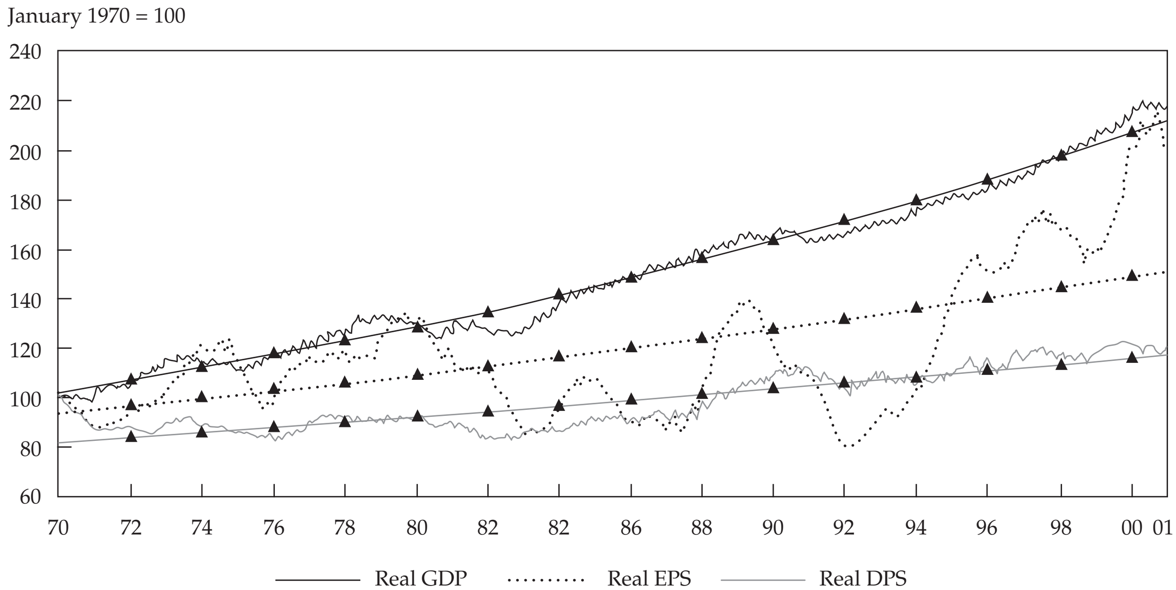
Table 1. The Ibbotson Data Revisited and Prospects for the Future

Component	75 Years Starting December 1925	Prospects from October 2001
Starting dividend yield	5.4%	1.7%
Growth in real dividends	1.0	2.0
Change in valuation levels[a]	1.7	???
Cumulative real return	8.1	±3.7
Less starting bond real yield	3.7[c]	3.4[d]
Less bond valuation change[b]	–0.4	???
Cumulative risk premium	4.7	±0.3

[a] Yields went from 5.4 percent to 1.4 percent, representing a 2.1 percent increase in the price/dividend valuation level.
[b] Bond yields went from 3.7 percent to 5.5 percent, representing a 0.3 percent annualized drop in long bond prices.
[c] A 3.7 percent yield, less an assumed 1926 inflation expectation of zero.
[d] The yield on U.S. government inflation-indexed bonds.
Source: Based on Ibbotson Associates (2001) data.

[1] TIPS are Treasury Inflation-Protected Securities; these securities are now called Treasury Inflation-Indexed Securities.

Figure 1. GDP, EPS, and DPS: United States, January 1970–January 2001



Note: Triangles identify exponentially fitted lines.
Source: Data from Organization for Economic Cooperation and Development (OECD).

growth. However, this pattern has occurred in the context of earnings as a share of the macroeconomy rising from below historical norms to above historical norms, including a huge boom in the 1990s. From the line of best fit, we can see that the growth trend in real earnings and real dividends is materially slower than the growth in the economy.

Is the picture different in Canada? Yes, it is. **Figure 2** illustrates that real earnings and real dividends on an indexed portfolio of Canadian equities have actually shrunk while real GDP has grown, producing a bigger gap between the series than we find in the United States. Why did this happen? In Canada, the fundamental nature of the economy has evolved in the past 30 years from resource driven to information and services driven.

The experience of the United Kingdom, where real earnings and real dividends grew materially slower than real GDP, has been similar to that of the United States. The experience of Japan has been rather more like Canada's. Japan, like Canada, is a fundamentally restructured economy. The result is that over the past 30 years, entrepreneurial capitalism in Japan has had a larger dilutive effect on shareholders in existing enterprises than it has in the United States.

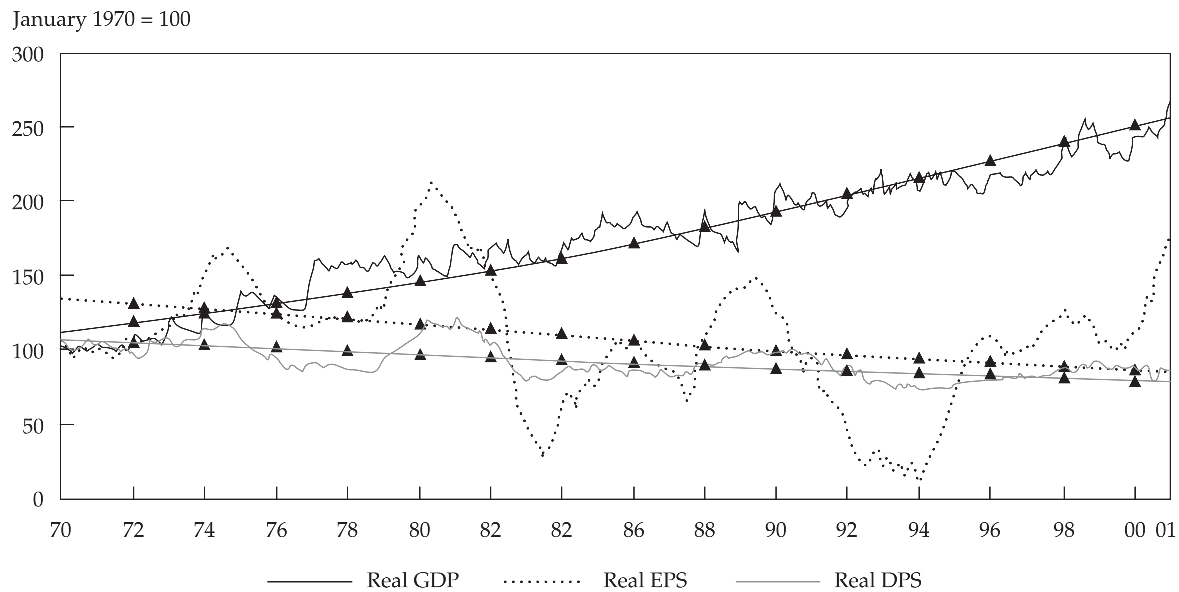
Table 2 shows, for the period from 1970 through 2000, the average growth of the four countries in real GDP, real EPS, real DPS, and average real EPS plus real DPS; Table 2 also shows the combined averages for each country and for all four countries grouped together. The general pattern is clear: Entrepreneurial capitalism is the dominant source of GDP growth, so it dilutes the growth of earnings for investors in existing enterprises.

We can look back over a much longer span for the U.S. market, from 1802 to 2001. **Figure 3** graphs the growth of $100 invested in U.S. stocks at the beginning of the 200-year period. Assuming dividends are reinvested, the $100 would have grown to more than $600 million by December 2001—a nice appreciation in any portfolio. By removing the effects of inflation and reinvestment of dividends, we can isolate the internal growth delivered by the existing companies. When the effect of inflation is removed, the ending value drops to $30 million. And when the assumption of reinvested dividends is removed, the ending value is reduced to a mere $2,000.

Figure 4 illustrates the link between real growth in stock value and economic growth. Real GDP growth increased 1,000-fold over the 1802–2001 period, real stock prices increased some 20-fold, and real per capita GDP growth similarly increased about 20-fold.

We can now assess the underlying engines of valuation. We'll examine the real dividend (you could do the same thing with real earnings). As **Figure 5**

Figure 2. GDP, EPS, and DPS: Canada, January 1970–January 2001



Note: Triangles identify exponentially fitted lines.
Source: OECD.

Table 2. Growth in GDP, EPS, DPS, and EPS + DPS, January 1970–January 2001

Measure	Canada	Japan	United Kingdom	United States	Average
Real GDP	2.7%	3.1%	2.4%	2.0%	2.5%
Real EPS	–1.4	–3.8	1.3	1.3	–0.6
Real DPS	–0.8	–1.6	2.0	1.0	0.1
Average real EPS + real DPS	–1.1	–2.7	1.6	1.1	–0.3
Average EPS + DPS growth as a percentage of GDP	–41.0	–87.0	67.0	57.0	–11.0

Source: OECD; Morgan Stanley Capital International.

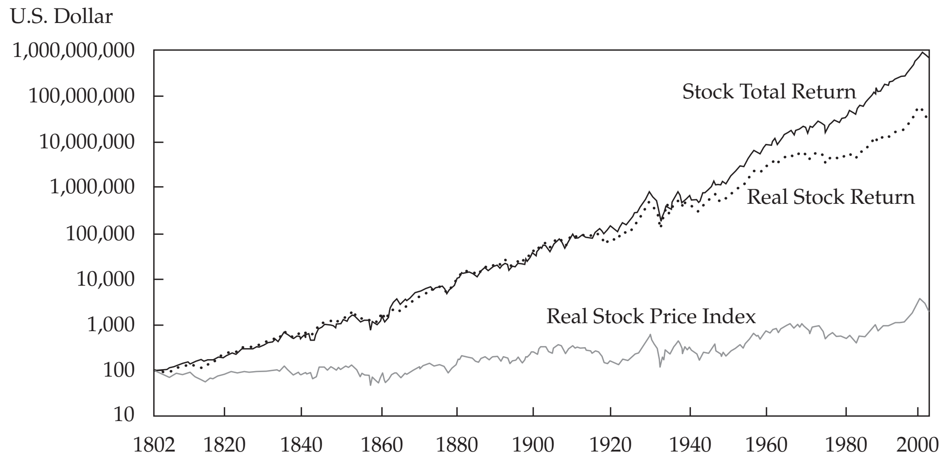
shows, real dividend growth matches very closely the growth in real per capita GDP. The implication is that the internal growth of a company is largely a matter of productivity growth in the economy and is, in fact, far slower than the conventional view—that dividends grow at the same rate as GDP.

Now we are ready to model and estimate real stock returns. In **Figure 6**, the dashed line represents the dilution of GDP growth in the growth of dividends. Growth in dividends tracks growth in real per capita GDP (the dotted line) remarkably tightly; the standard deviation is very modest—only 0.5 percent. This relationship is astonishingly stable. On a 40-year basis, the deviation is never above +0.1 percent and never below –1.6 percent. Moreover, current experience is in line with historical norms, despite anecdotal opinions that companies are delivering less in dividends than ever before.

A model that estimates real stock returns is useful only if its estimates actually fit subsequent experience. **Figure 7** is a scattergram providing the correlation between estimated and subsequent actual 10-year real stock returns. The correlation between the two is approximately 0.46 for the full period and far higher since World War II. The current figure for the real stock return is down in the 2–4 percent range. Of course, what the subsequent actual real return will be is anybody's guess, but I am not optimistic.

The same type of modeling can be done to estimate the real bond return. An inflation estimate can be subtracted from the nominal bond yield to arrive at an estimated real bond return. How do the

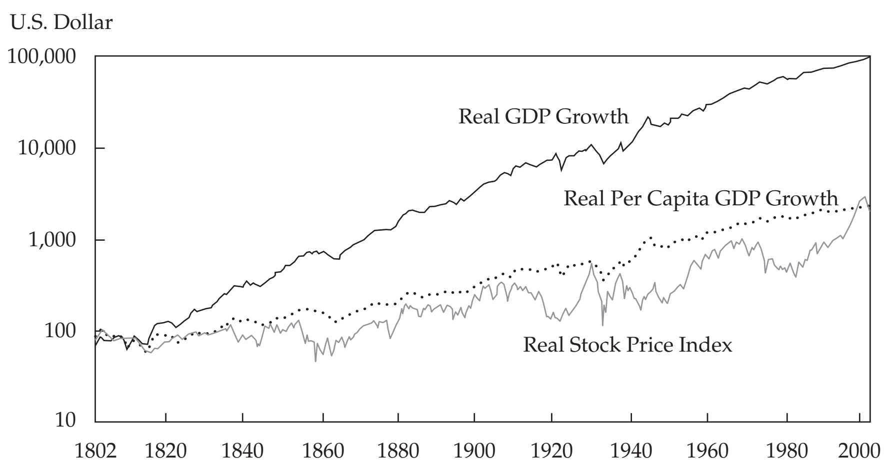
Figure 3. Return from Inflation and Dividends, 1802–2001



Notes: The "Real Stock Price Index" is the internal growth of real dividends—that is, the growth that an index fund would expect to see in its own real dividends in the absence of additional investments, such as reinvestment of dividends.

Source: Arnott and Bernstein (2002).

Figure 4. The Link between Stock Prices and Economic Growth, 1802–2001



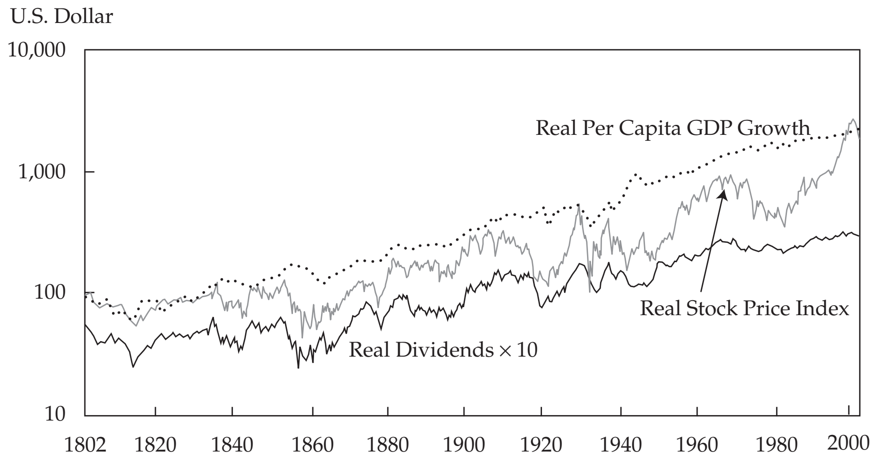
Source: Arnott and Bernstein (2002).

estimates calculated by this model fit with the subsequent real bond returns? As **Figure 8** shows, over a 200-year span, they fit pretty darned well. The loops off to the left relate to wartime. In several periods—the Civil War, World War I, World War II—investors were content to receive a negative expected real return for bonds, which can perhaps be attributed to patriotism. The country survived, so the real returns exceeded the expectations.

By taking the difference between the estimated real stock return and the estimated real bond yield, you get an objective estimate of what the forward-looking equity risk premium might have been for investors who chose to go through this sort of straightforward analysis at the various historical points in time. As shown in **Figure 9**, the *ex ante* risk premium of 5 percent, considered normal by many in the investment business, actually appears only during major wars, the Great Depression, and their aftermaths.

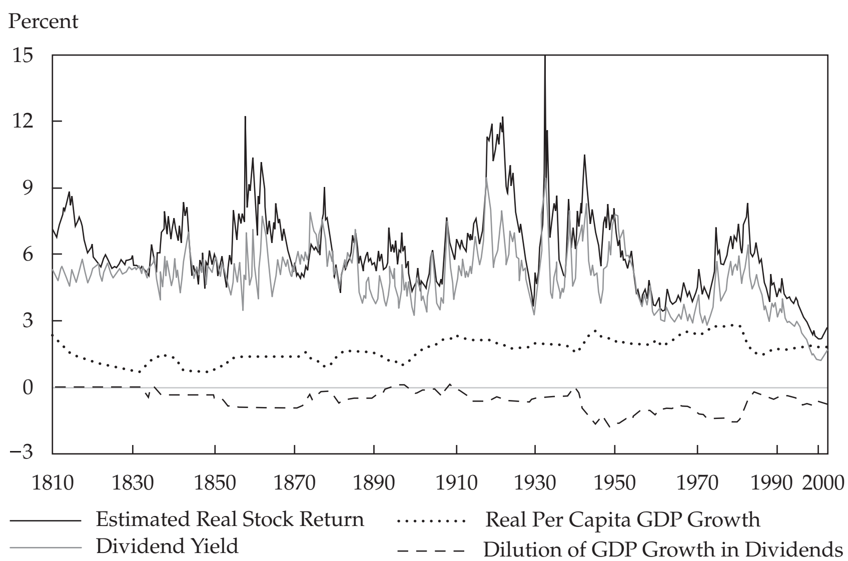
How good is the fit between this estimated risk premium and subsequent 10-year excess returns of

Figure 5. Dividends and Economic Growth, 1802–2001



Notes: Real dividends were multiplied by 10 to bring the line visually closer to the others; the result is that on those few occasions when the price line and dividend line touch, the dividend yield is 10 percent.
Source: Arnott and Bernstein (2002).

Figure 6. Estimating Real Stock Returns, 1810–2001

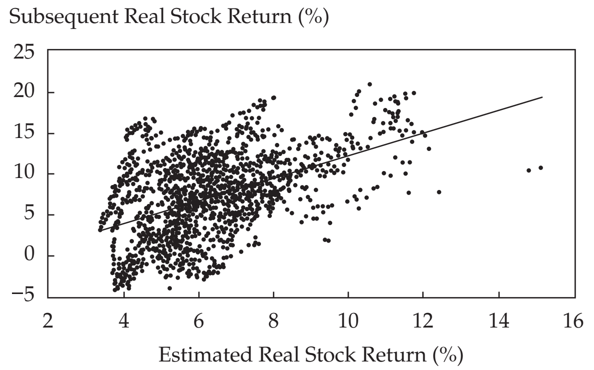


Notes: Based on rolling 40-year numbers. Real stock return = Dividend yield + Per capita GDP growth – Dividend/GDP dilution. The line "Dilution of GDP Growth in Dividends" indicates how much less rapidly dividends (and earnings) on existing enterprises can grow than the economy at large.
Source: Arnott and Bernstein (2002).

stocks over bonds? **Figure 10** shows that the fit is fairly good, which is worrisome in light of the poor current outlook. The current point on the *x*-axis (when this particular formulation is used) is about –0.5 percent. The implications for forward-looking 10-year real excess returns of stocks relative to bonds are worrisome—if this model holds in the future, if things are not truly different this time.

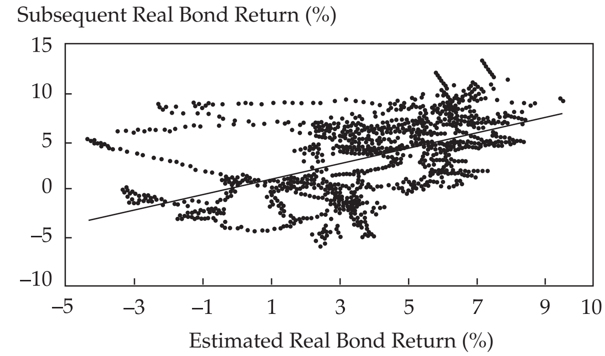
Figure 11 is a scattergram that relates the payout ratio to subsequent 10-year earnings growth from 1950 through 1991. This information ties in with Cliff Asness's talk [in the "Theoretical Foundations"

Figure 7. Estimated and Subsequent Actual Real Stock Returns, 1802–2001



Source: Arnott and Bernstein (2002).

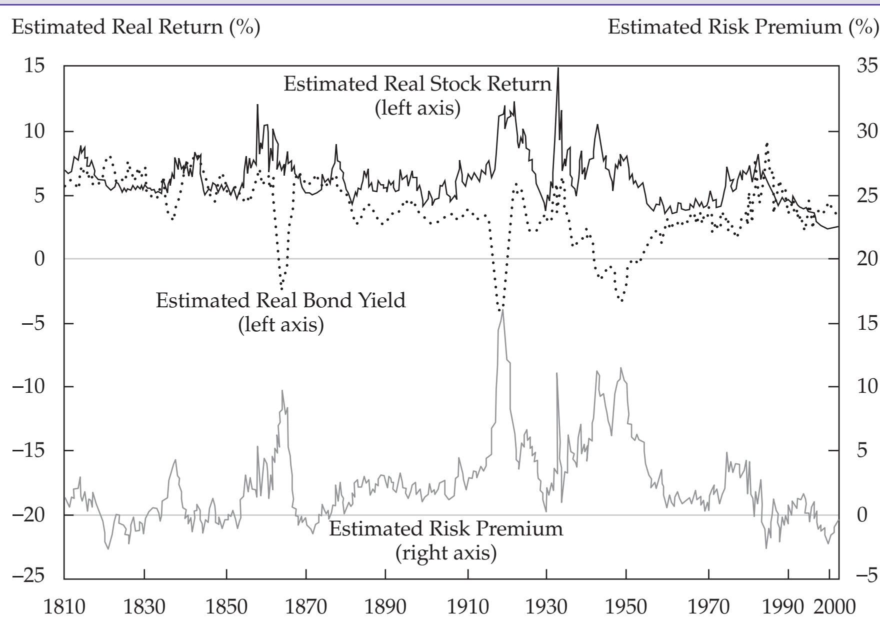
Figure 8. Estimated and Subsequent Actual Real Bond Yields, 1802–2001



Source: Arnott and Bernstein (2002).

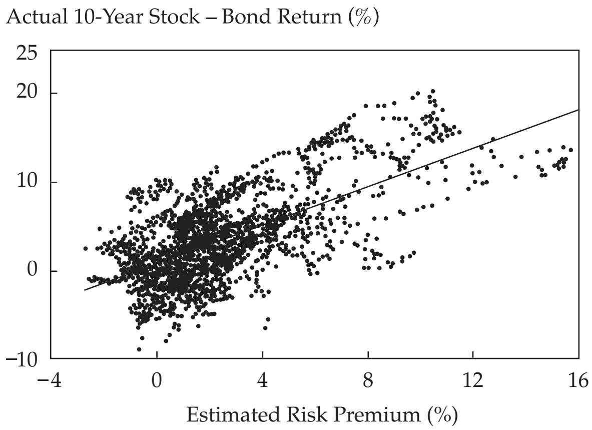
session]. Modigliani and Miller would suggest that if payout ratios are low (see Modigliani and Miller 1958), the reinvestment averaged across the market should produce the same market return that one could get by receiving those dividends and reinvesting them in the market. The tangible evidence is not encouraging. (Keep in mind that the M&M focus is cross-sectional, not intertemporal, so what I've just said is a variant of Modigliani and Miller's work, but it is a widely cited variant. M&M's work is frequently referred to in making the case that earnings growth is going to be faster than ever before.) Based on Figure 11, the correlation between payout ratios and subsequent 10-year earnings growth is a *negative* 0.60—which is worrisome. With recent payout ratios well below 40 percent, the implication for earnings growth is a rate of about –2 percent or worse, from the 2000 earnings peak, over the coming decade. If we combine an assumed negative earnings growth rate with an assumed zero risk premium, I believe that we have a serious problem.

Figure 9. Estimating the Equity Risk Premium, 1810–2001



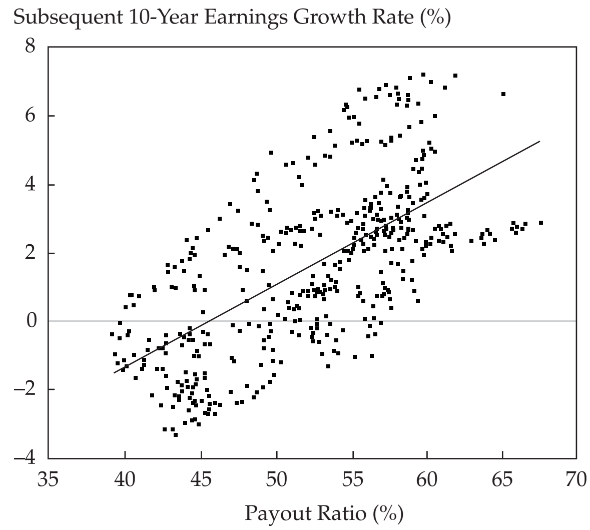
Source: Arnott and Bernstein (2002).

Figure 10. Risk Premium and Subsequent 10-Year Excess Stock Returns: Correlations, 1810–1991



Source: Arnott and Bernstein (2002).

Figure 11. Payout Ratio and Subsequent 10-Year Earnings Growth, 1950–91



EQUITY RISK PREMIUM FORUM, NOVEMBER 8, 2001

Implications for Asset Allocation, Portfolio Management, and Future Research I

Robert D. Arnott
First Quadrant, L.P.
Pasadena, California

SUMMARY

by Peter Williamson
Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

Robert Arnott began with an emphasis on practice and empiricism, as opposed to theory. He urged the use of the terms "equity excess return" for the past and "equity risk premium" for the future.

We have seen a decline in bond yields. Does this decline portend an increase or a decrease in bond returns? And we have seen a decline in stock earnings yields (earnings to price). Does this decline portend an increase or decrease in stock returns? The participants in the Equity Risk Premium Forum would all, he believes, when shaping expectations, back out the portion of return attributable to the drop in earnings or dividend yield from the historical return. But he had not heard much discussion of the fact that a drop in earnings yield should have a second-stage impact—a haircut in expected returns accompanying the fall in earnings yield.

Arnott estimated an *ex ante* risk premium at the present time of zero. In this case, the old policy of balancing risk and return no longer works. Rebalancing used to recognize that more stock meant more risk and more return. So, fiduciaries gauged the risk tolerance of the investment committee and pushed the portfolio as far into stocks as that risk tolerance would permit. If the return expectations for stocks and bonds are similar, the policy asset allocation matters in terms of risk but not in terms of returns and the allocation decision is far less critical than it was in the past.

Strategic Implications

Historically, rebalancing has produced an alpha by reducing risk. Over long periods, it produced a little extra return. Now, with no risk premium, with any pattern of reversion to a mean for stocks and for bonds, rebalancing can boost returns.

Tactical asset allocation achieved episodic returns that conveyed a large alpha in the turbulent 1970s and 1980s but did not necessarily add value in the roaring bull market of the 1990s, although it could reduce risk. If the U.S. market is headed for a repeat of the 1970s, then TAA may be especially worthwhile in the near future.

What about strategic implications for pension funds? If conventional returns lag actuarial estimates, which is likely, then current funding ratios are misleading, contributions will have to catch up, and alpha matters. In a world of lower returns, an emphasis on such alternative investments as private equity may be appealing, but to the extent that this emphasis relies on a strong equity market for an exit strategy, it may not be so attractive. International stocks and bonds may be attractive, but the expected returns there will also be low. Rebalancing and cash equitization are worth a look. Uncorrelated alternatives such as TIPS, real estate, REITs (real estate investment trusts), and commodities will be promising.[1] Absolute return strategies may be seen as more important in inefficient markets. There will be increased searching for inefficiencies by active managers and increased searching for avoidance of negative alpha by those who believe in market efficiency.

Empirical Results

Turning from practice to empiricism, Arnott's **Table 1** showed the Ibbotson data together with the prospects based on our current situation. Starting with a dividend yield of 5.4 percent, the U.S. equity market has seen an approximately 8 percent compounded real return on stocks over the past 75 years. The change in the price/dividend valuation ratio added 1.7 percent, which should be backed out of the returns for forecasting purposes. Note that real dividends grew at a scant 1 percent. The initial real bond yield in 1925 was 3.7 percent, and because it

[1] TIPS are Treasury Inflation-Protected Securities; these securities are now called Treasury Inflation-Indexed Securities.

Table 1. The Ibbotson Data Revisited and Prospects for the Future

Component	75 Years Starting December 1925	Prospects from October 2001
Starting dividend yield	5.4%	1.7%
Growth in real dividends	1.0	2.0
Change in valuation levels[a]	1.7	???
Cumulative real return	8.1	±3.7
Less starting bond real yield	3.7[c]	3.4[d]
Less bond valuation change[b]	–0.4	???
Cumulative risk premium	4.7	±0.3

[a] Yields went from 5.4 percent to 1.4 percent, representing a 2.1 percent increase in the price/dividend valuation level.

[b] Bond yields went from 3.7 percent to 5.5 percent, representing a 0.3 percent annualized drop in long bond prices.

[c] A 3.7 percent yield, less an assumed 1926 inflation expectation of zero.

[d] The yield on U.S. government inflation-indexed bonds.

Source: Based on Ibbotson Associates (2001) data.

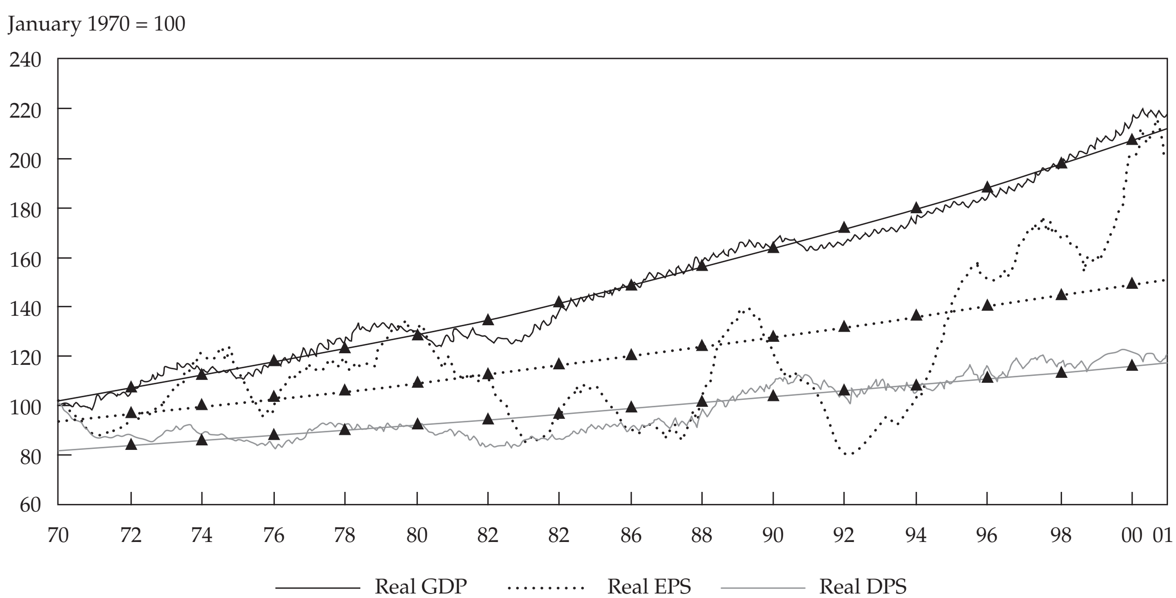
was the quoted bond yield, investors had no reason to expect that inflation would matter. So, the excess return of equities over bonds was close to 5 percent. Now, we are looking at a 1.7 percent starting dividend yield, roughly a 2 percent growth in real dividends, and probably no increase in valuation levels—for a total prospective real return of about 3.7 percent. Subtracting a 3.4 percent real bond yield (e.g., the TIPS yield) produces a 0.3 percent (30 bps) cumulative risk premium plus or minus some small standard deviation.

Why did dividends grow at only 1 percent in the past? Looking at the Figure 1 graph of real GDP, real EPS, and real dividends per share (DPS), we can see that earnings have almost kept pace with GDP growth—but in the context of going from a small share of the national economy to a large share. Entrepreneurial capitalism dilutes the growth experienced by investors in existing enterprises. The trend in dividend growth is well below that of GDP. Over the period January 1970 to January 2001, real GDP growth was fairly steady. Real earnings growth and real dividend growth followed slower trends and were quite irregular, with relatively high earnings growth since about 1995. The relative growth in GDP, equity earnings, and dividends has been similar in the United Kingdom to that in the United States. In Canada and Japan, however, the trend in earnings and dividends has been down, not up, over the past 30 years.

Turning to the 200-year history beginning in 1802, Arnott's Figure 3 indicated that $100 invested in stocks in 1802 would have grown, with dividends reinvested, to nearly $1 billion in 200 years.[2] In real

[2] Table and figure numbers in each Summary correspond to the table and figure numbers in the full presentation.

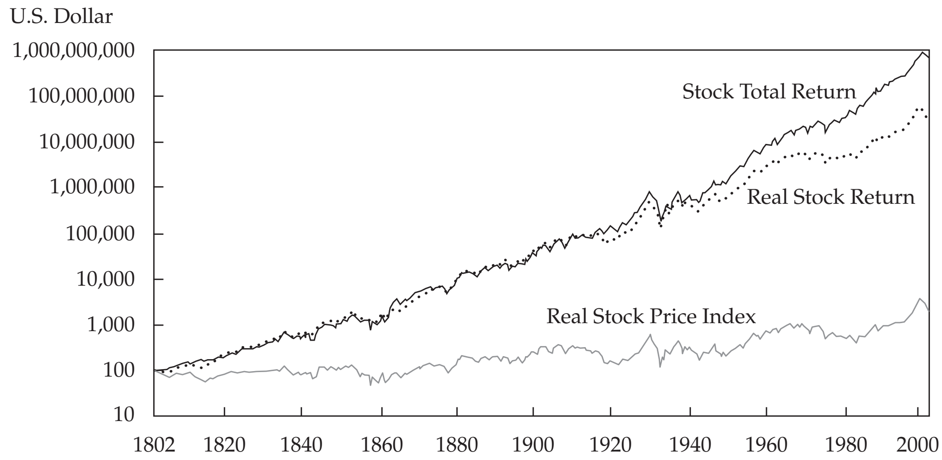
Figure 1. GDP, EPS, and DPS: United States, January 1970–January 2001



Note: Triangles identify exponentially fitted lines.

Source: Data from Organization for Economic Cooperation and Development (OECD).

Figure 3. Return from Inflation and Dividends, 1802–2001



Notes: The "Real Stock Price Index" is the internal growth of real dividends—that is, the growth that an index fund would expect to see in its own real dividends in the absence of additional investments, such as reinvestment of dividends.

Source: Arnott and Bernstein (2002).

terms, however, the ending amount is $30 million, and when we look at the index alone, without dividend reinvestment, the $100 rose barely above $1,000.

Real dividends have trailed per capita GDP growth. **Figure 4** indicated that, in this time frame, an index of real stock prices tracked real per capita GDP growth rather well in the United States, although the index persistently trailed aggregate GDP growth for the 200 years.

Figure 6 provided a basis for modeling and estimating real stock returns. Real per capita GDP growth and dilution of GDP growth in dividends are both remarkably stable and closely parallel. The note to Figure 6 provides Arnott's equation for estimating real stock returns. This equation can also be used for the more recent subperiod of 1950–2001 to forecast future real stock returns. A similarly simple model can be used to estimate future real bond returns.

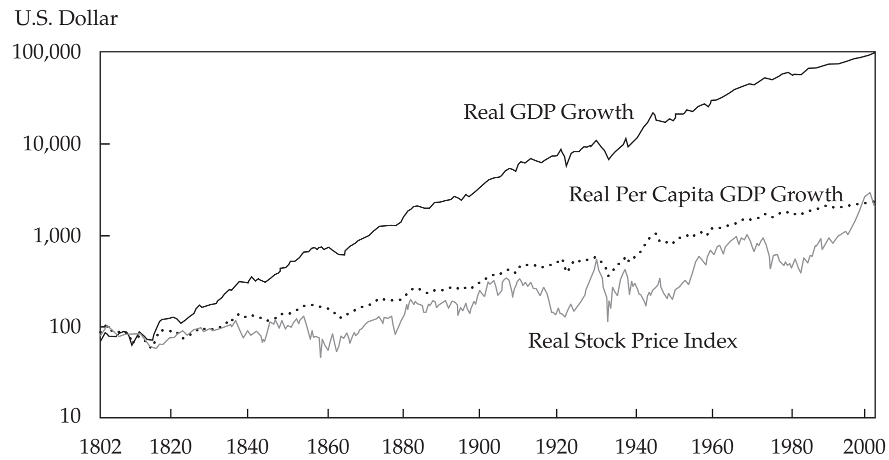
Figure 9 showed the results of using these simple models to estimate the real stock return, real bond yield, and equity risk premium (what might be called the "objective risk premium") year-by-year from 1810 to 2001. The risk premium rarely rose above 5 percent, only at the times of the Civil War, World War I, the Great Depression, and World War II. The premium is currently at or below zero.

During previous discussion of the Miller and Modigliani propositions, Arnott had commented that empirical evidence was not consistent with M&M. In this presentation, he showed the **Figure 11** plot of the payout ratio against subsequent 10-year earnings growth. Noting that M&M dealt with cross-sectional, not time-series, propositions and that he was showing time-series evidence, Arnott pointed out that high earnings retention (low payout) led *not* to higher earnings growth but to *lower* growth, a source of some concern.

Summary Implications

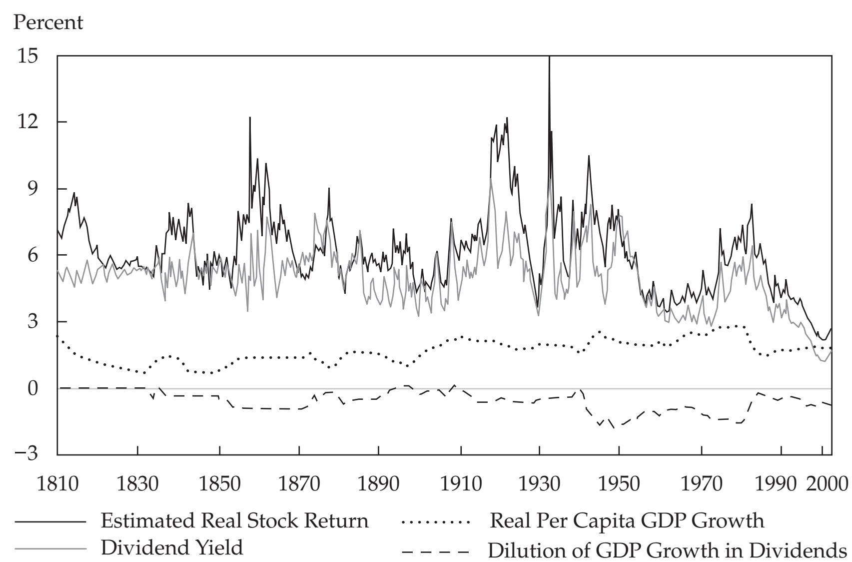
The implications of lower expected returns for policy allocation are as follows: In the past, the choice between stocks and fixed income was the essence of the policy asset-allocation decision. More stocks meant more risk and more return. For the future, with prospective stock and bond returns similar, policy allocation is no longer "king." If real earnings fall, as the empirical evidence on payout ratios suggests, or if valuation ratios "revert to the mean," then the situation is even worse.

Figure 4. The Link between Stock Prices and Economic Growth, 1802–2001



Source: Arnott and Bernstein (2002).

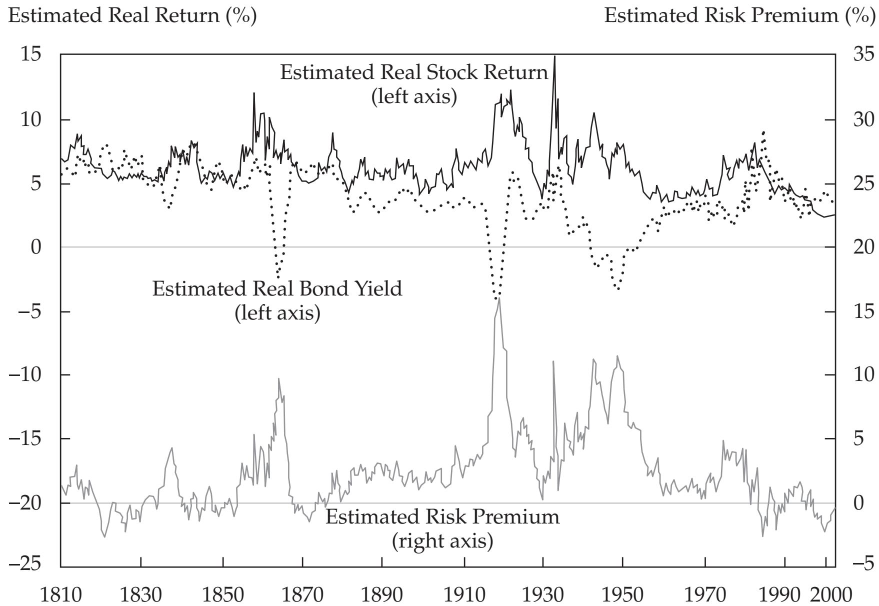
Figure 6. Estimating Real Stock Returns, 1810–2001



Notes: Based on rolling 40-year numbers. Real stock return = Dividend yield + Per capita GDP growth – Dividend/GDP dilution. The line "Dilution of GDP Growth in Dividends" indicates how much less rapidly dividends (and earnings) on existing enterprises can grow than the economy at large.

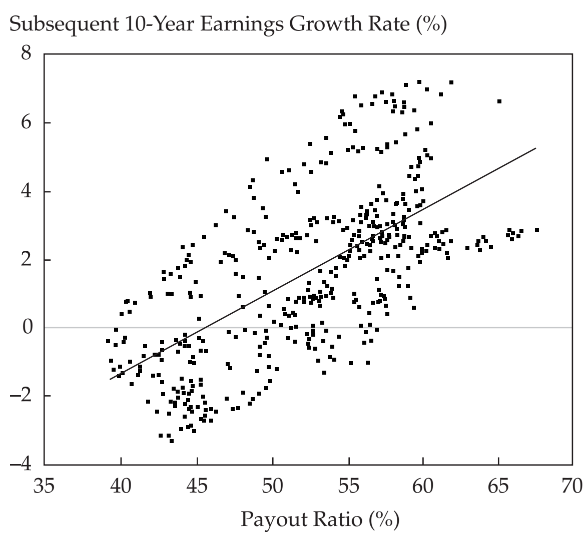
Source: Arnott and Bernstein (2002).

Figure 9. Estimating the Equity Risk Premium, 1810–2001



Source: Arnott and Bernstein (2002).

Figure 11. Payout Ratio and Subsequent 10-Year Earnings Growth, 1950–91



Implications for Asset Allocation, Portfolio Management, and Future Research II

Campbell Harvey

Duke University, Durham, North Carolina
National Bureau of Economic Research, Cambridge, Massachusetts

The reported survey of chief financial officers of U.S. corporations makes a unique contribution to the measurement of the expected equity risk premium and market volatility. Beginning with the second quarter of 2000, the research team has been conducting an ongoing, multiperiod survey of CFOs about their estimates of future equity risk premiums and equity market volatility. Results of the survey indicate the following: Return forecasts are positively influenced by past returns, which constitutes a type of "expectational momentum"; expected volatility is negatively related to past returns; the respondents seem to be very confident in their forecasts; and time horizon makes a big difference, in that a positive relationship was found between risk and expected return only for long-horizon forecasts.

After everything that has been said today, it is a challenge to make a unique contribution. We have heard how difficult it is to get a measure of expectations in terms of the equity risk premium, and what I am going to present is an approach to measuring expectations that is different from those that have been discussed.

For the past five years, John Graham and I, in conjunction with Financial Executives International, have been conducting a survey of chief financial officers of U.S. corporations about their estimates of future equity risk premiums and volatility.[1] Beginning in the second quarter of 2000 and, so far, extending into the third quarter of 2001, we have analyzed the more than 1,200 responses from the CFOs. Only 6 observations will appear in the graphs, but each observation is based on approximately 200 observations.

We know from other surveys that have been done that CFOs do actually think about the risk premium problem. We know that 75 percent of corporate financial executives—treasurers and CFOs—admit to using a CAPM-like or multifactor model. Therefore, we believe that the CFOs we are surveying are a reasonable sample of the population to question about the equity risk premium. I believe it is a sample group superior to that of economists surveyed—for example, by the Federal Reserve Bank of Philadelphia. The Philadelphia Fed's survey contains unreliable data (which I know from directly examining these data). I also think our survey has advantages over the survey of financial economists reported by Ivo Welch (2000) because our respondents are making real investment decisions. Finally, it is well known that the forecasts by financial analysts are biased. So, the survey we are conducting should provide some benefit in our search for *ex ante* risk premiums.

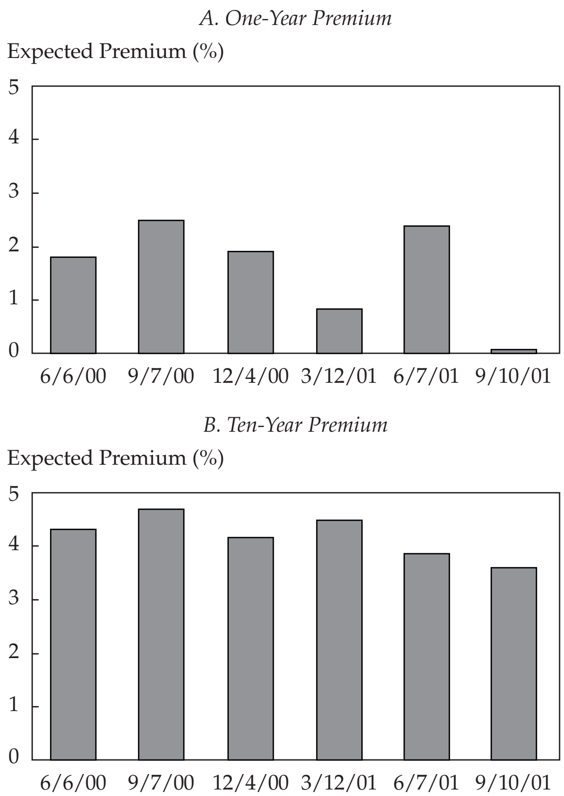
Survey of CFOs

Our survey has a number of components; it does not simply ask what the respondent thinks the risk premium is today. First, our survey is a multiperiod survey that shows us how the expectations of the risk premium change through time. Second, we ask about forecasts of the risk premium over different horizons. We have not talked much today about the effect of the investment horizon on the expected risk premium, but in our survey, we are asking about risk premium expectations for a 1-year horizon and a 10-year horizon. A third piece of information that we get in the survey is a measure of expected market volatility. Finally, we can recover from the responses a measure of the asymmetry or skewness in the distribution of the risk premium estimates.

[1] For a complete description of the study reported here, see Graham and Harvey (2001a).

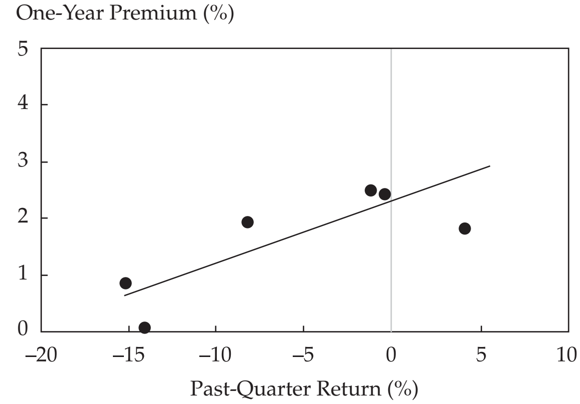
The first result I want to show you is striking. Panel A of **Figure 1** indicates that the CFOs' one-year *ex ante* risk premiums (framed in the survey as the excess return of stocks over U.S. T-bills) vary considerably over time. The last survey, finished on September 10, 2001, indicates the CFOs were forecasting at that time a one-year-ahead risk premium of, effectively, zero. The 10-year-horizon *ex ante* risk premium, given in Panel B, is interesting because it is higher than the 1-year-horizon forecast and is stable from survey to survey at about 4 percent (400 bps). Note that the September 10, 2001, forecast is 3.6 percent.

Figure 1. Survey Respondents' One-Year and Ten-Year Risk Premium Expectations



One of the first aspects we investigate is whether the CFOs' expectations about future returns are influenced by past returns. That is, if the market has performed poorly in the immediate past, does this performance lead to lower expected returns? **Figure 2** is a simple plot of the expected one-year equity risk premium against the previous quarter's return. (As we go through the analysis, please keep in mind that one can really be fooled by having so few observations. Indeed, this problem is exactly the reason we chose to present most of the results graphically. By eyeballing the data, you can see whether one observation is driving the relationship.) Figure 2 shows a fairly reliable positive relationship between past return and future near-term expected risk premium. Also, we found that you can pull out any of these observations and the fit is still similar. Apparently, a one-year-horizon forecast carries what Graham and I call "expectational momentum." Therefore, negative returns influence respondents to lower their forecast of the short-term future premium.

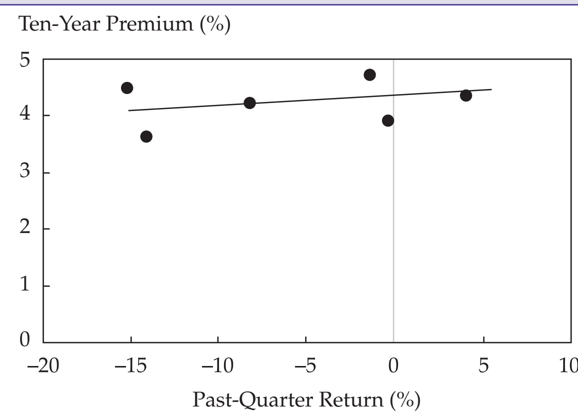
Figure 2. One-Year Risk Premium and Recent Returns



Notes: $y = 0.1096x + 2.3068$; $R^2 = 0.7141$.

Figure 3 plots the same variables for the 10-year horizon. There is a slight positive relationship between the past quarter's return and the *ex ante* 10-year-horizon risk premium, but it is not nearly as positive as the relationship observed for the 1-year horizon.

Figure 3. Ten-Year Risk Premium and Recent Returns

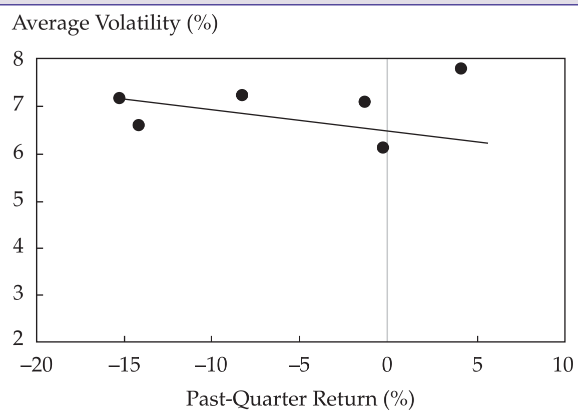


Notes: $y = 0.0179x + 4.3469$; $R^2 = 0.1529$.

We measured expected market volatility by deducing each respondent's probability distribution. We asked the respondents to provide a high and a low forecast by finishing two sentences: "During the next year, there is a 1-in-10 chance the S&P 500 return will be *higher* than ______ percent" and "During the next year, there is a 1-in-10 chance the S&P 500 return will be *lower* than _______ percent." The expected market volatility is a combination of the average of the individual expected volatilities (which I will refer to in the figures as "average volatility") plus the dispersion of the risk premium forecasts (referred to as "disagreement").[2]

Figure 4 shows that (annualized) average expected volatility for the one-year horizon is weakly negatively related to the past quarter's return. In fact, if one observation were pulled out, we might find no relationship whatsoever. And **Figure 5** shows the (annualized) disagreement component—basically, the standard deviation of the risk premium forecast—for the one-year horizon. The disagreement component for the one-year horizon is strongly related to the past quarter's return. A bad past return suggests a higher disagreement volatility. Even with so few data points, this relationship appears to be strong.

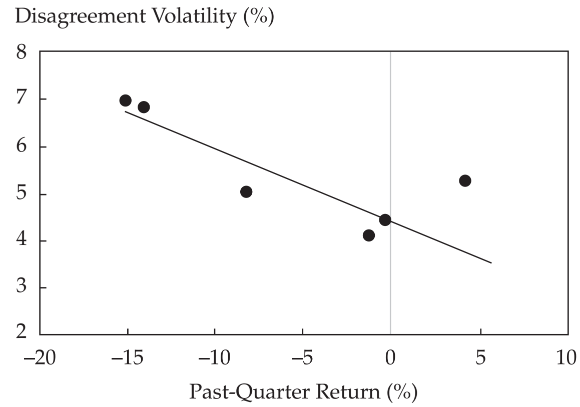
Figure 4. Average (One-Year-Horizon) Volatility and Recent Returns



Notes: $y = -0.0452x + 6.4722$; $R^2 = 0.1282$.

One thing to keep in mind is that these points on Figures 4 and 5 are annualized. When you examine the individual volatilities, you find that these respondents are extremely confident in their assessments. The result is a 6–7 percent annualized volatility in

Figure 5. Disagreement (One-Year Horizon) Volatility and Recent Returns



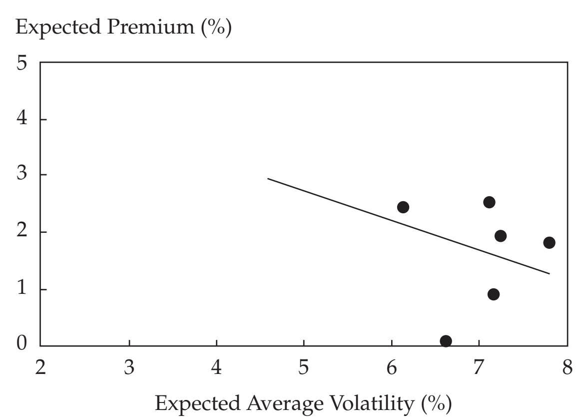
Notes: $y = -0.153x + 4.3658$; $R^2 = 0.7298$.

the one-year-horizon *ex ante* risk premium. This volatility is much smaller than typical market estimates, such as the Chicago Board Options Exchange VIX (Volatility Index) number on the S&P 100 option, which averages around 20 percent.

We also found that our measure of asymmetry is positively related to the past quarter's return. Given that we get the tails of the distribution, we can look at the mass above and below the mean and compare them, which gives us an *ex ante* measure of skewness. If past returns are negative, we find more negative *ex ante* skewness in the data.

Instead of looking at the relationship of the forecasted risk premium to past return, **Figure 6** relates the forecasted (*ex ante*) risk premium to expected (*ex ante*) volatility. Many papers in academic finance have examined the relationship between expected risk and expected reward. Intuitively, one would expect the

Figure 6. Expected Average Volatility and Expected Risk Premium: One-Year Horizon



Notes: $y = -0.5178x + 5.2945$; $R^2 = 0.2538$.

[2]Market volatility was measured as

$$\mathrm{var}[r] = E[\mathrm{var}(r|Z)] + \mathrm{var}[E(r|Z)],$$

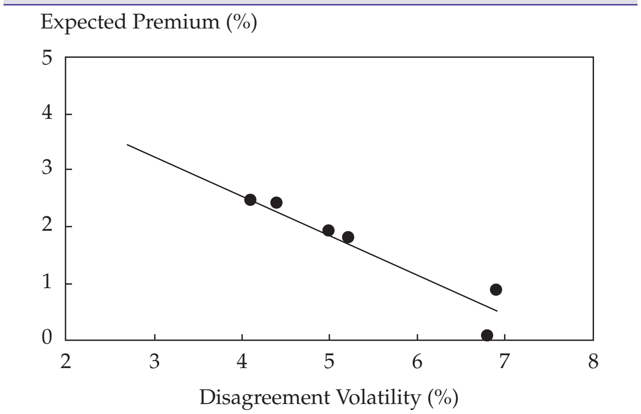
where r is the market return, Z is the information that the CFOs are using to form their forecasts, $[E(r|Z)]$ is the expected risk premium conditional on the CFO's information, $E[\mathrm{var}(r|Z)]$ is the average of each CFO's individual volatility estimate, and $\mathrm{var}[E(r|Z)]$ is disagreement volatility or the variance of the CFOs' forecasts of the premium. Individual volatilities were measured as

$$\mathrm{var} = \left[\frac{x(0.90) - x(0.10)}{2.65}\right]^2,$$

where $x(0.90)$ is the "one in ten chance that the return will be higher than" and $x(0.10)$ is the "one in ten chance that the return will be lower than." The equation for individual volatilities is from Davidson and Cooper (1976).

relationship to be positive, but the literature is actually split. Indeed, many papers have documented a negative relationship, which is basically what we see for the one-year-horizon predictions. In Figure 6, the *ex ante* premium and the *ex ante* average volatility appear to be weakly negatively related. **Figure 7** plots the one-year-horizon expected risk premium against disagreement about the expected premium. The result is a strongly negative relationship: The higher the disagreement, the lower the expected premium over one year. Again, almost any observation could be pulled out without changing the degree of fit.

Figure 7. Disagreement Volatility and Expected Risk Premium: One-Year Horizon

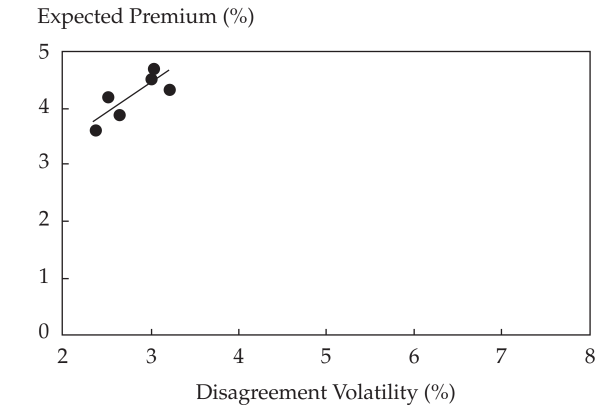


Notes: $y = -0.6977x + 5.3410$; $R^2 = 0.9283$.

Using the same variables as in Figure 7 and keeping the scale the same, **Figure 8** shows the data for the 10-year horizon. The fit is again strikingly good, but the relationship is positive. Notice that the disagreement is much smaller for the 10-year horizon than for the 1-year horizon. This positive relationship between the *ex ante* premium and *ex ante* volatility is suggested by basic asset-pricing theory.

The latest survey documented in Figures 2–8 is June 1, 2001, plus data returned to us by September 10, 2001. We just happened to fax our most recent quarterly survey to the survey participants at 8:00 a.m. on the morning of September 10. I did not include observations from the surveys returned on September 11 because the survey might have been completed on either September 10 or 11, and classification of the responses as pre- or post-September 11 was not possible. The response data we received on September 12 or later we maintained and analyzed separately. **Table 1** provides a comparison of pre- and post-September 11 data for the 1- and 10-year horizons. Although the size of the sample is small (33 observations), one can see the impact of September

Figure 8. Disagreement Volatility and Expected Risk Premium: Ten-Year Horizon



Notes: $y = 0.9949x + 1.4616$; $R^2 = 0.6679$.

11. The 1-year-horizon mean forecasted premium decreases after September 11, but volatility—both disagreement and average—increases. For the 10-year horizon, the mean forecasted premium and disagreement volatility increase. I'll be the first to admit that these results are not statistically significant, but the data tell an interesting story. After September 11, perceived risk increases—which is no surprise. In the short term, participants believe that market returns will be lower. In the long term, however, premiums increase to compensate for this additional risk.

Table 1. Impact of September 11, 2001: Equity Risk Premium and Volatility

Measure	Before	After
Observations	127	33
1-year premium		
Mean premium	0.05 %	–0.70 %
Average volatility	6.79	9.76
Disagreement volatility	6.61	7.86
10-year premium		
Mean premium	3.63 %	4.82 %
Disagreement volatility	2.36	3.03

Implications of Results

So, what have we learned from this exercise? First, expectations are affected, at least in the short term, by what has happened in the recent past—an expectational momentum effect. Second, these new expectational data appear to validate the so-called leverage effect—that negative returns increase expected volatility. Third, the individual volatilities (at 6–7 percent) seem very low, given what we would have expected. And fourth, there is apparently a positive relationship between risk and expected return (or the risk premium) only at longer horizons. So, the horizon is critical.

How should we interpret these results, what are the outstanding issues, and where do we go from here? The CFOs in the survey are probably not using their one-year expected risk premiums for one-year project evaluations. What CFOs think is going to happen in the market is different from what they use as the hurdle rate for an investment. I do think that the 10-year-horizon risk premium estimates we are getting from them are close to what they are using. An interesting paper being circulating by Ravi Jagannathan and Iwan Meier (2001) makes some of these same arguments—that higher hurdle rates are probably being used for a number of reasons: the scarcity of management time, the desire to wait for the best projects, and financial flexibility. Corporate managers want to wait for the best project, and with limited management time, a hurdle rate that is higher than what would be implied by a simple asset-pricing model allows that time.

Another angle is that the premium *should* be high in times of recession. Indeed, a lot of research documents apparently countercyclical behavior in the premium. Such behavior implies that today's one-year-horizon investment should have a high hurdle rate.

Further Research

We hope our research sheds some light on the measure of expectations. I believe in asset-pricing models based on fundamentals, but it is also enlightening to observe a direct measure of expectations. Our data may not be the true expectations, but they supply additional information about the *ex ante* risk premium in terms of investment horizon, expected volatility, and asymmetry.

Our next step is to conduct interviews in the first week of December 2001 with a number of the CFOs participating in the multiperiod survey. We have already carried out a few preliminary interviews, and we find it extraordinary how much thought CFOs have given to these issues. The main question we want to ask in December is the reason (or reasons) for the difference between their risk premium forecasts for a one-year horizon and the actual internal hurdle rates they use to evaluate one-year-horizon projects. How do CFOs use the *ex ante* risk premium in terms of making real allocation decisions? I will keep you updated on the progress of our research project.

EQUITY RISK PREMIUM FORUM, NOVEMBER 8, 2001

Implications for Asset Allocation, Portfolio Management, and Future Research II

Campbell Harvey

Duke University, Durham, North Carolina
National Bureau of Economic Research, Cambridge, Massachusetts

SUMMARY

by Peter Williamson

Amos Tuck School of Business Administration
Dartmouth College, Hanover, New Hampshire

The presentation made by Campbell Harvey was unique, in that it was based essentially on surveys of investor expected risk premiums. What he had heard from the previous speakers was how difficult it is to get a measure of investor expectations.

Harvey's surveys, over time, of chief financial officers offered what he considered to be a less biased sample than the surveys that have been made of economists or financial analysts. CFOs are known to be concerned about a measure of their cost of capital for investment planning purposes and have no reason to favor high or low forecasts. He stated that, although he does not see the survey results as a replacement for the kind of analyses presented by previous speakers, he does believe that the surveys add valuable information.

The survey questions and responses were for 1-year and 10-year time horizons, which provided an opportunity to compare short-term with long-term expectations. The surveys elicited information not only on the expected premiums but also on the probability distributions of the respondents' forecasts. Harvey considered two components of expected market volatility: the average of the individual expected volatilities (from each individual's probability distribution) and the disagreement over the risk premium forecasts (the standard deviation of the risk premium forecasts).

Figure 1 shows the results of six surveys asking for a 1-year risk premium estimate and a 10-year estimate. The 10-year forecasts show little variation, whereas the 1-year forecasts vary widely through time. The 10-year forecasts are also consistently higher than the 1-year forecasts.

Figure 1. Survey Respondents' One-Year and Ten-Year Risk Premium Expectations

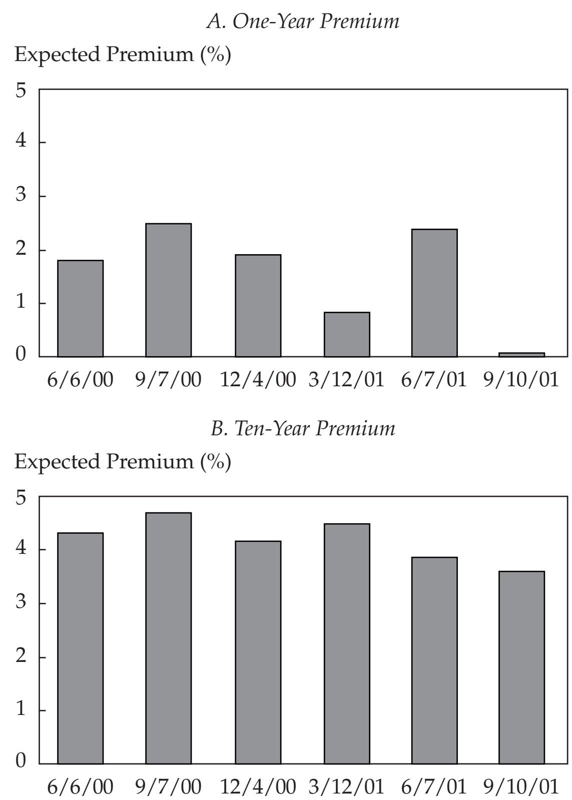
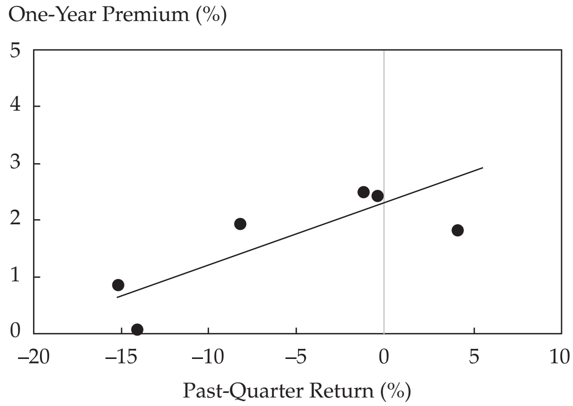


Figure 2 shows the influence of past returns on forecasts of 1-year premiums, and **Figure 3** does the same for 10-year premiums. Past returns had a positive impact on 1-year forecasts and a very slight positive effect on 10-year forecasts. Past returns also had a weak negative effect on expected 1-year average volatility and a strong negative effect on disagreement. They had a strong positive effect on expected skewness. Negative returns led to more negative skewness in the forecasts.

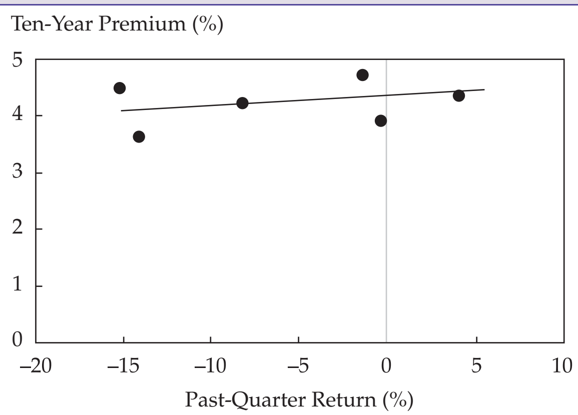
Turning to the effect of expected rather than past returns, Harvey showed in **Figure 6** that the average

Figure 2. One-Year Risk Premium and Recent Returns



Notes: $y = 0.1096x + 2.3068$; $R^2 = 0.7141$.

Figure 3. Ten-Year Risk Premium and Recent Returns



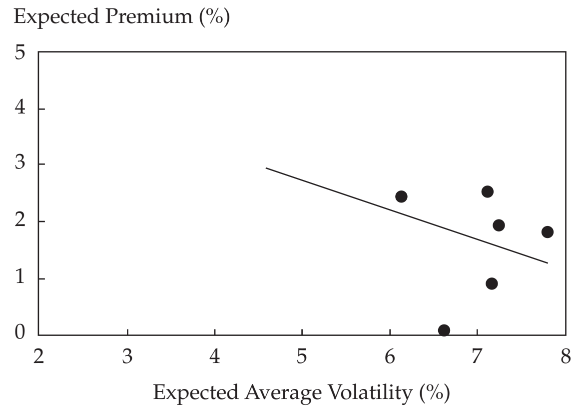
Notes: $y = 0.0179x + 4.3469$; $R^2 = 0.1529$.

of individual volatilities is weakly *negatively* related to expected 1-year returns.[1] One-year expected returns were found to be strongly negatively related to disagreement volatility, as shown in **Figure 7**. This finding may seem counter to the usual risk–expected return theories, but the finding is for very short term forecasts. For the 10-year horizon shown in **Figure 8**, however, expected returns are strongly *positively* related to disagreement—which is consistent with the way we usually think about risk and expected reward.

Harvey reported the impact of the events of September 11, 2001, in **Table 1**. After the crisis, the CFOs revised expected returns for the 1-year forecasts downward. For both the 1-year and the 10-year forecasts, expected volatility increased after the crisis.

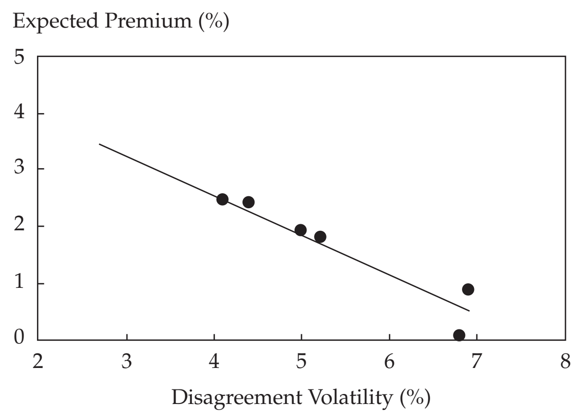
[1] Table and figure numbers in each Summary correspond to the table and figure numbers in the full presentation.

Figure 6. Expected Average Volatility and Expected Risk Premium: One-Year Horizon



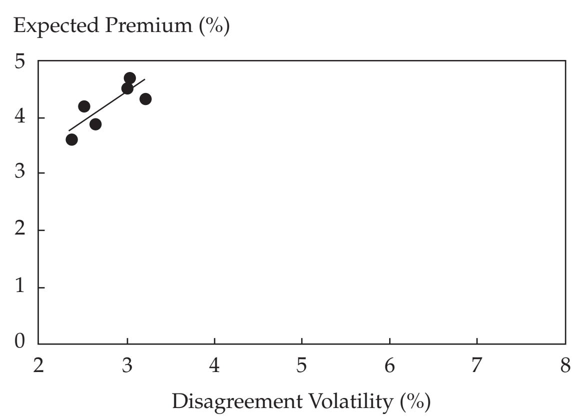
Notes: $y = -0.5178x + 5.2945$; $R^2 = 0.2538$.

Figure 7. Disagreement Volatility and Expected Risk Premium: One-Year Horizon



Notes: $y = -0.6977x + 5.3410$; $R^2 = 0.9283$.

Figure 8. Disagreement Volatility and Expected Risk Premium: Ten-Year Horizon



Notes: $y = 0.9949x + 1.4616$; $R^2 = 0.6679$.

Table 1. Impact of September 11, 2001: Equity Risk Premium and Volatility

Measure	Before	After
Observations	127	33
1-year premium		
Mean premium	0.05%	–0.70%
Average volatility	6.79	9.76
Disagreement volatility	6.61	7.86
10-year premium		
Mean premium	3.63%	4.82%
Disagreement volatility	2.36	3.03

Summarizing, Harvey presented the following conclusions:

- Survey measures of expectations provide useful alternatives to statistical measurements.
- Return forecasts are positively influenced by past returns—what John Graham and Harvey (2001a) call "expectational momentum."
- Expected volatility is negatively related to past returns.
- Individual volatilities seem very low; the respondents seem very confident in their forecasts.
- Time horizon makes a big difference. There is a positive relationship between risk and expected return but only for long-horizon forecasts.

In closing, Harvey expressed doubt that the CFOs were actually using their 1-year forecasts for hurdle rates in 1-year project evaluations. He suggested that there is a difference between what CFOs believe will happen to the market next year and the rate of return they would accept for a new project. The 10-year forecasts are probably closer to what the CFOs are using for the cost of capital.

Implications for Asset Allocation, Portfolio Management, and Future Research: Discussion

Roger Ibbotson (*Moderator*)
Robert Arnott
John Campbell
Bradford Cornell
William Goetzmann
Campbell Harvey
Martin Leibowitz
Thomas Philips
William Reichenstein, CFA

ROGER IBBOTSON (Moderator)

I was particularly pleased to see Campbell Harvey's paper because we have seen surveys of financial analysts, individuals, and economists (such as Welch's 2000 survey of financial economists), but the Graham and Harvey (2001a, 2001b) survey breaks new ground by surveying a particularly astute group. The results of their survey bring fresh information to the table. The survey was also well designed, which gives us confidence in the data.

I think each of us understands that we are concerned with equity risk premiums looking forward, but the distance we are looking ahead, our horizons, may differ. And today we have had both discussions—looking short term and looking out long term. The differences between the short-run and the long-run risk premium were certainly brought out by Rajnish Mehra [in the "Current Estimates and Prospects for Change" session] and are highlighted in the Graham and Harvey work.

I would like to present a few ideas from a paper that Peng Chen and I wrote (Ibbotson and Chen 2002) that uses much of the same data that Rob Arnott used but interprets the data almost completely differently. One of the reasons for the lack of overlap in interpretations is that Rob's primary focus is a short-run prediction of the market.

Figure 1 is yet another P/E chart—this one based on the Wilson and Jones (forthcoming 2002) data because their earnings data match the S&P 500 Index earnings data. The S&P 500 had very low, not negative but very low, earnings in the 1930s, and the actual maximum P/E is off the chart for that period. Figure 1 begins with a P/E, calculated as price divided by prior-year earnings, of 10.22 in 1926 and ends with a P/E of 25.96 at year-end 2000 (the October 2001 P/E, excluding extraordinary earnings, is 21); that growth from about 10 to the most recent P/E is an important consideration in the forecast I will discuss.

The forecast that Peng and I are making is based on the real drivers of P/E growth. We focus on the contribution of earnings to P/E growth and on GDP. **Table 1** shows the historical average nominal return for stocks over the 75-year period of 1926 through 2000 to be 10.70 percent. We can break that nominal stock return into its contributing components: about 3 percentage points (pps) inflation, and so forth. The P/E growth rate from a multiple of about 10 in 1926 to a multiple of almost 26 in 2000 amounts to 1.25 percent a year. When we make our forecasts, we remove that historical growth rate because that P/E jump from 10 to 26, in our opinion, will not be repeated. The "Earnings Forecast" column in Table 1 shows what history was without the P/E growth rate; that is, the forecasted return is 1.25 pps less than the historical return.

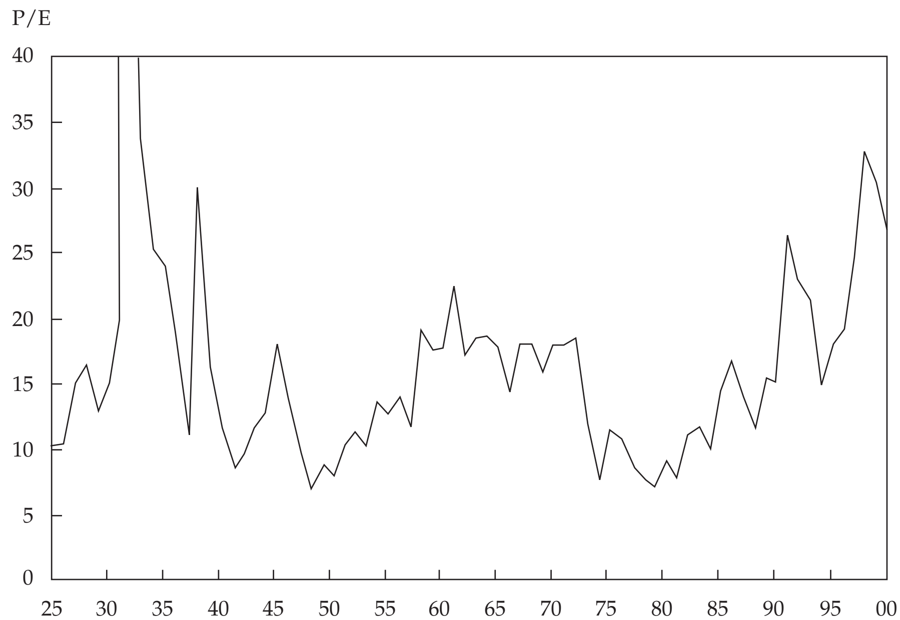
Table 1. Historical and Forecasted Components of Stock Returns, 1926–2000

Component	Historical[a]	Earnings Forecast
Income	4.28 pps	4.28 pps
P/E growth	1.25	—
Earnings growth	1.75	1.75
Inflation	3.08	3.08

[a]Total historical return for the period is 10.70 percent; data do not sum to that total because of the geometrical mathematics used.

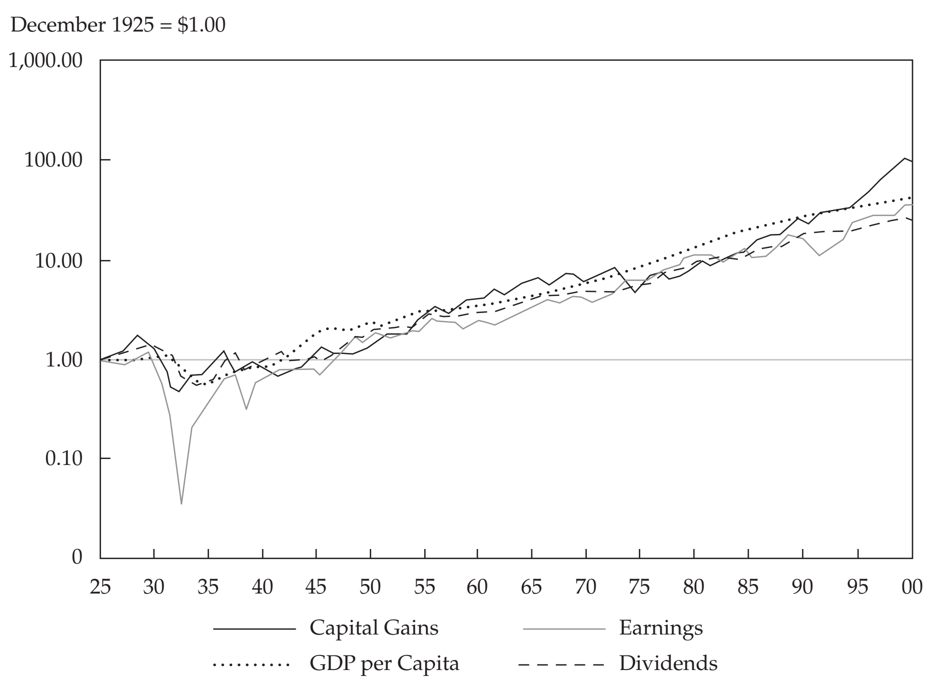
Figure 2 provides the historical growth of per capita GDP and of earnings, dividends, and capital gains on a per share, not aggregated, basis. All are indexed to $1 at the end of 1925. The capital gains grow to about $90 at the end of 2000—the most growth of any of the measures shown. Earnings are less because of the increase in the P/E multiple. The $90 is the $36 multiplied by 2.5, which was the P/E

Figure 1. The P/E, December 1925–December 2000



Note: The P/E for December 1932 was 136.5.

Figure 2. Historical Growth of per Capita GDP and of per Share Earnings, Dividends, and Capital Gains, December 1925–December 2000



Note: At end date, capital gains were $90.50, GDP per capita was $44.10, earnings were $35.60, and dividends were $24.20.

change from 10 to 26. The line for GDP per capita shows that the economy (on a per capita basis) has outgrown earnings by a small amount over the entire period. And finally, the growth in dividends trails the pack. So, I very much agree with the comment that Bill Reichenstein made earlier today that dividends are not a good forecasting tool; they grow the most slowly and even distort the picture for earnings growth [see "Current Estimates and Prospects for Change: Discussion"].

I am struck by how tied together each data series is—how the stock market is related to the economy, which is related to earnings, which are related to dividends. Although the link between earnings and dividends is a little less close than the other links, it is still there. One of the reasons Peng and I wanted to carry out this type of analysis is that the economy *should* be reflected in the stock market. And in fact, the separation in their behaviors is solely the result of the changing P/E, which we have thus removed from our forecasts. The P/E rose from 1926 to 2000 for a reason, but that reason will not continually recur in perpetuity. For that annual growth rate in the P/E multiple of 1.25 percent a year to continue, to assume that it will replicate, would mean that in another 75 years, the P/E will have grown to 62.

Figure 3 shows why dividends are not a good tool for forecasting the future. Dividend yields started the period at 5.15 percent and averaged 4.28 percent over the past 75 years; if you include the data for the 19th century, the historical average dividend yield is much higher. Every time we found a dividend for the 19th century, it seemed to be 100 percent. The dividend yield has now dropped to 1.10 percent (the most recent year would push it up somewhat). Thus, a long-run secular decline has occurred in the dividend yield, which was largely caused by the decreasing payout ratio. As **Figure 4** shows, the payout ratio, which began the period at 46.68 percent and averaged almost 60 percent over the 1926–2000 period, is now 31.78 percent.

Several reasons could explain the trend toward lower payout ratios. We interpret the trend as an issue of trust and changing attitudes about trust. As investors place more trust in the companies in which they invest and in the financial market system, shareholders no longer require that the companies pay all of their earnings to the shareholders; the discipline that dividends were designed to impose on corporations is gradually falling by the wayside. Another possible reason for the trend toward lower payout ratios is that, of course, dividends and capital gains (the fruit of reinvested corporate earnings) are taxed differently—providing an incentive for shareholders to relax their desire for company earnings to be paid out as dividends. Moreover, today, earnings can be taken out in many forms, such as share repurchases, buyouts in a merger or acquisition, or investment in internal projects of a company. I predict that these myriad forms of paying out earnings will remain. A

Figure 3. Dividend Yield, December 1925–December 2000

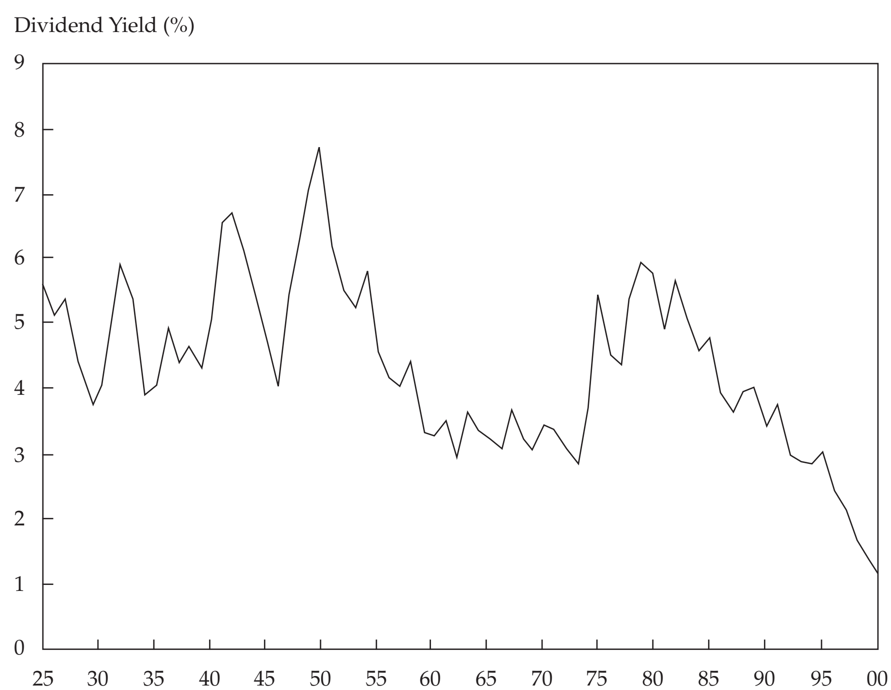
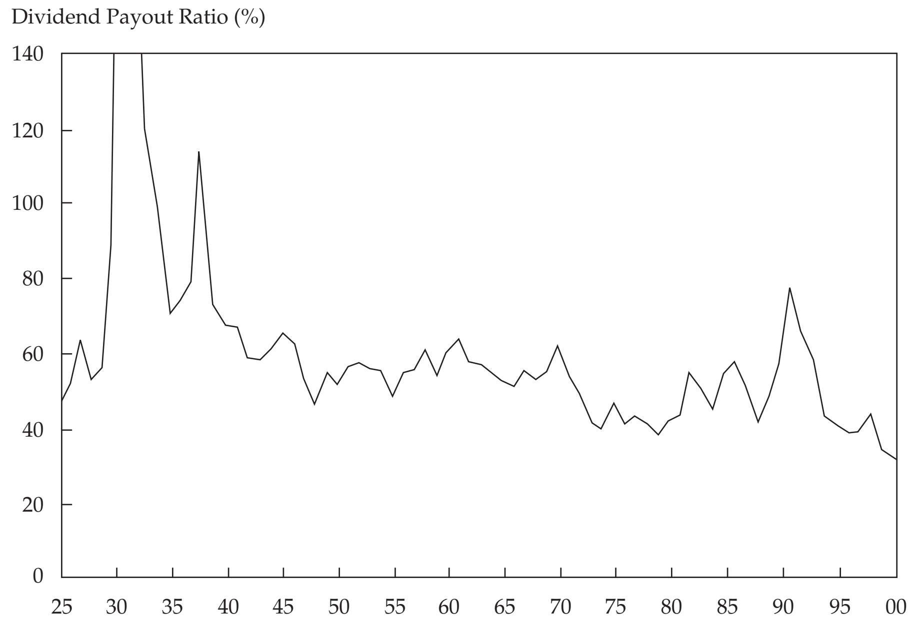


Figure 4. Dividend Payout Ratio, December 1925–December 2000



Note: The payout ratio as of December 1931 was 190.52 percent; as of December 1932, it was 929.12 percent.

larger and larger portion of companies in the market are not paying earnings out in the form of dividends. For example, the technology companies do not pay out any of their earnings as dividends. Thus, the payout ratio is not stable, and we may see it continue to fall.

A contender in the race to be a reliable forecasting tool (one that a number of people have already discussed today) is the dividend yield model in one of its many forms. If you could accept the dividend yield model by itself and with its purest assumptions—that is, the dividend yield plus dividend growth, assuming constant growth—the model would be a forecast of the stock market. But there are three problems with the pure dividend yield model that we must make adjustments for if the model is to be useful for forecasting. The first two problems are potential violations of Modigliani and Miller theory.

I am assuming that M&M holds true. (Despite what some of you have said about how dividend payouts do not seem to be reinvested in anything at all, I am clearly on the other side of that argument. If there is any truth to that supposition, however, that theory needs further investigation.) So, the first problem with some forms of the dividend yield model is that they violate M&M because they assume you can add the current dividend yield (which is now 1.10 percent) to historical dividend growth. Historical dividend growth underestimates historical earnings growth, however, because of the decrease in the payout ratio. Dividends have run slowest in the growth race because the payout ratio has continually dropped.

The second problem with using the dividend yield model as a forecasting tool (and it is, again, a violation of M&M) is that if the low payout ratios of today (31.8 percent) were reflected in the historical series, the percentage of earnings retained would have been higher and, therefore, historical earnings would have grown faster than observed. In short, the first problem is that dividend growth has been too slow historically, and the second problem is that with further earnings retention, historical earnings growth would have been potentially faster than observed.

The third problem with the dividend yield approach is the high P/E multiple observed today—over 25. Unlike some of you, I am going to assume efficient markets, which in this case I take to mean that the current high P/E implies higher-than-average future EPS growth.

My estimate of the average geometric equity risk premium is about 4 percent relative to the long-term bond yield. It is, however, 1.25 percent lower than the pure sample geometric mean from the risk premium of the Ibbotson and Sinquefield study (Ibbotson Associates 2001).

We have had some debate today on future growth rates—specifically for the 10-year horizon. Data that Peng and I are studying provide some support for the tie between high P/Es and high future growth. One of the problems with the 10-year horizon is that 10 years is not really long enough to encompass many independent events.

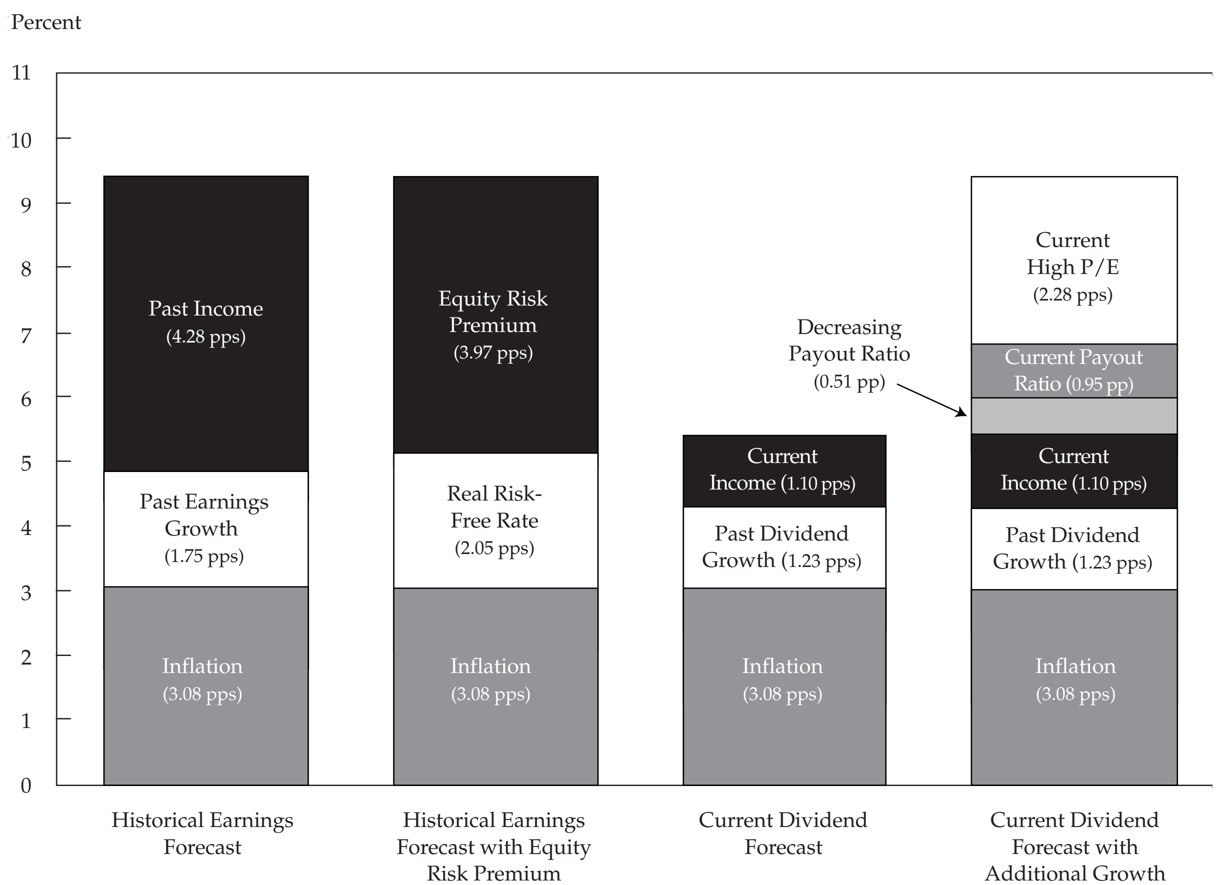
The extreme end of the spectrum of proponents of the dividend yield model would support using past dividend growth to forecast future dividend growth, then add current income. (Of course, that method almost wipes out the risk premium, and in some ways, it is actually similar to what Rob Arnott presented.)

In our response, we make three adjustments to the dividend yield model shown in the third column ("Current Dividend Forecast") of **Figure 5**. These are shown in the fourth column ("Current Dividend Forecast with Additional Growth"). We add 0.51 pp so that historical dividend growth matches historical earnings growth, we add an additional 0.95 pp because of the extra retention associated with the current record low payout rate, and finally we add 2.28 pps to future earnings growth to reflect the current high P/E that we assume forecasts higher earnings growth.

What about long-term earnings growth? Corporate America is likely to proceed in the next quarter century as it did in the previous 75 years. Corporate cash will be used for projects, investments, share repurchases, and acquisitions, but less and less will it be used for dividend payouts. Future earnings growth will be higher than past growth because of lower dividend payouts and the high current P/E. For the next 25 years, I predict (1) stocks will outperform bonds, (2) increased earnings growth will offset future low dividend yields, (3) the P/E jump from 10 to 26 will not repeat, and (4) the stock market return will provide more than 9 percent a year over the 25-year period.

JOHN CAMPBELL: When you make the adjustments, aren't you assuming not only efficient markets but also a constant discount rate? If so, you are assuming the answer. We are trying to find out what the discount rate is, but you assume the discount rate in your calculation. If so, aren't you bound to come up with an answer for the end that is the same as historical norms going in?

Figure 5. Historical versus Forecasts Based on Earnings and Dividend Models



IBBOTSON: True. In addition to assuming an efficient market (M&M), we are not assuming that the discount rate is dynamic. We are assuming it to be unknown, and we are searching for the single discount rate that best describes history. The presumption is that history can be extrapolated forward. It could be considered a reconciliation between the two approaches. Certainly, our quest is debatable.

BRADFORD CORNELL: I have some questions for Campbell Harvey. Are CFOs really not using their one-year-horizon market forecasts in evaluating their internal investments? Maybe the one-year market forecast they provide you is just a throw-away number; they are so uncertain about it that they do not incorporate it into any decision they make. If they really believe that the equity risk premium is zero today, shouldn't they be issuing stock?

CAMPBELL HARVEY: I think this survey gives us respondents' guesses of what is going to happen in the market; it does not necessarily map into what they are going to do in terms of their real project evaluations at a one-year horizon. In a recent working paper by Jagannathan and Meier (2001), which is based on some older work by McDonald and Siegal (1986), they say people tend to have higher hurdle rates than what the capital asset pricing model (CAPM) would suggest. CFOs are looking for the best projects, internal investments that throw off the best return, and there is no way they are going to accept a project with a rate of return equal to the T-bill rate—even if they expect next year's market return to be basically the same as the T-bill's return. So, what the data suggest to me is that there is a big difference between the short-horizon expectation of return and the hurdle rate one would actually use in terms of project evaluation. Of course, I want to go deeper into this problem by asking the survey participants for more details.

ROBERT ARNOTT: One would assume that to arrive at the estimated required return of any new commitment, a "credibility" hurdle rate is added on top of the cost-of-capital hurdle rate. Those cost-of-capital hurdle rates are always optimistic, so the credibility rate is added and is part of where the reported hurdle rate in the responses comes from.

MARTIN LEIBOWITZ: Just one clarification: How did your 10-year risk premium, 4.5 percent, relate to the hurdle rate? Do you have any evidence of what that longer-term hurdle rate is?

HARVEY: For the 10-year horizon, the risk premium reported is closer to the hurdle rate for internal projects than for the 1-year horizon. We don't have much information about the longer-term hurdle rate, but the next phase of my research with John Graham will be interviewing the CFO participants to shed additional light on these issues.

WILLIAM GOETZMANN: I was very excited to see Campbell Harvey's paper—to see more interesting data about dispersion of opinion. I know that in one of your earlier papers—the one on the market-timing ability of investment newsletter writers (Graham and Harvey 1996)—you unexpectedly found dispersion of opinion that had some forecasting ability. Cragg and Malkiel (1982) also found some dispersion in analysts' forecasts in relation to risk. Also, Massimo Massa and I have been finding some information about dispersion related to price effects and so forth (Goetzmann and Massa 2001). What particularly strikes me in looking at your results is the consistent message that this dispersion of opinion is having interesting effects that we ought to explore. If you are going to be talking to these CFOs, it would be great to find out more about the basis for the dispersion. It is an interesting potential area of research.

HARVEY: We have a lot of data on earnings forecasts, but I am more interested in the dispersion than the actual forecasts. An older paper by Frankel and Froot (1990) looked at dispersion of beliefs in terms of currency forecasting. It is very impressive. So, I agree that this area is worthy of more research.

THOMAS PHILIPS: I want to address the question about forecasts versus hurdle rates by describing an experience that I had. When I talk to our corporate clients, I often ask if they need help estimating their cost of capital (which, of course, is the same as the expected return) and I ask how they do it currently. Some tell me that they use the CAPM, while others say they use a more complicated factor model. But one answer stands out for its simplicity and its brilliance. At National Service Industries, an executive told me that his cost of capital was 10 percent. I asked him how he knew that it was 10 percent. He replied that he did not *know* that it was 10 percent. So, I queried further: "Why, then, do you assert that it is 10 percent?" He replied, "In my world, the cost of capital is not very important in terms of making new investment decisions. We have a hurdle rate to make that type of decision. The cost of capital is important to us because the lines of business that we are in are not fabulously profitable, and the simplest mistake we can make is to squander the capital we have invested in them. The one thing I want to do is to have every employee understand that capital is a real input and that it is incredibly easy to squander. When I use 10 percent as the cost of capital, everyone from the janitor to the CEO can apply it. They can move a decimal point; they can divide by 10. So, I can explain to them in simple terms that $1 million worth of equipment sitting idle represents $100,000 of real money going down the tubes every year. And that ability is much more important to me and to the company than having the right answer." Theoretically, he has the wrong answer, but in spite of that, his answer and approach are absolutely brilliant.

The other comment that I want to make is an observation on the difference in earnings growth rates. Roger Ibbotson is showing it growing close to per capita GDP.

ARNOTT: No, he has it growing faster than GDP.

PHILIPS: Roughly the same rate.

IBBOTSON: Historically, it is the same.

ARNOTT: But now the payout ratio is lower, so earnings would have to grow faster. Earnings growth is going to gain on GDP on a per share basis, not necessarily on an aggregate basis as Bradford Cornell was talking about.

WILLIAM REICHENSTEIN: Going back to what Rob Arnott said about taking another look at tactical asset allocation. Let's say that over the next 10 years, stocks, bonds, and cash will all produce a 10 percent rate of return. It seems to me the 10-year return should not make any difference; the asset-allocation decision is relatively insignificant at that point.

ARNOTT: Correct, the policy asset allocation decision is insignificant. For rebalancing to add value, for tactical asset allocation to add value, the absolutely crucial premise is that reversion to the mean will occur in at least a weak form.

REICHENSTEIN: That is when you pick up your alpha?

ARNOTT: Right. The presumption is based on a long-term historical record for live TAA experience. Even when it did not add value (in the 1990s), it did produce alpha. If there were not some weak reversion to the mean at work in the 1990s, it would not have produced an alpha.

LEIBOWITZ: Why do you say policy allocation is invariant? Even if you have zero difference in returns, you still have volatility.

ARNOTT: I am assuming geometric, not arithmetic, returns. If we assume arithmetic returns are the same, then the volatility differences carry a cost. If we assume the geometric returns are the same, then the return-maximizing portfolio is the risk-minimizing portfolio, which would probably have an allocation of only 10–20 percent equities. But the difference in returns would be tiny, so whether the allocation was 20/80 or 80/20 would not make much difference in the return.

LEIBOWITZ: But you would not have much in equities?

ARNOTT: This message is not welcomed with open arms by investors or investment practitioners. It has not been good for First Quadrant's business for me to publish this sort of stuff. Some consultants are annoyed because we are saying, basically, that the assumptions they are endorsing are wrong. Clients don't want to hear it because we've been correct for the last year and a half, and the losses hurt. When we first proposed the idea, it was viewed as slightly flaky, but since then, it's been on target—which has made some people even angrier.

GOETZMANN: I'm a bit confused. Are you talking about just *your* track record or evidence about TAA in general? I haven't seen any empirical evidence indicating that, on average (or even in the tails), any tactical allocators have been successful.

ARNOTT: I am speaking on the basis of our track record and what little information I can garner about competitors' track records. The comparative studies, like the one that Tom Philips did (Philips, Rogers, and Capaldi 1996), have dwindled to next to nothing because no one is interested in TAA. Our founding chairman was fond of saying, "Don't buy what's easy to sell. Do buy what's tough to sell." Well, TAA is tough to sell right now. I think it is an interesting idea that has fallen from favor in a circumstance where, prospectively, it is probably going to produce the kind of results that we had in the 1970s, which were breathtaking, just breathtaking.

PHILIPS: Let me comment on that. In the paper of mine that Rob Arnott is referring to, I took the actual live track records of every domestic TAA manager (about a dozen of them, and they had 95 percent of the assets under management in TAA at the time) and performed Henriksson–Merton and Cumby–Modest tests for timing skills. I found that in the 1970s, TAA was very successful. Then, in the 1980s, the results become a little mixed. If you include the period up to and including the crash of 1987, *all* the TAA managers added value; after the crash, no one added value. But here's an interesting twist to the story: Let's say a genie came to you once a quarter or once a month, take your choice, from 1980 onwards, and whispered "buy stocks" or "buy bonds" in your ear—and the genie was never wrong. And let's say you can make the appropriate portfolio changes without transaction costs. By how much did the genie outperform a simple 60/40 mixture of stocks and bonds? It turns out that the genie's outperformance went down enormously from the precrash to the postcrash period. It dropped from about 24 percent a year to about 15 percent a year. In effect, the genie got a lot less prosperous after 1987, so it's not surprising that TAA managers found themselves in trouble.

EQUITY RISK PREMIUM FORUM, NOVEMBER 8, 2001

Summary Comments

Robert Arnott
John Campbell
Peng Chen, CFA
Bradford Cornell
William Goetzmann
Brett Hammond
Campbell Harvey
Roger Ibbotson
Martin Leibowitz
Rajnish Mehra
Thomas Philips
William Reichenstein, CFA
Robert Shiller
Kevin Terhaar, CFA
Peter Williamson

MARTIN LEIBOWITZ: I think it might be interesting to just go around the table for any last comments on our topic, the equity risk premium, or for any comments on any of the papers presented today.[1]

BRETT HAMMOND: I would like to hear more discussion from Roger Ibbotson and Rob Arnott. As I have listened to the presentations today, I have been trying to decide what we could say if we were charged as a group with coming to some consensus. I'm going to assume the role of the naive observer, and in that role, I can say I have learned that in some areas, we are talking past each other and in other areas, once we clarify the definitions (or what is being measured and how), we are closer together. That understanding is useful, but what is the next step in educating our colleagues and practitioners? What would we want to tell them about their problem, which is, of course, estimating the equity risk premium looking forward? I have been wanting to ask this question all day, so now I will: What would you tell them about the equity risk premium?

[1]For Martin Leibowitz's summary of academic and practitioner research on the equity risk premium, see the Webcast of his presentation to "Research for the Practitioner: The Research Foundation Pre-Conference Workshop" held in conjunction with the AIMR 2002 Annual Conference. The Webcast is available in summer 2002 at aimr.direct.org.

ROGER IBBOTSON: What you say is to the point. First, we see a need for clarification of what we mean by the equity risk premium: I think all of us in this room see it as an expectation, not a realization; if we look at realizations, it's to help us understand expectations. But not everybody outside the room understands this distinction.

The second issue is the use of "arithmetic" versus "geometric." Every time we make a forecast, we should say whether the forecast is arithmetic or geometric and which risk-free rate we are using—U.S. T-bills, the long bond, or TIPS.

Third, we need to distinguish between yields and returns. Jeremy Siegel, for example, used realized returns, whereas others today used realized yields.

Fourth, we should always specify the forecast horizon—whether we are talking about a short or a long horizon. The risk premium for a short horizon is basically about timing, an attempt to judge whether the market is currently over- or undervalued; the risk premium for the very long horizon provides a more stable concept of what the risk premium is—namely, the long-term extra return that an investor is expected to get for taking risks, assuming the market is fairly valued.

If we could at least get these definitions delineated and clarified and let everybody know what the definitions are, it would help identify the differences among us. We are actually much more of one mind than some might think. And the theoretical analyses actually come closer to the empirical results I might have imagined before this conference.

The 4 percent (400 bps) equity risk premium forecast that I have presented here today is a geometric return in excess of the long-term government bond yield. It is a long-term forecast, under the assumption that today's market is fairly valued.

WILLIAM REICHENSTEIN: I want to make a comment in terms of asset allocation based on the geometric difference between future stock and future bond returns. Let's say that the real return on stocks is expected to be 4 percent. Of course, the numbers would depend on the assumptions used; if you use the dividend model, the real return might be 2.5 percent, and with the earnings model, it might increase to 4 percent, but in either case, we are talking about a number well below the historical 7 percent real return on stocks. If we are looking at a real return on stocks of 4 percent and a real return on bonds of 3 percent, the equity risk premium is about 1 percent, which is much lower than in the past. So, the expectation for future equity real returns is down. But for a 50/50 stock/bond portfolio, if you use the historical Ibbotson numbers of 7 percent for stocks and 2 percent for bonds, then your historical real return on a 50/50 portfolio is 4.5 percent. How much worse off are you today at an estimate of 4 percent real return on stocks and 3 percent real return on bonds? That 50/50 portfolio has 3.5 percent real return instead of 4.5 percent, and that is only a 1 percentage point difference. Part of the reason the equity risk premium is lower, it seems to me, is because the real returns on bonds are up.

ROBERT ARNOTT: That's a very good point. The 4.5 percent versus the 3.5 percent expected *portfolio* return invites the question: Why is the actuarial community allowing sponsors to use 6.5 percent as an actuarial real return assumption for their aggregate balanced pension funds? The average nominal return is 9.3 percent, and the average inflation assumption is 2.8 percent. I would say that assuming a 6.5 percent real return is irresponsible and dangerous regardless of whether the reasonable expectation for real return going forward is 4.5 percent or 3.5 percent.

KEVIN TERHAAR: I think of the risk premium as most appropriately viewed as a discount rate element corresponding to a long horizon and relative to a risk-free rate, *commensurate with the asset's risk*. The risk premium issues that we have been discussing today are not unique to the U.S. equity market. Equities or bonds, or any other asset class for that matter, should be discounted in light of the risks that the asset entails. Although there seems to be some agreement on definition and, to a lesser extent, expectations, we are still left with a question that is one step removed from the equity risk premium: What is the appropriate price of risk as we look to the future? Even if we can agree that risk is more stable and thus more easily forecastable than return, and we are able to develop agreed-upon and reasonable forward-looking risk estimates, the issue of the appropriate *price of risk* still exists. Ultimately, it is this price of risk that determines the risk premium, not only of U.S. equities, but also of any other asset class. The risk premium on the domestic equity market should not and cannot be viewed in isolation.

LEIBOWITZ: In response to Brett Hammond, I'm very impressed by the level of consensus on the view that earnings can grow only at a somewhat slower rate than GDP per capita and that no one seems to feel it can grow much more—except Roger Ibbotson, who thought EPS could grow faster than GDP because of extra earnings retention and the implicit growth estimate inherent in the high recent price-to-earnings ratio. The fact that we're basically in agreement that earnings are tightly bound to the growth in the economy has, I think, a lot of implications. Also, I think we can agree that the distinction between arithmetic and geometric is important in terms of the way these concepts are discussed and analyzed. Another important point is that the term structure that is being used to analyze the risk premium must be defined. We also need to keep in mind that the estimation error over the short term is very, very high. So, our views, at least our expectations, may be more convergent over time, but the differences still remain.

Another thing that is surprising is the disconnect between the low growth assumption and the risk premium we tend to believe in, or at least corporate executives tend to believe in. Historically, the risk premium has been more than 5 percent, which may be tough to get in the future with the earnings growth numbers that have been cited today. I think we've come to some important agreements here.

I am troubled, however, by one aspect we haven't explored: Given the growth rate of GDP (the rate of all the corporate profits—including all the entrepreneurial profits that are not captured in the public market, all the free enterprise profits in the economy), how much of the earnings has to be reinvested to sustain that growth? That's a critical equilibrium question. Roger is the only person who addressed it, which he did in terms of his historical study. I think this point is worthy of a lot more thought.

ARNOTT: In terms of the lessons learned today, a tidy way to look at the whole returns picture is to hearken back to the basic notion that the real return on stocks has just three constituent parts—changes in valuation levels, growth, and income (whether income is dividends or dividends plus buybacks). We typically know the yield, so much of the discussion gets simplified to a reexamination of two key issues: (1) Is current pricing wrong? Should valuation levels change? (2) What growth rate is reasonable to expect? As you saw in the rather sharp dichotomy between my formulation for growth and Roger Ibbotson's formulation for growth, there's plenty of room for dialogue—in fact, immense room for dialogue.

A related aspect I think is interesting to observe is that, although there are a whole host of theories relating to finance, some of them elegant, brilliantly crafted, and sensible formulations of the way the world *ought* to work—the capital asset pricing model and Modigliani and Miller being two vivid examples—comparatively few people believe that the world actually works in exact accord with any such theories. We've seen tangible evidence that M&M, while a fine theory, doesn't necessarily work intertemporally. And we know that the CAPM in its raw form doesn't fit the data very well. This doesn't make it a bad theory; it's a wonderful theory and a wonderful formulation of the way the world ought to work. Similarly, the notion that higher P/Es should, in an efficient market, imply faster future permanent growth makes sense. It's an intuitive theory. Does it stand up to historical testing? No.

A similar lesson I think we can take away from today is that the theory and the reality of the risk premium puzzle differ. There are a host of theories that relate to the risk premium puzzle and, from our views on the risk premium, relate to the asset allocation decision, but the theories don't stand up to empirical tests. A very interesting area of exploration for the years ahead will be to try to find a theoretically robust construct that fits the real world.

CAMPBELL HARVEY: I was struggling through the morning just with the vocabulary related to the risk premium: It depends on the horizon; it depends on the risk-free rate; it's a moving target through time; it's conditional; it's unconditional. I now have a better understanding of these concepts and the difficulties in defining them. It is extraordinary that, given the importance of the definitions of these variables, there is so much disagreement in terms of approach. Indeed, I have to teach this material, and it is a difficult topic for the students. We talk in class about the risk premium, but we also have to take a step back and define risk, which is extraordinarily difficult to do.

We have talked today about the current state-of-the-art models. There is a burgeoning literature on different measures of risk, and we are learning a lot from the new behavioral theories. So, we are moving forward in our understanding of the risk premium. Indeed, some of the foremost contributors to this effort are in this room. And I think more progress will be made in the future. It is somewhat frustrating that we are not there yet. I cannot go into the classroom or into the corporate world and say with some confidence, "*This* is the risk premium."

ROBERT SHILLER: I was thinking about the ambiguity of our definitions of the equity risk premium and about what we mean by expectations. We tend to blur the concepts of our own expectations with the public's expectations and with rational expectations. And the interpretations we give to the concept of expectations have changed through time. The history of thought about expectations is interesting. I remember a 1969 article by Conard and Frankena about the term structure—before the rational expectations revolution—that asserted that there is no objective way to specify expectations in a testable model but by assuming perfect foresight. They wrote this after Muth (1961) wrote the first treatise on rational expectations but before it had any impact on the profession. Without access to the theoretical framework proposed by Muth, there was no concept at all of rational expectations. That was then, and now, today, 30 years later, we economists often seem to think that the word "expectations" has no other meaning than "rational expectations."

Economists today think expectation is the summation of P_iX_i, where P is the probability, but that is a very abstract concept that we've been taught. We can trace the word "probability" very far back in time, but it didn't always have all the associations that it has today. The word "probability" didn't even have the meaning that we attach to it now until the mid-1600s, when it seemed to suddenly explode on the intellectual scene. Before then, the word "probability" existed, but it meant "trustworthiness" and had no connection at all to our modern concept of probability. Suddenly, Blaise Pascal and others got people talking about probability, which led naturally to the concept of mathematical expectation.

Just as "probability" is not a natural concept, I think "expectations" is not a natural concept. When you do surveys and you ask people for their expectations, should we expect them to give us some calculation of mathematical expectations? In fact, their reaction to questions about their expectations often seems a sort of a panic: What are these people asking for? What kind of number do they want? I have to come up with a number fast! (Incidentally, a lot of people don't remember that John Maynard Keynes' first claim to fame was a 1921 book about probability in which he argued that people really don't have probabilities as we think of them today.[2])

With all of these ambiguities, one starts to wonder what the equity risk premium is measuring. When I was surveying individual and institutional investors about their outlook for the market, I found that if I asked investors what they thought the DJIA would do in the next year, the average answer was + 5 percent. But the PaineWebber/Gallup survey taken at the same time found that investors thought the DJIA would rise by 15 percent. That's quite a big discrepancy. So, I called Gallup and asked them if we could figure out the reason for such different results. As it turned out, the different survey responses were a function of the wording of the questions. The Gallup

[2] This work can be found in Keynes (1973).

poll was conducted by randomly telephoning people at the dinner hour. Their question was (more or less): What return do you expect on the stock market in the next year in percentage terms? My survey was conducted through a written questionnaire, and the specific question about the market was (more or less): "What do you think the DJIA is going to do in the next 12 months? Put a plus mark if you think it's going to go up and put a minus mark if you think it's going to go down."

The critical difference is that I mentioned the possibility that the market might go down, so about one-third of my answers were negative. I called Gallup and asked them what fraction of their respondents said "Down." And they said that there were so few down responses that they rounded them to zero. So, I was trying to figure out why they got so few negative responses. Well, the Gallup respondents were called at dinnertime, and maybe the person who called was somewhat intimidating, so respondents had to have some courage to say they thought the market return was going to be negative. In my survey, however, I brought up in writing a possible negative choice, and I got a lot of negative responses. So, I think reported expectations are very fragile.

In the investment profession, we've learned to have respect for psychologists and the concepts they use because they've learned a lot by studying how people frame their thinking and decision making. The concepts arising from this knowledge can be very helpful to us in our work. And psychologists deal with other attitudes related to expectations—aspiration, hope, regret, fear, and the salience of stories. All of these parameters are constantly changing through time. So, when you ask someone about their expectations, the answer they give will be very context sensitive.

With surveys, we've learned you need to ask exactly the same questions in exactly the same order on each questionnaire. Even so, you don't know quite what you're really getting because expectations have so many different definitions.

RAJNISH MEHRA: I want to make two quick comments. My first point is that valuation models help us structure the problem, but what breathes life into a valuation model are the forecasts, and these forecasts have huge conditional errors. Not many of the estimates for the equity premium that were given today were accompanied by the standard deviation of that estimate. That standard deviation is too important to be missing. For example, in my data relating the expected mean equity risk premium to national income, the standard deviation around that mean is huge. Just giving a point estimate is not enough. The omission of the conditional error worries me.

My second point is that profound demographic shifts are going to be occurring in the United States, in terms of the Baby Boomers retiring, about which Ed Prescott and I wrote (1985). That phenomenon is going to lead to asset deflation, which has profound implications for the *ex ante* equity premium.

THOMAS PHILIPS: I have been very interested to see two broad strands of thought discussed today. One of these strands, exemplified by Rajnish Mehra, is the line of thinking in which the basic model involves human economic behavior, whether that behavior is utility maximizing or motivated by something else, and the effects of that behavior in the capital markets. The second strand is more empirical—constructing a point estimate for the equity risk premium—and it is exemplified by Rob Arnott's and Roger Ibbotson's work. I see two somewhat different challenges for these two strands, and ultimately, they have to meet in the middle so that we can build a unified theory.

For the economist, the challenge I see is related to Richard Feynman's argument about why scientific imagination is so beautiful: It must be consistent. You cannot imagine just anything; it has to be consistent with classical mechanics, with quantum mechanics, with general relativity, and so on and so forth. Within this set of constraints, beautiful ideas are born that tie neatly into a powerful edifice. I see the challenge for financial economists as not simply explaining the equity risk premium but explaining a fairly wide range of economic phenomena within a unified framework. Instead of a patchwork of models, financial economics needs to look more like physics.

The challenge for the second group of people, those who provide the point estimates, is (as Rajnish Mehra correctly points out) to estimate some of the errors in our estimates and to be able to communicate all this information in a language that is accessible to the person on the street. In particular, we need to dissuade investors from using the sample mean as the best estimator of the true mean.

So, the two challenges are different, but the overarching challenge is to somehow unify the two approaches in a clean way that answers the question of what the equity risk premium is and makes tactical predictions.

BRADFORD CORNELL: I like to think more in terms of valuation and expected returns than in terms of the equity risk premium. The salient feature to me in that regard is that corporate profits after tax seem to be closely tied to GNP, particularly if the market is measured properly, in the aggregate and not limited to the S&P 500 Index, so that what we have to value is not all that uncertain. However, the way we value earnings, as Rajnish Mehra pointed out, has changed quite a bit. Stock market value in the United States has varied over time from half of GNP to twice GNP, which is about where it is now. To say that earnings are twice GNP, we either have to say that the expected returns are low and are expected to remain low for the long term or that the market has simply made a mistake. The one point that I would make to practitioners, fund managers, and so forth, is that they cannot maintain a 6.5 percent actuarial assumption in light of these data.

PENG CHEN: I think there are probably two types of data: One type is what the companies and the economy reveal—the analysis that Roger Ibbotson and I are working on—and the other type is drawn from the investor's point of view—how much the investor expects from a project or a security. What I think is really interesting is that the answers are going to lie between these two dynamics. How people adjust to the dynamics, how the dynamics change people's behavior, and how that behavior affects the market are very important to observe. I think the reason we see the valuation of the market rise and fall is not necessarily because the entire investment community believes the actual risk premium has fallen or gone up or that risk rose or fell but because of this dynamic. Not all investors have to change their minds to affect market value. Maybe the dynamic affected only a small number or a certain group of investors; only a marginal number of investors have to change their minds. So, it would be interesting to see how the two sides work together dynamically.

PETER WILLIAMSON: One of the most interesting aspects of our discussion today is the areas of agreement and of disagreement. The benefit of identifying areas of disagreement is that it can lead to the search for the reason for the disagreement. It is fascinating to me how all of the findings or theory might be implemented. Can you imagine an active manager turning to his clients and saying, "You must understand that the growth in earnings of your portfolio can't exceed GDP growth"? The client wouldn't believe it, and the manager wouldn't believe it. An active manager can't afford to believe it. Or can you imagine a firm that sells S&P 500 indexed funds sending a letter to all of the shareholders saying that they must realize earnings cannot grow faster than GDP? I can't imagine that message going out. So, what impact does all of the discussion we have had today make on the actual allocation of assets, the actual management of money? I don't know. I don't know whether investors ever have to *really* understand the equity risk premium, whether it's even in their best interest to understand it.

As for allocation, my sense is that different sectors of the investment community will do very different things in terms of asset allocation on the strength of the same expected risk premium. I think that the CREF participant who's 25 years old—looking ahead 40 years to retirement, saving money—versus the investor who is 66 years old—in the process of "dissaving," consuming now—given the same expected rate of return on equity, might do very different things with their money.

Richard Thaler and I deal with the problem of college and university endowment funds. One would think that endowment funds should all be thinking very long term, but the decisions are made by people—who don't live centuries and who, in fact, can be very embarrassed if the endowment has even one very poor quarter. For example, I am on the investment committee of a prep school, and years ago, the trustees agreed that the school should be much more heavily invested in equities, that the school should be thinking long term—but not yet. And each year, the suggestion is repeated, but the decision is: not yet.

It's very, very difficult for people to think long term. Yet, to a large extent, what we've been talking about today is what's sensible for the long term. Well, if people simply cannot think long term, then we are reduced to decisions for the short term. And the asset allocation implications may be very different for investors who cannot think much beyond the next quarter from the implications for those who, in theory at least, ought to be thinking about the next 50 years.

In short, I'm really puzzled about where all that we have discussed goes in terms of making any impact on investment behavior and on asset allocation.

JOHN CAMPBELL: My starting point is that we live in a world in which the forward-looking, *ex ante* equity premium that you might expect if you're a thoughtful investor trying to be rational changes over time, and those changes have implications for the methods used to estimate the premium. We've discussed these estimation methods today, and I think we have quite a consensus that past returns can be very misleading so it is probably better to start with valuation ratios and adjust them for growth expectations.

If we live in a world in which these numbers—the real interest rate, the equity premium, and so forth—change over time, that has a big impact on asset allocation. So, I can't resist plugging my forthcoming book with Luis Viceira (2002), *Strategic Asset*

Allocation: Portfolio Choice for Long-Term Investors. Brad Cornell's colleagues at UCLA coined the term "strategic asset allocation" to contrast with tactical asset allocation (Brennan, Schwartz, and Lagnado 1997). TAA is myopic; it looks at the next period, at the risk–return in one period. The idea behind strategic asset allocation is that if risk premiums are changing over time, the risks of different asset classes may look different for different horizons. You wouldn't get such an effect if returns were identically and independently distributed, but it can become quite important if the stock market is mean reverting or if real interest rates change over time.

I'm a little more optimistic than Peter Williamson is. I think there is some hope of influencing the practical world to think about these issues, because many of the rules of thumb that financial planners have used for years have this flavor. That is, the rules make more sense in a dynamically changing world than they would in an i.i.d. world. So, there's been a mismatch between academic research and practitioners' rules of thumb. We can close that gap if we accept in our models of asset allocation that investment opportunities change over time. So, we might, with some additional work, be able to narrow the gap between how practitioners think and how academics think.

WILLIAM GOETZMANN: The thing that struck me about our discussion today is that, with the exception of Campbell Harvey's paper, almost everything we're doing is an interpretation of history—whether it's historical valuation ratios, arithmetic means, or what have you. That basis for argument is exciting but has its limitations. History, after all, is a series of accidents; the existence of the time series since 1926 might itself be an accident. So, I'm more convinced than ever that we've got to find a way out of the focus on U.S. historical data if we want to solve some of these questions and to reassure ourselves, if indeed we can, that the equity premium is of a certain magnitude.

LEIBOWITZ: Thank you all.

References and Recommended Readings

Abel, Andrew B. 1990. "Asset Pricing under Habit Formation and Catching Up with the Joneses." *American Economic Review*, vol. 80, no. 2:38–42.

Ang, Andrew, and Geert Bekaert. 2001. "Stock Return Predictability: Is it there?" National Bureau of Economic Research (NBER) Working Paper 8207 (April).

Arnott, Robert D., and Clifford S. Asness. 2002. "Does Dividend Policy Foretell Earnings Growth?" Unpublished working paper (January).

Arnott, Robert D., and Peter L. Bernstein. 2002. "What Risk Premium is 'Normal'?" *Financial Analysts Journal*, vol. 58, no. 2 (March/April 2002):64–85.

Arnott, Robert D., and James N. von Germeten. 1983. "Systematic Asset Allocation." *Financial Analysts Journal,* vol. 39, no. 6 (November/December):31–38.

Arnott, Robert D., and Ronald Ryan. 2001. "The Death of the Risk Premium: Consequences of the 1990s." *Journal of Portfolio Management*, vol. 27, no. 3 (Spring):61–74.

Asness, Clifford S. 2000a. "Bubble Logic or How to Learn to Stop Worrying and Love the Bull." AQR working paper (June).

———. 2000b. "Stocks versus Bonds: Explaining the Equity Risk Premium." *Financial Analysts Journal*, vol. 56, no. 2 (March/April):96–113.

Bagwell, Laurie Simon, and John B. Shoven. 1989. "Cash Distributions to Shareholders." *Journal of Economic Perspectives*, vol. 3, no. 3 (Summer):129–140.

Bansal, Ravi, and Amir Yaron. 2000. "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles." NBER Working Paper 8059 (December).

Bansal, Ravi, Robert F. Dittmar, and Christian T. Lundblad. 2001. "Consumption, Dividends, and the Cross-Section of Equity Returns." Working paper, Duke University (October).

Barberis, N., M. Huang, and T. Santos. 1996. "Prospect Theory and Asset Prices." Working paper, University of Chicago.

Benartzi, S., and R. Thaler. 1995. "Myopic Loss Aversion and the Equity Premium Puzzle." *Quarterly Journal of Economics*, vol. 110, no. 1 (February):73–92.

Bernstein, Peter L. 1993. *Volatility: Two Views, Two Signals.* Newsletter. (November 15).

———. 1996. "Are Stocks the Best Place to Be in the Long Run? A Contrary Opinion." *Journal of Investing*, vol. 5, no. 2 (Summer):6–9.

———. 1997. *Stock/Bond Risk Perceptions and Expected Returns.* Newsletter. (February 1).

———. 2001a. "Ending Endism." *Economics and Portfolio Strategy* (April 30).

———. 2001b. "The Real Economy and the Unreal Economy." *Economics and Portfolio Strategy* (May 15).

Black, Fisher. 1976. "Studies of Stock Price Volatility Changes." *Proceedings of the 1976 Meetings of the American Statistical Society, Business and Economics Statistics Section*:177–181.

Bogle, John C. 1991. "Investing in the 1990s: Occam's Razor Revisited." *Journal of Portfolio Management*, vol. 18, no. 1 (Fall):88–91.

———. 1995. "The 1990s at the Halfway Mark." *Journal of Portfolio Management*, vol. 21, no. 4 (Summer):21–31.

Boudoukh, Jacob, and Matthew Richardson. 1994. "The Statistics of Long-Horizon Regressions Revisited." *Mathematical Finance*, vol. 4, no. 2 (April): 103–119.

Brennan, Michael J., Eduardo S. Schwartz, and Ronald Lagnado. 1997. "Strategic Asset Allocation." *Journal of Economic Dynamics and Control,* vol. 21, no. 8–9 (June):1377–1403.

Campbell, J.Y. Forthcoming 2002. "Consumption Based Asset Pricing." In *Handbook of the Economics of Finance.* Edited by G.M. Constantinides, M. Harris, and R. Stulz. Amsterdam, Netherlands: North-Holland.

Campbell, John Y., and J.H. Cochrane. 1995. "By Force of Habit: A Consumption-Based Explanation of

Aggregate Stock Market Behavior." NBER Working Paper 4995.

———. 1999. "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior." *Journal of Political Economy*, vol. 107 (April):205–251.

Campbell, John Y., and Robert J. Shiller. 1988. "Stock Prices, Earnings, and Expected Dividends." *Journal of Finance*, vol. 43, no. 3 (July):661–676.

———. 1998. "Valuation Ratios and the Long-Run Stock Market Outlook." *Journal of Portfolio Management*, vol. 24, no. 2 (Winter):11–26.

———. 2001. "Valuation Ratios and the Long-Run Stock Market Outlook: An Update." NBER Working Paper 8221 (April).

Campbell, John Y., and Luis M. Viceira. 2002. *Strategic Asset Allocation: Portfolio Choice for Long-Term Investors*. Oxford, U.K.: Oxford University Press.

Chancellor, Edward. 1999. *Devil Take the Hindmost*. New York: Farrar, Straus, and Giroux.

Claus, James, and Jacob Thomas. 2001. "Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stocks." *Journal of Finance,* vol. 56, no. 5 (October):1629–66.

Cole, Kevin, Jean Helwege, and David Laster. 1996. "Stock Market Valuation Indicators: Is This Time Different?" *Financial Analysts Journal*, vol. 52, no. 3 (May/June):56–64.

Conard, Joseph W., and Mark W. Frankena. 1969. In *Essays on Interest Rates*. Edited by Jack M. Guttentag and Philip Cagan. New York: NBER and Columbia University Press.

Constantinides, George C. 1990. "Habit Formation: A Resolution of the Equity Premium Puzzle." *Journal of Political Economy*, vol. 98 (June):519–543.

Constantinides, George M., John B. Donaldson, and Rajnish Mehra. 1998. "Junior Can't Borrow: A New Perspective on the Equity Premium Puzzle." NBER Working Paper 6617 (June).

Cornell, Bradford. 1999. *The Equity Risk Premium*. New York: John Wiley & Sons.

Cowles, Alfred. 1938 (1939, 2nd edition). *Common Stock Indexes: 1871–1937*. Bloomington, IN: Principia.

Cragg, John G., and Burton G. Malkiel. 1982. *Expectations and the Structure of Share Prices*. Chicago, IL: University of Chicago Press.

Damodaran, Aswath. Forthcoming 2002. "Choosing the Right Valuation Model." In *Equity Valuation Techniques*. Charlottesville, VA: AIMR.

Davidson, L.B., and D.O. Cooper. 1976. "A Simple Way of Developing a Probability Distribution of Present Value." *Journal of Petroleum Technology* (September):1069–78.

Davis, S.J., and Rajnish Mehra. Forthcoming 2002. *Stocks and Bonds in the Portfolio Life-Cycle*. Saddle River, NJ: Prentice Hall.

DeLong, B., A. Shleifer, L. Summers, and R. Waldmann. 1990. "Noise Trader Risk in Financial Markets." *Journal of Political Economy*, vol. 98, no. 4 (August):703–738.

Diermeier, Jeffrey, Roger Ibbotson, and Laurence B. Siegel. 1984. "The Supply of Capital Market Returns." *Financial Analysts Journal*, vol. 40, no. 2 (March/April):74–80.

Dimson, Elroy, Paul Marsh, and Mike Staunton. 2001. *Triumph of the Optimists: 101 Years of Global Investment Returns*. Princeton, NJ: Princeton University Press.

Epstein, L., and S. Zin. 1989. "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework." *Econometrica,* vol. 57, no. 4 (July):937–969.

Fama, Eugene F., and Kenneth R. French. 1988. "Dividend Yields and Expected Stock Returns." *Journal of Financial Economics*, vol. 22, no. 1 (October):3–26.

———. 1989. "Business Conditions and Expected Returns on Stocks and Bonds." *Journal of Financial Economics*, vol. 25, no. 1 (July):23–50.

———. 2000. *The Equity Risk Premium*. Center for Research in Security Prices Working Paper 522 (April).

Fama, Eugene F., and Kenneth R. French. 2001. "The Equity Premium." Center for Research in Security Prices Working Paper No. 522 (April).

Fisher, Irving. 1930. *The Theory of Interest*. New York: MacMillan.

Frankel, Jeffery, and Kenneth Froot. 1990. "Chartists, Fundamentalists, and Trading in the Foreign

Exchange Market." *American Economic Review*, vol. 80, no. 2 (May):181–185.

French, Kenneth R., G. William Schwert, and Robert F. Stambaugh. 1987. "Expected Stock Returns and Volatility." *Journal of Financial Economics*, vol. 19, no. 1 (January):3–29.

Garber, Peter M. 2000. *Famous First Bubbles: The Fundamentals of Early Manias*. Cambridge, MA: MIT Press.

Glassman, James K., and Kevin A. Hassett. 1999. *Dow 36,000*. New York: Random House.

Goetzmann, William N., and Philippe Jorion. 1993. "Testing the Predictive Power of Dividend Yields." *Journal of Finance*, vol. 48, no. 2 (June):663–679.

Goetzmann, William N., and Massimo Massa. 2001. "Dispersion of Opinion and Stock Returns: Evidence from Index Fund Investors." Yale ICF Working Paper No. 00-55 (August).

Goyal, Amit, and Ivo Welch. 1999. "Predicting the Equity Premium." Working paper, University of California at Los Angeles.

———. 2001. "Predicting the Equity Premium with Dividend Ratios." Yale ICF working paper, University of California at Los Angeles (December).

Graham, B., and D.L. Dodd. 1934. *Security Analysis*. New York: McGraw-Hill.

Graham, John, and Campbell R. Harvey. 1996. "Market Timing Ability and Volatility Implied in Investment Newsletters' Asset Allocation Recommendations." *Journal of Financial Economics*, vol. 42 (January):397–422.

———. 2001a. "Expectations of Equity Risk Premia, Volatility and Asymmetry from a Corporate Finance Perspective." Working paper, Duke University.

———. 2001b. "The Theory and Practice of Corporate Finance: Evidence from the Field." *Journal of Financial Economics*, vol. 60, no. 2–3 (May):187–243.

———. 2002. "How Do CFOs Make Capital Budgeting and Capital Structure Decisions?" Working paper, Duke University (March).

Granger, C.J.W., and P. Newbold. 1974. "Spurious Regressions in Econometrics." *Journal of Econometrics*, vol. 2:111–120.

Hicks, Sir John Richard. 1946. *Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory*. Oxford, UK: Oxford University Press.

Ibbotson, Roger, and Peng Chen. 2002. "Stock Market Returns in the Long Run: Participating in the Real Economy." Yale ICF Working Paper (March).

Ibbotson, Roger, and Rex A. Sinquefield. 1976a. "Stocks, Bonds, Bills and Inflation: Year-by-Year Historical Returns (1926–74)." *Journal of Business*, vol. 49, no. 1 (January):11–47.

———. 1976b. "Stocks, Bonds, Bills and Inflation: Simulations of the Future (1976–2000)." *Journal of Business*, vol. 49, no. 3 (July):313–338.

Ibbotson Associates. 2001. *Stocks, Bonds, Bills, and Inflation: 2000 Yearbook*. Chicago, IL: Ibbotson Associates.

Ilmanen, Antti. 1995. "Time-Varying Expected Returns in International Bond Markets." *Journal of Finance*, vol. 50, no. 2 (June):481–506.

Jagannathan, Murali, Clifford P. Stephens, and Michael S. Weisbach. 2000. "Financial Flexibility and the Choice between Dividends and Stock Repurchases." *Journal of Financial Economics*, vol. 57, no. 3 (September):355–384.

Jagannathan, Ravi, and Iwan Meier. 2001. "Do We Need the CAPM for Capital Budgeting?" Working paper, Northwestern University.

Jagannathan, Ravi, Ellen R. McGrattan, and Anna Scherbina. 2000. "The Declining U.S. Equity Premium." *Quarterly Review*, Federal Reserve Bank of Minneapolis, vol. 24, no. 4 (Fall):3–19.

Janis, Irving. 1982. *Groupthink*. Boston, MA: Houghton Mifflin.

Jones, Charles. 2001. "A Century of Stock Market Liquidity and Trading Costs." Paper presented to the NBER Summer Institute, Asset Pricing Meetings.

Kahneman, Daniel, and Amos Tversky. 1974. "Judgment under Uncertainty: Heuristics and Biases." *Science*, vol. 185, no. 4157 (September):1124–31.

———. 1979 (and 1974). "Prospect Theory: An Analysis of Decision under Risk." *Econometrica*, vol. 46, no. 2 (March):171–185.

Kane, Alex, Alan J. Marcus, and Jaesun Noh. 1996. "The P/E Multiple and Market Volatility." *Financial Analysts Journal*, vol. 52, no. 4 (July/August):16–24.

Keynes, John Maynard. 1936. *The General Theory of Employment, Interest, and Money*. New York: Harcourt Brace and World.

———. 1973. *Treatise on Probability* [1921]. In *The Collected Writings of John Maynard Keynes*. London, U.K.: MacMillan, for the Royal Economic Society.

Kirby, Chris. 1997. "Testing the Predictable Variation in Stock and Bond Returns." *Review of Financial Studies*, vol. 10, no. 3 (Fall):579–630.

Knight, Frank. 1964. *Risk, Uncertainty and Profit*. New York: Augustus M. Kelley.

Lander, Joel, Athanasios Orphanides, and Martha Douvogiannis. 1997. "Earnings Forecasts and the Predictability of Stock Returns: Evidence from Trading the S&P." *Journal of Portfolio Management*, vol. 23, no. 4 (Summer):24–35.

Lintner, John. 1956. "Distribution of Incomes of Corporations among Dividends, Retained Earnings, and Taxes." *American Economic Review*, vol. 46:97–113.

Macaulay, Frederick R. 1938. *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856*. Washington, DC: National Bureau of Economic Research.

McDonald, R., and Dan Siegal. 1986. "The Value of Waiting to Invest." *Quarterly Journal of Economics*, vol. 101, no. 4:707–728.

McGrattan, Ellen R., and Edward C. Prescott. 2000. "Is the Stock Market Overvalued?" *Federal Reserve Bank of Minneapolis Quarterly Review*, vol. 24, no. 4 (Fall):20–40.

McGrattan, Ellen R., and Edward C. Prescott. 2001. "Taxes, Regulations, and Asset Prices." Unpublished paper, Federal Reserve Bank of Minneapolis (March).

Mehra, Rajnish. 1998. "On the Volatility of Stock Prices: An Exercise in Quantitative Theory." *International Journal of Systems Science*, vol. 29, no. 11:1203–11.

———. Forthcoming 2002a "Equity Premium Puzzle." In *Mastering Investments*. Edited by James Pickford. Saddle River, NJ: Prentice Hall.

———. Forthcoming 2002b. "The Equity Premium: Why Is It a Puzzle?" *Financial Analysts Journal*.

Mehra, Rajnish, and Edward C. Prescott. 1985. "The Equity Premium: A Puzzle." *Journal of Monetary Economies*, vol. 15, no. 2 (March):145–161.

———. 1988. "The Equity Risk Premium: A Solution?" *Journal of Monetary Economics*, vol. 22 (July):133–136.

———. Forthcoming 2002. "The Equity Premium Puzzle in Retrospect." In *Handbook of the Economics of Finance*. Edited by G.M. Constantinides, M. Harris, and R. Stulz. Amsterdam, Netherlands: North Holland.

Merton, R.C. 1980. "On Estimating the Expected Return on the Market." *Journal of Financial Economics*, vol. 8, no. 4 (June):323–361.

Miller, Merton, and Franco Modigliani. 1961. "Dividend Policy, Growth, and the Valuation of Shares." *Journal of Business*, vol. 34, no. 4 (October):411–433.

Modigliani, F., and R. Cohn. 1979. "Inflation, Rational Valuation, and the Market." *Financial Analysts Journal*, vol. 35, no. 2 (March/April):24–44.

Modigliani, Franco, and Merton H. Miller. 1958. "The Cost of Capital, Corporation Finance, and the Theory of Investment." *American Economic Review*, vol. 48, no. 3 (June):261–297.

Muth, John F. 1961. "Rational Expectations and the Theory of Price Movements." *Econometrica*, vol. 29:315–335.

Philips, Thomas K. 1999. "Why Do Valuation Ratios Forecast Long-Run Equity Returns?" *Journal of Portfolio Management*, vol. 25, no. 3 (Spring):39–44.

Philips, T.K., G.T. Rogers, and R.E. Capaldi. 1996. "Tactical Asset Allocation: 1977–1994." *Journal of Portfolio Management*, vol. 23, no. 1 (Fall):57–64.

Poterba, James M., and Lawrence H. Summers. 1986. "The Persistence of Volatility and Stock Market Fluctuations." *American Economic Review*, vol. 76, no. 5 (December):1142–51.

Reichenstein, William. Forthcoming 2002. "What do Past Stock Market Returns Tell Us about the Future?" *Journal of Financial Planning*.

Samuelson, Paul A. 1994. "The Long-Term Case for Equities and How It Can Be Oversold." *Journal of Portfolio Management*, vol. 21, no. 1 (Fall):15–26.

———. 1979. "Why We Should Not Make Mean Log of Wealth Big Though Years to Act Are Long." *Journal of Banking and Finance*, vol. 3, no. 4:305–308.

Schwert, G. William. 1989. "Why Does Stock Market Volatility Change over Time?" *Journal of Finance*, vol. 44, no. 5 (December):1115–54.

Schwert, G. William. 1990. "Indexes of United States Stock Prices from 1802 to 1987." *Journal of Business*, vol. 63, no. 3 (July):399–426.

Shafir, E., I. Simonson, and A. Tversky. 2000. "Reason-Based Choice." In *Choices, Values, and Frames*. Edited by D. Kahneman and A. Tversky. Cambridge, U.K.: Cambridge University Press.

Shiller, Robert J. 1981. "Do Stock Prices Move Too Much to Be Justified by Subsequent Changes in Dividends?" *American Economic Review*, vol. 73, no. 3 (June):421–436.

———. 1989. *Market Volatility*. Boston, MA: Massachusetts Institute of Technology Press.

———. 1990. "Market Volatility and Investor Behavior." *American Economic Review*, vol. 80:58–62.

———. 2000. *Irrational Exuberance*. Princeton, NJ: Princeton University Press.

———. 2002. "Bubbles, Human Judgment, and Expert Opinion." *Financial Analysts Journal*, vol. 58, no. 3 (May/June):18–26.

Shleifer, Andrei, and Nicholas Barberis. 2000. "Style Investing." NBER Working Paper No. 8039 (December).

Siegel, Jeremy J. 1998. *Stocks for the Long Run*. 2nd. ed. New York: McGraw Hill.

———. 1999. "The Shrinking Equity Premium." *Journal of Portfolio Management*, vol. 26, no. 1 (Fall):10–17.

———. 2002. *Stocks for the Long Run*. 3rd ed. New York: McGraw Hill.

Smith, Edgar Lawrence. 1924. *Common Stocks as Long-Term Investments*. New York: MacMillan.

Sorensen, Eric H., and Robert D. Arnott. 1988. "The Risk Premium and Stock Market Performance." *Journal of Portfolio Management*, vol. 14, no. 4 (Summer):50–55.

Stambaugh, Robert F. 1984. "Bias in Regressions with Lagged Stochastic Regressors." Manuscript.

Statman, Meir. 2002. "Lottery Players/Stock Traders." *Financial Analysts Journal*, vol. 58, no. 1 (January/February):14–21.

Thaler, R., A. Tversky, D. Kahneman, and A. Schwartz. 1997. "The Effect of Myopia and Loss Aversion on Risk Taking: An Experimental Test." *Quarterly Journal of Economics*, vol. 112, no. 2 (May):647–661.

Welch, Ivo. 2000. "Views of Financial Economists on the Equity Premium and on Financial Controversies." *Journal of Business*, vol. 73, no. 4 (October):501–537.

Wilson, Jack W., and Charles P. Jones. Forthcoming 2002. "An Analysis of the S&P 500 Index and Cowles Extensions: Price Indexes and Stock Returns, 1870-1999." *Journal of Business*.

Note on Value Drivers[1]

Value-based management assumes that value creation should be a primary consideration in managerial decision making. It requires a thorough understanding of what creates value and why as well as the ability to measure value accurately. The goal of this note is to highlight the determinants of equity value and, in doing so, provide a framework for making financial, strategic, and investment decisions. In particular, the note describes three value drivers: profitability, advantage horizon, and reinvestment. Using both a theoretical model and a numerical example, it shows how each value driver affects equity value and explains why. It also presents empirical evidence to support the relation between the value drivers and value creation.

Theoretical Equity Valuation Model

Discounted cash flow (DCF) analysis translates future cash flows into current market values. For example, given a stream of equity cash flows (ECF) and a discount rate equal to the cost of equity (K_E), the market value of equity (E_{MV}) is the present value of future equity cash flows:

$$E_{MV} = ECF_1/(1+K_E) + ECF_2/(1+K_E)^2 + \ldots \quad (1)$$

When the equity cash flows and discount rate are constant over time, this series is a stable perpetuity which can be written as:

$$E_{MV} = ECF/K_E \quad (2)$$

Assuming that the equity cash flows are equal to the accounting return on equity (ROE) times the book value of equity (E_{BV}) at the beginning of the period, then equation 2 can be rewritten as:

$$E_{MV} = [(ROE)^*(E_{BV})]/K_E \quad (3)$$

$$\text{where } ROE = \text{Net Income}/E_{BV}$$

While the assumption that equity cash flows are equal to accounting earnings is convenient for expositional reasons, this assumption is clearly not valid except in very special circumstances. For example, non-cash items such as depreciation or deferred taxes, and cash-items that do not flow through the income statement such as changes in working capital and fixed assets both cause cash

[1] Much of the material in this note appears in Fruhan (1979), chapter 1.

Professor Benjamin C. Esty prepared this note as the basis for class discussion.

flows to deviate from reported net income. Nevertheless, this assumption is not a bad approximation and, as will be shown in the next section, seems to generate reasonable empirical predictions.

After dividing each side of equation 3 by the book value of equity, the left side of the equality becomes the market-to-book ratio (the market value of equity divided by the book value of equity):

$$\text{Market/Book} = E_{MV} / E_{BV} = \text{ROE}/K_E \quad (4)$$

Equation 4 says that a firm's market-to-book ratio equals the ratio of its return on equity to its cost of equity. This simple valuation model, or variations of it, can be used to analyze the relation between profitability, growth, and value.

Profitability

The first value driver, profitability, is immediately clear from equation 4. For a given industry, more profitable firms—those able to generate higher returns per dollar of equity—should have higher market-to-book ratios. Conversely, firms which are unable to generate returns in excess of their cost of equity should sell for less than book value.

Profitability	Value
If ROE > K_E	then Market/Book > 1
If ROE = K_E	then Market/Book = 1
If ROE < K_E	then Market/Book < 1

One implication of this model is that firms can increase equity value by increasing their return on equity. The Du Pont formula decomposes ROE into three components and provides some guidance on how to increase it:

$$\begin{aligned}\text{ROE} &= (\text{Net Income/Equity}) \\ &= (\text{Net Income/Sales}) * (\text{Sales/Assets}) * (\text{Assets/Equity}) \\ &= (\text{Profit Margin}) * (\text{Asset Turnover}) * (\text{Financial Leverage})\end{aligned}$$

For example, increasing the profit margin through higher prices or lower costs will increase the ROE. Similarly, increasing the asset turnover by increasing inventory turnover or reducing days receivables will increase the ROE. However, increasing financial leverage has dual, and possibly contradictory, effects. It increases not only the ROE through the Du Pont formula, but also the cost of equity.

A firm's cost of equity, or equivalently investors' expected return on equity, can be estimated using the Capital Asset Pricing Model (CAPM). According to the model, the expected return on equity is a function of a firm's equity beta (β_E) which, in turn, is a function of both leverage and asset risk (β_A):

$$K_E = R_F + \beta_E (R_M - R_F) \quad (5)$$

where:

R_M = return on the market portfolio
R_F = risk-free rate of return

$$\beta_E = [\, \beta_A - \beta_D (D/V) \,] (V/E) \quad (6)$$

because:

$$\beta_A = \beta_D (D/V) + \beta_E (E/V) \quad (7)$$

and

$$\text{Firm Value } (V) = \text{Debt Value } (D) + \text{Equity Value } (E) \quad (8)$$

Assuming riskless debt, meaning the beta of debt is zero, then equation 6 can be written as:

$$\beta_E = \beta_A \,(V/E) \tag{9}$$

As financial leverage (D/V) increases, the ratio of firm value to equity value (V/E) increases, the equity beta increases, and, according to equation 5, the expected return on equity increases. The expected return increases because equity cash flows are riskier: leverage increases debtholders fractional claim on the firm's cash flows. As a result, an increase in leverage can either increase or decrease the ratio in equation 4 depending on whether the return on equity (the numerator) or the cost of equity (the denominator) increases faster.

Advantage Horizon

Equation 4 presents a firm's market-to-book ratio as a stable perpetuity under the assumption that its profitability remains constant forever. An alternative, and more realistic assumption, is that firms generate positive abnormal returns—returns in excess of their cost of capital—for only a limited number of years. The period during which firms generate positive abnormal returns is known as the advantage horizon.

Using a variation of the simple valuation model in equation 4, Appendix 1 derives the market-to-book ratio as an annuity rather than a stable perpetuity. It assumes that a firm's equity returns can be divided into two parts: *normal* returns equal to the firm's cost of equity (K_E) and *abnormal* returns equal to the actual ROE less the cost of equity (ROE - K_E). Viewed in this fashion, one can think of abnormal returns and the advantage horizon in the same way Stewart (1991) defines economic value added (EVA) and the competitive advantage period (CAP). Equation A1.8 from the Appendix 1 is:[2]

$$\textbf{Market/Book} = 1 + (ROE-K_E) * [(1/K_E) - (1/(K_E(1+K_E)^n)] \tag{10}$$

where the advantage horizon is defined as n years. According to this formula, the greater the spread between a firm's return on equity and its cost of equity (ROE - K_E), the longer the advantage horizon (increasing n), and the sooner abnormal returns occur (positive abnormal returns in early years), the higher the market-to-book ratio. Firms that earn normal returns (K_E = ROE) in all periods should have market-to-book ratios equal to one; firms that generate negative abnormal returns during the advantage (disadvantage) period should have market-to-book ratios less than one.

Equation 10 is more realistic than equation 4 because most firms earn positive abnormal returns for only a limited number of years. The presence of positive abnormal returns encourages entry by new firms and increased competition by existing firms. Over time, competition reduces excess returns to the point where firms just earn the expected, or normal, rate of return. Although there is typically an inverse relation between the magnitude of positive abnormal profits and the length of the advantage horizon, this model implies that firms should seek to extend the advantage horizon as long as possible for a given level of profitability.

Ghemawat (1991) refers to this ability to preserve competitive advantage as sustainability and asserts it is a key determinant of value creation. Sustainability, he maintains, depends on a firm's ability to create scarcity value and for the firm's owners to capture or appropriate this value. Threats to scarcity value include imitation and substitution. A firm can defend against imitation by erecting barriers to entry or forestalling entry through aggressive positioning; a firm can defend against substitution by continually improving or augmenting its product. Threats to appropriability include

[2] This formula is a variation of the accounting-based valuation methods described in Bernard (1994); Palepu, Bernard, and Healy (1996), and Ohlson (1995).

slack and hold-up both of which result from misaligned incentives. Slack occurs when firms fail to create as much value as they are capable of creating; hold-up occurs when non-owners, instead of owners, capture value. Non-owners are often able to capture value when they provide complementary, and necessary, inputs.

Reinvestment

The third value driver, reinvestment, builds on the other two factors and incorporates the concept of growth. Firms that have attractive investment opportunities, meaning that investments are expected to generate positive abnormal earnings, can create equity value by reinvesting earnings or by investing additional equity. Appendix 2 derives a valuation model which allows for reinvestment of earnings at rate γ where γ equals the retention rate or the fraction of net income reinvested in the firm. The quantity γROE is a firm's sustainable growth rate, the rate at which it can grow its assets (or sales if they are proportional to assets) without changing its capital structure or raising external equity. With reinvestment, the valuation model becomes (equation A2.4):

$$\text{Market/Book} = [\text{ROE}(1 - \gamma)] / (K_E - \gamma\text{ROE}) \qquad (11)$$

When a firm pays out all of its earnings as dividends, then the retention rate is zero ($\gamma = 0$) and equation 11 reduces to the simple valuation model in equation 4. Assuming a firm has attractive investment opportunities in which it can generate positive abnormal returns (ROE>K_E), then it can increase value by retaining a larger fraction of earnings and investing them in the business. Thus reinvestment and growth creates value only when a firm can generate positive abnormal returns on future investment opportunities. Those firms with the greatest number and the most profitable investment opportunities should have the highest market-to-book ratios provided they are able to fund the projects.

In fact, it is often convenient to think of firm value as consisting of two parts: the present value of <u>assets in place</u> and the present value of <u>future growth opportunities</u> (Myers, 1977). The former require little in the way of additional investment, while the latter are investment opportunities which are expected to earn positive abnormal returns. These investment opportunities are called "real" options because they resemble financial options, particularly call options. They can be interpreted and managed using option pricing theory and valued using option pricing techniques (see Luehrman, 1995).

Numerical Example

Combining equations 10 and 11 produces a single valuation model that incorporates all three value drivers. Exhibit 1 shows this model as well as the relation between a hypothetical firm's market-to-book ratio and the value drivers. The exhibit presents three cases with differing levels of reinvestment (γ = 0%, 33%, and 66%). For each case, there is a sensitivity table showing how the market-to-book ratio depends on the advantage horizon and level of profitability (ROE).

Case #1 (no reinvestment) shows that more profitable firms have higher market-to-book ratios—the ratio increases as one reads across the rows. As stated earlier, the impact of the advantage horizon depends on whether a firm generates positive or negative abnormal earnings. The longer a firm can generate positive abnormal earnings, the greater its market-to-book ratio. However, because of discounting, abnormal earnings in later years have a smaller impact on the market-to-book ratio than abnormal earnings in early years. Alternatively, firms that generate negative abnormal earnings have market-to-book ratios less than one. Moreover, their market-to-book ratio falls as the advantage (disadvantage) horizon gets longer. Finally, the market-to-book ratio is equal to one and is independent of the advantage horizon for firms that generate normal earnings (the case where ROE=K_E).

Cases #2 and #3 (with reinvestment rates equal to 33% and 66%, respectively) illustrate the impact of reinvestment. Like the advantage horizon, reinvestment creates additional value only for firms that generate positive abnormal earnings. When firms are able to generate positive abnormal returns (ROE = 25%), have a long advantage horizon (30 years), and reinvest a large fraction of earnings (γ = 66%), they create significant value. The difference between the market-to-book ratio in the high return/long horizon with no reinvestment (case #1) and with reinvestment (case #3) is large: 1.66 vs. 4.27.

Empirical Evidence

This section presents empirical evidence on the relation between the value drivers and value creation. Despite the assumptions imbedded in the simple valuation models, they do, nonetheless, yield predictions which are consistent with what we observe in practice.

Profitability

The model predicts that there is a relation between a firm's market-to-book ratio and the ratio of its return on equity to its cost of equity. Given a set of firms in a single industry, the model implies that there should be a positive relation between ROE's and market-to-book ratios for these firms assuming their costs of capital are approximately equal. To a first approximation, it is reasonable to assume that firms in the same industry will have similar capital costs because they hold similar assets and, typically, have similar capital structures.

Exhibit 2 shows the relation between market-to-book ratios and firm profitability for two quite different industries: grocery stores and oil field service companies. Whereas the grocery industry is a retail business with high inventories and low margins, the oil-field services industry is a service business with industrial customers and higher margins. Yet in both cases, there is a very clear, positive relation between equity value and ROE's: higher ROE's are associated with higher market-to-book ratios. Fruhan (1996) presents similar evidence for a much wider range of industries including newspapers, telecommunications, and specialty chemicals.

There are at least two reasons why this relation does not hold perfectly. First, not all firms in the same industry have the same leverage or same asset risk. Thus, financial and operating differences cause the cost of equity to differ across firms. Second, accounting data is subject to manipulation by managers. On the one hand, managers provide valuable information through their choice of accounting disclosures and policies. On the other hand, they are biased which may lead them to distort reported numbers. Fortunately, however, most distortions occur through accruals which eventually get reversed. Because accounting data is subject to this kind of manipulation, it is critical to understand whether the reported numbers reflect economic reality. To the extent high ROE's reflect economic reality, and not unreasonable deferral of costs or a one-time aberrations, then the relation shown in exhibit 2 will be stronger. When accounting data does not reflect economic reality, one must undo the distortions before trying to make substantive conclusions about the business or its prospects.

Advantage Horizon

Several researchers have studied the length of the advantage horizon. For example, Fruhan (1995) examined a sample of 87 "high-performing" firms defined as those firms with sales of greater than $200 million and an average ROE of greater than 25% for five consecutive years between 1976-82. He calculated the median ROE for the firms from 1976-78 and from 1989-93, and then compared these medians against the average ROE for firms on the S&P 400 (see Exhibit 3). Whereas the median ROE for the high-performing subgroup was 21% above the average ROE for the S&P 400 in 1976-82, it was only 2% above in the later period. Thus the high-performing firms' abnormal earnings had largely dissipated over the fifteen year interval.

Palepu *et al* (1996, pp. 5.4-5.7) report similar findings: abnormally high or low ROE's tend to revert to normal levels, roughly between 10-14%, often within five years and usually within ten years.[3] The reversion in ROE's is largely due to reversion in profit margins rather than reversion in asset turnover or leverage which remain relatively constant over time. The fact that advantage horizon lasts for five or ten years provides some justification for using five or ten-year projections in discounted cash flow analysis.

In another study, Ghemawat (1991) examined the returns on investment (ROI) for 692 business units from 1971-1980. After sorting the business units by their ROI in 1971, he divided the sample into two equal subgroups and calculated the average ROI for each subgroup over the next ten years. Initially, the top group had an average ROI of 39% compared to 3% for the bottom group. The 36% spread between the two groups decreased to less than 3% by the end of ten years: the average ROI for the top group had decreased to 21.5% while the average ROI for the bottom group increased to 18.0%.

While the evidence consistently shows that the advantage horizon is finite, firms like Coca-Cola, Wal-Mart, and Microsoft have been able to extend their advantage horizons for many years. These firms have been able to create tremendous value for shareholders by sustaining their ability to generate positive abnormal profits.

Reinvestment

The key insight from the model regarding investment is that reinvestment of earnings is value enhancing only when investment opportunities generate expected returns in excess of the cost of equity (ROE>K_E). Because investment opportunities vary across firms and vary over time for the same firm, it is impossible to make conclusive statements on the value of reinvestment. Nevertheless, there is some evidence that reinvestment creates value. Recent studies have shown that firms which announce major capital expenditure or research and development (R&D) programs experience positive abnormal equity returns.[4] The market interprets these announcements as good news and their stock prices usually increase. While it may be the case that firms announce only their most positive NPV investments, Fruhan (1979, Table 1-6) provides evidence from a sample of almost 1500 firms that broadly supports the relation among high profitability, high reinvestment, and high equity valuations.

Acquisitions represent another form of investment for many firms. Jensen and Ruback (1983) review the many studies on acquirer returns surrounding merger announcements. They conclude that, on average, acquirer shareholders do not lose and target shareholders gain from merger

[3] See also Freeman, Ohlson, and Penman (1982).
[4] McConnell and Muscarella (1985) analyze capital expenditure announcements while Chan, Martin, and Kensigner (1990) analyze R&D expenditure announcements.

announcements. Thus, acquisitions create net gains for both firms combined even though they do not increase acquirer shareholder value.

Jensen (1986, 1993) presents an opposing view. He argues that managers often overinvest, i.e. invest in negative net present value projects, especially when their firms generate substantial free cash flow. Their incentive to overinvest results from their compensation being tied, indirectly, to firm size which, in turn, is a function of the amount investment. They are able to over invest because internal control systems such as board oversight are weak. In the absence of effective internal control systems, external forces such as the market for corporate control discipline investment activity. Jensen cites the oil industry in general and the Gulf Oil takeover in particular as examples where takeovers eliminated wasteful capital expenditures. Just as investing in positive NPV projects creates value, so, too, does eliminating negative NPV investments.

Warren Buffet, the prominent investor and chairman of Berkshire Hathaway, acknowledged the problem of overinvestment in his company's 1984 annual report:

> Many corporations that show consistently good returns have, indeed, employed a large portion of their retained earnings on an economically unattractive, even disastrous, basis. Their marvelous core businesses camouflage repeated failures in capital allocation elsewhere (usually involving high-priced acquisitions). The managers at fault periodically report on the lessons they have learned from the latest disappointment. They then usually seek out future lessons. (Failure seems to go to their heads.). . . In such cases, shareholders would be far better off if the earnings were retained to expand only the high-return business, with the balance being paid in dividends or used to repurchase stock...

Although stated in his characteristically droll way, Buffet's point is clear: reinvestment destroys value unless it generates an appropriate risk-adjusted rate of return.

References

Bernard, Victor L, 1994, Accounting-Based valuation methods, Determinants of market-to-Book Ratios, and Implications for Financial Statement Analysis," University of Michigan working paper.

Chan, Su Han, John D. Martin, and John W. Kensigner, 1990, Corporate research and development expenditures and share value, *Journal of Financial Economics* , 26: 255-276.

Freeman, Robert, James Ohlson, and Stephen Penman, 1982, Book Rate-of-Return and Prediction of Earnings Changes: An Empirical Investigation, *Journal of Accounting Research* , Autumn: 639-653.

Fruhan, William F., 1996, How do we link together profitability, cash flows, capital cost, growth, and stock value?, Harvard Business School presentation.

Fruhan, William F., 1979, Financial Strategy: Studies in the Creation, Transfer, and Destruction of Shareholder Value, (Irwin, Homewood, IL).

Ghemawat, Pankaj, 1991, Commitment, (The Free Press, Macmillan, Inc., New York, NY).

Jensen, Michael C., 1986, Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers, *American Economic Review*, 2:323-329.

Jensen, Michael C., 1993, The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems, *Journal of Finance*, 3:831-880.

Jensen, Michael C., and Richard S. Ruback, 1983, The market for Corporate Control: The Scientific Evidence, *Journal of Financial Economics*, 11:5-50.

Luehrman, Timothy A., Capital Projects as Real Options: An introduction, Harvard Business School Note N9-295-074 (Rev. March 22, 1995)

McConnell, John J., and Chris J. Muscarella, 1985, Corporate Capital Expenditure Decisions and the Market Value of the Firm, *Journal of Financial Economics*, 14: 399-422.

Myers, Stewart C., 1977, Determinants of Corporate Borrowing, *Journal of Financial Economics*, 5: 147-175.

Ohlson, J. A., 1995, Earnings, Book Values, and Dividends in Equity Valuation, *Contemporary Accounting Research*, 661-687.

Palepu, Krishna G., Victor L. Bernard, and Paul M. Healy, 1996, Business Analysis & Valuation Using Financial Statements, South-Western College Publishing (Cincinnati, Ohio).

Stewart, G. Bennett, III, 1991, The Quest for Value: The EVA Management Guide, (Harper Business, New York, NY).

Exhibit 1: Numerical example of the relation between the value drivers and value creation

Combining equations 10 and 11 yields the following equation:

$$\textbf{Market/Book} = [(1+\gamma ROE) / (1+K_E)]^n + [ROE(1-\gamma) / (K_E - \gamma ROE)]\,[1 - ((1+\gamma ROE) / (1+K_E))^n]$$

This Exhibit shows the hypothetical market-to-book ratios as a function of the three value drivers: profitability, advantage horizon, and re-investment.; assuming the firm has a cost of equity equal to 15%. The three cases differ by the level of reinvestment which varies from 0% to 66%.

Case #1: Reinvestment rate (γ) = 0%

Advantage Horizon	Return on Equity (ROE) 5%	15%	25%
5 years	0.66	1.00	1.34
15 years	0.42	1.00	1.58
30 years	0.34	1.00	1.66

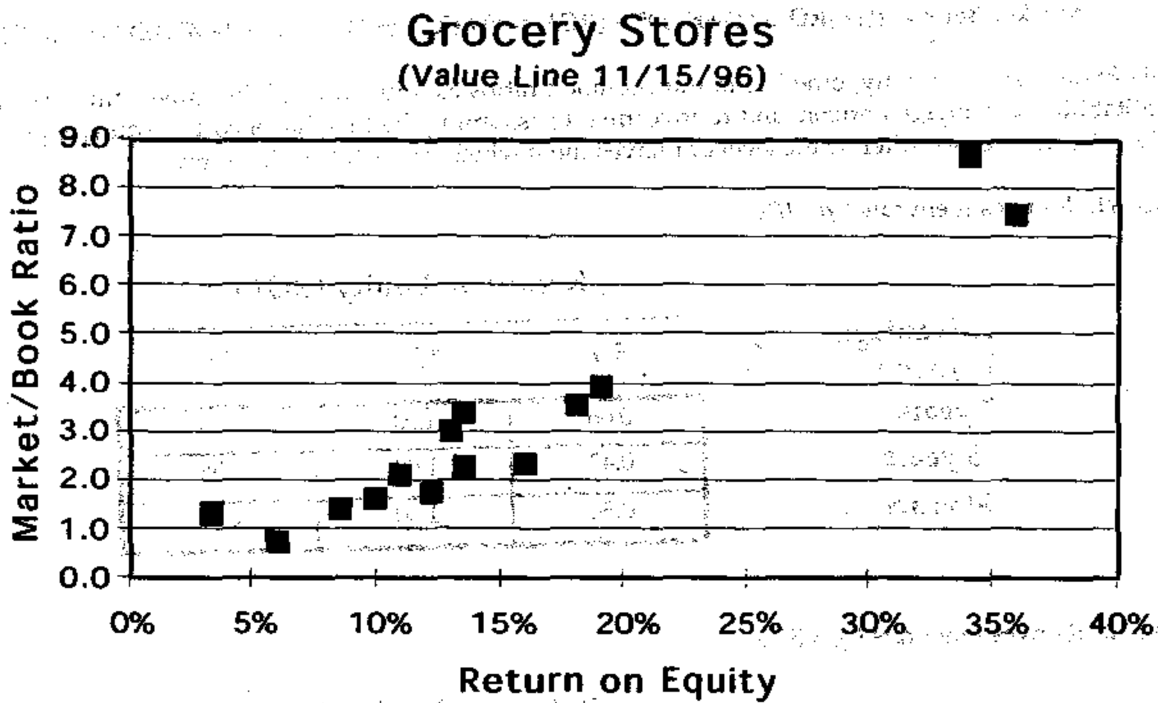
Case #2: Reinvestment rate (γ) = 33%

Advantage Horizon	Return on Equity (ROE) 5%	15%	25%
5 years	0.65	1.00	1.39
15 years	0.37	1.00	1.88
30 years	0.27	1.00	2.24

Case #3: Reinvestment rate (γ) = 66%

Advantage Horizon	Return on Equity (ROE) 5%	15%	25%
5 years	0.65	1.00	1.45
15 years	0.32	1.00	2.43
30 years	0.18	1.00	4.27

Exhibit 2: Relation between Return on Equity (ROE) and Market-to-Book Ratio



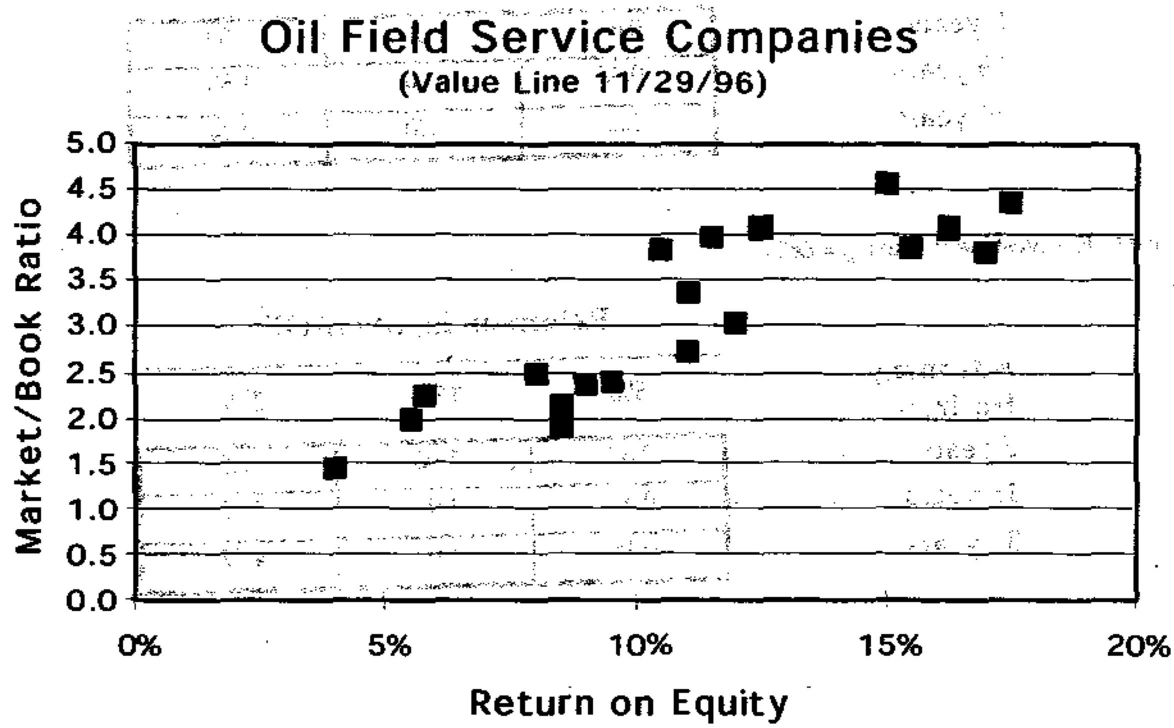


Exhibit 3: Advantage horizon

Fruhan (1995) analyzed the advantage horizon of a sample of 87 high-performing firms. To be included in the sample, firms had to have an average ROE of more than 25% for five consecutive years between 1976-82 and have sales greater than $200 million. He found the following:

Top Performers:	1976-78 Average ROE
1. Petrie Stores	2.03
2. H&R Block	1.45
3. Standard Microsystems	1.43
4. Airborne Freight	0.77
5. Wendy's International	0.74
6. Commerce Clearing House	0.67
7. Avon Products	0.67
8. Southwest Airlines	0.63
9. Charming Shoppes	0.56
10. Loctite Corp.	0.56

For the period from 1976-78:

Median ROE for the top 87 firms	= 37%
S&P 400 Average ROE	= 15%
Spread	**= 21%**

For the period from 1989-93:

Median ROE for the top 87 firms	= 17%
S&P 400 Average ROE	= 15%
Spread	**= 2%**

Lesson: The advantage horizon is <u>finite</u>.

Appendix 1: Equity value and the advantage horizon

Equations 1 and 3 show that a firm's equity market value is a function of its return on equity (ROE) and cost of equity (K_E). Assuming no retention of earnings and constant returns, equity value is:

$$E_{MV} = ROE^*E_{BV} / (1+K_E) + ROE^*E_{BV} / (1+K_E)^2 + \ldots \quad \text{(A1.1)}$$

dividing through by the book value of equity (E_{BV}) yields

$$\text{Market/Book} = E_{MV} / E_{BV} = ROE / (1+K_E) + ROE / (1+K_E)^2 + \ldots \quad \text{(A1.2)}$$

The ROE can be divided into two parts: ROE = (ROE - K_E) + K_E. The first term (ROE- KE) consists of "abnormal" earnings, returns to equity in excess of the cost of equity; the second term consists of "normal" earnings because that is the expected return on equity. Substituting back into equation A1.2 yields:

$$\text{Market/Book} = [ROE\text{-}K_E) + K_E]/(1+K_E) + [ROE\text{-}K_E) + K_E] / (1+K_E)^2 + \ldots \quad \text{(A1.3)}$$

$$\text{Market/Book} = (ROE\text{-}K_E)/(1+K_E) + ([ROE\text{-}K_E)/(1+K_E)^2 + \ldots$$

$$+ K_E/(1+K_E) + K_E/(1+K_E)^2 + \ldots \quad \text{(A1.4)}$$

Equation A1.4 is the sum of two geometric series, one of normal earnings and one of abnormal earnings. The present value of the normal earnings (using a perpetuity formula) is one:

$$1 = K_E/K_E = K_E/(1+K_E) + K_E/(1+K_E)^2 + \ldots \quad \text{(A1.5)}$$

The present value of the abnormal earnings depends on how long the firm expects to earn abnormal earnings. It can be thought of as an annuity: The firm receives a stream of abnormal earnings for a period of n years. The present value of an annuity can be written as:

$$\text{present value} = (ROE\text{-}K_E) * [(1/K_E) - (1/(K_E(1+K_E)^n)] \quad \text{(A1.6)}$$

Combining equations A1.5 and A1.6 yields:

$$\textbf{Market/Book} = 1 + \{(ROE\text{-}K_E)^*[(1/K_E) - (1/(K_E(1+K_E)^n)]\} \quad \text{(A1.7)}$$

as n approaches infinity, equation A1.7 reduces to equation 4 in the note.

Appendix 2: Equity value and reinvestment

This appendix derives a model of equity valuation as a growing perpetuity. Given a firm with a constant return on equity (ROE), it can either retain its earnings or pay them out to equityholders as dividends. Assuming the firms retains a fraction of earnings (γ) and pays out the remainder, then the market value of equity can be determined as follows.

Time	Total Earnings	Amount Paid Out (ECF)	Amount Retained	Book Value of Equity
t=0				E_0
t=1	$ROE*E_0$	$(1-\gamma)*ROE*E_0$	$(\gamma)*ROE*E_0$	$E_1 = E_0 + (\gamma)*ROE*E_0$ $E_1 = E_0(1+\gamma ROE)$
t=2	$ROE*E_1$ $ROE*[E_0(1+\gamma ROE)]$	$(1-\gamma)*ROE*E_1$ $(1-\gamma)*ROE*E_0(1+\gamma ROE)$	$(\gamma)*ROE*E_1$ $(\gamma)*ROE*E_0(1+\gamma ROE)$	$E_2 = E_1 + (\gamma)*ROE*E_1$ $E_2 = E_1(1+\gamma ROE)$ $E_2 = E_0(1+\gamma ROE)^2$
t=3	$ROE*E_2$ $ROE*[E_0(1+\gamma ROE)^2]$	$(1-\gamma)*ROE*E_2$ $(1-\gamma)*ROE*E_0(1+\gamma ROE)^2$	$(\gamma)*ROE*E_2$ $(\gamma)*ROE*E_0(1+\gamma ROE)^2$	$E_3 = E_2 + (\gamma)*ROE*E_2$ $E_3 = E_2(1+\gamma ROE)$ $E_3 = E_0(1+\gamma ROE)^3$
t=4	(etc.)			
Growth Rate	γROE	γROE	γROE	γROE

Value = discounted present value of payouts (equity cash flows)

$$= \frac{((1-\gamma)*ROE*E_0)}{(1+K_E)} + \frac{((1-\gamma)*ROE*E_0(1+\gamma ROE)}{(1+K_E)^2} + \ldots \quad \text{(A2.1)}$$

$$= \frac{((1-\gamma)*ROE*E_0)}{(1+K_E)} \{1 + [(1+\gamma ROE)/(1+K_E)] + [(1+\gamma ROE)/(1+K_E)]^2 + \ldots\} \quad \text{(A2.2)}$$

Equation A-2 is a growing perpetuity with growth rate equal to γROE. It can be rewritten as:

$$\text{Equity Value} = \frac{(1-\gamma)*ROE*E_0}{(K_E - \gamma ROE)} \quad \text{(A2.3)}$$

After multiplying through by the book value of equity (E_0), one gets the ratio of equity at market value to equity at book value ($E_{MV}/E_{BV} = V/E_0$):

$$\textbf{Market/Book} = \frac{(1-\gamma)*ROE}{(K_E - \gamma ROE)} \quad \text{(A2.4)}$$

Network for Studies on Pensions, Aging and Retirement

Netspar DISCUSSION PAPERS

Casper van Ewijk, Henri de Groot and Coos Santing

A Meta-Analysis of the Equity Premium

Discussion Paper 09/2010-050

A Meta-Analysis of the Equity Premium

Casper van Ewijk,[a,b] Henri L.F. de Groot[a,c,d] and Coos Santing[e]

[a] CPB Netherlands Bureau for Economic Policy Analysis, The Hague, The Netherlands
[b] University of Amsterdam, Amsterdam, The Netherlands
[c] Tinbergen Institute, Amsterdam-Rotterdam, The Netherlands
[d] Dept. of Spatial Economics, VU University Amsterdam, The Netherlands
[e] Ministry of Finance, The Hague, The Netherlands

Abstract

The equity premium is a key parameter in asset allocation policies. There is a vigorous debate in the literature regarding the actual measurement of the equity premium, its size and the determinants of its variation. This study aims to take stock of this literature by means of a meta-analysis. We identify how the size of the equity premium depends on the way it is measured, along with its evolution over time and its variation across regions in the world. We find that the equity premium is significantly lower if measured by ex ante methods rather than ex post, in more recent periods, and for more developed countries. In addition, looking at the underlying fundamentals, we find that larger volatility in GDP growth tends to raise the equity premium while a higher nominal interest rate has a negative impact on the equity premium.

Keywords: equity premium, meta-analysis

JEL codes: D53, E44, G12, N20

Useful comments by Clemens Kool, Peter Schotman, Bas ter Weel and Ed Westerhout are gratefully acknowledged. We are also grateful to Jan Luiten van Zanden for sharing historical interest rates and inflation rates (from International Institute of Social History) that underlie our analysis in Section 4.3. The usual disclaimer applies.

1. Introduction: The Equity Premium

The equity premium is a key parameter in asset allocation policies. It measures the excess return above the risk-free return and as such it can be seen as the price for risk. There has been a lively debate in the theoretical as well as the empirical literature on the measurement, size and sources of variation of the equity premium. In their seminal contribution, Mehra and Prescott (1985) identified the famous equity premium puzzle according to which there is a discrepancy between the equity premium as measured empirically and the premium that follows from standard theory. Mehra and Prescott calculated a historical equity premium of 6.2 percent in the United States for the period 1889–1978. Economic theory, based on the consumption capital asset pricing model (CCAPM), only justifies a premium up to a maximum of about 0.35 percent using conventional values for risk aversion. Their study initiated an intense debate in the scientific literature on the determination and size of the equity premium, both on the theoretical side (cf. Weil, 1989, Kocherlakota, 1996, Campbell and Cochrane, 1999, and many others) and on the empirical side of the puzzle. This paper focuses on the empirical aspects of the discussion, and aims to take stock of the existing literature by performing a meta-analysis of a wide selection of empirical studies on the equity premium, and to explain the sources of variation in this literature.

Meta-analysis provides us with a toolkit of statistical techniques enabling a quantitative review of the existing literature. As such, it complements narrative reviews.[1] Meta-analysis originated in the experimental sciences and was later on extended to fields such as the medical sciences where it has gained the status of a common practise instrument to merge results from different trials on the effectiveness of a specific drug or treatment. The research method has subsequently been introduced in psychology and education and is gradually gaining ground in economics (see, e.g., Florax et al., 2002, for an overview). Nowadays meta-analyses have been performed for a wide array of both microeconomic and macroeconomic issues. This study adds a new topic to the list which is at the heart of finance and also has close ties to macroeconomics.

Considering the empirics of the equity premium, four major issues stand out. First, the equity premium as measured from ex post stock returns proves to be quite sensitive to the observation period. This even holds for the long periods that are often used to identify the premium, which is obviously due to the large volatility of stock prices. This causes controversy on the 'true' value of the equity premium. For example, Siegel (1992) suggests that the high equity premium found by Mehra and Prescott (1985) was the result of the relatively low risk free rate in the period 1889–1978. Siegel found that the equity premium in this period is 4% higher than in the two decades just before and after this

---

[1] For good overviews of the literature, see Dimson et al. (2002) and Mehra (2008). See also Fernandez (2009a,b) for studies complementary to our meta-analysis which are based on a survey among professors and a review of information provided in 150 textbooks in finance.

period (viz. the periods 1880–1888 and 1979–1990, respectively). Including these adjacent periods would lower the equity premium by some 0.8% points.

A second, and related, controversy concerns the question whether the equity premium is constant over time. Several authors suggest that the equity premium is declining over time, especially since World War II (e.g., Blanchard, 1993, Siegel, 1999, Dimson et al., 2002), whereas others claim that the equity premium will continue to remain high (e.g., Mehra, 2003).

Third, the equity premium may vary across space. There is no strict need that the equity premium should be identical across countries and regions. Differences in stage of development leading to different aggregate risks, or differences in institutions leading to differences in leverage, could well explain different values of the equity premium. Moreover, as better time series tend to be available for the more successful stock markets, in particular the United States, this may have caused a bias in research as well. Jorion and Goetzmann (1999) conclude that the high equity premium obtained for U.S. equities could be the exception rather than the rule. Extending the data set to other markets – including the ones that did not survive – they find a lower estimate of the world rate of return on equity by 0.29 % points. Since that study the scope of research is broadened as more data become available for other countries. An important study in this respect is the *"Triumph of the Optimists"* by Dimson et al. (2002) who have calculated the equity premium for 17 countries over a period of 101 years.

A final issue is whether the equity premium should be measured ex post or ex ante. In ex post studies the equity premium is calculated as the difference in the mean return on stocks, either taken geometrically or arithmetically, and the risk free rate, mostly the short term interest rate (T-bills) or long term government bonds. This ex post approach is taken by Mehra and Prescott (1985) as well as many others (cf. Siegel, 1999, Dimson et al., 2002). Ex ante studies, in contrast, take the dividend yield or the earnings-price ratio as a starting point and derive the implied equity premium using an estimate for the capital gains. Seminal contributions here are Blanchard (1993), and Fama and French (1988, 2002) who found substantially lower estimates for the equity premium – ranging from 2.5% to 3% in the last study – than in most ex post studies.

After having addressed these issues, our analysis will be extended by looking at some fundamentals of the equity premium. First, we will have a closer look at the relationship between the equity premium and the interest rate and the rate of inflation. Next, we will investigate two underlying macroeconomic determinants. It is typically argued in the literature that the equity premium is higher in emerging markets than in mature markets (Shackman, 2006, and Erbas and Mirakhor, 2007). Investing in developing countries is generally perceived to be more risky, which has to be compensated in terms of a higher return. The stage of development of a country will be proxied by its Gross Domestic Product (GDP) per capita. Another macroeconomic factor that can influence the equity premium is the size of aggregate risk, here measured by the volatility of GDP growth. It is well known that higher volatility of consumption leads to higher required returns (Weil, 1989). In this vein Lettau et al. (2008) provide evidence that decreasing macroeconomic risk explains the boom of the stock markets in the 1990s. We will consider whether differences in the volatility of the economy indeed affect the equity premium. In this respect this study may contribute to the understanding of the impact of the credit crisis on the equity premium, even though the credit crisis itself is beyond the scope of this study (the most recent paper on the equity premium included in our meta-analysis being from 2008).

The remainder of this paper is structured as follows. Section 2 discusses several measurement issues, and identifies potential sources of variation in the equity premium. It thus paves the road for the selection of moderator variables to be employed in the meta-regression analysis. Section 3 describes the selection process of the primary studies of the meta-analysis and provides summary statistics of the explanatory variables. Section 4 discusses the results of the meta-regression, investigates the impact of structural underlying variables, and finally constructs benchmark values for the equity premium. Section 5 concludes.

2. How to measure the equity premium?

The literature on the equity premium provides no unanimity on how to measure the equity premium. In theory the equity premium represents the additional risk premium on equity relative to the return on safe assets. Or, more precisely the equity premium (*EP*) is defined as difference between the required return on equity ($\bar{r}_e$) and the risk free rate (r_f):

$$EP \equiv \bar{r}_e - r_f \,. \tag{1}$$

Assuming market efficiency, the required rate of return equals the expected rate of return (viz. $\bar{r}_e = E[r_e]$). There are a number of issues concerning the measurement of the equity premium. First and most fundamental, there is the difference between ex post and ex ante approaches to estimate the equity premium. Second, the choice of the market portfolio of stocks may matter for the height of the equity premium. In general, authors use a wide portfolio corresponding to well-established indices for official stock markets. Second, as purely safe assets do not exist in practice, one has to find a suitable proxy for the risk free rate. Third, there is a more technical issue of measuring returns as an arithmetic or geometric mean. Each of these issues is briefly discussed below.

Ex post or ex ante measurement of the equity premium

Mehra and Prescott (1985) measure the equity premium by calculating the historical return on stocks compared to the risk free rate. This 'ex post' approach is followed by many others (e.g., Dimson et al., 2002). It is not undisputed though. In particular, this method may be biased if the equity premium is not stationary during the observation period. Rising price earnings ratios over a prolonged period after World War II (up to the credit crisis) may point to a secular decline in the risk premium on equity. Indeed, building on Gordon's (1962) dividend discount model, Blanchard (1993) estimated that the equity premium in the United States had fallen to 2-3% in the early 1990s. Essentially, this 'ex ante' method takes the equity price as the present value of future dividends or earnings. Then, estimating future growth of earnings (dividends), one can calculate the equity premium implied in observed earnings to price ratio, or dividend to price ratio. Blanchard's finding of a declining premium was confirmed in other ex ante studies such as Jagannathan et al. (2000), and Fama and French (2002).[2]

The choice in method can thus have substantial consequences for the size of the equity premium. For the United States, Fama and French (2002) find that the ex-post equity premium for the period 1951–2001 is almost three times as high as the ex-ante estimate. In a stationary environment both methods, ex ante and ex post, are expected to converge in the long run. In a non-stationary environment, however, the outcome can differ for the two methods, even producing seemingly contradictory results (e.g., Lengwiler, 2004). This is because changes in the required rate of return produce just the opposite effect on the realised return through the revaluation of stocks. For this reason Dimson et al. (2002) warn not to extrapolate the high post-war returns into the future. As these high ex-post returns were caused by the revaluation of stocks due to a *fall* in the prospective rate of return, they rather point to low future returns.

Choice of market portfolio

Most authors measure the equity premium using the well-known stock market indices for a broad market portfolio, such as Standard and Poors for the United States and the MSCI for the developed countries. Usually midcaps are not included in the data. This may matter, as the equity premium depends on the risk profile of the companies, and also on the equity-debt composition in financing the firm. Higher risk and higher leverage imply higher returns on equity. As most authors use broad market portfolios, we will make no further distinction with regard to the portfolio in the meta-analysis. When using long time series one should furthermore be aware of the sensitivity of the results for survivorship of companies over time. If indexes are constructed by only including companies that are

---

[2] Early 'ex ante' studies focused on the equity premium *per se*. Others have extended this framework by allowing the projected growth of dividends and earnings to depend on other variables. This leads to the so-called conditional model of the equity premium, as distinct from the unconditional model employed by, for example, Fama and French (2002). Claus and Thomas (2001) use several accounting variables to do this. Earlier, Blanchard (1993) used the unconditional dividend model, but took account of expectations of the interest rate and inflation rate.

present today, a bias is created since companies that went bankrupt are excluded by construction (Brown et al., 1995). However, the general idea is that survivorship bias in stock market returns is small. In our meta-analysis we will therefore neglect the potential influence of 'survivorship bias'. However, Jorion and Goetzmann point out that there may exist a survival bias across stock markets as well, as existing long data series tend to focus on markets that have been successful up to date. Also, time series often break down during deep crises such as wars and revolutions. Indeed, the very focus in research on the most successful stock market, *viz.* the United States, may lead to a significant bias. Constructing data for other stock markets Jorion and Goetzmann show that U.S. equities have the highest return over the period 1921–1996, at 4.3%, versus a mean return for other countries in the sample of only 0.8%. Taking the average of all countries, including these other markets, lowers the world market return by 0.29% points relative to the U.S. return.

Risk free rate

The second important measurement issue concerns the choice of the risk free rate. In theory, a risk free asset should deliver an income flow in real terms that is independent of the state of the world (Lengwiler, 2004). Unfortunately such an asset does not exist. Government paper comes closest, as it has low default risk.[3] Therefore, most studies on the equity premium use the return on short term treasury bills or long term bonds as a proxy for the risk free rate. A disadvantage of such assets is that their real return depends on inflation. Inflation-indexed governments bonds do exist, but are only recently available. Economists therefore prefer treasury bills (T-bills) or notes with a short time to maturity, as they are less sensitive to inflation and interest rate risk. Others, however, prefer long term bonds, as this is more in line with the long-term character of equity.[4] The impact of the risk-free asset against which the equity premium is determined will be identified in the meta-analysis by using a dummy indicating whether the risk-free rate is proxied by T-bills (short-term) or long-term bonds.[5]

Arithmetic versus geometric measurement of mean returns

Using historical time series, the return on equity can be calculated as a geometric mean (*GR*) or an arithmetic mean (*AR*). The difference relates to the way in which series of returns are averaged over time. If returns are measured arithmetically, the average is taken as the sum of the returns per period divided by the number of periods. If returns are measured geometrically this is calculated as the

---

[3] In deep crises, such as wars and revolutions, also governments may default on their liabilities. For this reason Jorion and Goetzmann (1999) focus on real equity return, that is the return relative to commodities, rather than on the equity premium which measures the return relative to government debt.

[4] Recently, some work is being done on the term structure of the equity premium (cf. Lemke and Werner, 2009). In this meta-analysis we will take account of the term of the risk free rate, but ignore potential differences in the equity premium arising from a term structure as knowledge on this is still pre-mature.

[5] See Dimson et al. (2007) for an extensive discussion on the impact of maturity of the risk free rate on the equity premium.

compound rate of return (Derrig and Orr, 2003). Arithmetic returns tend to be higher than the geometric returns. With lognormal returns the expected geometric return (*GR*) converges to the expected arithmetic return minus half the variance, that is $GR = AR - \frac{1}{2}\sigma^2$ (see, e.g., Welch, 2000, Dimson et al., 2002, and Ibbotson and Chen, 2002). The arithmetic mean is generally considered to produce the best estimate of the mean return; the geometric mean approximates the median return rather than the mean (Campbell et al., 1997, Jacquier et al., 2003, and Ten Cate, 2009). In the meta-regression model the difference between the arithmetic and geometric return is captured by a simple dummy variable.

3. Data Sources and Summary Statistics

This section describes the selection of the studies that are used in our meta-analysis, and provides a brief characterization of the database by some descriptive statistics. The formal meta-regression model and its results will be presented in the next section. The equity premium puzzle that was identified by Mehra and Prescott (1985) resulted in a flood of studies on the equity premium, both theoretical and empirical. We focus on the empirical studies. To construct the database for the meta-analysis, we started using the search engine Econlit covering published articles in English in academic journals.[6] The keywords used for our search were 'equity premium'. This resulted in 242 hits of which 15 studies measure the size of the equity premium. Using the technique of snowballing (see, for example, Cooper and Hedges, 1994), nine other studies were found which were added to the database. We are thus left with 24 studies that form the heart of our meta-analysis. Each study reports several equity premiums, covering different time periods, countries and methodologies.[7] The resulting database consists of 535 observations. Appendix A provides a list of all studies and their summary statistics. The studies are also clearly marked in the list of references.

Clearly, the database is not balanced across the spatial and time dimension. In the spatial distribution, there is a bias towards developed countries, in particular the United States. Over the past couple of years, however, the sample of countries for which equity risk premiums are available has increased substantially due to, for example, studies by Dimson et al. (2002), Shackman (2005), and Salomons and Grootveld (2003). In total, our database includes 44 countries. Almost half of the observations (256) refer to the United States. For many other countries, there is only a couple of observations available. We therefore combine these countries into relatively homogeneous regions, viz. Canada, Oceania (Australia, New Zealand and Japan), Canada, Western Europe, Advanced Emerging Countries (including amongst others Brazil, Mexico, Poland and South Africa), Secondary

---

[6] Econlit American Economic Association's electronic bibliography contains 750 journals since 1962 (see www.econlit.org).

[7] There are studies reporting premiums covering a broad time span as well as premiums for sub-periods within this broad time span. In these cases, the former is omitted from the analysis to avoid double counting.

Emerging Countries (including amongst others Argentina, China, India, Turkey), and the Asian Tigers.[8]

Across the temporal dimension there is a bias towards more recent periods. Some studies cover a long time span of almost two centuries (from 1830 to present), but most studies cover more recent periods. About 9% of the observations is characterized by a mid-year before 1900. About 13% has a mid-year that falls in the period 1900–1950. For the remaining 78%, the mid-year is 1950 or later.[9] Concerning the way of measurement, over 80% of the observations measure the equity premium on an ex post basis. Furthermore, the majority concerns equity premiums that are measured arithmetically (354 compared to 181 on a geometric basis).[10] Finally, of the 535 observations, 310 are calculated with T-bills or closely related substitutes. The other 225 equity premiums are calculated with bonds proxying for the risk free asset.

3.1 Descriptive analysis of the data

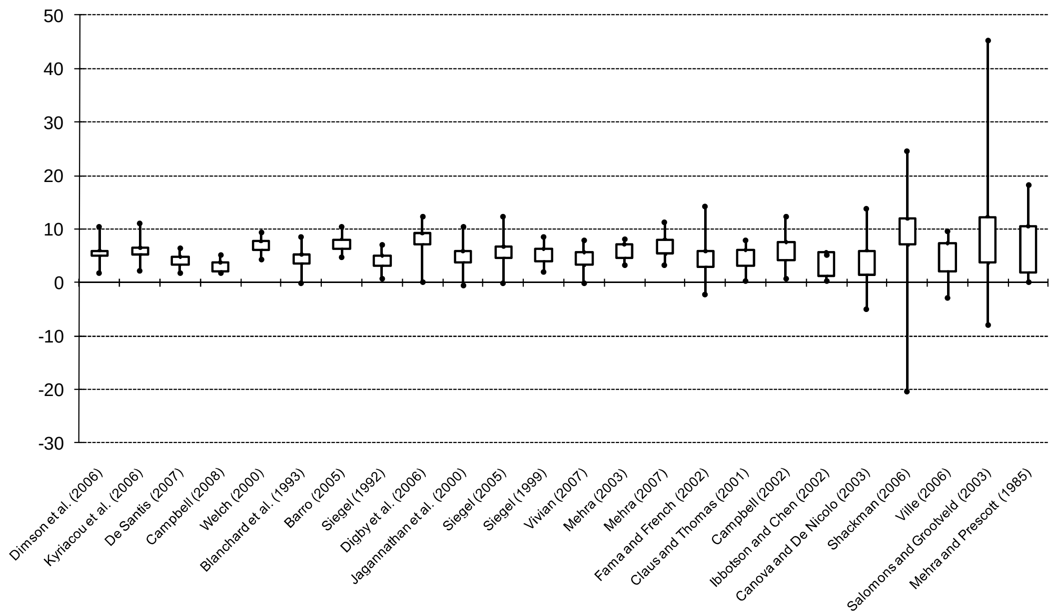
The within-study distribution of the observations is presented in Figure 1. For each individual study it gives the minimum and maximum value of the equity premium along with a 95% confidence interval.[11] The primary studies are ordered according to the within-study variation measured by the size of the 95% confidence interval.

According to Figure 1, some studies in the meta-analysis report negative equity premiums (viz. Blanchard et al., 1993, Canova and Nicolo, 2003, Digby et al., 2006, Fama and French, 2002, Jagannathan et al., 2000, Salomons and Grootveld, 2003, Shackman, 2006, Siegel, 2005, Ville, 2006, and Vivian, 2007). There are also very large equity premiums as is the case for the study by Salomons and Grootveld (2003). We see large differences for the within-study variation of the equity premium. For Dimson et al. (2006), the lower bound of the 95% confidence interval is 5.0% and the upper bound is 6.0%. In contrast, for Mehra and Prescott (1985) the lower bound is 1.9% and the upper bound is 10.5%.

---

[8] Further details on country groupings are available upon request.
[9] The mid-year is the average of the initial and final year of the period covered by the observation.
[10] If studies do not report the method to calculate returns the arithmetic one is assumed. We performed a robustness check to investigate the sensitivity for this assumption. Details are available upon request from the authors.
[11] The confidence interval of the mean is equal to the within study mean plus or minus two times the within study standard-deviation divided by the square root of the number of observations.

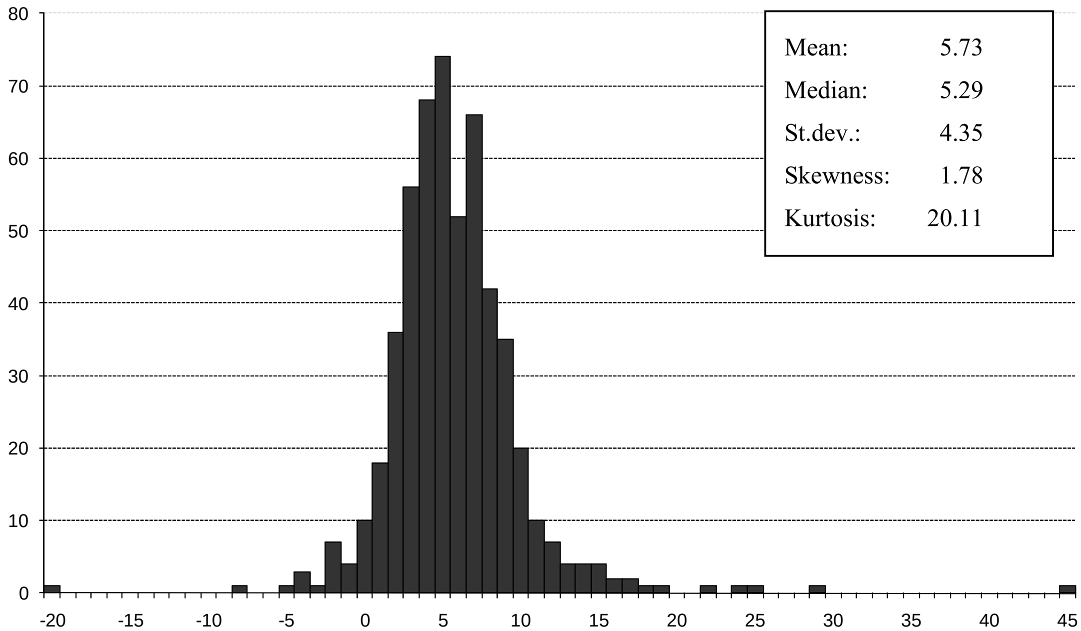
Figure 1. Within- and between-study variation of the Equity Premium



Note: lines indicate minimum and maximum EP's found in the respective studies. The boxes indicate a 95% confidence interval around the mean of the respective studies.

Figure 2 further describes the distribution of the equity premium for the entire sample of 535 observations. The mean is 5.73. The null-hypothesis of a normal distribution is clearly rejected (p-value <0.001). There are 24 observations with a negative equity premium, whereas 48 observations have equity premiums exceeding 10%.

Figure 2. Histogram the Equity Premium



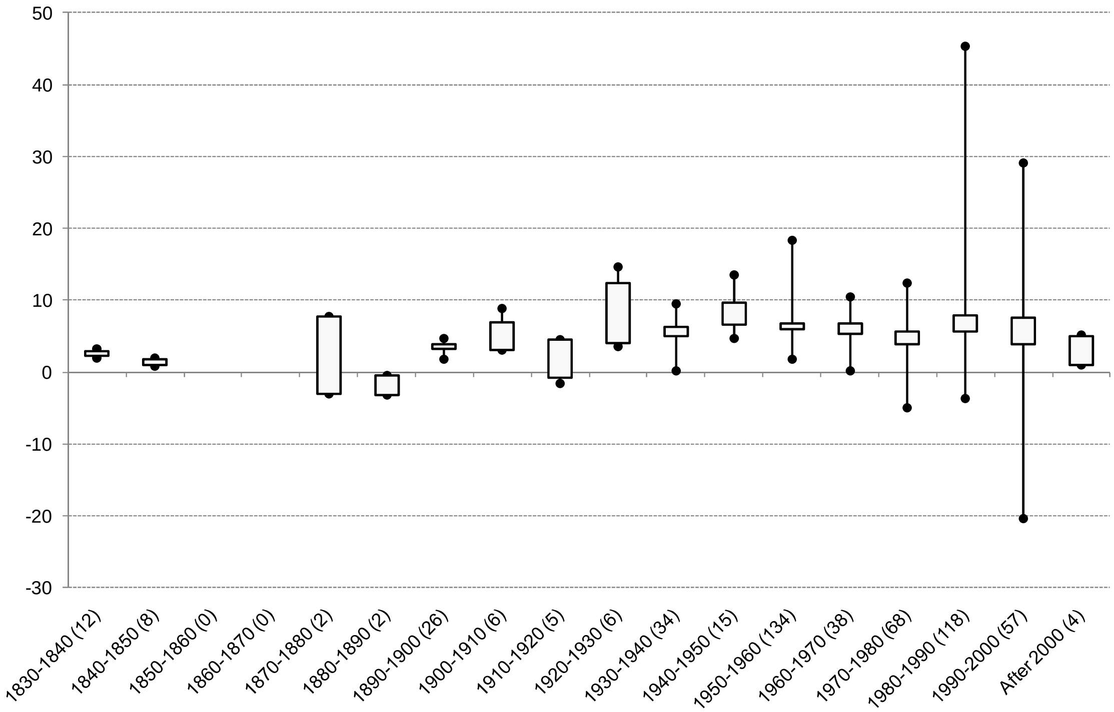
Time Variation

Figure 3 gives an impression of the temporal variation of the equity premium. More precisely, each observation is expressed for the mid-year of the period on which this observation is based. This figure confirms the overall picture that the equity premium was low until 1920, high in the 1920s and again high in the post war period. Short term deviations from this overall pattern are observed in the 1970s (with a dip and a recovery thereafter). The recent crisis on the financial markets falls beyond the scope of all studies included in the sample.[12]

---

[12] It should be noted that this is not a complete representation of the variation of the equity premium over time. As the data points refer to the mid year of observation periods with different lengths, the evolution of the equity premium is smoothed. Restricting the dataset to only observation periods of 10 years or less, shows a similar pattern but with greater volatility. Looking at the length of the period studied in somewhat greater detail, we can distinguish several categories, viz. 0–10 years (123 observations), 11–20 years (66 observations), 21–30 years (79 observations), 31–50 years (51 observations), 51–100 years (110 observations) and more than 100 years (106 observations). In our database, there are no observations based on periods shorter than 5 years or longer than 203 years. Further details on the impact of differences in the length of the observation period are available upon request from the authors.

Figure 3. Variation over time in the equity premium by mid year of the observation period

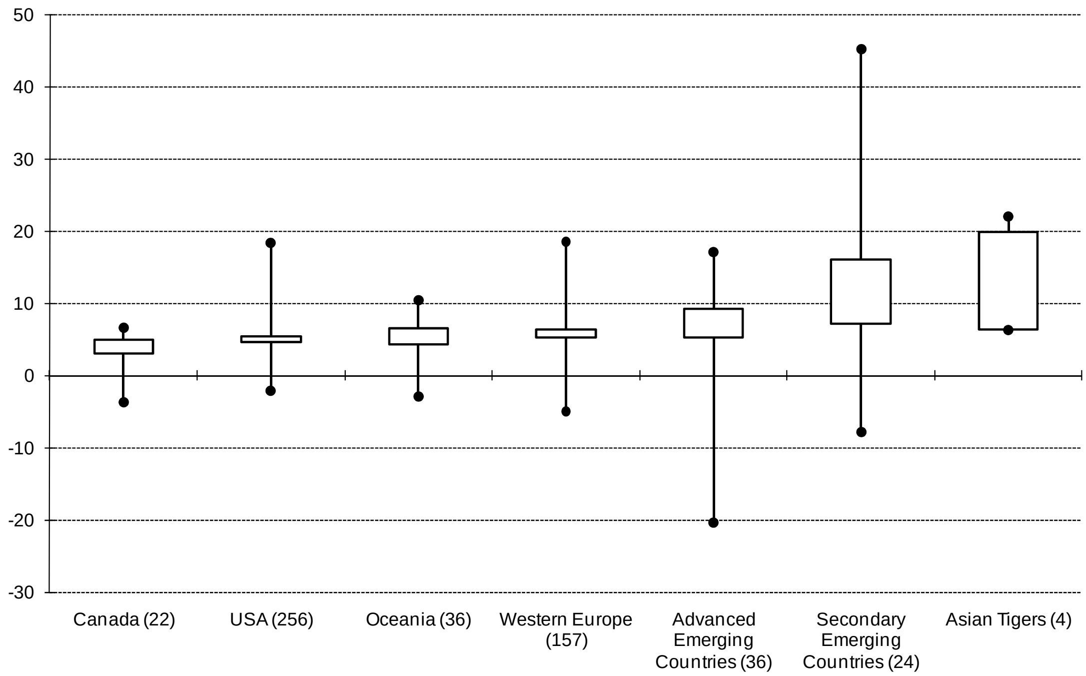


Note: lines indicate minimum and maximum EP's found in the respective periods. The boxes indicate a 95% confidence interval around the mean of the respective regions. The number of observations for each period is indicated in brackets.

Spatial Variation

The equity premium also varies considerably over space as is shown in Figure 4. To obtain a more balanced set, some countries are grouped into relatively homogeneous groups. We find that the equity premium is relatively high in emerging countries. The lowest average equity premium is found in Canada, and the highest is found for the Asian Tigers. The mean of the equity premium for these groups of countries varies from 3.95 percent in Canada to 13.14 in the Asian Tigers.

Figure 4. The Equity Premium by Country or Region



Note: lines indicate minimum and maximum EP's found in the respective regions. The boxes indicate a 95% confidence interval around the mean of the respective regions. The number of observations for each region is indicated in brackets

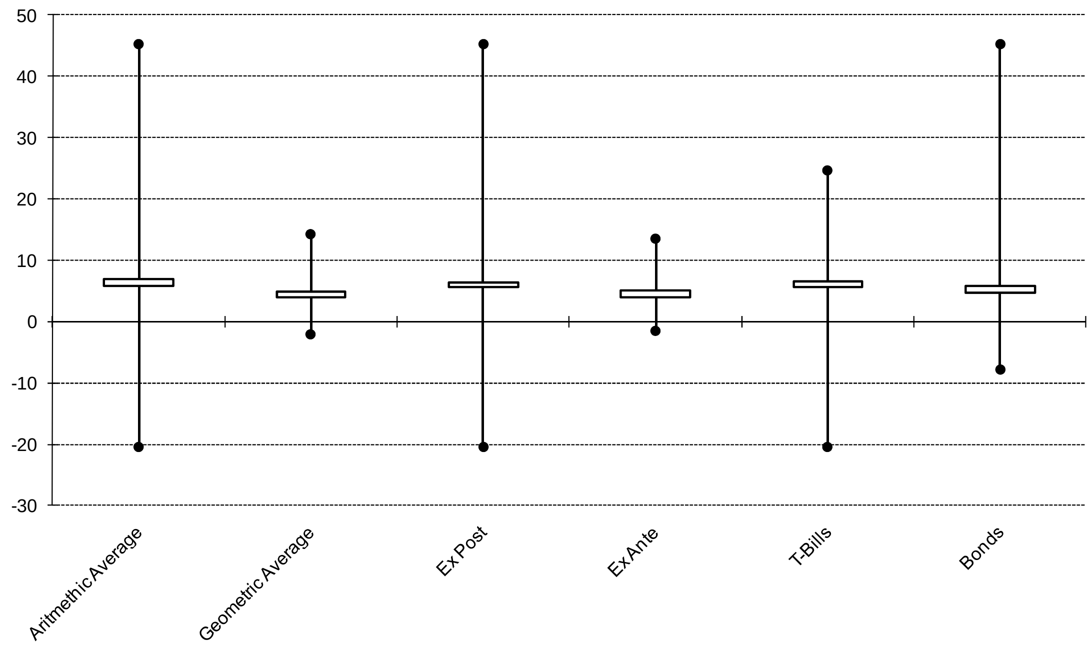
Variation in Method

Finally, Figure 5 illustrates the variation in the equity premium due to differences in definition of method of measurement. The mean of the observations calculating an arithmetic average is 6.37% whereas the mean of the observations calculating a geometric average is 4.46%. This is in line what might be expected on the basis of the variance in the series (see Section 2).[13] The second measurement issue is whether the equity premium is measured ex-ante or ex-post. As was explained in Section 2, the ex ante approach tends to produce lower estimates. This is confirmed by Figure 5. The average mean for the ex-post equity premium is 6.03%, whereas the mean of the ex-ante equity premium is 4.48%, a gap of 1.55% points which is in line with half the variance. Finally, the results for the equity premium depend on the proxy for the risk free rate. The mean of the equity premium calculated with T-bills as risk free rate is 6.07%, whereas the mean with bonds as risk free rate is 5.26%, a difference of 0.81% points.

---

[13] For a few observations it is unknown whether the mean is arithmetic or geometric. We have reckoned these to be arithmetic. Alternatively, if these observations with unknown method were assumed to be geometric the mean of the equity premiums with an arithmetic average is 6.59% and the mean of the equity premium with the geometric average is 4.98%. The difference in between measurement methods would then decrease from 1.8% to 1.6%.

Figure 5. Equity Premiums according to Method



Note: lines indicate minimum and maximum EP's found using the respective methods. The boxes indicate a 95% confidence interval around the mean for the respective methods.

To conclude this section, we present in Table 1 the simple correlations between the equity premium and the main explanatory variables. As to be expected, the equity premium tends to be higher in studies that use the arithmetic mean, the ex post method and the short term interest rate.

Table 1. Simple correlation matrix for equity premium and methods (N=535)

	Equity Premium	Arithmetic mean	Ex Post	T-Bill
Equity Premium	1.00	0.21	0.14	0.09
Arithmetic mean	0.21	1.00	0.07	–0.12
Ex Post	0.14	0.07	1.00	0.16
T-Bill	0.09	–0.12	0.16	1.00

4. The Meta-Regression Analysis

In this section, we turn to a meta-regression analysis to identify the (conditional) effects of the moderator variables on the equity premium. First, we present the basic meta-regression model and discuss its results. Then we extend the model including underlying fundamentals of the equity premium to get better insight into what explains the variation of the equity premium over time and across regions. Finally, we quantify benchmark values for the equity premium on the basis of the data set in this study.

4.1 The Meta Regression Model

The factors that may cause variation in the equity premium were identified in the previous sections. We will estimate meta-regression models that allow us to identify the contribution of these factors to the observed variation in the equity premium. For this purpose, we use the Huber-White estimator. This estimator simultaneously corrects for heteroskedasticity and cluster autocorrelation (see Williams, 2000, and Wooldridge, 2002, Section 13.8.2). The advantage of this estimator is that it accounts for the pooled data set-up by allowing for different variances and non-zero co-variances for clusters of observations taken from the same study.[14] More specifically, we postulate the following simple model:

$$EP_i = \alpha_0 + \sum_k \alpha_k Z_{ik} + \varepsilon_i \tag{2}$$

where EP is the equity premium derived from the primary studies (indexed i= 1,2 ....., L) – as defined in equation (1) – and Z are the explanatory variables (indexed k= 1,....., K). The effect of the explanatory variables is measured by the regression coefficients α_k. The explanatory factors that we consider are (i) characteristics of the methodology used to derive the equity premium; (ii) temporal sources of variation; (iii) spatial sources of variation; and (iv) characteristics of the economy.

---

[14] Dependence may also occur for estimates from the same country or time period. Robust standard errors accounting for spatial or temporal dependence of the observations are presented in Appendix B.

The first three sets of factors will be central in the Section 4.2 in which we present the basic model. The three method variables (arithmetic versus geometric, ex post versus ex ante, and the use of treasury bills versus bonds) that we consider in our basic specification are easily captured by a dummy variable because each of them only has two categories. For the observation period, we include two dummy variables characterizing (i) the mid year to which the observation pertains and (ii) the length of the period covered by the observation. Regarding spatial variation, we include dummies for the countries and regions distinguished. Section 4.3 elaborates on this basic model by adding underlying fundamental determinants of the equity premium.[15]

4.2 Basic results

Table 2 describes the results of our base model in which we consider the impact of research method, and spatial and temporal factors. In the base specification (0) we only include the dummy variables capturing variation in methods. In specification (1), we also consider spatial variation, and we make a distinction between three different time periods.[16] All three methodological variables in specification (1) have a statistically significant impact on the equity premium. Equity premiums with an arithmetic average are on average 1.37% larger than equity premiums with a geometric average. This is fairly close to the 1.28% estimate reported as an average in Dimson et al. (2002).

The economic significance of the other methodology variables is somewhat smaller, but still substantial. Equity premiums that have been measured ex-post are on average 1.31% higher than equity premiums that are measured ex-ante. The size of this effect is comparable to other studies: Salomons (2008) estimates a difference between ex post and ex ante measurement of 1.08% for the United States in the period 1871–2003, and Madsen (2004) estimates a difference of 3% for the major industrialised countries in the period 1878–2002. The use of T-bills as risk free rate results on average in a 0.81% higher equity premium than the use of bonds as risk free rate. This is slightly higher than the 0.5% found by Dimson et al. (2002).

The country dummies capture differences in the equity premium relative to the United States which is taken as our benchmark country. The country effects for Canada, Secondary Emerging Countries and Asian Tigers are statistically significant. On average, an equity premium in Secondary Emerging Countries is 5.25% higher than in the United States and 6.60% in the Asian Tigers. In

---

[15] A distinctive feature of this meta-analysis is that the equity premium is often calculated rather than estimated. This implies that we cannot apply standard practice in most meta-analyses which is to weight observations with the standard error of the estimate in order to correct for variation in the precision or accuracy of observations. In our basic model we will not apply any weighting of observations. As it could be argued that the variance decreases with the number of observations, and thus with the length of the observation period, we have by means of robustness check also applied a weighting scheme based on the square root of the length of the observation time period (T). This hardly affects the results that we present. Further information is available upon request from the authors.

[16] The two specification tests indicate that the model is correctly specified. The White test and Breusch-Pagan test present evidence for heteroscedasticity of the error term of the equity premium, as has been expected.

contrast, Canada faces an equity premium that is 1.72% lower than in the United States. Equity premiums in Oceania, Western Europe, the Advanced Emerging Countries are not statistically different from those in the United States. Economically the magnitude of equity premiums which are calculated in emerging countries is very large, suggesting that the excess return for risky assets is substantially larger in those countries.

Table 2. Equity premium: base model

	Spec. 0	Spec. 1	Spec. 2	Spec. 3
Constant	2.94***	4.00***	4.10***	3.84***
	(0.44)	(0.62)	(0.59)	(0.66)
Arithmetic mean	1.96***	1.37***	1.42***	1.41***
	(0.45)	(0.29)	(0.33)	(0.33)
Ex Post	1.22***	1.31***	1.05***	1.17***
	(0.32)	(0.26)	(0.30)	(0.40)
T-bill used	0.89*	0.81***	0.92***	0.89***
	(0.50)	(0.29)	(0.26)	(0.25)
Region effects (relative to USA)				
Canada		–1.72***	–1.65***	–1.60***
		(0.50)	(0.48)	(0.51)
Oceania		–0.53	–0.64	–0.69
		(0.74)	(0.63)	(0.68)
Western Europe		–0.03	–0.22	–0.17
		(0.52)	(0.64)	(0.66)
Advanced emerging		1.17	1.31	1.39
		(0.85)	(0.86)	(0.88)
Secondary emerging		5.25***	5.95***	5.93***
		(0.43)	(0.74)	(0.75)
Asian Tigers		6.60***	7.11***	7.06***
		(2.23)	(2.01)	(2.02)
Period effects (relative to 1910–1950)				
Before 1910		–3.54***	–3.46***	–3.38***
		(0.58)	(0.57)	(0.51)
After 1950		–0.74	0.16	0.29
		(0.66)	(0.62)	(0.57)
Trend after 1950			–0.04**	–0.05*
			(0.02)	(0.02)
Length of period < 40 years				0.42
				(0.63)
# observations	535	535	535	535
R^2	0.07	0.21	0.22	0.22

Note: cluster robust standard errors corrected for within-study dependence are reported in parentheses. Statistical significance of the estimated coefficients is indicated by ***, ** and * referring, respectively, to the 1%, 5% and 10% significance level. Appendix B provides a more detailed cluster analysis taking account of dependence by country/region and time period.

Regarding variation over time, we find that the pre-war period (before 1910) was characterized by a substantially lower equity risk-premium than the period 1910–1950. A similar conclusion was drawn by Dimson et al. (2006) and Siegel (1992). The number of observations in the 19th century is, however, limited. In the second specification, we extend the basic specification (1) by allowing for a time trend in the equity premium in the post-war period. The results reveal that this trend is significantly negative, resulting in an annual decline of the equity premium by 0.038% points (cumulating to 0.94 % in 25 years). Apart from some variation in the size of the coefficients, the qualitative results described in specification (1) are unaffected by the inclusion of the time trend.
In specification (3) in Table 2, we look at the effect of the length of the observation period by including a dummy for shorter periods (0–40 years). Although positive, the effect is statistically insignificant. Inclusion of the effect hardly affects the other results. We will therefore take specification (2) as our basis model in the remaining.

4.3 Underlying fundamentals

Going one step beyond the standard meta-analysis we will also explore some underlying economic fundamentals of the equity premium. Therefore we extend the previous analysis by adding some underlying explanatory variables which may be relevant to the equity premium. This provides us with a more substantive way of identifying sources of variation and can enhance the understanding of the deeper determinants of observed variation over time and space. Specifically, we look at the impact of volatility of income, the stage of development of the country, the interest rate and inflation.

Both the stage of economic development and income volatility can influence the price of risk underlying the equity premium. The stage of development can be regarded as a proxy for the maturity of financial markets in the country or region at hand. In general, mature markets offer better opportunities for spreading risks, and could therefore lead to a lower equity premium (cf. Levine et al., 2006). Volatility is taken as an indicator for the size of risk in the economy. It is well established that equity returns tend to be higher in periods of high volatility in stock markets (cf. Lettau et al., 2008). Here we include the volatility in GDP as the underlying explanatory variable.

These additional variables are not directly available in the studies on the equity premium in our sample. We therefore have to revert to other sources. The stage of economic development can be proxied by Gross Domestic Product (GDP) per capita. The database of Maddison (2007) provides information on GDP per capita for many countries and over a long time period. The benchmark year of the database is 1990 and GDP is measured in Geary-Khamis dollars. These Geary-Khamis dollars convert local currencies into international dollars by using purchasing power parity rates. For each observation, GDP per capita is measured at the mid-year of the period for each observation of the equity premium. Information on GDP per capita could be obtained for 500 observations (the Maddison data are only available for periods after 1870). The lowest GDP per capita is observed in India, Pakistan, the Philippines and Indonesia. The United States has the highest GDP per capita. There is not only variation across countries but also over time. The GDP per capita in the United States was $2,570 in 1876 and increased to $28,347 in 2001. The degree of uncertainty in an economy is measured by the variance of the economic growth (GDP) for the period of observation. Doing this we are able to construct GDP variances for 494 of our observations. The largest variance is found for the 1940s for the United States. For the period of the 'great moderation' in the 1990s, the variance of economic growth is lowest, again in the United States. Table 3 describes the partial correlations between the variables. This shows a positive covariance of the equity premium and volatility, and negative covariance with GDP and inflation. Furthermore, the strong correlations between volatility and the interest rate, volatility and GDP, and the interest rate and inflation stand out.

Table 3. Simple correlation matrix equity premium and economic variables (N=460)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Equity Risk Premium	1.00	0.18	0.17	0.15	0.22	−0.11	−0.21	0.01
(2) Arithmetic mean		1.00	0.04	−0.14	−0.07	−0.07	0.07	0.11
(3) Ex Post			1.00	0.19	0.14	−0.20	0.03	0.10
(4) T-Bill				1.00	-0.04	−0.02	0.15	0.13
(5) Log(business cycle)					1.00	−0.59	−0.56	−0.13
(6) Log(GDP per capita)						1.00	0.16	−0.04
(7) Interest							1.00	0.58
(8) Inflation								1.00

The results of our regression analysis are presented in Table 4. For reference, specification (0) reiterates our basic model in the previous analysis, viz. specification (2) in Table 2, here taken for the comprehensive data set including GDP as well as interest rates and inflation. Specification (1) includes volatility measured as the variance of economic growth and GDP per capita. The number of observations decreases slightly as compared to the basic specification presented in Table 2 due to missing data for periods before 1870. The effect of the variance of economic growth is statistically significant and has the expected positive effect. The impact is substantial: an increase in volatility by 1 standard deviation leads to a 1.7%-point higher equity premium. The effect of GDP per capita is positive, but statistically only marginally significant. This is largely caused by the fact that region-dummies have been included. These pick up a large part of the impact of GDP per capita. Omitting the region-dummies results in a statistically significant negative effect of GDP per capita (see also the partial correlations in Table 3). The coefficients of the other explanatory variables are comparable to those in the basic specification in Table 2.

Table 4. Equity premium, model including economic variables

	Spec. 0	Spec. 1	Spec. 2	Spec. 3
Constant	4.02***	–23.78*	5.09***	–6.99
	(0.71)	(11.76)	(0.77)	(6.11)
Arithmetic mean	1.22***	1.35***	1.26***	1.20***
	(0.29)	(0.30)	(0.33)	(0.31)
Ex Post	1.35***	1.00***	1.33***	1.37***
	(0.31)	(0.32)	(0.31)	(0.34)
T-bill used	0.82**	0.97***	1.13***	1.05***
	(0.36)	(0.32)	(0.30)	(0.30)
Canada	–1.75***	–1.32***	–1.11**	–0.90*
	(0.49)	(0.43)	(0.45)	(0.44)
Oceania	–0.45	0.90	–0.85	–0.09
	(0.73)	(0.77)	(0.66)	(0.51)
Western Europe	–0.31	1.22	–0.001	0.73
	(0.45)	(0.97)	(0.60)	(0.89)
Advanced emerging	1.51	4.44***	3.46***	6.42***
	(0.97)	(1.51)	(1.14)	(1.75)
Secondary emerging		8.28***		
		(1.39)		
Asian Tigers		7.25***		
		(2.12)		
Before 1910	–2.46***	–0.29	–1.73***	–0.68
	(0.70)	(1.00)	(0.58)	(0.51)
After 1950	–0.68	–0.34	0.88	0.80
	(0.71)	(0.47)	(0.52)	(0.53)
Volatility (log var GDP)		1.49***		0.60**
		(0.43)		(0.25)
GDP per capita (log)		2.51**		1.14*
		(1.15)		(0.62)
Nominal interest rate			–0.53***	–0.52***
			(0.13)	(0.14)
Inflation rate			0.03	–0.02
			(0.15)	(0.17)
# observations	438	493	460	438
R^2	0.13	0.25	0.26	0.28

Note: cluster robust standard errors corrected for within-study dependence are reported in parentheses. Statistical significance of the estimated coefficients is indicated by ***, ** and * referring, respectively, to the 1%, 5% and 10% significance level. The dummy for Secondary Emerging Countries and the Asian Tigers is omitted in specifications (3) and (4) because of lacking data. For comparison, specification (0) uses the specification in Table 2 using a sample of observations that is equal to the sample underling specification (3).

Specification (2) considers the impact of the nominal interest rates and inflation.[17] Since interest rates are not available for the Secondary Emerging Countries and the Asian Tigers, these had to be omitted from the sample. Nominal interest rates are clearly negatively associated with the equity premium. A one percent increase in the interest rate leads to a half percent decline in the rate of return on equity. The result for inflation reported in specification (2) is statistically and economically insignificant.

Finally, specification (3) includes all economic indicators in one equation. The previous results stand upright. Also here we find a positive impact of GDP per capita which captures the variation of GDP per capita within the groups of countries that are distinguished by the dummies. Again, omitting all country and region dummies would alter this result and produce a negative association.

These results have been tested for their robustness. Instead of the volatility of GDP we also considered an alternative measure of macroeconomic uncertainty, viz. the fraction of economic downturns during the observation period. This variable is not statistically significant, and as the number of observations drops also the significance of other variable deteriorates as well. Also for the stage of economic development we looked at other – more direct – indicators, such as market capitalization and credit to the private sector. Market capitalisation ratios are available in the databases of Levine et al. (2006) and the World Development Indicators (World Bank, 2006). The data are available for almost every country but the time period is limited. For WDI, the period is restricted to 1988–2006 and for Levine to 1976–2006. The sample of observations for which this information can be used is thus relatively small. Credit to the private sector is available in the database by Levine et al. (2006) for the period 1960–2005. Using these data we are left with 285 observations. The lowest amount of credit to the private sector relative to GDP is measured for Venezuela, Argentina and Mexico. In these countries the ratio is only 0.1. The highest one is measured in Japan where in the 1990s the ratio of credit to the private sector to GDP was 1.8. In most countries the ratio of credit to the private sector to GDP is about 0.5. This variable is statistically significant at the 5% significance level when country dummies are dropped. With country dummies included the effect is statistically insignificant at the 10% significance level.

4.4 Benchmark values for the equity premium

The equity premium is a crucial parameter in today's financial decision making. This applies to households who have to decide on their investment portfolio, to pension funds determining the financial strategy, and governments who have estimate future tax revenues. This meta-analysis can

---

[17] Data were kindly made available by Jan Luiten van Zanden and are derived from (i) Mitchell, B.R. (1998), International historical statistics: Africa, Asia and Oceania, 1750-1993, London: Macmillan; (ii) Mitchell, B.R. (1998), International historical statistics: Europe, 1750-1993, London: Macmillan; (iii) Mitchell, B.R. (1998): International historical statistics: The Americas 1750-1993, London: Macmillan. Further information was derived from Dimson et al., Morningstar Encorr, and IMF (2009), International Financial Statistics.

help to narrow down the uncertainty about the equity premium and provide benchmark values that are useful for economists, policymakers and investors. The meta-analysis also allows us to construct confidence intervals for these benchmarks, although these should be treated with caution as we are not certain what is the best specification to use. In the remainder, we use specification (2) in Table 2, thus including a trend term for the post war period.[18] This model includes a time trend for the post war period. Furthermore, we focus on the results for the United States – as this provides the best bench-mark with most of the literature – and on the results using the ex ante method, as this method can take account of possible non-stationarity in the data.

As there is no general consensus on the way to define the equity premium, Table 5 provides two benchmarks, and their confidence intervals, depending on whether the equity premium is measured relative to the T-bill rate or the bond rate. These benchmarks refer to the year 2000. The 90% confidence intervals are given between parentheses.

Table 5. Benchmark values for the equity premium in the year 2000

	Mean	Confidence interval
T-bill	4.7	3.6 – 5.9
Bonds	3.8	2.8 – 4.8

The bench-marks are taken for the ex ante method. This is to be preferred because this method is better able to take account of the time variation in the equity premium. Furthermore, we use arithmetic returns as these correspond to the mean of the underlying (asymmetric) distribution of the equity premium. We thus find a bench-mark for the equity premium of 4.7% relative to T-bills, and 3.8% relative to government bonds. Alternatively, using the geometric method the results would have been lower, namely a premium of 3.3% relative to T-bill rates (confidence interval 2.4 - 4.2) and 2.4% relative to bond rates (confidence interval 1.5 - 3.3). This, however, corresponds to the median rather than to the mean of the equity premium.

A few qualifications are in order. First, these bench-marks refer to the United States and cannot automatically be taken to be representative for the world. For European countries and Canada often lower equity premiums are found, while for emerging countries they tend to be higher. In addition, it has to be remembered that focussing on the United States may lead to a survival bias in the results. As mentioned earlier, Jorion and Goetzmann conclude that taking account of this bias will lead to lower world returns on equity by some 0.29% points.

---

[18] If one would neglect this downward trend, and base the benchmarks on the first regression in Table 4.1, the results would have been higher by about 0.9%-points.

A next and obvious limitation is that these benchmarks are constructed for the relatively steady period up to the year 2000. These results should therefore be regarded as a benchmark for the equity premium in a hypothetical steady situation. It is clear that the economy today is far from its normal state. Unfortunately, it is too early to assess the impact of the credit crisis on the equity premium. Using the extended model including the economic fundamentals (Table 4) one could argue that the higher volatility in GDP and lower interest rates would lead to a higher equity premium at present. This is particularly so, if – with hindsight – the volatility experienced in the period up to 2000 was low by historical standards (see also Lettau et al., 2006). On the other hand, the credit crisis may also have deteriorated other fundamentals underlying the equity price, namely expected profits. Therefore, it is impossible at this stage to establish the impact of the credit crisis on the equity premium with any reliability.

And there is a further issue in this regard. Even if the recent fall in equity prices has been triggered by higher volatility in the economy, and is thus associated with a higher prospective equity premium, that does not mean that this can be usefully exploited in terms of an investment strategy (see also Broer et al., 2010). As these high expected returns coincide with high volatility, they do not yield better investment opportunities but rather a shift along the risk-return frontier.

5. Conclusion

This meta-analysis provides an accurate measure of the factors that cause variation in the equity premium. Thereby it explains, to a considerable extent, the heterogeneity of the equity premium in the economic literature. We determine the effects of several factors on the equity premium. The first factor is the applied methodology to measure the equity premium. Variation in the equity premium is the result of calculating equity premiums ex-post or ex-ante, average returns arithmetically or geometrically and using T-bills or bonds as the risk free rate. This variation can easily add up to 3.5% points between the extremes of ex ante/geometric/bond rate on the one hand and ex post/arithmetic/T-bill rate on the other hand. This again indicates how important it is to be clear about the method of measurement.

The second factor is the variation over time. Several authors have pointed to a possible downward trend in the equity premium over time, which can be explained by the development of financial markets allowing for better diversification of risks. The meta-analysis confirms such a pattern. The precise results should be interpreted with care, however. One difficulty in the meta-analysis is that the underlying studies use different periods of observation, both in length and in precise dates. This makes it difficult to accurately pin down an observation of the equity premium to a certain period. At the same time the meta-analysis is of special value here, as it charts the – apparently discretionary – choices made by the different authors in a consistent manner. In the current study, we break down the time dimension into three periods: before 1910, the period after 1950, and the intermediate period characterized by the two World Wars. We also allow for the possibility of a trend in the post-war period.

The third factor concerns the spatial dimension. We find significant differences in equity premiums between the United States, Canada, Secondary Emerging Countries and the Asian Tigers. Emerging countries have a larger equity premium than the United States, whereas Canada has a lower equity premium. For Oceania (including Japan) and Western Europe the differences in comparison with the United States are small and statistically insignificant.

Finally, we have looked into some underlying determinants of the equity premium. The equity premium tends to be higher in periods and countries with larger economic volatility. There is also a clear negative effect of the interest rate, indicating that the return on equity does not vary one-for-one with changes in the interest rate. This also implies that the return on equity cannot be determined by adding a constant equity risk premium to a time varying short or long interest rate. The rate of return on equity has its own dynamics which is only partly associated with the dynamics of the interest rate.

The aim of this meta-analysis was to shed light on the ongoing debate on the height of the equity premium, which tends to be hampered by differences in definition, method of measurement and observation periods. We believe that charting this complex field from a different angle using meta-analysis provides a useful contribution to this literature. The analysis is not meant to replace other (econometric) techniques as being a superior one. Similarly, the value of the equity premium suggested by our analysis as a bench-mark is conditional on the model used in this paper, and should by not be interpreted as a consensus estimate of the equity premium. But exactly because of the uncertainty about the right method and model, meta-analysis is helpful for surveying this literature in a structured manner and enhancing our understanding of sources of variation in estimated equity premiums.

References[19]

Barro, R.J. (2005). Rare Events and the Equity Premium. *National Bureau of Economic Research Working Paper*, no. 11310, Cambridge, MA. ■

Brown, S.J., W.N. Goetzmann and S.A. Ross (1995). Survival. *Journal of Finance*, 50(3), 853–873.

Blanchard, O.J. (1993). Movements in the Equity Premium. *Brookings Papers on Economic Activity*, 1993(2), 75-138. ■

Broer, D.P., T. Knaap and E. Westerhout (2010). Risk Factors in Pension Returns. *Panel Paper*, Netspar, Tilburg (forthcoming).

Campbell, J.Y. and J.H. Cochrane (1999). By Force of Habit: A Consumption-based Explanation of Aggregate Stock Market Behavior. *Journal of Political Economy*, 107(2), 205–251.

Campbell, J.Y. (2008). Viewpoint: Estimating the Equity Premium. *Canadian Journal of Economics*, 41(1), 1–21. ■

---

[19] Studies included in the database are marked with ■

Campbell, J., A. Lo and A.C. MacKinlay (1997). *The Econometrics of Financial Markets*. Princeton: Princeton University Press.

Canova, F. and Nicoló de G. (2003). The Properties of the Equity Premium and the Risk-Free Rate: An Investigation Across Time and Countries. *IMF Staff Papers*, 50(2), 222–248. ■

Cate, A. ten (2009). *Arithmetic and Geometric Mean Rates of Return in Discrete Time*. CPB Memorandum 223, CPB Netherlands Bureau for Economic Policy Analysis, The Hague.

Chen, M.H. and P.V. Bidarkota (2004). Consumption Equilibrium Asset Pricing in two Asian Emerging Markets. *Journal of Asian Economics*, 15, 305–319.

Claus, J. and J. Thomas (2001). Equity Premiums as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets. *Journal of Finance*, 56(5), 1629–1666. ■

Cooper, H. and L.V. Hedges (1994). *Handbook of Research Synthesis*. New York: Russell Sage Foundation.

Derrig, R.A. and E.D. Orr (2003). Equity Risk Premium: Expectations Great and Small. *North American Actuarial Journal*, 8(1), 45–69.

Dimson, E., P. Marsh and M. Staunton (2002). *Triumph of the Optimists: 101 Years of Global Investment Returns.* Princeton: Princeton University Press.

Dimson E., P. Marsh and M. Staunton (2006). The Worldwide Equity Premium: A Smaller Puzzle. *London Business School*, mimeo. ■

Erbas, S.N. and A. Mirakhor (2007). The Equity Premium Puzzle, Ambiguity Aversion, and Institutional Quality. *International Monetary Fund Working Paper,* no. 07-230, Washington.

Fama, E. and K. French (1988). Dividend Yields and Expected Returns on Stocks and Bonds. *Journal of Financial Economics*, 25, 23–49. ■

Fama, E. and K. French (2002). The Equity Premium. *Journal of Finance*, 57(2), 637–659. ■

Fernandez, P. (2009a). The Equity Premium in 150 Textbooks. *Working Paper IESE Business School*, no. WP-829, Barcelona.

Fernandez, P. (2009b). Market Risk Premium Used in 2008 by Professors: A Survey with 1,400 Answers. *Working Paper IESE Business School*, no. WP-796, Barcelona.

Florax, R.J.G.M., H.L.F. de Groot and R.A. de Mooij (2002). Meta-analysis: A Tool for Upgrading Inputs of Macroeconomic Policy Models. *Tinbergen Institute Discussion Paper*, no. 041(3), Amsterdam-Rotterdam.

Gordon, M.J. (1962). *The Investment, Financing, and Valuation of the Corporation*. Homewood, Illinois: Richard D. Irwin.

Ibbotson R.G. and P. Chen (2003). Stock Market Returns in the Long Run: Participating in the Real Economy. *Financial Analysts Journal*, 59(1), 88–98. ■

Jacquier, E., A. Kane and A. Marcus (2003). Geometric or Arithmetic Mean: A Reconsideration. *Financial Analysts Journal*, 59, 46–53.

Jagannathan, R., E.R. McGrattan and A. Scherbina (2000). The Declining U.S. Equity Premium. *Federal Reserve Bank of Minneapolis Quarterly Review*, 24(4), 3–19. ■

Jorion, Ph. and W.N. Goetzmann (1999). Global Stock Markets in the Twentieth Century. *Journal of Finance*, 54, 953–980

Kocherlakota, N.R. (1996). The Equity Premium: It's Still a Puzzle. *Journal of Economic Literature*, 34(1), 42–71.

Kyriacou, K., J.B. Madsen and B. Mase (2006). Does Inflation Exaggerate the Equity Premium? *Journal of Economic Studies*, 33(5), 344–356. ■

La Porta, R.F. Lopez-de-Silanes, A. Shleifer and R.W. Vishny (1998). Law and Finance. *Journal of Political Economy*, 106(6), 1113–1155.

Lemke, W. and T. Werner (2009). The Term Structure of Equity Premiums in an Affine Arbitrage-Free Model of Bond Market and Stock Market Dynamics. *ECB Working Paper*, no. 1045, European Central Bank.

Lengwiler, Y. (2004). *Microfoundations of Financial Economics: An Introduction to General Equilibrium Asset Pricing*. Princeton: Princeton University Press.

Lettau, M., S.C. Ludvigson and J.A. Wachter (2008). The Declining Equity Premium: What Role Does Macroeconomic Risk Play. *Review of Financial Studies*, 21(4), 1653–1687.
Levine, R. (1997). Financial Development and Economic Growth: Views and Agenda. *Journal of Economic Literature*, 35(2), 688–726.
Maddison, A. (2007). *Contours of the World Economy, 1-2030 AD*. Oxford: Oxford University Press.
Madsen, J.B. (2004). The Equity Premium Puzzle and the Ex Post Bias. *FRU Working Papers*, no. 01, University of Copenhagen, Department of Economics Finance Research Unit.
Mehra, R. (2003). The Equity Premium: Why Is It a Puzzle? *Financial Analysts Journal*, January / February, 54–69. ■
Mehra, R. (2007). The Equity Premium in India. In: K. Basu (ed.), *The Oxford Companion to Economics in India*. Oxford: Oxford University Press. ■
Mehra, R. (ed.) (2008). *Handbook of the Equity Risk Premium*. Amsterdam: Elsevier.
Mehra, R. and E.C. Prescott (1985). The Equity Premium: A Puzzle. *Journal of Monetary Economics*, 15(2), 145–161. ■
Salomons, R. and H. Grootveld (2003). The Equity Risk Premium: Emerging versus Developed Markets. *SOM Theme E: Financial Markets and Institutions*, University of Groningen. ■
Salomons, R. (2008). A Theoretical and Practical Perspective on the Equity Risk Premium. *Journal of Economic Surveys*, 22(2), 299–329.
Santis, M. de (2007). Movements in the Equity Premium: Evidence from a Time-Varying VAR. *Studies in Nonlinear Dynamics and Econometrics*, 11(4), 1–39. ■
Shackman, J.D. (2006). The Equity Premium and Market Integration: Evidence from International Data. *Journal of International Financial Markets, Institutions and Money*, 16(2), 155–179. ■
Siegel, J.J. (1992). The Real Rate of Interest from 1800-1990: A Study of the U.S. and the U.K. *Journal of Monetary Economics*, 29, 227–252. ■
Siegel, J.J. (1999). The Shrinking Equity Premium: Historical Facts and Future Forecasts. *Journal of Portfolio Management*, 26(1), 10–17. ■
Siegel, J.J. (2005). Perspectives on the Equity Risk Premium. *Financial Analyst Journal CFA Institute,* 61–73. ■
Ville, S. (2006). The Equity Premium Puzzle: Australia and the United States in Comparative Perspective. *University of Wollongong Economics Working Paper Series*, no. 06–25, Wollongong, Australia. ■
Vivian, A. (2007). The UK Equity Premium: 1901-2004. *Journal of Business and Accounting*, 34(9/10), 1496–1527. ■
Weil, Ph. (1989). The Equity Premium Puzzle and the Risk-Free Rate Puzzle. *Journal of Monetary Economics,* 24 (3), 401–421.
Welch, I. (2000). Views of Financial Economists of the Equity Premium and on Professional Controversies. *Journal of Business*, 73(4), 501–537. ■
Williams, R.L. (2000). A Note on Robust Variance Estimation for Cluster-Correlated Data. *Biometrics*, 56, 645–646.
Wooldridge, J.M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
World Bank (2006). *World Development Indicators*. Washington:World Bank.

Appendix A. Summary statistics per study

Study	# obs	Minimum ep	Average ep	Maximum ep	Mid year	Initial year	Final year
Barro (2005)	13	4.70	7.16	10.40	1968.00	1880	2004
Blanchard et al. (1993)	32	–0.20	4.37	8.50	1941.63	1802	1992
Campbell (2002)	15	0.80	5.93	12.35	1978.53	1891	1999
Campbell (2008)	8	1.80	2.95	5.10	1994.25	1982	2006
Canova and De Nicolo (2003)	21	–4.91	3.70	13.84	1985.67	1971	1999
Claus and Thomas (2001)	12	0.21	4.56	7.91	1993.17	1985	1999
De Santis (2007)	14	1.70	4.04	6.40	1966.39	1928	2004
Digby et al. (2006)	23	–0.02	8.14	12.30	1971.20	1910	2004
Dimson et al. (2006)	68	1.80	5.50	10.46	1952.50	1900	2005
Fama and French (2002)	33	–2.15	4.44	14.27	1942.06	1872	2000
Ibbotson and Chen (2002)	4	0.24	3.42	5.24	1963.00	1926	2000
Jagannathan et al. (2000)	38	–0.65	4.84	10.35	1967.13	1930	1999
Kyriacou et al. (2006)	50	2.18	5.95	11.02	1942.00	1871	2002
Mehra (2003)	8	3.30	5.95	8.00	1963.94	1802	2000
Mehra (2007)	12	3.30	6.73	11.30	1968.71	1802	2004
Mehra and Prescott (1985)	9	0.18	6.18	18.30	1933.50	1889	1978
Salomons and Grootveld (2003)	25	–7.86	7.99	45.26	1992.20	1976	2002
Shackman (2006)	39	–20.37	9.50	24.64	1986.00	1970	2002
Siegel (1992)	24	0.79	4.15	7.04	1920.67	1800	1990
Siegel (1999)	16	1.90	5.12	8.60	1917.00	1802	1998
Siegel (2005)	36	–0.21	5.68	12.34	1947.11	1802	2004
Ville (2006)	9	–2.91	4.73	9.53	1933.50	1889	1978
Vivian (2007)	14	–0.09	4.43	7.94	1974.36	1901	2004
Welch (2000)	12	4.30	6.90	9.40	1961.00	1870	1998
Grand Total	535	–20.37	5.73	45.26	1958.56	1800	2006

Appendix B. Accounting for dependence

Dependence among observations in meta-analysis studies may occur between estimates from the same study, country, region or time period and results in standard errors that are wrong. In the main text, we have accounted for within-study dependence by reporting Huber-White cluster robust standard errors. This Appendix shows results with standard errors that have been corrected for dependence across regions (Western Europe, Developing countries, Canada, Australia, South Africa, Japan and the United States) and time periods (pre-1910, 1910–1950 and post 1950). We take the specification (2) in Table 2 as the base specification. Comparable results for other specifications are available upon request.

Table B.1. Accounting for different types of dependence

	Base	Spatial	Temporal
Constant	4.10***	4.10***	4.10**
	(0.59)	(0.45)	(0.55)
Arithmetic mean	1.42***	1.42***	1.42***
	(0.33)	(0.22)	(0.13)
Ex Post	1.05***	1.05***	1.05
	(0.30)	(0.25)	(0.75)
T-bill used	0.92***	0.92***	0.92*
	(0.26)	(0.21)	(0.24)
Region effects (relative to USA)			
Canada	–1.65***	–1.65***	–1.65***
	(0.48)	(0.11)	(0.08)
Oceania	–0.64	–0.64***	–0.64
	(0.63)	(0.08)	(0.38)
Western Europe	–0.22	–0.22*	–0.22
	(0.64)	(0.10)	(0.11)
Advanced emerging	1.31	1.31***	1.31***
	(0.86)	(0.27)	(0.10)
Secondary emerging	5.95***	5.95***	5.95***
	(0.74)	(0.77)	(0.23)
Asian Tigers	7.11***	7.11***	7.11***
	(2.01)	(0.66)	(0.28)
Period effects			
Before 1910	–3.46***	–3.46***	–3.46***
	(0.57)	(0.36)	(0.19)
After 1950	0.16	0.16	0.16
	(0.62)	(0.70)	(0.16)
Trend after 1950	–0.04**	–0.04	–0.04**
	(0.02)	(0.04)	(0.004)
# observations	535	535	535
R^2	0.22	0.22	0.22

Note: Statistical significance of the estimated coefficients is indicated by ***, ** and * referring, respectively, to the 1%, 5% and 10% significance level.

Journal of Economic Perspectives—Volume 18, Number 3—Summer 2004—Pages 25–46

The Capital Asset Pricing Model: Theory and Evidence

Eugene F. Fama and Kenneth R. French

The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of asset pricing theory (resulting in a Nobel Prize for Sharpe in 1990). Four decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. It is the centerpiece of MBA investment courses. Indeed, it is often the only asset pricing model taught in these courses.[1]

The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor—poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions. But they may also be caused by difficulties in implementing valid tests of the model. For example, the CAPM says that the risk of a stock should be measured relative to a comprehensive "market portfolio" that in principle can include not just traded financial assets, but also consumer durables, real estate and human capital. Even if we take a narrow view of the model and limit its purview to traded financial assets, is it

[1] Although every asset pricing model is a capital asset pricing model, the finance profession reserves the acronym CAPM for the specific model of Sharpe (1964), Lintner (1965) and Black (1972) discussed here. Thus, throughout the paper we refer to the Sharpe-Lintner-Black model as the CAPM.

■ *Eugene F. Fama is Robert R. McCormick Distinguished Service Professor of Finance, Graduate School of Business, University of Chicago, Chicago, Illinois. Kenneth R. French is Carl E. and Catherine M. Heidt Professor of Finance, Tuck School of Business, Dartmouth College, Hanover, New Hampshire. Their e-mail addresses are ⟨eugene.fama@gsb.uchicago.edu⟩ and ⟨kfrench@dartmouth.edu⟩, respectively.*

legitimate to limit further the market portfolio to U.S. common stocks (a typical choice), or should the market be expanded to include bonds, and other financial assets, perhaps around the world? In the end, we argue that whether the model's problems reflect weaknesses in the theory or in its empirical implementation, the failure of the CAPM in empirical tests implies that most applications of the model are invalid.

We begin by outlining the logic of the CAPM, focusing on its predictions about risk and expected return. We then review the history of empirical work and what it says about shortcomings of the CAPM that pose challenges to be explained by alternative models.

The Logic of the CAPM

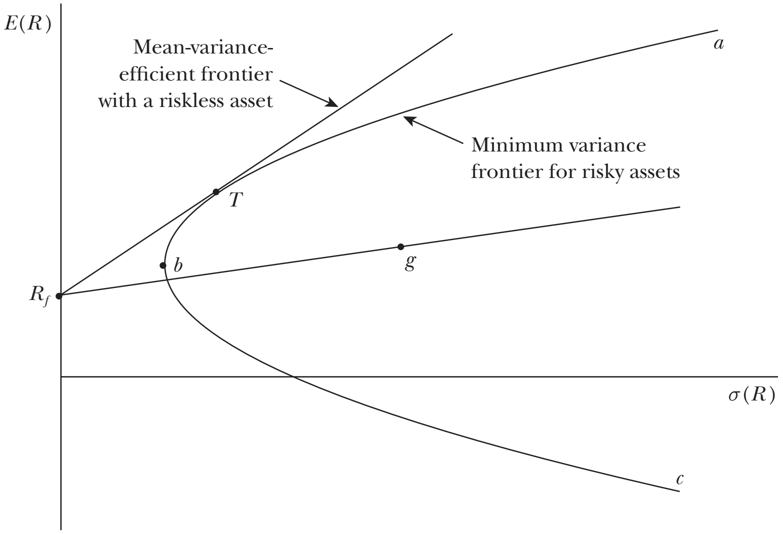
The CAPM builds on the model of portfolio choice developed by Harry Markowitz (1959). In Markowitz's model, an investor selects a portfolio at time $t - 1$ that produces a stochastic return at t. The model assumes investors are risk averse and, when choosing among portfolios, they care only about the mean and variance of their one-period investment return. As a result, investors choose "mean-variance-efficient" portfolios, in the sense that the portfolios 1) minimize the variance of portfolio return, given expected return, and 2) maximize expected return, given variance. Thus, the Markowitz approach is often called a "mean-variance model."

The portfolio model provides an algebraic condition on asset weights in mean-variance-efficient portfolios. The CAPM turns this algebraic statement into a testable prediction about the relation between risk and expected return by identifying a portfolio that must be efficient if asset prices are to clear the market of all assets.

Sharpe (1964) and Lintner (1965) add two key assumptions to the Markowitz model to identify a portfolio that must be mean-variance-efficient. The first assumption is *complete agreement*: given market clearing asset prices at $t - 1$, investors agree on the joint distribution of asset returns from $t - 1$ to t. And this distribution is the true one—that is, it is the distribution from which the returns we use to test the model are drawn. The second assumption is that there is *borrowing and lending at a risk-free rate*, which is the same for all investors and does not depend on the amount borrowed or lent.

Figure 1 describes portfolio opportunities and tells the CAPM story. The horizontal axis shows portfolio risk, measured by the standard deviation of portfolio return; the vertical axis shows expected return. The curve *abc*, which is called the minimum variance frontier, traces combinations of expected return and risk for portfolios of risky assets that minimize return variance at different levels of expected return. (These portfolios do not include risk-free borrowing and lending.) The tradeoff between risk and expected return for minimum variance portfolios is apparent. For example, an investor who wants a high expected return, perhaps at point *a*, must accept high volatility. At point *T*, the investor can have an interme-

Figure 1
Investment Opportunities



diate expected return with lower volatility. If there is no risk-free borrowing or lending, only portfolios above *b* along *abc* are mean-variance-efficient, since these portfolios also maximize expected return, given their return variances.

Adding risk-free borrowing and lending turns the efficient set into a straight line. Consider a portfolio that invests the proportion x of portfolio funds in a risk-free security and $1 - x$ in some portfolio g. If all funds are invested in the risk-free security—that is, they are loaned at the risk-free rate of interest—the result is the point R_f in Figure 1, a portfolio with zero variance and a risk-free rate of return. Combinations of risk-free lending and positive investment in g plot on the straight line between R_f and g. Points to the right of g on the line represent borrowing at the risk-free rate, with the proceeds from the borrowing used to increase investment in portfolio g. In short, portfolios that combine risk-free lending or borrowing with some risky portfolio g plot along a straight line from R_f through g in Figure 1.[2]

[2] Formally, the return, expected return and standard deviation of return on portfolios of the risk-free asset f and a risky portfolio g vary with x, the proportion of portfolio funds invested in f, as

$$R_p = xR_f + (1 - x)R_g,$$

$$E(R_p) = xR_f + (1 - x)E(R_g),$$

$$\sigma(R_p) = (1 - x)\sigma(R_g),\ x \leq 1.0,$$

which together imply that the portfolios plot along the line from R_f through g in Figure 1.

To obtain the mean-variance-efficient portfolios available with risk-free borrowing and lending, one swings a line from R_f in Figure 1 up and to the left as far as possible, to the tangency portfolio T. We can then see that all efficient portfolios are combinations of the risk-free asset (either risk-free borrowing or lending) and a single risky tangency portfolio, T. This key result is Tobin's (1958) "separation theorem."

The punch line of the CAPM is now straightforward. With complete agreement about distributions of returns, all investors see the same opportunity set (Figure 1), and they combine the same risky tangency portfolio T with risk-free lending or borrowing. Since all investors hold the same portfolio T of risky assets, it must be the value-weight market portfolio of risky assets. Specifically, each risky asset's weight in the tangency portfolio, which we now call M (for the "market"), must be the total market value of all outstanding units of the asset divided by the total market value of all risky assets. In addition, the risk-free rate must be set (along with the prices of risky assets) to clear the market for risk-free borrowing and lending.

In short, the CAPM assumptions imply that the market portfolio M must be on the minimum variance frontier if the asset market is to clear. This means that the algebraic relation that holds for any minimum variance portfolio must hold for the market portfolio. Specifically, if there are N risky assets,

$$\text{(Minimum Variance Condition for } M) \quad E(R_i) = E(R_{ZM}) + [E(R_M) - E(R_{ZM})]\beta_{iM}, \; i = 1, \ldots, N.$$

In this equation, $E(R_i)$ is the expected return on asset i, and β_{iM}, the market beta of asset i, is the covariance of its return with the market return divided by the variance of the market return,

$$\text{(Market Beta)} \quad \beta_{iM} = \frac{\text{cov}(R_i, R_M)}{\sigma^2(R_M)}.$$

The first term on the right-hand side of the minimum variance condition, $E(R_{ZM})$, is the expected return on assets that have market betas equal to zero, which means their returns are uncorrelated with the market return. The second term is a risk premium—the market beta of asset i, β_{iM}, times the premium per unit of beta, which is the expected market return, $E(R_M)$, minus $E(R_{ZM})$.

Since the market beta of asset i is also the slope in the regression of its return on the market return, a common (and correct) interpretation of beta is that it measures the sensitivity of the asset's return to variation in the market return. But there is another interpretation of beta more in line with the spirit of the portfolio model that underlies the CAPM. The risk of the market portfolio, as measured by the variance of its return (the denominator of β_{iM}), is a weighted average of the covariance risks of the assets in M (the numerators of β_{iM} for different assets).

Thus, β_{iM} is the covariance risk of asset i in M measured relative to the average covariance risk of assets, which is just the variance of the market return.[3] In economic terms, β_{iM} is proportional to the risk each dollar invested in asset i contributes to the market portfolio.

The last step in the development of the Sharpe-Lintner model is to use the assumption of risk-free borrowing and lending to nail down $E(R_{ZM})$, the expected return on zero-beta assets. A risky asset's return is uncorrelated with the market return—its beta is zero—when the average of the asset's covariances with the returns on other assets just offsets the variance of the asset's return. Such a risky asset is riskless in the market portfolio in the sense that it contributes nothing to the variance of the market return.

When there is risk-free borrowing and lending, the expected return on assets that are uncorrelated with the market return, $E(R_{ZM})$, must equal the risk-free rate, R_f. The relation between expected return and beta then becomes the familiar Sharpe-Lintner CAPM equation,

$$\text{(Sharpe-Lintner CAPM)} \quad E(R_i) = R_f + [E(R_M) - R_f)]\beta_{iM},\ i = 1, \ldots, N.$$

In words, the expected return on any asset i is the risk-free interest rate, R_f, plus a risk premium, which is the asset's market beta, β_{iM}, times the premium per unit of beta risk, $E(R_M) - R_f$.

Unrestricted risk-free borrowing and lending is an unrealistic assumption. Fischer Black (1972) develops a version of the CAPM without risk-free borrowing or lending. He shows that the CAPM's key result—that the market portfolio is mean-variance-efficient—can be obtained by instead allowing unrestricted short sales of risky assets. In brief, back in Figure 1, if there is no risk-free asset, investors select portfolios from along the mean-variance-efficient frontier from a to b. Market clearing prices imply that when one weights the efficient portfolios chosen by investors by their (positive) shares of aggregate invested wealth, the resulting portfolio is the market portfolio. The market portfolio is thus a portfolio of the efficient portfolios chosen by investors. With unrestricted short selling of risky assets, portfolios made up of efficient portfolios are themselves efficient. Thus, the market portfolio is efficient, which means that the minimum variance condition for M given above holds, and it is the expected return-risk relation of the Black CAPM.

The relations between expected return and market beta of the Black and Sharpe-Lintner versions of the CAPM differ only in terms of what each says about $E(R_{ZM})$, the expected return on assets uncorrelated with the market. The Black version says only that $E(R_{ZM})$ must be less than the expected market return, so the

[3] Formally, if x_{iM} is the weight of asset i in the market portfolio, then the variance of the portfolio's return is

$$\sigma^2(R_M) = Cov(R_M, R_M) = Cov\left(\sum_{i=1}^{N} x_{iM}R_i,\ R_M\right) = \sum_{i=1}^{N} x_{iM}Cov(R_i, R_M).$$

premium for beta is positive. In contrast, in the Sharpe-Lintner version of the model, $E(R_{ZM})$ must be the risk-free interest rate, R_f, and the premium per unit of beta risk is $E(R_M) - R_f$.

The assumption that short selling is unrestricted is as unrealistic as unrestricted risk-free borrowing and lending. If there is no risk-free asset and short sales of risky assets are not allowed, mean-variance investors still choose efficient portfolios—points above *b* on the *abc* curve in Figure 1. But when there is no short selling of risky assets and no risk-free asset, the algebra of portfolio efficiency says that portfolios made up of efficient portfolios are not typically efficient. This means that the market portfolio, which is a portfolio of the efficient portfolios chosen by investors, is not typically efficient. And the CAPM relation between expected return and market beta is lost. This does not rule out predictions about expected return and betas with respect to other efficient portfolios—if theory can specify portfolios that must be efficient if the market is to clear. But so far this has proven impossible.

In short, the familiar CAPM equation relating expected asset returns to their market betas is just an application to the market portfolio of the relation between expected return and portfolio beta that holds in any mean-variance-efficient portfolio. The efficiency of the market portfolio is based on many unrealistic assumptions, including complete agreement and either unrestricted risk-free borrowing and lending or unrestricted short selling of risky assets. But all interesting models involve unrealistic simplifications, which is why they must be tested against data.

Early Empirical Tests

Tests of the CAPM are based on three implications of the relation between expected return and market beta implied by the model. First, expected returns on all assets are linearly related to their betas, and no other variable has marginal explanatory power. Second, the beta premium is positive, meaning that the expected return on the market portfolio exceeds the expected return on assets whose returns are uncorrelated with the market return. Third, in the Sharpe-Lintner version of the model, assets uncorrelated with the market have expected returns equal to the risk-free interest rate, and the beta premium is the expected market return minus the risk-free rate. Most tests of these predictions use either cross-section or time-series regressions. Both approaches date to early tests of the model.

Tests on Risk Premiums

The early cross-section regression tests focus on the Sharpe-Lintner model's predictions about the intercept and slope in the relation between expected return and market beta. The approach is to regress a cross-section of average asset returns on estimates of asset betas. The model predicts that the intercept in these regressions is the risk-free interest rate, R_f, and the coefficient on beta is the expected return on the market in excess of the risk-free rate, $E(R_M) - R_f$.

Two problems in these tests quickly became apparent. First, estimates of beta for individual assets are imprecise, creating a measurement error problem when they are used to explain average returns. Second, the regression residuals have common sources of variation, such as industry effects in average returns. Positive correlation in the residuals produces downward bias in the usual ordinary least squares estimates of the standard errors of the cross-section regression slopes.

To improve the precision of estimated betas, researchers such as Blume (1970), Friend and Blume (1970) and Black, Jensen and Scholes (1972) work with portfolios, rather than individual securities. Since expected returns and market betas combine in the same way in portfolios, if the CAPM explains security returns it also explains portfolio returns.[4] Estimates of beta for diversified portfolios are more precise than estimates for individual securities. Thus, using portfolios in cross-section regressions of average returns on betas reduces the critical errors in variables problem. Grouping, however, shrinks the range of betas and reduces statistical power. To mitigate this problem, researchers sort securities on beta when forming portfolios; the first portfolio contains securities with the lowest betas, and so on, up to the last portfolio with the highest beta assets. This sorting procedure is now standard in empirical tests.

Fama and MacBeth (1973) propose a method for addressing the inference problem caused by correlation of the residuals in cross-section regressions. Instead of estimating a single cross-section regression of average monthly returns on betas, they estimate month-by-month cross-section regressions of monthly returns on betas. The times-series means of the monthly slopes and intercepts, along with the standard errors of the means, are then used to test whether the average premium for beta is positive and whether the average return on assets uncorrelated with the market is equal to the average risk-free interest rate. In this approach, the standard errors of the average intercept and slope are determined by the month-to-month variation in the regression coefficients, which fully captures the effects of residual correlation on variation in the regression coefficients, but sidesteps the problem of actually estimating the correlations. The residual correlations are, in effect, captured via repeated sampling of the regression coefficients. This approach also becomes standard in the literature.

Jensen (1968) was the first to note that the Sharpe-Lintner version of the

[4] Formally, if x_{ip}, $i = 1, \ldots, N$, are the weights for assets in some portfolio p, the expected return and market beta for the portfolio are related to the expected returns and betas of assets as

$$E(R_p) = \sum_{i=1}^{N} x_{ip}E(R_i), \text{ and } \beta_{pM} = \sum_{i=1}^{N} x_{ip}\beta_{pM}.$$

Thus, the CAPM relation between expected return and beta,

$$E(R_i) = E(R_f) + [E(R_M) - E(R_f)]\beta_{iM},$$

holds when asset i is a portfolio, as well as when i is an individual security.

relation between expected return and market beta also implies a time-series regression test. The Sharpe-Lintner CAPM says that the expected value of an asset's excess return (the asset's return minus the risk-free interest rate, $R_{it} - R_{ft}$) is completely explained by its expected CAPM risk premium (its beta times the expected value of $R_{Mt} - R_{ft}$). This implies that "Jensen's alpha," the intercept term in the time-series regression,

$$\text{(Time-Series Regression)} \quad R_{it} - R_{ft} = \alpha_i + \beta_{iM}(R_{Mt} - R_{ft}) + \varepsilon_{it},$$

is zero for each asset.

The early tests firmly reject the Sharpe-Lintner version of the CAPM. There is a positive relation between beta and average return, but it is too "flat." Recall that, in cross-section regressions, the Sharpe-Lintner model predicts that the intercept is the risk-free rate and the coefficient on beta is the expected market return in excess of the risk-free rate, $E(R_M) - R_f$. The regressions consistently find that the intercept is greater than the average risk-free rate (typically proxied as the return on a one-month Treasury bill), and the coefficient on beta is less than the average excess market return (proxied as the average return on a portfolio of U.S. common stocks minus the Treasury bill rate). This is true in the early tests, such as Douglas (1968), Black, Jensen and Scholes (1972), Miller and Scholes (1972), Blume and Friend (1973) and Fama and MacBeth (1973), as well as in more recent cross-section regression tests, like Fama and French (1992).

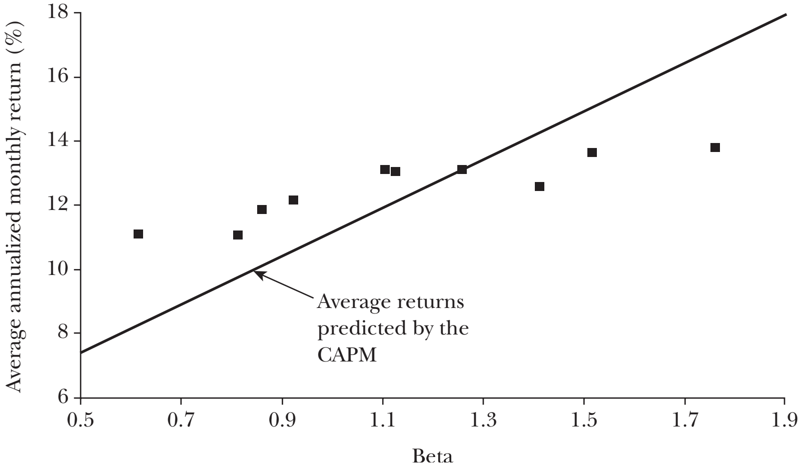
The evidence that the relation between beta and average return is too flat is confirmed in time-series tests, such as Friend and Blume (1970), Black, Jensen and Scholes (1972) and Stambaugh (1982). The intercepts in time-series regressions of excess asset returns on the excess market return are positive for assets with low betas and negative for assets with high betas.

Figure 2 provides an updated example of the evidence. In December of each year, we estimate a preranking beta for every NYSE (1928–2003), AMEX (1963–2003) and NASDAQ (1972–2003) stock in the CRSP (Center for Research in Security Prices of the University of Chicago) database, using two to five years (as available) of prior monthly returns.[5] We then form ten value-weight portfolios based on these preranking betas and compute their returns for the next twelve months. We repeat this process for each year from 1928 to 2003. The result is 912 monthly returns on ten beta-sorted portfolios. Figure 2 plots each portfolio's average return against its postranking beta, estimated by regressing its monthly returns for 1928–2003 on the return on the CRSP value-weight portfolio of U.S. common stocks.

The Sharpe-Lintner CAPM predicts that the portfolios plot along a straight

[5] To be included in the sample for year t, a security must have market equity data (price times shares outstanding) for December of $t - 1$, and CRSP must classify it as ordinary common equity. Thus, we exclude securities such as American Depository Receipts (ADRs) and Real Estate Investment Trusts (REITs).

Figure 2
Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on Prior Beta, 1928–2003



line, with an intercept equal to the risk-free rate, R_f, and a slope equal to the expected excess return on the market, $E(R_M) - R_f$. We use the average one-month Treasury bill rate and the average excess CRSP market return for 1928–2003 to estimate the predicted line in Figure 2. Confirming earlier evidence, the relation between beta and average return for the ten portfolios is much flatter than the Sharpe-Lintner CAPM predicts. The returns on the low beta portfolios are too high, and the returns on the high beta portfolios are too low. For example, the predicted return on the portfolio with the lowest beta is 8.3 percent per year; the actual return is 11.1 percent. The predicted return on the portfolio with the highest beta is 16.8 percent per year; the actual is 13.7 percent.

Although the observed premium per unit of beta is lower than the Sharpe-Lintner model predicts, the relation between average return and beta in Figure 2 is roughly linear. This is consistent with the Black version of the CAPM, which predicts only that the beta premium is positive. Even this less restrictive model, however, eventually succumbs to the data.

Testing Whether Market Betas Explain Expected Returns

The Sharpe-Lintner and Black versions of the CAPM share the prediction that the market portfolio is mean-variance-efficient. This implies that differences in expected return across securities and portfolios are entirely explained by differences in market beta; other variables should add nothing to the explanation of expected return. This prediction plays a prominent role in tests of the CAPM. In the early work, the weapon of choice is cross-section regressions.

In the framework of Fama and MacBeth (1973), one simply adds predetermined explanatory variables to the month-by-month cross-section regressions of returns on beta. If all differences in expected return are explained by beta, the average slopes on the additional variables should not be reliably different from zero. Clearly, the trick in the cross-section regression approach is to choose specific additional variables likely to expose any problems of the CAPM prediction that, because the market portfolio is efficient, market betas suffice to explain expected asset returns.

For example, in Fama and MacBeth (1973) the additional variables are squared market betas (to test the prediction that the relation between expected return and beta is linear) and residual variances from regressions of returns on the market return (to test the prediction that market beta is the only measure of risk needed to explain expected returns). These variables do not add to the explanation of average returns provided by beta. Thus, the results of Fama and MacBeth (1973) are consistent with the hypothesis that their market proxy—an equal-weight portfolio of NYSE stocks—is on the minimum variance frontier.

The hypothesis that market betas completely explain expected returns can also be tested using time-series regressions. In the time-series regression described above (the excess return on asset i regressed on the excess market return), the intercept is the difference between the asset's average excess return and the excess return predicted by the Sharpe-Lintner model, that is, beta times the average excess market return. If the model holds, there is no way to group assets into portfolios whose intercepts are reliably different from zero. For example, the intercepts for a portfolio of stocks with high ratios of earnings to price and a portfolio of stocks with low earning-price ratios should both be zero. Thus, to test the hypothesis that market betas suffice to explain expected returns, one estimates the time-series regression for a set of assets (or portfolios) and then jointly tests the vector of regression intercepts against zero. The trick in this approach is to choose the left-hand-side assets (or portfolios) in a way likely to expose any shortcoming of the CAPM prediction that market betas suffice to explain expected asset returns.

In early applications, researchers use a variety of tests to determine whether the intercepts in a set of time-series regressions are all zero. The tests have the same asymptotic properties, but there is controversy about which has the best small sample properties. Gibbons, Ross and Shanken (1989) settle the debate by providing an F-test on the intercepts that has exact small-sample properties. They also show that the test has a simple economic interpretation. In effect, the test constructs a candidate for the tangency portfolio T in Figure 1 by optimally combining the market proxy and the left-hand-side assets of the time-series regressions. The estimator then tests whether the efficient set provided by the combination of this tangency portfolio and the risk-free asset is reliably superior to the one obtained by combining the risk-free asset with the market proxy alone. In other words, the Gibbons, Ross and Shanken statistic tests whether the market proxy is the tangency portfolio in the set of portfolios that can be constructed by combining the market portfolio with the specific assets used as dependent variables in the time-series regressions.

Enlightened by this insight of Gibbons, Ross and Shanken (1989), one can see a similar interpretation of the cross-section regression test of whether market betas suffice to explain expected returns. In this case, the test is whether the additional explanatory variables in a cross-section regression identify patterns in the returns on the left-hand-side assets that are not explained by the assets' market betas. This amounts to testing whether the market proxy is on the minimum variance frontier that can be constructed using the market proxy and the left-hand-side assets included in the tests.

An important lesson from this discussion is that time-series and cross-section regressions do not, strictly speaking, test the CAPM. What is literally tested is whether a specific proxy for the market portfolio (typically a portfolio of U.S. common stocks) is efficient in the set of portfolios that can be constructed from it and the left-hand-side assets used in the test. One might conclude from this that the CAPM has never been tested, and prospects for testing it are not good because 1) the set of left-hand-side assets does not include all marketable assets, and 2) data for the true market portfolio of all assets are likely beyond reach (Roll, 1977; more on this later). But this criticism can be leveled at tests of any economic model when the tests are less than exhaustive or when they use proxies for the variables called for by the model.

The bottom line from the early cross-section regression tests of the CAPM, such as Fama and MacBeth (1973), and the early time-series regression tests, like Gibbons (1982) and Stambaugh (1982), is that standard market proxies seem to be on the minimum variance frontier. That is, the central predictions of the Black version of the CAPM, that market betas suffice to explain expected returns and that the risk premium for beta is positive, seem to hold. But the more specific prediction of the Sharpe-Lintner CAPM that the premium per unit of beta is the expected market return minus the risk-free interest rate is consistently rejected.

The success of the Black version of the CAPM in early tests produced a consensus that the model is a good description of expected returns. These early results, coupled with the model's simplicity and intuitive appeal, pushed the CAPM to the forefront of finance.

Recent Tests

Starting in the late 1970s, empirical work appears that challenges even the Black version of the CAPM. Specifically, evidence mounts that much of the variation in expected return is unrelated to market beta.

The first blow is Basu's (1977) evidence that when common stocks are sorted on earnings-price ratios, future returns on high E/P stocks are higher than predicted by the CAPM. Banz (1981) documents a size effect: when stocks are sorted on market capitalization (price times shares outstanding), average returns on small stocks are higher than predicted by the CAPM. Bhandari (1988) finds that high debt-equity ratios (book value of debt over the market value of equity, a measure of leverage) are associated with returns that are too high relative to their market betas.

Finally, Statman (1980) and Rosenberg, Reid and Lanstein (1985) document that stocks with high book-to-market equity ratios (B/M, the ratio of the book value of a common stock to its market value) have high average returns that are not captured by their betas.

There is a theme in the contradictions of the CAPM summarized above. Ratios involving stock prices have information about expected returns missed by market betas. On reflection, this is not surprising. A stock's price depends not only on the expected cash flows it will provide, but also on the expected returns that discount expected cash flows back to the present. Thus, in principle, the cross-section of prices has information about the cross-section of expected returns. (A high expected return implies a high discount rate and a low price.) The cross-section of stock prices is, however, arbitrarily affected by differences in scale (or units). But with a judicious choice of scaling variable X, the ratio X/P can reveal differences in the cross-section of expected stock returns. Such ratios are thus prime candidates to expose shortcomings of asset pricing models—in the case of the CAPM, shortcomings of the prediction that market betas suffice to explain expected returns (Ball, 1978). The contradictions of the CAPM summarized above suggest that earnings-price, debt-equity and book-to-market ratios indeed play this role.

Fama and French (1992) update and synthesize the evidence on the empirical failures of the CAPM. Using the cross-section regression approach, they confirm that size, earnings-price, debt-equity and book-to-market ratios add to the explanation of expected stock returns provided by market beta. Fama and French (1996) reach the same conclusion using the time-series regression approach applied to portfolios of stocks sorted on price ratios. They also find that different price ratios have much the same information about expected returns. This is not surprising given that price is the common driving force in the price ratios, and the numerators are just scaling variables used to extract the information in price about expected returns.

Fama and French (1992) also confirm the evidence (Reinganum, 1981; Stambaugh, 1982; Lakonishok and Shapiro, 1986) that the relation between average return and beta for common stocks is even flatter after the sample periods used in the early empirical work on the CAPM. The estimate of the beta premium is, however, clouded by statistical uncertainty (a large standard error). Kothari, Shanken and Sloan (1995) try to resuscitate the Sharpe-Lintner CAPM by arguing that the weak relation between average return and beta is just a chance result. But the strong evidence that other variables capture variation in expected return missed by beta makes this argument irrelevant. If betas do not suffice to explain expected returns, the market portfolio is not efficient, and the CAPM is dead in its tracks. Evidence on the size of the market premium can neither save the model nor further doom it.

The synthesis of the evidence on the empirical problems of the CAPM provided by Fama and French (1992) serves as a catalyst, marking the point when it is generally acknowledged that the CAPM has potentially fatal problems. Research then turns to explanations.

One possibility is that the CAPM's problems are spurious, the result of data dredging—publication-hungry researchers scouring the data and unearthing contradictions that occur in specific samples as a result of chance. A standard response to this concern is to test for similar findings in other samples. Chan, Hamao and Lakonishok (1991) find a strong relation between book-to-market equity (B/M) and average return for Japanese stocks. Capaul, Rowley and Sharpe (1993) observe a similar B/M effect in four European stock markets and in Japan. Fama and French (1998) find that the price ratios that produce problems for the CAPM in U.S. data show up in the same way in the stock returns of twelve non-U.S. major markets, and they are present in emerging market returns. This evidence suggests that the contradictions of the CAPM associated with price ratios are not sample specific.

Explanations: Irrational Pricing or Risk

Among those who conclude that the empirical failures of the CAPM are fatal, two stories emerge. On one side are the behavioralists. Their view is based on evidence that stocks with high ratios of book value to market price are typically firms that have fallen on bad times, while low B/M is associated with growth firms (Lakonishok, Shleifer and Vishny, 1994; Fama and French, 1995). The behavioralists argue that sorting firms on book-to-market ratios exposes investor overreaction to good and bad times. Investors overextrapolate past performance, resulting in stock prices that are too high for growth (low B/M) firms and too low for distressed (high B/M, so-called value) firms. When the overreaction is eventually corrected, the result is high returns for value stocks and low returns for growth stocks. Proponents of this view include DeBondt and Thaler (1987), Lakonishok, Shleifer and Vishny (1994) and Haugen (1995).

The second story for explaining the empirical contradictions of the CAPM is that they point to the need for a more complicated asset pricing model. The CAPM is based on many unrealistic assumptions. For example, the assumption that investors care only about the mean and variance of one-period portfolio returns is extreme. It is reasonable that investors also care about how their portfolio return covaries with labor income and future investment opportunities, so a portfolio's return variance misses important dimensions of risk. If so, market beta is not a complete description of an asset's risk, and we should not be surprised to find that differences in expected return are not completely explained by differences in beta. In this view, the search should turn to asset pricing models that do a better job explaining average returns.

Merton's (1973) intertemporal capital asset pricing model (ICAPM) is a natural extension of the CAPM. The ICAPM begins with a different assumption about investor objectives. In the CAPM, investors care only about the wealth their portfolio produces at the end of the current period. In the ICAPM, investors are concerned not only with their end-of-period payoff, but also with the opportunities they will have to consume or invest the payoff. Thus, when choosing a portfolio at time $t - 1$, ICAPM investors consider how their wealth at t might vary with future *state variables*, including labor income, the prices of consumption goods and the nature of portfolio opportunities at t, and expectations about the labor income, consumption and investment opportunities to be available after t.

Like CAPM investors, ICAPM investors prefer high expected return and low return variance. But ICAPM investors are also concerned with the covariances of portfolio returns with state variables. As a result, optimal portfolios are "multifactor efficient," which means they have the largest possible expected returns, given their return variances and the covariances of their returns with the relevant state variables.

Fama (1996) shows that the ICAPM generalizes the logic of the CAPM. That is, if there is risk-free borrowing and lending or if short sales of risky assets are allowed, market clearing prices imply that the market portfolio is multifactor efficient. Moreover, multifactor efficiency implies a relation between expected return and beta risks, but it requires additional betas, along with a market beta, to explain expected returns.

An ideal implementation of the ICAPM would specify the state variables that affect expected returns. Fama and French (1993) take a more indirect approach, perhaps more in the spirit of Ross's (1976) arbitrage pricing theory. They argue that though size and book-to-market equity are not themselves state variables, the higher average returns on small stocks and high book-to-market stocks reflect unidentified state variables that produce undiversifiable risks (covariances) in returns that are not captured by the market return and are priced separately from market betas. In support of this claim, they show that the returns on the stocks of small firms covary more with one another than with returns on the stocks of large firms, and returns on high book-to-market (value) stocks covary more with one another than with returns on low book-to-market (growth) stocks. Fama and French (1995) show that there are similar size and book-to-market patterns in the covariation of fundamentals like earnings and sales.

Based on this evidence, Fama and French (1993, 1996) propose a three-factor model for expected returns,

$$\text{(Three-Factor Model)} \quad E(R_{it}) - R_{ft} = \beta_{iM}[E(R_{Mt}) - R_{ft}] + \beta_{is}E(SMB_t) + \beta_{ih}E(HML_t).$$

In this equation, SMB_t (small minus big) is the difference between the returns on diversified portfolios of small and big stocks, HML_t (high minus low) is the difference between the returns on diversified portfolios of high and low B/M stocks, and the betas are slopes in the multiple regression of $R_{it} - R_{ft}$ on $R_{Mt} - R_{ft}$, SMB_t and HML_t.

For perspective, the average value of the market premium $R_{Mt} - R_{ft}$ for 1927–2003 is 8.3 percent per year, which is 3.5 standard errors from zero. The average values of SMB_t, and HML_t are 3.6 percent and 5.0 percent per year, and they are 2.1 and 3.1 standard errors from zero. All three premiums are volatile, with annual standard deviations of 21.0 percent $(R_{Mt} - R_{ft})$, 14.6 percent (SMB_t) and 14.2 percent (HML_t) per year. Although the average values of the premiums are large, high volatility implies substantial uncertainty about the true expected premiums.

One implication of the expected return equation of the three-factor model is that the intercept α_i in the time-series regression,

$$R_{it} - R_{ft} = \alpha_i + \beta_{iM}(R_{Mt} - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \varepsilon_{it},$$

is zero for all assets i. Using this criterion, Fama and French (1993, 1996) find that the model captures much of the variation in average return for portfolios formed on size, book-to-market equity and other price ratios that cause problems for the CAPM. Fama and French (1998) show that an international version of the model performs better than an international CAPM in describing average returns on portfolios formed on scaled price variables for stocks in 13 major markets.

The three-factor model is now widely used in empirical research that requires a model of expected returns. Estimates of α_i from the time-series regression above are used to calibrate how rapidly stock prices respond to new information (for example, Loughran and Ritter, 1995; Mitchell and Stafford, 2000). They are also used to measure the special information of portfolio managers, for example, in Carhart's (1997) study of mutual fund performance. Among practitioners like Ibbotson Associates, the model is offered as an alternative to the CAPM for estimating the cost of equity capital.

From a theoretical perspective, the main shortcoming of the three-factor model is its empirical motivation. The small-minus-big (SMB) and high-minus-low (HML) explanatory returns are not motivated by predictions about state variables of concern to investors. Instead they are brute force constructs meant to capture the patterns uncovered by previous work on how average stock returns vary with size and the book-to-market equity ratio.

But this concern is not fatal. The ICAPM does not require that the additional portfolios used along with the market portfolio to explain expected returns "mimic" the relevant state variables. In both the ICAPM and the arbitrage pricing theory, it suffices that the additional portfolios are well diversified (in the terminology of Fama, 1996, they are multifactor minimum variance) and that they are sufficiently different from the market portfolio to capture covariation in returns and variation in expected returns missed by the market portfolio. Thus, adding diversified portfolios that capture covariation in returns and variation in average returns left unexplained by the market is in the spirit of both the ICAPM and the Ross's arbitrage pricing theory.

The behavioralists are not impressed by the evidence for a risk-based explanation of the failures of the CAPM. They typically concede that the three-factor model captures covariation in returns missed by the market return and that it picks up much of the size and value effects in average returns left unexplained by the CAPM. But their view is that the average return premium associated with the model's book-to-market factor—which does the heavy lifting in the improvements to the CAPM—is itself the result of investor overreaction that happens to be correlated across firms in a way that just looks like a risk story. In short, in the behavioral view, the market tries to set CAPM prices, and violations of the CAPM are due to mispricing.

The conflict between the behavioral irrational pricing story and the rational risk story for the empirical failures of the CAPM leaves us at a timeworn impasse. Fama (1970) emphasizes that the hypothesis that prices properly reflect available information must be tested in the context of a model of expected returns, like the CAPM. Intuitively, to test whether prices are rational, one must take a stand on what the market is trying to do in setting prices—that is, what is risk and what is the relation between expected return and risk? When tests reject the CAPM, one cannot say whether the problem is its assumption that prices are rational (the behavioral view) or violations of other assumptions that are also necessary to produce the CAPM (our position).

Fortunately, for some applications, the way one uses the three-factor model does not depend on one's view about whether its average return premiums are the rational result of underlying state variable risks, the result of irrational investor behavior or sample specific results of chance. For example, when measuring the response of stock prices to new information or when evaluating the performance of managed portfolios, one wants to account for known patterns in returns and average returns for the period examined, whatever their source. Similarly, when estimating the cost of equity capital, one might be unconcerned with whether expected return premiums are rational or irrational since they are in either case part of the opportunity cost of equity capital (Stein, 1996). But the cost of capital is forward looking, so if the premiums are sample specific they are irrelevant.

The three-factor model is hardly a panacea. Its most serious problem is the momentum effect of Jegadeesh and Titman (1993). Stocks that do well relative to the market over the last three to twelve months tend to continue to do well for the next few months, and stocks that do poorly continue to do poorly. This momentum effect is distinct from the value effect captured by book-to-market equity and other price ratios. Moreover, the momentum effect is left unexplained by the three-factor model, as well as by the CAPM. Following Carhart (1997), one response is to add a momentum factor (the difference between the returns on diversified portfolios of short-term winners and losers) to the three-factor model. This step is again legitimate in applications where the goal is to abstract from known patterns in average returns to uncover information-specific or manager-specific effects. But since the momentum effect is short-lived, it is largely irrelevant for estimates of the cost of equity capital.

Another strand of research points to problems in both the three-factor model and the CAPM. Frankel and Lee (1998), Dechow, Hutton and Sloan (1999), Piotroski (2000) and others show that in portfolios formed on price ratios like book-to-market equity, stocks with higher expected cash flows have higher average returns that are not captured by the three-factor model or the CAPM. The authors interpret their results as evidence that stock prices are irrational, in the sense that they do not reflect available information about expected profitability.

In truth, however, one can't tell whether the problem is bad pricing or a bad asset pricing model. A stock's price can always be expressed as the present value of expected future cash flows discounted at the expected return on the stock (Campbell and Shiller, 1989; Vuolteenaho, 2002). It follows that if two stocks have the same price, the one with higher expected cash flows must have a higher expected return. This holds true whether pricing is rational or irrational. Thus, when one observes a positive relation between expected cash flows and expected returns that is left unexplained by the CAPM or the three-factor model, one can't tell whether it is the result of irrational pricing or a misspecified asset pricing model.

The Market Proxy Problem

Roll (1977) argues that the CAPM has never been tested and probably never will be. The problem is that the market portfolio at the heart of the model is theoretically and empirically elusive. It is not theoretically clear which assets (for example, human capital) can legitimately be excluded from the market portfolio, and data availability substantially limits the assets that are included. As a result, tests of the CAPM are forced to use proxies for the market portfolio, in effect testing whether the proxies are on the minimum variance frontier. Roll argues that because the tests use proxies, not the true market portfolio, we learn nothing about the CAPM.

We are more pragmatic. The relation between expected return and market beta of the CAPM is just the minimum variance condition that holds in any efficient portfolio, applied to the market portfolio. Thus, if we can find a market proxy that is on the minimum variance frontier, it can be used to describe differences in expected returns, and we would be happy to use it for this purpose. The strong rejections of the CAPM described above, however, say that researchers have not uncovered a reasonable market proxy that is close to the minimum variance frontier. If researchers are constrained to reasonable proxies, we doubt they ever will.

Our pessimism is fueled by several empirical results. Stambaugh (1982) tests the CAPM using a range of market portfolios that include, in addition to U.S. common stocks, corporate and government bonds, preferred stocks, real estate and other consumer durables. He finds that tests of the CAPM are not sensitive to expanding the market proxy beyond common stocks, basically because the volatility of expanded market returns is dominated by the volatility of stock returns.

One need not be convinced by Stambaugh's (1982) results since his market proxies are limited to U.S. assets. If international capital markets are open and asset prices conform to an international version of the CAPM, the market portfolio should include international assets. Fama and French (1998) find, however, that betas for a global stock market portfolio cannot explain the high average returns observed around the world on stocks with high book-to-market or high earnings-price ratios.

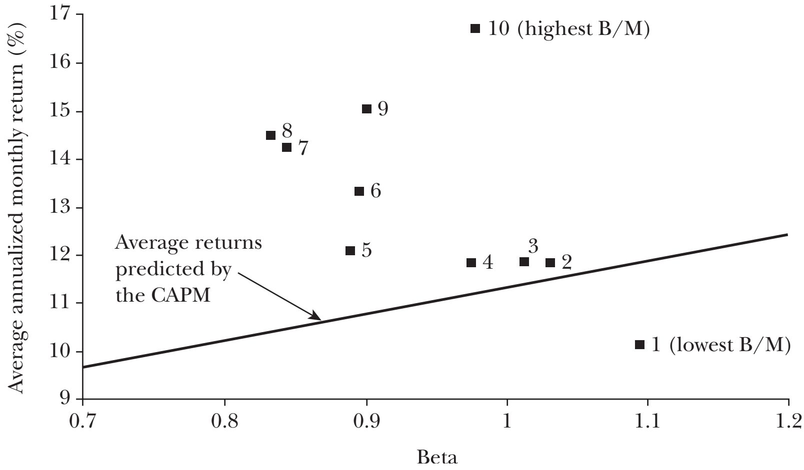
A major problem for the CAPM is that portfolios formed by sorting stocks on price ratios produce a wide range of average returns, but the average returns are not positively related to market betas (Lakonishok, Shleifer and Vishny, 1994; Fama and French, 1996, 1998). The problem is illustrated in Figure 3, which shows average returns and betas (calculated with respect to the CRSP value-weight portfolio of NYSE, AMEX and NASDAQ stocks) for July 1963 to December 2003 for ten portfolios of U.S. stocks formed annually on sorted values of the book-to-market equity ratio (B/M).[6]

Average returns on the B/M portfolios increase almost monotonically, from 10.1 percent per year for the lowest B/M group (portfolio 1) to an impressive 16.7 percent for the highest (portfolio 10). But the positive relation between beta and average return predicted by the CAPM is notably absent. For example, the portfolio with the lowest book-to-market ratio has the highest beta but the lowest average return. The estimated beta for the portfolio with the highest book-to-market ratio and the highest average return is only 0.98. With an average annualized value of the riskfree interest rate, R_f, of 5.8 percent and an average annualized market premium, $R_M - R_f$, of 11.3 percent, the Sharpe-Lintner CAPM predicts an average return of 11.8 percent for the lowest B/M portfolio and 11.2 percent for the highest, far from the observed values, 10.1 and 16.7 percent. For the Sharpe-Lintner model to "work" on these portfolios, their market betas must change dramatically, from 1.09 to 0.78 for the lowest B/M portfolio and from 0.98 to 1.98 for the highest. We judge it unlikely that alternative proxies for the market portfolio will produce betas and a market premium that can explain the average returns on these portfolios.

It is always possible that researchers will redeem the CAPM by finding a reasonable proxy for the market portfolio that is on the minimum variance frontier. We emphasize, however, that this possibility cannot be used to justify the way the CAPM is currently applied. The problem is that applications typically use the same

[6] Stock return data are from CRSP, and book equity data are from Compustat and the Moody's Industrials, Transportation, Utilities and Financials manuals. Stocks are allocated to ten portfolios at the end of June of each year t (1963 to 2003) using the ratio of book equity for the fiscal year ending in calendar year $t - 1$, divided by market equity at the end of December of $t - 1$. Book equity is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Depending on availability, we use the redemption, liquidation or par value (in that order) to estimate the book value of preferred stock. Stockholders' equity is the value reported by Moody's or Compustat, if it is available. If not, we measure stockholders' equity as the book value of common equity plus the par value of preferred stock or the book value of assets minus total liabilities (in that order). The portfolios for year t include NYSE (1963–2003), AMEX (1963–2003) and NASDAQ (1972–2003) stocks with positive book equity in $t - 1$ and market equity (from CRSP) for December of $t - 1$ and June of t. The portfolios exclude securities CRSP does not classify as ordinary common equity. The breakpoints for year t use only securities that are on the NYSE in June of year t.

Figure 3
Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on B/M, 1963–2003



market proxies, like the value-weight portfolio of U.S. stocks, that lead to rejections of the model in empirical tests. The contradictions of the CAPM observed when such proxies are used in tests of the model show up as bad estimates of expected returns in applications; for example, estimates of the cost of equity capital that are too low (relative to historical average returns) for small stocks and for stocks with high book-to-market equity ratios. In short, if a market proxy does not work in tests of the CAPM, it does not work in applications.

Conclusions

The version of the CAPM developed by Sharpe (1964) and Lintner (1965) has never been an empirical success. In the early empirical work, the Black (1972) version of the model, which can accommodate a flatter tradeoff of average return for market beta, has some success. But in the late 1970s, research begins to uncover variables like size, various price ratios and momentum that add to the explanation of average returns provided by beta. The problems are serious enough to invalidate most applications of the CAPM.

For example, finance textbooks often recommend using the Sharpe-Lintner CAPM risk-return relation to estimate the cost of equity capital. The prescription is to estimate a stock's market beta and combine it with the risk-free interest rate and the average market risk premium to produce an estimate of the cost of equity. The typical market portfolio in these exercises includes just U.S. common stocks. But empirical work, old and new, tells us that the relation between beta and average return is flatter than predicted by the Sharpe-Lintner version of the CAPM. As a result, CAPM estimates of the cost of equity for high beta stocks are too high (relative to historical average returns) and estimates for low beta stocks are too low (Friend and Blume, 1970). Similarly, if the high average returns on value stocks (with high book-to-market ratios) imply high expected returns, CAPM cost of equity estimates for such stocks are too low.[7]

The CAPM is also often used to measure the performance of mutual funds and other managed portfolios. The approach, dating to Jensen (1968), is to estimate the CAPM time-series regression for a portfolio and use the intercept (Jensen's alpha) to measure abnormal performance. The problem is that, because of the empirical failings of the CAPM, even passively managed stock portfolios produce abnormal returns if their investment strategies involve tilts toward CAPM problems (Elton, Gruber, Das and Hlavka, 1993). For example, funds that concentrate on low beta stocks, small stocks or value stocks will tend to produce positive abnormal returns relative to the predictions of the Sharpe-Lintner CAPM, even when the fund managers have no special talent for picking winners.

The CAPM, like Markowitz's (1952, 1959) portfolio model on which it is built, is nevertheless a theoretical tour de force. We continue to teach the CAPM as an introduction to the fundamental concepts of portfolio theory and asset pricing, to be built on by more complicated models like Merton's (1973) ICAPM. But we also warn students that despite its seductive simplicity, the CAPM's empirical problems probably invalidate its use in applications.

■ *We gratefully acknowledge the comments of John Cochrane, George Constantinides, Richard Leftwich, Andrei Shleifer, René Stulz and Timothy Taylor.*

[7] The problems are compounded by the large standard errors of estimates of the market premium and of betas for individual stocks, which probably suffice to make CAPM estimates of the cost of equity rather meaningless, even if the CAPM holds (Fama and French, 1997; Pastor and Stambaugh, 1999). For example, using the U.S. Treasury bill rate as the risk-free interest rate and the CRSP value-weight portfolio of publicly traded U.S. common stocks, the average value of the equity premium $R_{Mt} - R_{ft}$ for 1927–2003 is 8.3 percent per year, with a standard error of 2.4 percent. The two standard error range thus runs from 3.5 percent to 13.1 percent, which is sufficient to make most projects appear either profitable or unprofitable. This problem is, however, hardly special to the CAPM. For example, expected returns in all versions of Merton's (1973) ICAPM include a market beta and the expected market premium. Also, as noted earlier the expected values of the size and book-to-market premiums in the Fama-French three-factor model are also estimated with substantial error.

References

Ball, Ray. 1978. "Anomalies in Relationships Between Securities' Yields and Yield-Surrogates." *Journal of Financial Economics.* 6:2, pp. 103–26.

Banz, Rolf W. 1981. "The Relationship Between Return and Market Value of Common Stocks." *Journal of Financial Economics.* 9:1, pp. 3–18.

Basu, Sanjay. 1977. "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis." *Journal of Finance.* 12:3, pp. 129–56.

Bhandari, Laxmi Chand. 1988. "Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence." *Journal of Finance.* 43:2, pp. 507–28.

Black, Fischer. 1972. "Capital Market Equilibrium with Restricted Borrowing." *Journal of Business.* 45:3, pp. 444–54.

Black, Fischer, Michael C. Jensen and Myron Scholes. 1972. "The Capital Asset Pricing Model: Some Empirical Tests," in *Studies in the Theory of Capital Markets.* Michael C. Jensen, ed. New York: Praeger, pp. 79–121.

Blume, Marshall. 1970. "Portfolio Theory: A Step Towards its Practical Application." *Journal of Business.* 43:2, pp. 152–74.

Blume, Marshall and Irwin Friend. 1973. "A New Look at the Capital Asset Pricing Model." *Journal of Finance.* 28:1, pp. 19–33.

Campbell, John Y. and Robert J. Shiller. 1989. "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors." *Review of Financial Studies.* 1:3, pp. 195–228.

Capaul, Carlo, Ian Rowley and William F. Sharpe. 1993. "International Value and Growth Stock Returns." *Financial Analysts Journal.* January/February, 49, pp. 27–36.

Carhart, Mark M. 1997. "On Persistence in Mutual Fund Performance." *Journal of Finance.* 52:1, pp. 57–82.

Chan, Louis K.C., Yasushi Hamao and Josef Lakonishok. 1991. "Fundamentals and Stock Returns in Japan." *Journal of Finance.* 46:5, pp. 1739–789.

DeBondt, Werner F. M. and Richard H. Thaler. 1987. "Further Evidence on Investor Overreaction and Stock Market Seasonality." *Journal of Finance.* 42:3, pp. 557–81.

Dechow, Patricia M., Amy P. Hutton and Richard G. Sloan. 1999. "An Empirical Assessment of the Residual Income Valuation Model." *Journal of Accounting and Economics.* 26:1, pp. 1–34.

Douglas, George W. 1968. *Risk in the Equity Markets: An Empirical Appraisal of Market Efficiency.* Ann Arbor, Michigan: University Microfilms, Inc.

Elton, Edwin J., Martin J. Gruber, Sanjiv Das and Matt Hlavka. 1993. "Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios." *Review of Financial Studies.* 6:1, pp. 1–22.

Fama, Eugene F. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance.* 25:2, pp. 383–417.

Fama, Eugene F. 1996. "Multifactor Portfolio Efficiency and Multifactor Asset Pricing." *Journal of Financial and Quantitative Analysis.* 31:4, pp. 441–65.

Fama, Eugene F. and Kenneth R. French. 1992. "The Cross-Section of Expected Stock Returns." *Journal of Finance.* 47:2, pp. 427–65.

Fama, Eugene F. and Kenneth R. French. 1993. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics.* 33:1, pp. 3–56.

Fama, Eugene F. and Kenneth R. French. 1995. "Size and Book-to-Market Factors in Earnings and Returns." *Journal of Finance.* 50:1, pp. 131–55.

Fama, Eugene F. and Kenneth R. French. 1996. "Multifactor Explanations of Asset Pricing Anomalies." *Journal of Finance.* 51:1, pp. 55–84.

Fama, Eugene F. and Kenneth R. French. 1997. "Industry Costs of Equity." *Journal of Financial Economics.* 43:2 pp. 153–93.

Fama, Eugene F. and Kenneth R. French. 1998. "Value Versus Growth: The International Evidence." *Journal of Finance.* 53:6, pp. 1975–999.

Fama, Eugene F. and James D. MacBeth. 1973. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy.* 81:3, pp. 607–36.

Frankel, Richard and Charles M.C. Lee. 1998. "Accounting Valuation, Market Expectation, and Cross-Sectional Stock Returns." *Journal of Accounting and Economics.* 25:3 pp. 283–319.

Friend, Irwin and Marshall Blume. 1970. "Measurement of Portfolio Performance under Uncertainty." *American Economic Review.* 60:4, pp. 607–36.

Gibbons, Michael R. 1982. "Multivariate Tests of Financial Models: A New Approach." *Journal of Financial Economics.* 10:1, pp. 3–27.

Gibbons, Michael R., Stephen A. Ross and Jay Shanken. 1989. "A Test of the Efficiency of a Given Portfolio." *Econometrica.* 57:5, pp. 1121–152.

Haugen, Robert. 1995. *The New Finance: The*

Case against Efficient Markets. Englewood Cliffs, N.J.: Prentice Hall.

Jegadeesh, Narasimhan and Sheridan Titman. 1993. "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency." *Journal of Finance.* 48:1, pp. 65–91.

Jensen, Michael C. 1968. "The Performance of Mutual Funds in the Period 1945–1964." *Journal of Finance.* 23:2, pp. 389–416.

Kothari, S. P., Jay Shanken and Richard G. Sloan. 1995. "Another Look at the Cross-Section of Expected Stock Returns." *Journal of Finance.* 50:1, pp. 185–224.

Lakonishok, Josef and Alan C. Shapiro. 1986. Systemaitc Risk, Total Risk, and Size as Determinants of Stock Market Returns." *Journal of Banking and Finance.* 10:1, pp. 115–32.

Lakonishok, Josef, Andrei Shleifer and Robert W. Vishny. 1994. "Contrarian Investment, Extrapolation, and Risk." *Journal of Finance.* 49:5, pp. 1541–578.

Lintner, John. 1965. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economics and Statistics.* 47:1, pp. 13–37.

Loughran, Tim and Jay. R. Ritter. 1995. "The New Issues Puzzle." *Journal of Finance.* 50:1, pp. 23–51.

Markowitz, Harry. 1952. "Portfolio Selection." *Journal of Finance.* 7:1, pp. 77–99.

Markowitz, Harry. 1959. *Portfolio Selection: Efficient Diversification of Investments.* Cowles Foundation Monograph No. 16. New York: John Wiley & Sons, Inc.

Merton, Robert C. 1973. "An Intertemporal Capital Asset Pricing Model." *Econometrica.* 41:5, pp. 867–87.

Miller, Merton and Myron Scholes. 1972. "Rates of Return in Relation to Risk: A Reexamination of Some Recent Findings," in *Studies in the Theory of Capital Markets.* Michael C. Jensen, ed. New York: Praeger, pp. 47–78.

Mitchell, Mark L. and Erik Stafford. 2000. "Managerial Decisions and Long-Term Stock Price Performance." *Journal of Business.* 73:3, pp. 287–329.

Pastor, Lubos and Robert F. Stambaugh. 1999. "Costs of Equity Capital and Model Mispricing." *Journal of Finance.* 54:1, pp. 67–121.

Piotroski, Joseph D. 2000. "Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers." *Journal of Accounting Research.* 38:Supplement, pp. 1–51.

Reinganum, Marc R. 1981. "A New Empirical Perspective on the CAPM." *Journal of Financial and Quantitative Analysis.* 16:4, pp. 439–62.

Roll, Richard. 1977. "A Critique of the Asset Pricing Theory's Tests' Part I: On Past and Potential Testability of the Theory." *Journal of Financial Economics.* 4:2, pp. 129–76.

Rosenberg, Barr, Kenneth Reid and Ronald Lanstein. 1985. "Persuasive Evidence of Market Inefficiency." *Journal of Portfolio Management.* Spring, 11, pp. 9–17.

Ross, Stephen A. 1976. "The Arbitrage Theory of Capital Asset Pricing." *Journal of Economic Theory.* 13:3, pp. 341–60.

Sharpe, William F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." *Journal of Finance.* 19:3, pp. 425–42.

Stambaugh, Robert F. 1982. "On The Exclusion of Assets from Tests of the Two-Parameter Model: A Sensitivity Analysis." *Journal of Financial Economics.* 10:3, pp. 237–68.

Stattman, Dennis. 1980. "Book Values and Stock Returns." *The Chicago MBA: A Journal of Selected Papers.* 4, pp. 25–45.

Stein, Jeremy. 1996. "Rational Capital Budgeting in an Irrational World." *Journal of Business.* 69:4, pp. 429–55.

Tobin, James. 1958. "Liquidity Preference as Behavior Toward Risk." *Review of Economic Studies.* 25:2, pp. 65–86.

Vuolteenaho, Tuomo. 2002. "What Drives Firm Level Stock Returns?" *Journal of Finance.* 57:1, pp. 233–64.

THE JOURNAL OF FINANCE • VOL. LVII, NO. 2 • APRIL 2002

The Equity Premium

EUGENE F. FAMA and KENNETH R. FRENCH*

ABSTRACT

We estimate the equity premium using dividend and earnings growth rates to measure the expected rate of capital gain. Our estimates for 1951 to 2000, 2.55 percent and 4.32 percent, are much lower than the equity premium produced by the average stock return, 7.43 percent. Our evidence suggests that the high average return for 1951 to 2000 is due to a decline in discount rates that produces a large unexpected capital gain. Our main conclusion is that the average stock return of the last half-century is a lot higher than expected.

THE EQUITY PREMIUM—the difference between the expected return on the market portfolio of common stocks and the risk-free interest rate—is important in portfolio allocation decisions, estimates of the cost of capital, the debate about the advantages of investing Social Security funds in stocks, and many other applications. The average return on a broad portfolio of stocks is typically used to estimate the expected market return. The average real return for 1872 to 2000 on the S&P index (a common proxy for the market portfolio, also used here) is 8.81 percent per year. The average real return on six-month commercial paper (a proxy for the risk-free interest rate) is 3.24 percent. This large spread (5.57 percent) between the average stock return and the interest rate is the source of the so-called equity premium puzzle: Stock returns seem too high given the observed volatility of consumption (Mehra and Prescott (1985)).

We use fundamentals (dividends and earnings) to estimate the expected stock return. Along with other evidence, the expected return estimates from fundamentals help us judge whether the realized average return is high or low relative to the expected value.

The logic of our approach is straightforward. The average stock return is the average dividend yield plus the average rate of capital gain:

$$A(R_t) = A(D_t/P_{t-1}) + A(GP_t), \tag{1}$$

* Fama is from the University of Chicago and French is from Dartmouth College. The comments of John Campbell, John Cochrane, Kent Daniel, John Heaton, Jay Ritter, Andrei Shleifer, Rex Sinquefield, Tuomo Vuolteenaho, Paul Zarowin, and seminar participants at Boston College, Dartmouth College, the NBER, Purdue University, the University of Chicago, and Washington University have been helpful. Richard Green (the editor) and the two referees get special thanks.

where D_t is the dividend for year t, P_{t-1} is the price at the end of year $t - 1$, $GP_t = (P_t - P_{t-1})/P_{t-1}$ is the rate of capital gain, and $A(\ )$ indicates an average value. (Throughout the paper, we refer to D_t/P_{t-1} as the dividend yield and D_t/P_t is the dividend–price ratio. Similarly, Y_t/P_{t-1}, the ratio of earnings for year t to price at the end of year $t - 1$, is the earnings yield and Y_t/P_t is the earnings–price ratio.)

Suppose the dividend–price ratio, D_t/P_t, is stationary (mean reverting). Stationarity implies that if the sample period is long, the compound rate of dividend growth approaches the compound rate of capital gain. Thus, an alternative estimate of the expected stock return is

$$A(RD_t) = A(D_t/P_{t-1}) + A(GD_t), \tag{2}$$

where $GD_t = (D_t - D_{t-1})/D_{t-1}$ is the growth rate of dividends. We call (2) the dividend growth model.

The logic that leads to (2) applies to any variable that is cointegrated with the stock price. For example, the dividend–price ratio may be nonstationary because firms move away from dividends toward share repurchases as a way of returning earnings to stockholders. But if the earnings–price ratio, Y_t/P_t, is stationary, the average growth rate of earnings, $A(GY_t) = A((Y_t - Y_{t-1})/Y_{t-1})$, is an alternative estimate of the expected rate of capital gain. And $A(GY_t)$ can be combined with the average dividend yield to produce another estimate of the expected stock return:

$$A(RY_t) = A(D_t/P_{t-1}) + A(GY_t). \tag{3}$$

We call (3) the earnings growth model.[1]

We should be clear about the expected return concept targeted by (1), (2), and (3). D_t/P_t and Y_t/P_t vary through time because of variation in the conditional (point-in-time) expected stock return and the conditional expected growth rates of dividends and earnings (see, e.g., Campbell and Shiller (1989)). But if the stock return and the growth rates are stationary (they have constant unconditional means), D_t/P_t and Y_t/P_t are stationary. Then, like the average return (1), the dividend and earnings growth models (2) and (3) provide estimates of the unconditional expected stock return. In short, the focus of the paper is estimates of the unconditional expected stock return.

The estimate of the expected real equity premium for 1872 to 2000 from the dividend growth model (2) is 3.54 percent per year. The estimate from the average stock return, 5.57 percent, is almost 60 percent higher. The difference between the two is largely due to the last 50 years. The equity premium for 1872 to 1950 from the dividend growth model, 4.17 percent per year, is close to the estimate from the average return, 4.40 percent. In con-

[1] Motivated by the model in Lettau and Ludvigson (2001), one can argue that if the ratio of consumption to stock market wealth is stationary, the average growth rate of consumption is another estimate of the expected rate of capital gain. We leave this path to future work.

trast, the equity premium for 1951 to 2000 produced by the average return, 7.43 percent per year, is almost three times the estimate, 2.55 percent, from (2). The estimate of the expected real equity premium for 1951 to 2000 from the earnings growth model (3), 4.32 percent per year, is larger than the estimate from the dividend growth model (2). But the earnings growth estimate is still less than 60 percent of the estimate from the average return.

Three types of evidence suggest that the lower equity premium estimates for 1951 to 2000 from fundamentals are closer to the expected premium. (a) The estimates from fundamentals are more precise. For example, the standard error of the estimate from the dividend growth model is less than half the standard error of the estimate from the average return. (b) The Sharpe ratio for the equity premium from the average stock return for 1951 to 2000 is just about double that for 1872 to 1950. In contrast, the equity premium from the dividend growth model has a similar Sharpe ratio for 1872 to 1950 and 1951 to 2000. (c) Most important, valuation theory specifies relations among the book-to-market ratio, the return on investment, and the cost of equity capital (the expected stock return). The estimates of the expected stock return for 1951 to 2000 from the dividend and earnings growth models line up with other fundamentals in the way valuation theory predicts. But the book-to-market ratio and the return on investment suggest that the expected return estimate from the average stock return is too high.

Our motivation for the dividend growth model (2) is simpler and more general, but (2) can be viewed as the expected stock return estimate of the Gordon (1962) model. Our work is thus in the spirit of a growing literature that uses valuation models to estimate expected returns (e.g., Blanchard (1993), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001)). Claus and Thomas and Gebhardt, Lee, and Swaminathan use forecasts by security analysts to estimate expected cash flows. Their analyst forecasts cover short periods (1985 to 1998 and 1979 to 1995). We use realized dividends and earnings from 1872 to 2000. This 129-year period provides a long perspective, which is important for judging the competing expected return estimates from fundamentals and realized stock returns. Moreover, though the issue is controversial (Keane and Runkle (1998)), Claus and Thomas find that analyst forecasts are biased; they tend to be substantially above observed growth rates. The average growth rates of dividends and earnings we use are unbiased estimates of expected growth rates.

Like us, Blanchard (1993) uses dividend growth rates to estimate the expected rate of capital gain, which he combines with an expected dividend yield to estimate the expected stock return. But his focus is different and his approach is more complicated than ours. He is interested in the path of the conditional expected stock return. His conditional expected return is the sum of the fitted values from time-series regressions of the realized dividend yield and a weighted average of 20 years of future dividend growth rates on four predetermined variables (the dividend yield, the real rate of capital gain, and the levels of interest rates and inflation). He focuses on describing the path of the conditional expected return in terms of his four explanatory variables.

In contrast, our prime interest is the unconditional expected return, which we estimate more simply as the sum of the average dividend yield and the average growth rate of dividends or earnings. This approach is valid if the dividend–price and earnings–price ratios are stationary. And we argue below that it continues to produce estimates of the average expected stock return when the price ratios are subject to reasonable forms of nonstationarity. Given its simplicity and generality, our approach is an attractive addition to the research toolbox for estimating the expected stock return.

Moreover, our focus is comparing alternative estimates of the unconditional expected stock return over the long 1872 to 2000 period, and explaining why the expected return estimates for 1951 to 2000 from fundamentals are much lower than the average return. Our evidence suggests that much of the high return for 1951 to 2000 is unexpected capital gain, the result of a decline in discount rates.

Specifically, the dividend–price and earnings–price ratios fall from 1950 to 2000; the cumulative percent capital gain for the period is more than three times the percent growth in dividends or earnings. All valuation models agree that the two price ratios are driven by expectations about future returns (discount rates) and expectations about dividend and earnings growth. Confirming Campbell (1991), Cochrane (1994), and Campbell and Shiller (1998), we find that dividend and earnings growth rates for 1950 to 2000 are largely unpredictable. Like Campbell and Shiller (1998), we thus infer that the decline in the price ratios is mostly due to a decline in expected returns. Some of this decline is probably expected, the result of reversion of a high 1950 conditional expected return to the unconditional mean. But most of the decline in the price ratios seems to be due to the unexpected decline of expected returns to ending values far below the mean.

The paper proceeds as follows. The main task, addressed in Sections I and II, is to compare and evaluate the estimates of the unconditional annual expected stock return provided by the average stock return and the dividend and earnings growth models. Section III then considers the issues that arise if the goal is to estimate the long-term expected growth of wealth, rather than the unconditional expected annual (simple) return. Section IV concludes.

I. The Unconditional Annual Expected Stock Return

Table I shows estimates of the annual expected real equity premium for 1872 to 2000. The market portfolio is the S&P 500 and its antecedents. The deflator is the Producer Price Index until 1925 (from Shiller (1989)) and the Consumer Price Index thereafter (from Ibbotson Associates). The risk-free interest rate is the annual real return on six-month commercial paper, rolled over at midyear. The risk-free rate and S&P earnings data are from Shiller, updated by Vuolteenaho (2000) and us. Beginning in 1925, we construct S&P book equity data from the book equity data in Davis, Fama, and French (2000), expanded to include all NYSE firms. The data on dividends, prices, and returns for 1872 to 1925 are from Shiller. Shiller's annual data on the

Table I

Real Equity Premium and Related Statistics for the S&P Portfolio

The inflation rate for year t is $Inf_t = L_t/L_{t-1} - 1$, where L_t is the price level at the end of year t. The real return for year t on six-month (three-month for the year 2000) commercial paper (rolled over at midyear) is F_t. The nominal values of book equity and price for the S&P index at the end of year t are b_t and p_t. Nominal S&P dividends and earnings for year t are d_t and y_t. Real rates of growth of dividends, earnings, and the stock price are $GD_t = (d_t/d_{t-1})*(L_{t-1}/L_t) - 1$, $GY_t = (y_t/y_{t-1})*(L_{t-1}/L_t) - 1$, and $GP_t = (p_t/p_{t-1})*(L_{t-1}/L_t) - 1$. The real dividend yield is $D_t/P_{t-1} = (d_t/p_{t-1})*(L_{t-1}/L_t)$. The real income return on investment is $Y_t/B_{t-1} = (1 + y_t/b_{t-1})*(L_{t-1}/L_t) - 1$. The dividend growth estimate of the real S&P return for t is $RD_t = D_t/P_{t-1} + GD_t$, the earnings growth estimate is $RY_t = D_t/P_{t-1} + GY_t$, and R_t is the realized real S&P return. The dividend and earnings growth estimates of the real equity premium for year t are $RXD_t = RD_t - F_t$ and $RXY_t = RY_t - F_t$, and $RX_t = R_t - F_t$ is the real equity premium from the realized real return. The Sharpe ratio for $RD_t - F_t$ (the mean of $RD_t - F_t$ divided by the standard deviation of R_t) is SD, SY is the Sharpe ratio for $RY_t - F_t$ (the mean of $RY_t - F_t$ divided by the standard deviation of R_t), and SR is the Sharpe ratio for $R_t - F_t$ (the mean of $R_t - F_t$ divided by the standard deviation of R_t). Except for the Sharpe ratios, all variables are expressed as percents, that is, they are multiplied by 100.

	Inf_t	F_t	D_t/P_{t-1}	GD_t	GY_t	GP_t	RD_t	RY_t	R_t	RXD_t	RXY_t	RX_t	SD	SY	SR
Means of annual values of variables															
1872–2000	2.16	3.24	4.70	2.08	NA	4.11	6.78	NA	8.81	3.54	NA	5.57	0.20	NA	0.31
1872–1950	0.99	3.90	5.34	2.74	NA	2.96	8.07	NA	8.30	4.17	NA	4.40	0.22	NA	0.23
1951–2000	4.00	2.19	3.70	1.05	2.82	5.92	4.74	6.51	9.62	2.55	4.32	7.43	0.15	0.25	0.44
Standard deviations of annual values of variables															
1872–2000	7.51	8.48	1.39	12.37	NA	17.83	12.56	NA	18.03	13.00	NA	18.51			
1872–1950	9.11	10.63	1.12	15.28	NA	18.48	15.41	NA	18.72	16.02	NA	19.57			
1951–2000	3.11	2.46	1.17	5.09	13.79	16.77	5.21	13.51	17.03	5.62	14.02	16.73			
Means of annual continuously compounded returns and growth rates															
1872–2000	1.86	2.87		1.34	NA	2.48			7.00						
1872–1950	0.59	3.33		1.60	NA	1.22			6.41						
1951–2000	3.88	2.14		0.92	1.89	4.46			7.94						

	b_t/p_t	RD_t	RY_t	R_t	Y_t/B_{t-1}
Means of annual values of variables					
1951–2000	0.66	4.74	6.51	9.62	7.60

level of the S&P (used to compute returns and other variables involving price) are averages of daily January values. The S&P dividend, price, and return data for 1926 to 2000 are from Ibbotson Associates, and the returns for 1926 to 2000 are true annual returns.

Without showing the details, we can report that the CRSP value-weight portfolio of NYSE, AMEX, and Nasdaq stocks produces average returns and dividend growth estimates of the expected return close to the S&P estimates for periods after 1925 when both indices are available. What one takes to be the risk-free rate has a bigger effect. For example, substituting the one-month Treasury bill rate for the six-month commercial paper rate causes estimates of the annual equity premium for 1951 to 2000 to rise by about one percent. But for our main task—comparing equity premium estimates from (1), (2), and (3)—differences in the risk-free rate are an additive constant that does not affect inferences.

One can estimate expected returns in real or nominal terms. Since portfolio theory says the goal of investment is consumption, real returns seem more relevant, and only results for real returns are shown. Because of suspicions about the quality of the price deflator during the early years of 1872 to 2000, we have replicated the results for nominal returns. They support all the inferences from real returns.

The dividend and earnings growth models (2) and (3) assume that the market dividend–price and earnings–price ratios are stationary. The first three annual autocorrelations of D_t/P_t for 1872 to 2000 are 0.73, 0.51, and 0.47. For the 1951 to 2000 period that occupies much of our attention, the autocorrelations are 0.83, 0.72, and 0.69. The autocorrelations are large, but their decay is roughly like that of a stationary first-order autoregression (AR1). This is in line with formal evidence (Fama and French (1988), Cochrane (1994), and Lamont (1998)) that the market dividend–price ratio is highly autocorrelated but slowly mean-reverting. S&P earnings data for the early years of 1872 to 2000 are of dubious quality (Shiller (1989)), so we estimate expected returns with the earnings growth model (3) only for 1951 to 2000. The first three autocorrelations of Y_t/P_t for 1951 to 2000, 0.80, 0.70, and 0.61, are again roughly like those of a stationary AR1.

We emphasize, however, that our tests are robust to reasonable nonstationarity of D_t/P_t and Y_t/P_t. It is not reasonable that the expected stock return and the expected growth rates of dividends and earnings that drive D_t/P_t and Y_t/P_t are nonstationary processes that can wander off to infinity. But nonstationarity of D_t/P_t and Y_t/P_t due to structural shifts in productivity or preferences that permanently change the expected return or the expected growth rates is reasonable. Such regime shifts are not a problem for the expected return estimates from (2) and (3), as long as D_t/P_t and Y_t/P_t mean-revert within regimes. If the regime shift is limited to expected dividend and earnings growth rates, the permanent change in expected growth rates is offset by a permanent change in the expected dividend yield, and (2) and (3) continue to estimate the (stationary) expected stock return. (An Appendix, available on request, provides an example.) If there is a permanent shift in the expected stock return, it is nonstationary, but like the average return in (1), the dividend and earnings growth models in (2) and (3) estimate the average expected return during the sample period.

Indeed, an advantage of the expected return estimates from fundamentals is that they are likely to be less sensitive than the average return to long-lived shocks to dividend and earnings growth rates or the expected stock return. For example, a permanent shift in the expected return affects the average dividend yield, which is common to the three expected return estimates, but it produces a shock to the capital gain term in the average return in (1) that is not shared by the estimates in (2) and (3). In short, the estimates of the expected stock return from fundamentals are likely to be more precise than the average stock return.

A. The Equity Premium

For much of the period from 1872 to 2000—up to about 1950—the dividend growth model and the average stock return produce similar estimates of the expected return. Thereafter, the two estimates diverge. To illustrate, Table I shows results for 1872 to 1950 (79 years) and 1951 to 2000 (50 years). The year 1950 is a big year, with a high real stock return (23.40 percent), and high dividend and earnings growth estimates of the return (29.96 percent and 24.00 percent). But because the three estimates of the 1950 return are similarly high, the ordering of expected return estimates, and the inferences we draw from them, are unaffected by whether 1950 is allocated to the earlier or the later period. Indeed, pushing the 1950 break-year backward or forward several years does not affect our inferences.

For the earlier 1872 to 1950 period, there is not much reason to favor the dividend growth estimate of the expected stock return over the average return. Precision is not an issue; the standard errors of the two estimates are similar (1.74 percent and 2.12 percent), the result of similar standard deviations of the annual dividend growth rate and the rate of capital gain, 15.28 percent and 18.48 percent. Moreover, the dividend growth model and the average return provide similar estimates of the expected annual real return for 1872 to 1950, 8.07 percent and 8.30 percent. Given similar estimates of the expected return, the two approaches produce similar real equity premiums for 1872 to 1950, 4.17 percent (dividend growth model) and 4.40 percent (stock returns).

The competition between the dividend growth model and the average stock return is more interesting for 1951 to 2000. The dividend growth estimate of the 1951 to 2000 expected return, 4.74 percent, is less than half the average return, 9.62 percent. The dividend growth estimate of the equity premium, 2.55 percent, is 34 percent of the estimate from returns, 7.43 percent. The 1951 to 2000 estimates of the expected stock return and the equity premium from the earnings growth model, 6.51 percent and 4.32 percent, are higher than for the dividend growth model. But they are well below the estimates from the average return, 9.62 percent and 7.43 percent.

B. Evaluating the Expected Return Estimates for 1951 to 2000

We judge that the estimates of the expected stock return for 1951 to 2000 from fundamentals are closer to the true expected value, for three reasons.

(a) The expected return estimates from the dividend and earnings growth models are more precise than the average return. The standard error of the dividend growth estimate of the expected return for 1951 to 2000 is 0.74 percent, versus 2.43 percent for the average stock return. Since earnings growth is more volatile than dividend growth, the standard error of the expected return from the earnings growth model, 1.93 percent, is higher than the estimate from the dividend growth model, but it is smaller than the 2.43 percent standard error of the average stock return. Claus and Thomas (2001) also argue that expected return estimates from fundamentals are more precise than average returns, but they provide no direct evidence.

(b) Table I shows Sharpe ratios for the three equity premium estimates. Only the average premium in the numerator of the Sharpe ratio differs for the three estimates. The denominator for all three is the standard deviation of the annual stock return. The Sharpe ratio for the dividend growth estimate of the equity premium for 1872 to 1950, 0.22, is close to that produced by the average stock return, 0.23. More interesting, the Sharpe ratio for the equity premium for 1951 to 2000 from the dividend growth model, 0.15, is lower than but similar to that for 1872 to 1950. The Sharpe ratio for the 1951 to 2000 equity premium from the earnings growth model, 0.25, is somewhat higher than the dividend growth estimate, 0.15, but it is similar to the estimates for 1872 to 1950 from the dividend growth model, 0.22, and the average return, 0.23.

In asset pricing theory, the Sharpe ratio is related to aggregate risk aversion. The Sharpe ratios for the 1872 to 1950 and 1951 to 2000 equity premiums from the dividend growth model and the earnings growth model suggest that aggregate risk aversion is roughly similar in the two periods. In contrast, though return volatility falls a bit, the equity premium estimate from the average stock return increases from 4.40 percent for 1872 to 1950 to 7.43 percent for 1951 to 2000, and its Sharpe ratio about doubles, from 0.23 to 0.44. It seems implausible that risk aversion increases so much from the earlier to the later period.

(c) Most important, the behavior of other fundamentals favors the dividend and earnings growth models. The average ratio of the book value of equity to the market value of equity for 1951 to 2000 is 0.66, the book-to-market ratio B_t/P_t is never greater than 1.12, and it is greater than 1.0 for only 6 years of the 50-year period. Since, on average, the market value of equity is substantially higher than its book value, it seems safe to conclude that, on average, the expected return on investment exceeds the cost of capital.

Suppose investment at time $t-1$ generates a stream of equity earnings for $t, t+1, \ldots, t+N$ with a constant expected value. The average income return on book equity, $A(Y_t/B_{t-1})$, is then an estimate of the expected return on equity's share of assets. It is an unbiased estimate when N is infinite and it is upward biased when N is finite. In either case, if the expected return on investment exceeds the cost of capital, we should find that (except for sampling error) the average income return on book equity is greater than estimates of the cost of equity capital (the expected stock return):

$$A(Y_t/B_{t-1}) > E(R). \tag{4}$$

Table I shows that (4) is confirmed when we use the dividend and earnings growth models to estimate the expected real stock return for 1951 to 2000. The estimates of $E(R)$, 4.74 percent (dividend growth model) and 6.51 percent (earnings growth model), are below 7.60 percent, the average real income return on book equity, $A(Y_t/B_{t-1})$. In contrast, the average real stock return for 1951 to 2000, 9.62 percent, exceeds the average income return by more than 2 percent. An expected stock return that exceeds the expected income return on book equity implies that the typical corporate investment has a negative net present value. This is difficult to reconcile with an average book-to-market ratio substantially less than one.

To what extent are our results new? Using analyst forecasts of expected cash flows and a more complicated valuation model, Claus and Thomas (2001) produce estimates of the expected stock return for 1985 to 1998 far below the average return. Like us, they argue that the estimates from fundamentals are closer to the true expected return. We buttress this conclusion with new results on three fronts. (a) The long-term perspective provided by the evidence that, for much of the 1872 to 2000 period, average returns and fundamentals produce similar estimates of the expected return. (b) Direct evidence that the expected return estimates for 1951 to 2000 from fundamentals are more precise. (c) Sharpe ratios and evidence on how the alternative expected return estimates line up with the income return on investment. These new results provide support for the expected return estimates from fundamentals, and for the more specific inference that the average stock return for 1951 to 2000 is above the expected return.

II. Unexpected Capital Gains

Valuation theory suggests three potential explanations for why the 1951 to 2000 average stock return is larger than the expected return. (a) Dividend and earnings growth for 1951 to 2000 is unexpectedly high. (b) The expected (post-2000) growth rates of dividends and earnings are unexpectedly high. (c) The expected stock return (the equity discount rate) is unexpectedly low at the end of the sample period.

A. Is Dividend Growth for 1951 to 2000 Unexpectedly High?

If the prosperity of the United States over the last 50 years was not fully anticipated, dividend and earnings growth for 1951 to 2000 exceed 1950 expectations. Such unexpected in-sample growth produces unexpected capital gains. But it does not explain why the average return for 1951 to 2000 (the average dividend yield plus the average rate of capital gain) is so much higher than the expected return estimates from fundamentals (the average dividend yield plus the average growth rate of dividends or earnings). To see the point, note that unexpected in-sample dividend and earnings growth do not affect either the 1950 or the 2000 dividend–price and earnings–price ratios. (The 2000 ratios depend on post-2000 expected returns and growth rates.) Suppose D_t/P_t and E_t/P_t were the same in 1950 and 2000. Then the total percent growth in dividends and earnings during the period would be the same as the percent growth in the stock price. And (1), (2), and (3) would provide similar estimates of the expected stock return.

It is worth dwelling on this point. There is probably survivor bias in the U.S. average stock return for 1872 to 1950, as well as for 1951 to 2000. During the 1872 to 2000 period, it was not a foregone conclusion that the U.S. equity market would survive several financial panics, the Great Depression, two world wars, and the cold war. The average return for a market that survives many potentially cataclysmic challenges is likely to be higher than the expected return (Brown, Goetzmann, and Ross (1995)). But if the positive bias shows up only as higher than expected dividend and earnings growth during the sample period, there is similar survivor bias in the expected return estimates from fundamentals—a problem we do not solve. Our more limited goal is to explain why the average stock return for 1951 to 2000 is so high relative to the expected return estimates from the dividend and earnings growth models.

Since unexpected growth for 1951 to 2000 has a similar effect on the three expected return estimates, the task of explaining why the estimates are so different falls to the end-of-sample values of future expected returns and expected dividend and earnings growth. We approach the problem by first looking for evidence that expected dividend or earnings growth is high at the end of the sample period. We find none. We then argue that the large spread of capital gains over dividend and earnings growth for 1951 to 2000, or equivalently, the low end-of-sample dividend–price and earnings–price ratios, are due to an unexpected decline in expected stock returns to unusually low end-of-sample values.

B. Are Post-2000 Expected Dividend and Earnings Growth Rates Unusually High?

The behavior of dividends and earnings provides little evidence that rationally assessed (i.e., true) long-term expected growth is high at the end of the sample period. If anything, the growth rate of real dividends declines during the 1951 to 2000 period (Table II). The average growth rate for the first two decades, 1.60 percent, is higher than the average growth rates for the last three, 0.68 percent. The regressions in Table III are more formal evidence on the best forecast of post-2000 real dividend growth rates. Re-

Table II

Means of Simple Real Equity Premium and Related Statistics for the S&P Portfolio for 10-year Periods

The inflation rate for year t is $Inf_t = L_t/L_{t-1} - 1$, where L_t is the price level at the end of year t. The real return for year t on six-month (three-month for the year 2000) commercial paper (rolled over at midyear) is F_t. The nominal price of the S&P index at the end of year t is p_t. Nominal S&P dividends and earnings for year t are d_t and y_t. Real rates of growth of dividends, earnings, and the stock price are $GD_t = (d_t/d_{t-1})*(L_{t-1}/L_t) - 1$, $GY_t = (y_t/y_{t-1})*(L_{t-1}/L_t) - 1$, and $GP_t = (p_t/p_{t-1})*(L_{t-1}/L_t) - 1$. The real dividend yield is $D_t/P_{t-1} = (d_t/p_{t-1})*(L_{t-1}/L_t)$. The dividend growth estimate of the real S&P return for t is $RD_t = D_t/P_{t-1} + GD_t$, the earnings growth estimate is $RY_t = D_t/P_{t-1} + GY_t$, and R_t is the realized real S&P return. The dividend and earnings growth estimates of the real equity premium for year t are $RXD_t = RD_t - F_t$ and $RXY_t = RY_t - F_t$, and $RX_t = R_t - F_t$ is the real equity premium from the realized real return. All variables are expressed as percents, that is, they are multiplied by 100.

	Inf_t	F_t	D_t/P_{t-1}	GD_t	GY_t	GP_t	RD_t	RY_t	R_t	RXD_t	RXY_t	RX_t
1872–1880	−2.77	9.86	6.29	4.62	NA	7.13	10.91	NA	13.42	1.06	NA	3.56
1881–1890	−1.72	7.23	5.04	0.69	NA	0.04	5.73	NA	5.08	−1.51	NA	−2.15
1891–1900	0.18	5.08	4.40	4.49	NA	4.75	8.89	NA	9.15	3.81	NA	4.08
1901–1910	1.95	3.18	4.45	3.25	NA	2.33	7.70	NA	6.78	4.52	NA	3.60
1911–1920	6.82	0.82	5.70	−3.43	NA	−6.52	2.27	NA	−0.83	1.45	NA	−1.64
1921–1930	−1.70	7.41	5.72	9.07	NA	11.83	14.78	NA	17.54	7.37	NA	10.13
1931–1940	−1.23	2.80	5.31	0.36	NA	2.21	5.67	NA	7.52	2.87	NA	4.72
1941–1950	6.04	−4.57	5.90	3.02	NA	2.33	8.91	NA	8.22	13.48	NA	12.79
1951–1960	1.79	1.05	4.68	1.22	0.61	10.64	5.90	5.30	15.32	4.85	4.24	14.27
1961–1970	2.94	2.27	3.21	1.98	2.07	2.69	5.19	5.27	5.90	2.92	3.01	3.63
1971–1980	8.11	−0.30	4.04	−0.86	3.47	−1.92	3.18	7.50	2.12	3.48	7.80	2.42
1981–1990	4.51	5.32	4.19	2.32	0.37	5.40	6.51	4.56	9.59	1.19	−0.75	4.28
1991–2000	2.68	2.61	2.36	0.58	7.58	12.80	2.94	9.94	15.16	0.32	7.32	12.54

Table III

Regressions to Forecast Real Dividend and Earnings Growth Rates, GD_t and GY_t

The price level at the end of year t is L_t. The nominal values of book equity and price for the S&P index at the end of year t are b_t and p_t. Nominal S&P dividends and earnings for year t are d_t and y_t. The real dividend and earnings growth rates for year t are $GD_t = (d_t/d_{t-1})*(L_{t-1}/L_t) - 1$ and $GY_t = (y_t/y_{t-1})*(L_{t-1}/L_t) - 1$, and R_t is the realized real return on the S&P portfolio for year t. The regression intercept is *Int*, and *t*-Stat is the regression coefficient (*Coef*) divided by its standard error. The regression R^2 is adjusted for degrees of freedom. Except for the dividend payout ratio, d_t/y_t, all variables are expressed as percents, that is, they are multiplied by 100.

Panel A: One Year: The Regressions Forecast Real Dividend Growth, GD_t, with Variables Known at $t - 1$

	Int	d_{t-1}/y_{t-1}	d_{t-1}/p_{t-1}	GD_{t-1}	GD_{t-2}	GD_{t-3}	R_{t-1}	R_{t-2}	R_{t-3}	R^2
1875–1950, $N = 76$ years										
Coef	29.56	−23.12	−2.63	−0.12	−0.07	−0.03	0.22	0.13	0.09	0.38
t-Stat	3.22	−3.17	−1.77	−1.08	−0.64	−0.29	2.24	1.37	1.01	
1951–2000, $N = 50$ years										
Coef	−2.16	2.97	0.11	−0.07	−0.20	−0.06	0.11	0.07	0.01	0.01
t-Stat	−0.40	0.33	0.16	−0.45	−1.57	−0.45	2.17	1.33	0.22	

Panel B: Two Years: The Regressions Forecast Real Dividend Growth, GD_t, with Variables Known at $t-2$

	Int	d_{t-2}/y_{t-2}	d_{t-2}/p_{t-2}	GD_{t-2}	GD_{t-3}	R_{t-2}	R_{t-3}	R^2
1875–1950, N = 76 years								
Coef	6.61	−11.60	0.31	−0.26	0.05	0.24	0.11	0.07
t-Stat	0.64	−1.28	0.18	−2.02	0.39	2.03	1.00	
1951–2000, N = 50 years								
Coef	−4.11	7.62	0.32	−0.14	−0.03	0.05	−0.01	−0.05
t-Stat	−0.73	0.81	0.46	−1.13	−0.28	0.99	−0.16	

Panel C: One Year: The Regressions Forecast Real Earnings Growth, GY_t, with Variables Known at $t-1$

	Int	Y_{t-1}/B_{t-2}	d_{t-1}/y_{t-1}	y_{t-1}/p_{t-1}	GY_{t-1}	GY_{t-2}	GY_{t-3}	R_{t-1}	R_{t-2}	R_{t-3}	R^2
1951–2000, N = 50 years											
Coef	5.48	0.11	13.06	−1.36	0.21	−0.13	−0.31	0.28	−0.25	0.03	0.40
t-Stat	0.33	0.11	0.52	−1.91	1.17	−0.89	−2.64	2.39	−2.18	0.26	

Panel D: Two Years: The Regressions Forecast Real Earnings Growth, GY_t, with Variables Known at $t-2$

	Int	Y_{t-2}/B_{t-3}	d_{t-2}/y_{t-2}	y_{t-2}/p_{t-2}	GY_{t-2}	GY_{t-3}	R_{t-2}	R_{t-3}	R^2
1951–2000, N = 50 years									
Coef	−7.60	0.46	2.05	−0.74	−0.16	−0.39	−0.31	−0.12	0.23
t-Stat	−0.43	1.66	0.76	−1.02	−0.92	−2.54	−2.59	−0.97	

gressions are shown for forecasts one year ahead (the explanatory variables for year t dividend growth are known at the end of year $t - 1$) and two years ahead (the explanatory variables are known at the end of year $t - 2$).

The regression for 1875 to 1950 suggests strong forecast power one year ahead. The slopes on the lagged payout ratio, the dividend–price ratio, and the stock return are close to or more than two standard errors from zero, and the regression captures 38 percent of the variance of dividend growth. Even in the 1875 to 1950 period, however, power to forecast dividend growth does not extend much beyond a year. When dividend growth for year t is explained with variables known at the end of year $t - 2$, the regression R^2 falls from 0.38 to 0.07. Without showing the details, we can report that extending the forecast horizon from two to three years causes all hint of forecast power to disappear. Thus, for 1875 to 1950, the best forecast of dividend growth more than a year or two ahead is the historical average growth rate.

We are interested in post-2000 expected dividend growth, and even the short-term forecast power of the dividend regressions for 1872 to 1950 evaporates in the 1951 to 2000 period. The lagged stock return has some information ($t = 2.17$) about dividend growth one year ahead. But the 1951 to 2000 regression picks up only one percent of the variance of dividend growth. And forecast power does not improve for longer forecast horizons. Our evidence that dividend growth is essentially unpredictable during the last 50 years confirms the results in Campbell (1991), Cochrane (1991, 1994), and Campbell and Shiller (1998). If dividend growth is unpredictable, the historical average growth rate is the best forecast of future growth.

Long-term expected earnings growth also is not unusually high in 2000. There is no clear trend in real earnings growth during the 1951 to 2000 period. The most recent decade, 1991 to 2000, produces the highest average growth rate, 7.58 percent per year (Table II). But earnings growth is volatile. The standard errors of 10-year average growth rates vary around 5 percent. It is thus not surprising that 1981 to 1990, the decade immediately preceding 1991 to 2000, produces the lowest average real earnings growth rate, 0.37 percent per year.

The regressions in Table III are formal evidence on the predictability of earnings growth during the 1951 to 2000 period. There is some predictability of near-term growth, but it is largely due to transitory variation in earnings that is irrelevant for forecasting long-term earnings. In the 1951 to 2000 regression to forecast earnings growth one year ahead, the slope on the first lag of the stock return is positive (0.28, $t = 2.39$), but the slope on the second lag is negative (-0.25, $t = -2.18$) and about the same magnitude. Thus, the prediction of next year's earnings growth from this year's return is reversed the following year. In the one-year forecast regression for 1951 to 2000, the only variable other than lagged returns with power to forecast earnings growth ($t = -2.64$) is the third lag of earnings growth. But the slope is negative, so it predicts that the strong earnings growth of recent years is soon to be reversed.

In the 1951 to 2000 regression to forecast earnings one year ahead, there is a hint ($t = -1.91$) that the low earnings–price ratio at the end of the period implies higher than average expected growth one year ahead. But the effect peters out quickly; the slope on the lagged earnings–price ratio in the regression to forecast earnings growth two years ahead is -1.02 standard errors from zero. The only variables with forecast power two years ahead are the second lag of the stock return and the third lag of earnings growth. But the slopes on these variables are negative, so again the 2000 prediction is that the strong earnings growth of recent years is soon to be reversed. And again, regressions (not shown) confirm that forecast power for 1951 to 2000 does not extend beyond two years. Thus, beyond two years, the best forecast of earnings growth is the historical average growth rate.

In sum, the behavior of dividends for 1951 to 2000 suggests that future growth is largely unpredictable, so the historical mean growth rate is a near optimal forecast of future growth. Earnings growth for 1951 to 2000 is somewhat predictable one and two years ahead, but the end-of-sample message is that the recent high growth rates are likely to revert quickly to the historical mean. It is also worth noting that the market survivor bias argument of Brown, Goetzmann, and Ross (1995) suggests that past average growth rates are, if anything, upward biased estimates of future growth. In short, we find no evidence to support a forecast of strong future dividend or earnings growth at the end of our sample period.

C. Do Expected Stock Returns Fall during the 1951 to 2000 Period?

The S&P dividend–price ratio, D_t/P_t, falls from 7.18 percent at the end of 1950 to a historically low 1.22 percent at the end of 2000 (Figure 1). The growth in the stock price, P_{2000}/P_{1950}, is thus 5.89 times the growth in dividends, D_{2000}/D_{1950}. The S&P earnings–price ratio, Y_t/P_t, falls from 13.39 percent at the end of 1950 to 3.46 percent at the end of 2000, so the percent capital gain of the last 50 years is 3.87 times the percent growth in earnings. (Interestingly, almost all of the excess capital gain occurs in the last 20 years; Figure 1 shows that the 1979 earnings–price ratio, 13.40 percent, is nearly identical to the 13.39 percent value of 1950.)

All valuation models say that D_t/P_t and E_t/P_t are driven by expected future returns (discount rates) and expectations about future dividend and earnings growth. Our evidence suggests that rational forecasts of long-term dividend and earnings growth rates are not unusually high in 2000. We conclude that the large spread of capital gains for 1951 to 2000 over dividend and earnings growth is largely due to a decline in the expected stock return.

Some of the decline in D_t/P_t and E_t/P_t during 1951 to 2000 is probably anticipated in 1950. The dividend–price ratio for 1950, 7.18 percent, is high (Figure 1). The average for 1872 to 2000 is 4.64 percent. If D_t/P_t is mean-reverting, the expectation in 1950 of the yield in 2000 is close to the unconditional mean, say 4.64 percent. The actual dividend–price ratio for 2000 is

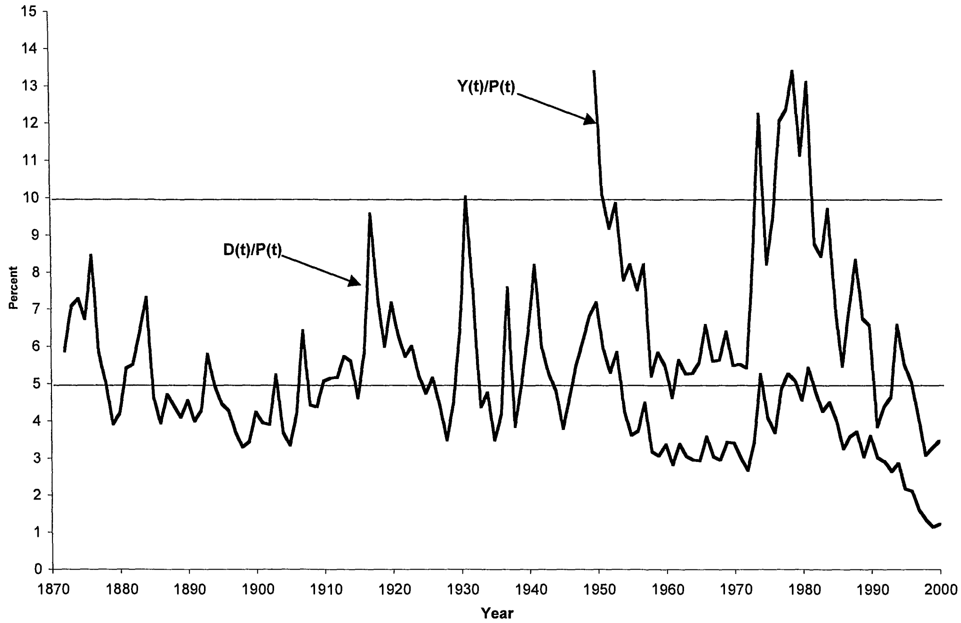


Figure 1. Dividend–price and earnings–price ratios.

1.22 percent. The 2000 stock price is thus 4.64/1.22 = 3.80 times what it would be if the dividend yield for 2000 hit the historical mean. Roughly speaking, this unexpected capital gain adds about 2.67 percent to the compound annual return for 1951 to 2000.

Similarly, part of the large difference between the 1951 to 2000 capital gain and the growth in earnings is probably anticipated in 1950. The 13.39 percent value of Y_t/P_t in 1950 is high relative to the mean for 1951 to 2000, 7.14 percent. If the earnings–price ratio is stationary, the expectation in 1950 of Y_t/P_t for 2000 is close to the unconditional mean, say 7.14 percent. The actual Y_t/P_t for 2000 is 3.46 percent. Thus, the 2000 stock price is 7.14/3.46 = 2.06 times what it would be if the ratio for 2000 hit the 7.14 percent average value for 1951 to 2000. Roughly speaking, this estimate of the unexpected capital gain adds about 1.45 percent to the compound annual return for the 50-year period.

In short, the percent capital gain for 1951 to 2000 is several times the growth of dividends or earnings. The result is historically low dividend–price and earnings–price ratios at the end of the period. Since the ratios are high in 1950, some of their subsequent decline is probably expected, but much of it is unexpected. Given the evidence that rational forecasts of long-term growth rates of dividends and earnings are not high in 2000, we conclude that the unexpected capital gains for 1951 to 2000 are largely due to a decline in the discount rate. In other words, the low end-of-sample price ratios imply low (rationally assessed, or true) expected future returns.

Like us, Campbell (1991), Cochrane (1994), and Campbell and Shiller (1998) find that, for recent periods, dividend and earnings growth are largely unpredictable, so variation in dividend–price and earnings–price ratios is largely due to the expected stock return. The samples in Campbell (1991) and Cochrane (1994) end in 1988 (before the strong subsequent returns that produce sharp declines in the price ratios), and they focus on explaining, in general terms, how variation in D_t/P_t splits between variation in the expected stock return and expected dividend growth. Campbell and Shiller (1998) focus on the low expected future returns implied by the low price ratios of recent years.

In contrast, we are more interested in what the decline in the price ratios says about past returns, specifically, that the average return for 1951 to 2000 is above the expected return. And this inference does not rest solely on the information in price ratios. We buttress it with two types of novel evidence. (a) The perspective from our long sample period that, although the average stock return for 1951 to 2000 is much higher than expected return estimates from fundamentals, the two approaches produce similar estimates for 1872 to 1950. (b) Evidence from Sharpe ratios, the book-to-market ratio, and the income return on investment, which also suggests that the average return for 1951 to 2000 is above the expected value.

III. Estimating the Expected Stock Return: Issues

There are two open questions about our estimates of the expected stock return. (a) In recent years the propensity of firms to pay dividends declines and stock repurchases surge. How do these changes in dividend policy affect our estimates of the expected return? (b) Under rather general conditions, the dividend and earnings growth models (2) and (3) provide estimates of the expected stock return. Are the estimates biased and does the bias depend on the return horizon? This section addresses these issues.

A. Repurchases and the Declining Incidence of Dividend Payers

Share repurchases surge after 1983 (Bagwell and Shoven (1989) and Dunsby (1995)), and, after 1978, the fraction of firms that do not pay dividends steadily increases (Fama and French (2001)). More generally, dividends are a policy variable, and changes in policy can raise problems for estimates of the expected stock return from the dividend growth model. There is no problem in the long-term, as long as dividend policies stabilize and the dividend–price ratio resumes its mean-reversion, though perhaps to a new mean. (An Appendix, available on request, provides an example involving repurchases.) But there can be problems during transition periods. For example, if the fraction of firms that do not pay dividends steadily increases, the market dividend–price ratio is probably nonstationary; it is likely to decline over time, and the dividend growth model is likely to underestimate the expected stock return.

Fortunately, the earnings growth model is not subject to the problems posed by drift in dividend policy. The earnings growth model provides an estimate of the expected stock return when the earnings–price ratio is stationary. And as discussed earlier, the model provides an estimate of the average expected return during the sample period when there are permanent shifts in the expected value of Y_t/P_t, as long as the ratio mean-reverts within regimes.

The earnings growth model is not, however, clearly superior to the dividend growth model. The standard deviation of annual earnings growth rates for 1951 to 2000 (13.79 percent, versus 5.09 percent for dividends) is similar to that of capital gains (16.77 percent), so much of the precision advantage of using fundamentals to estimate the expected stock return is lost. We see next that the dividend growth model has an advantage over the earnings growth model and the average stock return if the goal is to estimate the long-term expected growth of wealth.

B. The Investment Horizon

The return concept in discrete time asset pricing models is a one-period simple return, and our empirical work focuses on the one-year return. But many, if not most, investors are concerned with long-term returns, that is, terminal wealth over a long holding period. Do the advantages and disadvantages of different expected return estimates depend on the return horizon? This section addresses this question.

B.1. The Expected Annual Simple Return

There is downward bias in the estimates of the expected annual simple return from the dividend and earnings growth models—the result of a variance effect. The expected value of the dividend growth estimate of the expected return, for example, is the expected value of the dividend yield plus the expected value of the annual simple dividend growth rate. The expected annual simple return is the expected value of the dividend yield plus the expected annual simple rate of capital gain. If the dividend–price ratio is stationary, the compound rate of capital gain converges to the compound dividend growth rate as the sample period increases. But because the dividend growth rate is less volatile than the rate of capital gain, the expected simple dividend growth rate is less than the expected simple rate of capital gain.

The standard deviation of the annual simple rate of capital gain for 1951 to 2000 is 3.29 times the standard deviation of the annual dividend growth rate (Table I). The resulting downward bias of the average dividend growth rate as an estimate of the expected annual simple rate of capital gain is roughly 1.28 percent per year (half the difference between the variances of the two growth rates). Corrected for this bias, the dividend growth estimate of the equity premium in the simple returns of 1951 to 2000 rises from 2.55 to 3.83 percent (Table IV), which is still far below the estimate from the average return, 7.43 percent. Since the earnings growth rate and the annual rate of capital gain have similar standard deviations for 1951 to 2000,

Table IV

Estimates of the Real Equity Premium in Simple Annual and Long-term Returns: 1951 to 2000

The inflation rate for year t is $Inf_t = L_t/L_{t-1}$, where L_t is the price level at the end of year t. The real return for year t on six-month (three-month for the year 2000) commercial paper (rolled over at midyear) is F_t. The nominal value of the S&P index at the end of year t is p_t. Nominal S&P dividends and earnings for year t are d_t and y_t. Real rates of growth of dividends, earnings, and the stock price are $GD_t = (d_t/d_{t-1})*(L_{t-1}/L_t) - 1$, $GY_t = (y_t/y_{t-1})*(L_{t-1}/L_t) - 1$, and $GP_t = (p_t/p_{t-1})*(L_{t-1}/L_t) - 1$. The real dividend yield is $D_t/P_{t-1} = (d_t/p_{t-1})*(L_{t-1}/L_t)$. The dividend growth estimate of the real S&P return for t is $RD_t = D_t/P_{t-1} + GD_t$, the earnings growth estimate is $RY_t = D_t/P_{t-1} + GY_t$, and R_t is the realized real S&P return. The dividend and earnings growth estimates of the real equity premium for year t are $RXD_t = RD_t - F_t$ and $RXY_t = RY_t - F_t$, and $RX_t = R_t - F_t$ is the real equity premium from the realized real return. The average values of the equity premium estimates are $A(RXD_t)$, $A(RXY_t)$, and $A(RX_t)$. The first column of the table shows unadjusted estimates of the annual simple equity premium. The second column shows bias-adjusted estimates of the annual premium. The bias adjustment is one-half the difference between the variance of the annual rate of capital gain and the variance of either the dividend growth rate or the earnings growth rate. The third column shows bias-adjusted estimates of the expected equity premium relevant if one is interested in the long-term growth rate of wealth. The bias adjustment is one-half the difference between the variance of the annual dividend growth rate and the variance of either the growth rate of earnings or the rate of capital gain. The equity premiums are expressed as percents.

		Bias-adjusted	
	Unadjusted	Annual	Long-term
$A(RXD_t)$	2.55	3.83	2.55
$A(RXY_t)$	4.32	4.78	3.50
$A(RX_t)$	7.43	7.43	6.16

13.79 percent and 16.77 percent (Table I), the bias of the earnings growth estimate of the expected return is smaller (0.46 percent). Corrected for bias, the estimate of the equity premium for 1951 to 2000 from the earnings growth model rises from 4.32 to 4.78 percent (Table IV), which again is far below the 7.43 percent estimate from the average return.

B.2. Long-term Expected Wealth

The (unadjusted) estimate of the expected annual simple return from the dividend growth model is probably the best choice if we are concerned with the long-term expected wealth generated by the market portfolio. The annual dividend growth rates of 1951 to 2000 are essentially unpredictable. If the dividend growth rate is serially uncorrelated, the expected value of the compounded dividend growth rate is the compounded expected simple growth rate:

$$E\left[\prod_{t=1}^{T}(1 + GD_t)\right] = [1 + E(GD)]^T. \tag{5}$$

And if the dividend–price ratio is stationary, for long horizons the expected compounded dividend growth rate is the expected compounded rate of capital gain:

$$E\left[\prod_{t=1}^{T}(1+GD_t)\right] = E\left[\prod_{t=1}^{T}(1+GP_t)\right]. \tag{6}$$

Thus, when the horizon T is long, compounding the true expected annual simple return from the dividend growth model produces an unbiased estimate of the expected long-term return:

$$[1+E(RD)]^T = E\left[\prod_{t=1}^{T}(1+R_t)\right]. \tag{7}$$

In contrast, if the dividend growth rate is unpredictable and the dividend–price ratio is stationary, part of the higher volatility of annual rates of capital gain is transitory, the result of a mean-reverting expected annual return (Cochrane (1994)). Thus, compounding even the true unconditional expected annual simple return, $E(R)$, yields an upward biased measure of the expected compounded return:

$$[1+E(R)]^T > E\left[\prod_{t=1}^{T}(1+R_t)\right]. \tag{8}$$

There is a similar problem in using the average (simple) earnings growth rate to estimate long-term expected wealth. The regressions in Table III suggest that the predictability of earnings growth for 1951 to 2000 is due to transitory variation in earnings. As a result, annual earnings growth is 2.71 times more volatile than dividend growth (Table I). The compound growth rate of earnings for 1951 to 2000, 1.89 percent, is 2.05 times the compound dividend growth rate, 0.92 percent. But because earnings are more volatile, the average simple growth rate of earnings, 2.82 percent, is 2.69 times the average simple growth rate of dividends, 1.05 percent. As a result, the average simple growth rate of earnings produces an upward biased estimate of the compound rate of growth of long-term expected wealth.

We can correct the bias by subtracting half the difference between the variance of earnings growth and the variance of dividend growth (0.82 percent) from the average earnings growth rate. The estimate of the expected rate of capital gain provided by this adjusted average growth rate of earnings is 2.00 percent per year. Using this adjusted average growth rate of earnings, the earnings growth estimate of the expected real stock return for 1951 to 2000 falls from 6.51 to 5.69 percent. The estimate of the equity premium falls from 4.32 to 3.50 percent (Table IV), which is closer to the 2.55 percent obtained when the average dividend growth rate is used to estimate the expected rate of capital gain. Similarly, adjusting for the effects of transitory return volatility causes the estimate of the equity premium from realized stock returns to fall from 7.43 to 6.16 percent, which is still far above the bias-adjusted estimate of the earnings growth model (3.50 percent) and the estimate from the dividend growth model (2.55 percent).

Finally, we only have estimates of the expected growth rates of dividends and earnings and the expected rate of capital gain. Compounding estimates rather than true expected values adds upward bias to measures of expected long-term wealth (Blume (1974)). The bias increases with the imprecision of the estimates. This is another reason to favor the more precise estimate of the expected stock return from the dividend growth model over the earnings growth estimate or the estimate from the average stock return.

IV. Conclusions

There is a burgeoning literature on the equity premium. Our main additions are on two fronts. (a) A long (1872 to 2000) perspective on the competing estimates of the unconditional expected stock return from fundamentals (the dividend and earnings growth models) and the average stock return. (b) Evidence (estimates of precision, Sharpe ratios, and the behavior of the book-to-market ratio and the income return on investment) that allows us to choose between the expected return estimates from the two approaches.

Specifically, the dividend growth model and the realized average return produce similar real equity premium estimates for 1872 to 1950, 4.17 percent and 4.40 percent. For the half-century from 1951 to 2000, however, the equity premium estimates from the dividend and earnings growth models, 2.55 percent and 4.32 percent, are far below the estimate from the average return, 7.43 percent.

We argue that the dividend and earnings growth estimates of the equity premium for 1951 to 2000 are closer to the true expected value. This conclusion is based on three results.

(a) The estimates from fundamentals, especially the estimate from the dividend growth model, are more precise; they have lower standard errors than the estimate from the average return.

(b) The appealing message from the dividend and earnings growth models is that aggregate risk aversion (as measured by the Sharpe ratio for the equity premium) is on average roughly similar for the 1872 to 1949 and 1950 to 1999 periods. In contrast, the Sharpe ratio for the equity premium from the average return just about doubles from the 1872 to 1950 period to the 1951 to 2000 period.

(c) Most important, the average stock return for 1951 to 2000 is much greater than the average income return on book equity. Taken at face value, this says that investment during the period is on average unprofitable (its expected return is less than the cost of capital). In contrast, the lower estimates of the expected stock return from the dividend and earnings growth models are less than the income return on investment, so the message is that investment is on average profitable. This is more consistent with book-to-market ratios that are rather consistently less than one during the period.

If the average stock return for 1951 to 2000 exceeds the expected return, stocks experience unexpected capital gains. What is the source of the gains? Growth rates of dividends and earnings are largely unpredictable, so there is no basis for extrapolating unusually high long-term future growth. This leaves a decline in the expected stock return as the prime source of the unexpected capital gain. In other words, the high return for 1951 to 2000 seems to be the result of low expected future returns.

Many papers suggest that the decline in the expected stock return is in part permanent, the result of (a) wider equity market participation by individuals and institutions, and (b) lower costs of obtaining diversified equity portfolios from mutual funds (Diamond (1999), Heaton and Lucas (1999), and Siegel (1999)). But there is also evidence that the expected stock return is slowly mean reverting (Fama and French (1989) and Cochrane (1994)). Moreover, there are two schools of thought on how to explain the variation in expected returns. Some attribute it to rational variation in response to macroeconomic factors (Fama and French (1989), Blanchard (1993), and Cochrane (1994)), while others judge that irrational swings in investor sentiment are the prime moving force (e.g., Shiller (1989)). Whatever the story for variation in the expected return, and whether it is temporary or partly permanent, the message from the low end-of-sample dividend–price and earnings–price ratios is that we face a period of low (true) expected returns.

Our main concern, however, is the unconditional expected stock return, not the end-of-sample conditional expected value. Here there are some nuances. If we are interested in the unconditional expected annual simple return, the estimates for 1951 to 2000 from fundamentals are downward biased. The bias is rather large when the average growth rate of dividends is used to estimate the expected rate of capital gain, but it is small for the average growth rate of earnings. On the other hand, if we are interested in the long-term expected growth of wealth, the dividend growth model is probably best, and the average stock return and the earnings growth estimate of the expected return are upward biased. But our bottom line inference does not depend on whether one is interested in the expected annual simple return or long-term expected wealth. In either case, the bias-adjusted expected return estimates for 1951 to 2000 from fundamentals are a lot (more than 2.6 percent per year) lower than bias-adjusted estimates from realized returns. (See Table IV.) Based on this and other evidence, our main message is that the unconditional expected equity premium of the last 50 years is probably far below the realized premium.

REFERENCES

Bagwell, Laurie S., and John B. Shoven, 1989, Cash distributions to shareholders, *Journal of Economic Perspectives* 3, 129–149.

Blanchard, Olivier J., 1993, Movements in the equity premium, *Brooking Papers on Economic Activity* 2, 75–138.

Blume, Marshall, 1974, Unbiased estimators of long-run expected rates of return, *Journal of the American Statistical Association* 69, 634–638.
Brown, Stephen J., William N. Goetzmann, and Stephen Ross, 1995, Survival, *Journal of Finance* 50, 853–873.
Campbell, John Y., 1991, A variance decomposition for stock returns, *Economic Journal* 101, 157–179.
Campbell, John Y., and Robert J. Shiller, 1989, The dividend–price ratio and expectations of future dividends and discount factors, *Review of Financial Studies* 1, 195–228.
Campbell, John Y., and Robert J. Shiller, 1998, Valuation ratios and the long-run stock market outlook, *Journal of Portfolio Management* 24, 11–26.
Claus, James, and Jacob Thomas, 2001, Equity premia as low as three percent? Evidence from analysts' earnings forecasts for domestic and international stock markets, *Journal of Finance* 56, 1629-1666.
Cochrane, John, 1991, Volatility tests and efficient markets: A review essay, *Journal of Monetary Economics* 27, 463–487.
Cochrane, John H., 1994, Permanent and transitory components of GNP and stock prices, *Quarterly Journal of Economics* 109, 241–265.
Davis, James L., Eugene F. Fama, and Kenneth R. French, 2000, Characteristics, covariances, and average returns, *Journal of Finance* 55, 389–406.
Diamond, Peter A., 1999, What stock market returns to expect for the future? Center of Retirement Research at Boston College, September, Number 2.
Dunsby, Adam, 1995, *Share Repurchases, Dividends, and Corporate Distribution Policy* (Ph.D. thesis, The Wharton School, University of Pennsylvania).
Fama, Eugene F., and Kenneth R. French, 1988, Dividend yields and expected stock returns, *Journal of Financial Economics* 22, 3–25.
Fama, Eugene F., and Kenneth R. French, 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics* 25, 23–49.
Fama, Eugene F., and Kenneth R. French, 2001, Disappearing dividends: Changing firm characteristics or lower propensity to pay, *Journal of Financial Economics* 60, 3–43.
Gebhardt, William R., Charles M. C. Lee, and Bhaskaram Swaminathan, 2001, Toward an implied cost of capital, *Journal of Accounting Research* 39, June, 135–176.
Gordon, Myron, 1962, *The Investment Financing and Valuation of the Corporation* (Irwin, Homewood, IL).
Heaton, John, and Deborah Lucas, 1999, Stock prices and fundamentals, in Ben Bernanke and Julio Rotemberg, eds.: *Macroeconomics Annual 1999* (National Bureau of Economic Research, MIT Press, Cambridge, MA).
Keane, Michael P., and David E. Runkle, 1998, Are financial analysts' forecasts of corporate profits rational? *Journal of Political Economy* 106, 768–805.
Lamont, Owen, 1998, Earnings and expected returns, *Journal of Finance* 53, 1563–1587.
Lettau, Martin, and Sydney Ludvigson, 2001, Consumption, aggregate wealth, and expected stock returns, *Journal of Finance* 56, 815–849.
Mehra, Rajnish, and Edward Prescott, 1985, The equity premium: A puzzle, *Journal of Monetary Economics* 15, 145–161.
Shiller, Robert, 1989, *Market Volatility* (MIT Press, Cambridge, MA).
Siegel, Jeremy J., 1999, The shrinking equity premium, *Journal of Portfolio Management* 26, 10–17.
Vuolteenaho, Tuomo, 2000, Understanding the aggregate book-to-market ratio, Manuscript, University of Chicago.

LINKED CITATIONS

You have printed the following article:

The Equity Premium
Eugene F. Fama; Kenneth R. French
The Journal of Finance, Vol. 57, No. 2. (Apr., 2002), pp. 637-659.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28200204%2957%3A2%3C637%3ATEP%3E2.0.CO%3B2-%23

[Footnotes]

[1] **Consumption, Aggregate Wealth, and Expected Stock Returns**
Martin Lettau; Sydney Ludvigson
The Journal of Finance, Vol. 56, No. 3. (Jun., 2001), pp. 815-849.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28200106%2956%3A3%3C815%3ACAWAES%3E2.0.CO%3B2-N

References

Cash Distributions to Shareholders
Laurie Simon Bagwell; John B. Shoven
The Journal of Economic Perspectives, Vol. 3, No. 3. (Summer, 1989), pp. 129-140.
Stable URL:
http://links.jstor.org/sici?sici=0895-3309%28198922%293%3A3%3C129%3ACDTS%3E2.0.CO%3B2-9

Unbiased Estimators of Long-Run Expected Rates of Return
Marshall E. Blume
Journal of the American Statistical Association, Vol. 69, No. 347. (Sep., 1974), pp. 634-638.
Stable URL:
http://links.jstor.org/sici?sici=0162-1459%28197409%2969%3A347%3C634%3AUEOLER%3E2.0.CO%3B2-V

LINKED CITATIONS

Survival
Stephen J. Brown; William N. Goetzmann; Stephen A. Ross
The Journal of Finance, Vol. 50, No. 3, Papers and Proceedings Fifty-Fifth Annual Meeting, American Finance, Association, Washington, D.C., January 6-8, 1995. (Jul., 1995), pp. 853-873.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199507%2950%3A3%3C853%3AS%3E2.0.CO%3B2-0

A Variance Decomposition for Stock Returns
John Y. Campbell
The Economic Journal, Vol. 101, No. 405. (Mar., 1991), pp. 157-179.
Stable URL:
http://links.jstor.org/sici?sici=0013-0133%28199103%29101%3A405%3C157%3AAVDFSR%3E2.0.CO%3B2-X

The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors
John Y. Campbell; Robert J. Shiller
The Review of Financial Studies, Vol. 1, No. 3. (Autumn, 1988), pp. 195-228.
Stable URL:
http://links.jstor.org/sici?sici=0893-9454%28198823%291%3A3%3C195%3ATDRAEO%3E2.0.CO%3B2-O

Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets
James Claus; Jacob Thomas
The Journal of Finance, Vol. 56, No. 5. (Oct., 2001), pp. 1629-1666.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28200110%2956%3A5%3C1629%3AEPALAT%3E2.0.CO%3B2-6

Permanent and Transitory Components of GNP and Stock Prices
John H. Cochrane
The Quarterly Journal of Economics, Vol. 109, No. 1. (Feb., 1994), pp. 241-265.
Stable URL:
http://links.jstor.org/sici?sici=0033-5533%28199402%29109%3A1%3C241%3APATCOG%3E2.0.CO%3B2-K

Characteristics, Covariances, and Average Returns: 1929 to 1997
James L. Davis; Eugene F. Fama; Kenneth R. French
The Journal of Finance, Vol. 55, No. 1. (Feb., 2000), pp. 389-406.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28200002%2955%3A1%3C389%3ACCAAR1%3E2.0.CO%3B2-V

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

Toward an Implied Cost of Capital
William R. Gebhardt; Charles M. C. Lee; Bhaskaran Swaminathan
Journal of Accounting Research, Vol. 39, No. 1. (Jun., 2001), pp. 135-176.
Stable URL:
http://links.jstor.org/sici?sici=0021-8456%28200106%2939%3A1%3C135%3ATAICOC%3E2.0.CO%3B2-4

Are Financial Analysts' Forecasts of Corporate Profits Rational?
Michael P. Keane; David E. Runkle
The Journal of Political Economy, Vol. 106, No. 4. (Aug., 1998), pp. 768-805.
Stable URL:
http://links.jstor.org/sici?sici=0022-3808%28199808%29106%3A4%3C768%3AAFAFOC%3E2.0.CO%3B2-%23

Earnings and Expected Returns
Owen Lamont
The Journal of Finance, Vol. 53, No. 5. (Oct., 1998), pp. 1563-1587.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199810%2953%3A5%3C1563%3AEAER%3E2.0.CO%3B2-G

Consumption, Aggregate Wealth, and Expected Stock Returns
Martin Lettau; Sydney Ludvigson
The Journal of Finance, Vol. 56, No. 3. (Jun., 2001), pp. 815-849.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28200106%2956%3A3%3C815%3ACAWAES%3E2.0.CO%3B2-N

Market Risk Premium used in 88 countries in 2014:
a survey with 8,228 answers

Pablo Fernandez*, Pablo Linares** and Isabel Fernandez Acín***
IESE Business School

ABSTRACT

This paper contains the statistics of the Equity Premium or Market Risk Premium (MRP) used in 2014 for **88 countries**. We got answers for more countries, but we only report the results for 88 countries with more than 6 answers.

37% of the MRP used in 2014 decreased (vs. 2013) and 9% increased.

Most previous surveys have been interested in the Expected MRP, but this survey asks about the Required MRP. The paper also contains the references used to justify the MRP, comments from 30 persons that do not use MRP, and comments from 53 persons that do use MRP.

JEL Classification: G12, G31, M21

Keywords: equity premium; required equity premium; expected equity premium; historical equity premium

June 20, 2014

* Professor of Corporate Finance. e-mail: fernandezpa@iese.edu
** Research Assistant. e-mail: plinares@iese.edu
*** Independent research. e-mail: ifernandez.28@alumni.unav.es

xPPlhmlsjSaP

IESE Business School
Camino del Cerro del Aguila 3. 28023 Madrid, Spain. Telephone 34-91-211 3000

1. Market Risk Premium (MRP) used in 2014 in 88 countries

We sent a short email (see exhibit 1) on May and June 2014 to more than 29,000 email addresses of finance and economic professors, analysts and managers of companies obtained from previous correspondence, papers and webs of companies and universities. We asked about the Market Risk Premium (**MRP**) **used** *"to calculate the required return to equity in different countries"*. We also asked about "*Books or articles that I use to support this number*".

By June 19, 2014, we had received 3,104 emails with 8,094 specific MRP used in 2014.[1] We considered 139 of them as outliers because they provided a very small MRP (for example, -2% and 0 for the USA) or a very high MRP (for example, 30% for the USA). Other 134 persons answered that they do not use MRP for different reasons (see table 1). We would like to sincerely thank everyone who took the time to answer us.

Table 1. MRP used in 2014: 8,228 answers

	Professors	Analyst	Companies	Financial companies	Other	Total
Answers reported (MRP figures)	2022	1278	1968	1803	884	7955
Outliers	9	1	77	23	29	139
Answers that do not provide a figure	19	24	17	43	31	134
Total	2050	1303	2062	1869	944	8228

Some answers that do not provide a figure: *"We use a minimum IRR"; "We use multiples"; "MRP is a concept that we do not use"; "It is confidential"; "The CAPM is not very useful"; "I think about premia for particular stocks"; "I teach derivatives: I did not have to use a MRP"; "The MRP changes every day".*

Table 2 contains the statistics of the MRP used in 2014 **for 88 countries**. We got answers for more countries, but we only report the results for 88 countries with more than 6 answers. Fernandez et al (2011a)[2] is an analysis of the answers for the USA; it also shows the evolution of the Market Risk Premium used for the USA in 2011, 2010, 2009 and 2008 according to previous surveys (Fernandez et al, 2009, 2010a and 2010b). Fernandez et al (2011b)[3] is an analysis of the answers for Spain.

Figures 1 and 2 are graphic representations of the MRPs reported in table 2.

Surveys of previous years		
2013	MRP and Risk Free Rate used for 51 countries in 2013	http://ssrn.com/abstract=914160
2012	MRP used in 82 countries in 2012	http://ssrn.com/abstract=2084213
2011	MRP used in 56 countries in 2011	http://ssrn.com/abstract=1822182
2010	MRP used in 22 countries in 2010	http://ssrn.com/abstract=1609563

[1] 1,564 emails contained MRP for more than one country.
[2] Fernandez, P., J. Aguirreamalloa and L. Corres (2011a), "US Market Risk Premium Used in 2011 by Professors, Analysts and Companies: A Survey...", downloadable in **http://ssrn.com/abstract=1805852**
[3] Fernandez, P., J. Aguirreamalloa and L. Corres (2011b), "The Equity Premium in Spain: Survey 2011 (in Spanish)", downloadable in **http://ssrn.com/abstract=1822422**

Table 2. Market Risk Premium (%) used for 88 countries in 2014

		Average	Median	St Dev	Q1	Q3	min	Max	Skewness
1	USA	5,4%	5,0%	1,4%	4,5%	6,0%	1,5%	13,0%	0,6
2	Spain	6,2%	6,0%	1,6%	5,0%	6,5%	2,0%	13,0%	1,5
3	Germany	5,4%	5,0%	1,7%	4,5%	6,0%	1,0%	12,4%	1,0
4	UK	5,1%	5,0%	1,4%	4,3%	6,0%	1,5%	12,8%	1,5
5	Italy	5,6%	5,5%	1,5%	4,8%	6,0%	2,0%	10,1%	0,8
6	Canada	5,3%	5,0%	1,2%	4,5%	6,0%	3,0%	10,0%	1,3
7	Mexico	7,4%	6,7%	2,4%	6,0%	9,0%	3,0%	15,0%	1,2
8	Brazil	7,8%	7,0%	4,2%	5,5%	8,3%	1,8%	25,0%	2,4
9	France	5,8%	5,9%	1,5%	5,0%	6,1%	2,0%	11,4%	0,9
10	South Africa	6,3%	6,0%	1,4%	5,5%	7,0%	3,0%	11,8%	1,3
11	China	8,1%	7,0%	3,5%	6,0%	9,4%	3,9%	20,0%	1,9
12	Australia	5,9%	6,0%	1,6%	5,0%	6,0%	3,0%	15,0%	2,2
13	Netherlands	5,2%	5,0%	1,2%	4,5%	6,0%	2,5%	11,6%	1,5
14	Switzerland	5,2%	5,0%	1,1%	4,5%	6,0%	3,0%	9,6%	0,9
15	Russia	7,9%	7,0%	3,4%	6,0%	9,0%	2,7%	25,0%	3,1
16	India	8,0%	8,0%	2,4%	6,0%	8,6%	2,3%	16,0%	1,2
17	Sweden	5,3%	5,0%	1,0%	4,5%	6,0%	3,6%	9,0%	0,8
18	Chile	6,0%	5,6%	1,5%	5,3%	6,4%	4,0%	15,0%	3,1
19	Austria	5,5%	5,5%	1,5%	4,9%	6,0%	2,5%	14,3%	2,7
20	Belgium	5,6%	5,5%	1,1%	5,0%	6,2%	3,0%	8,1%	0,0
21	Norway	5,8%	5,0%	2,0%	4,5%	6,0%	3,5%	14,0%	1,8
22	Argentina	11,8%	11,5%	4,2%	9,0%	14,6%	5,0%	28,7%	1,2
23	Colombia	8,1%	7,8%	3,8%	6,5%	9,0%	2,0%	20,5%	1,0
24	Portugal	8,5%	8,5%	2,0%	7,0%	9,4%	4,0%	14,0%	0,0
25	Denmark	5,1%	5,0%	1,8%	4,2%	5,5%	2,0%	14,0%	2,6
26	Japan	5,3%	5,0%	2,4%	4,0%	6,0%	2,0%	16,7%	2,4
27	Poland	6,3%	6,0%	1,5%	5,0%	8,0%	4,4%	10,0%	0,6
28	Greece	15,0%	16,5%	4,7%	10,0%	19,0%	6,5%	23,0%	-0,5
29	Finland	5,6%	5,4%	1,6%	4,6%	6,0%	3,5%	12,0%	1,9
30	New Zealand	5,6%	5,5%	1,4%	4,9%	6,7%	2,0%	8,0%	-0,5
31	Peru	7,8%	7,5%	2,5%	6,5%	8,0%	3,5%	15,0%	1,4
32	Luxembourg	4,9%	5,0%	0,9%	4,1%	5,6%	3,5%	7,0%	0,3
33	Turkey	7,9%	7,0%	3,3%	5,4%	10,5%	2,5%	18,0%	0,8
34	Czech Republic	6,5%	6,5%	1,6%	5,5%	7,0%	4,3%	12,1%	1,9
35	Israel	5,8%	5,0%	2,1%	4,6%	6,8%	3,0%	15,0%	2,6
36	Indonesia	7,9%	8,0%	2,0%	6,5%	8,9%	4,5%	14,5%	1,0
37	Korea	6,3%	6,3%	1,8%	5,0%	7,3%	2,0%	11,1%	-0,2
38	Taiwan	7,5%	7,0%	2,1%	6,5%	8,0%	4,3%	15,0%	1,9
39	Ireland	6,8%	6,3%	2,4%	5,1%	8,8%	2,7%	12,3%	0,3
40	Singapore	5,7%	5,5%	1,3%	5,1%	6,0%	3,9%	9,6%	0,9
41	Hong Kong	7,0%	6,0%	2,4%	5,5%	7,7%	3,5%	12,0%	1,0
42	Pakistan	11,1%	11,5%	5,3%	6,0%	16,0%	2,5%	19,0%	0,0
43	Malaysia	6,4%	6,8%	1,5%	6,0%	7,3%	3,4%	8,8%	-0,5
44	Thailand	8,0%	7,5%	1,8%	7,0%	8,6%	6,0%	15,1%	2,7
45	Hungary	8,3%	8,9%	2,3%	6,0%	10,0%	5,0%	13,8%	0,2

Table 2 (cont). Market Risk Premium (%) used for 88 countries in 2014

		Average	Median	St Dev	Q1	Q3	min	Max	Skewness
46	Egypt	12,9%	13,0%	3,8%	11,4%	15,9%	3,5%	19,0%	-0,4
47	Kazakhstan	7,0%	7,5%	1,3%	6,0%	8,0%	4,7%	9,0%	-0,3
48	Nigeria	10,4%	9,0%	3,3%	8,5%	12,0%	6,9%	20,0%	2,0
49	Saudi Arabia	6,2%	5,7%	1,2%	5,5%	6,8%	5,0%	10,6%	2,4
50	Romania	7,3%	7,0%	1,5%	6,3%	8,0%	5,0%	10,0%	0,4
51	Philippines	8,1%	8,0%	1,4%	7,0%	8,8%	6,4%	11,0%	0,7
52	Croatia	7,3%	6,8%	1,8%	6,0%	9,0%	4,4%	10,0%	0,3
53	Ecuador	12,2%	13,0%	5,0%	6,9%	16,3%	5,0%	20,0%	-0,1
54	Liechtenstein	4,8%	5,0%	0,8%	4,0%	5,5%	3,6%	6,0%	0,1
55	United Arab Emirates	7,7%	8,5%	1,7%	7,0%	9,0%	4,0%	9,7%	-0,9
56	Kuwait	6,1%	5,5%	1,5%	5,5%	6,8%	4,0%	10,6%	2,0
57	Bulgaria	7,9%	7,8%	1,7%	6,8%	8,8%	6,0%	12,0%	1,0
58	Senegal	9,8%	10,0%	2,3%	9,0%	10,0%	5,0%	14,0%	-0,2
59	Bahrain	6,9%	5,8%	1,8%	5,5%	8,2%	5,5%	11,1%	1,1
60	Vietnam	10,3%	9,9%	3,3%	8,4%	12,0%	3,9%	16,0%	-0,1
61	Oman	6,0%	5,0%	1,8%	5,0%	7,0%	5,0%	11,1%	2,2
62	Qatar	6,8%	7,0%	1,4%	7,0%	7,0%	4,0%	10,1%	0,2
63	Zambia	8,9%	7,0%	3,0%	7,0%	9,8%	6,6%	16,0%	1,5
64	Bolivia	10,3%	10,0%	2,4%	8,0%	12,0%	7,5%	15,1%	0,6
65	Kenya	11,6%	11,9%	2,5%	10,8%	13,3%	6,0%	15,0%	-0,9
66	Morocco	8,4%	8,8%	2,3%	7,0%	10,0%	5,0%	12,0%	-0,2
67	Lebanon	11,6%	11,8%	2,1%	9,5%	13,0%	9,0%	14,5%	-0,1
68	Slovenia	7,2%	7,0%	2,1%	6,0%	8,7%	3,6%	10,0%	-0,1
69	Uruguay	8,1%	7,9%	1,9%	7,0%	9,9%	5,0%	10,4%	-0,2
70	Panama	8,6%	9,0%	1,9%	7,2%	9,8%	6,0%	11,3%	-0,1
71	Ghana	10,6%	10,0%	2,0%	9,3%	11,9%	8,0%	14,0%	0,3
72	Ukraine	13,9%	13,4%	3,3%	12,0%	15,9%	8,0%	19,0%	0,0
73	Venezuela	14,0%	15,6%	4,6%	11,9%	17,5%	6,0%	19,0%	-0,9
74	Slovakia	6,1%	6,0%	1,1%	5,0%	7,0%	5,0%	8,0%	0,5
75	Costa Rica	8,2%	8,3%	2,0%	7,0%	10,0%	3,8%	10,0%	-1,3
76	Malta	6,3%	6,4%	2,1%	4,9%	8,0%	3,1%	9,3%	-0,1
77	Iceland	8,5%	8,4%	1,4%	7,0%	10,0%	7,0%	10,0%	0,1
78	Guatemala	9,0%	8,7%	2,0%	7,3%	10,0%	7,0%	13,0%	1,1
79	Albania	10,1%	10,9%	3,3%	8,3%	12,3%	5,0%	14,0%	-0,6
80	Tunisia	9,4%	9,0%	2,1%	7,8%	11,2%	7,0%	12,0%	0,3
81	Trinidad and Tobago	9,5%	9,0%	4,8%	6,7%	9,0%	6,0%	20,0%	2,2
82	Macedonia	10,2%	10,4%	1,5%	9,3%	11,2%	8,0%	12,0%	-0,1
83	Honduras	13,0%	13,3%	2,7%	10,8%	15,5%	9,5%	16,0%	-0,1
84	Lithuania	7,2%	6,7%	1,5%	6,0%	8,6%	6,0%	9,0%	0,5
85	Angola	11,1%	11,2%	2,5%	9,4%	12,0%	8,0%	15,0%	0,5
86	Serbia	11,2%	11,8%	2,5%	9,7%	12,7%	7,5%	14,0%	-0,6
87	Sri Lanka	11,3%	10,9%	2,0%	10,0%	12,7%	9,0%	14,0%	0,3
88	Mozambique	12,1%	12,4%	2,3%	10,4%	13,8%	9,0%	15,0%	-0,2

Figure 1. Market Risk Premium used in 2014 for some countries (plot of answers)

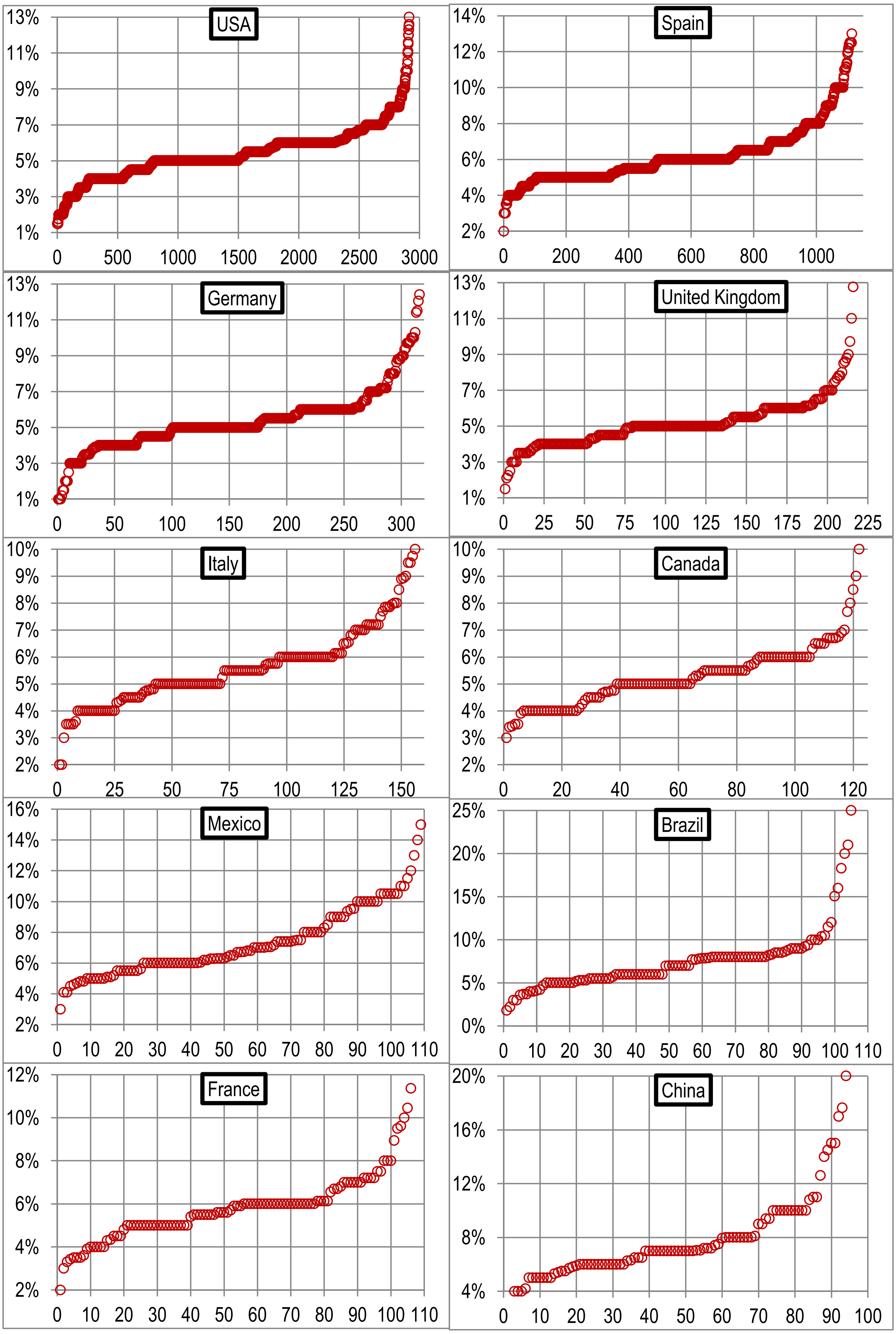
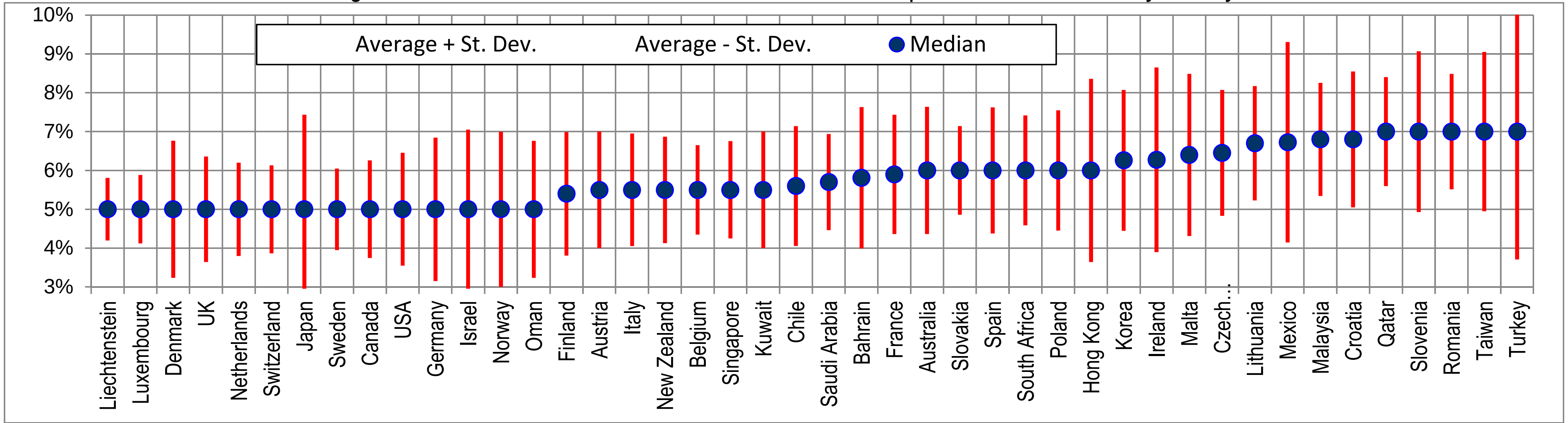
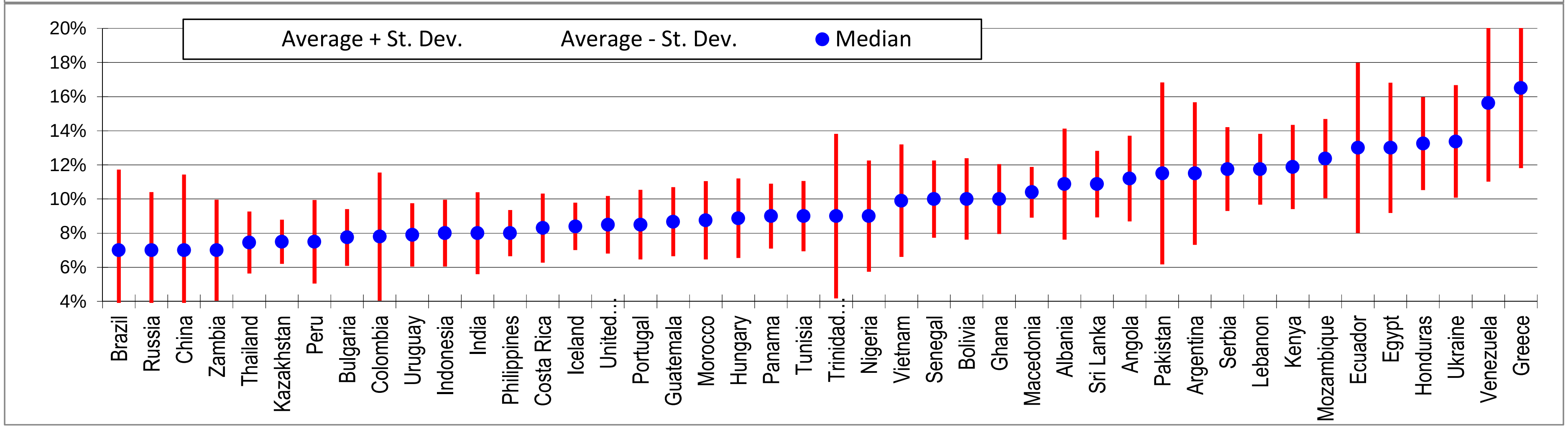


Figure 2. Market Risk Premium used in 2014. Median and dispersion of the answers by country





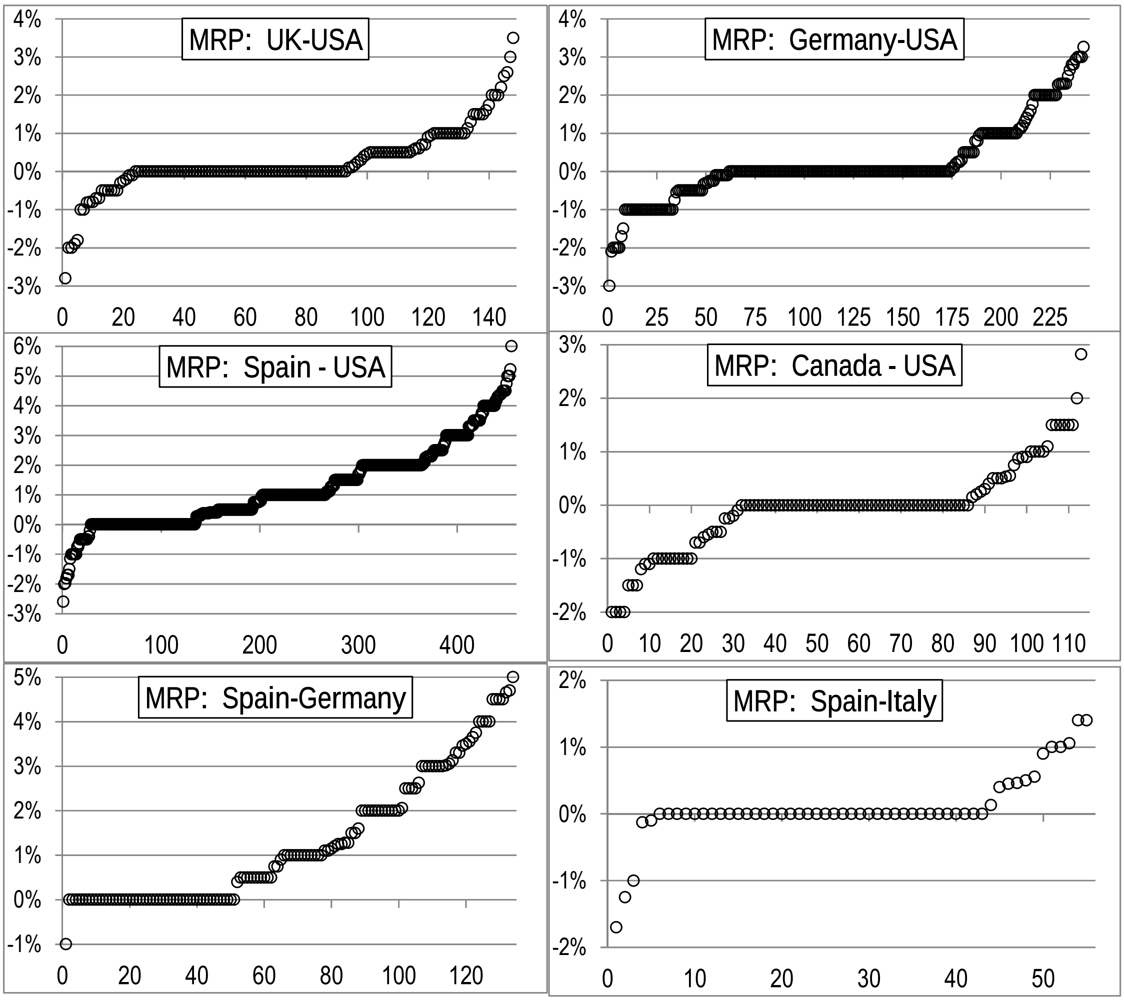
2. Differences among respondents

Table 3 and figure 3 show the differences in Market Risk Premium used by the same person for 2 countries. 242 respondents provided us with answers for USA and Germany. 148 provided us with answers for USA and UK.

Table 3. Difference in the Market Risk Premium used in 2014 by the same person for two countries

		Number of answers			
	Average	Total	<0	0	>0
MRP: UK-USA	0,24%	148	23	70	55
MRP: Germany-USA	0,19%	242	61	113	68
MRP: Spain - USA	1,22%	456	28	96	332
MRP: Canada - USA	-0,04%	113	31	55	27
MRP: Spain-Germany	1,30%	134	1	50	83
MRP: Spain-Italy	0,09%	55	5	38	12

Figure 3. Difference in the MRP used by the same person in 2014 for several countries



3. References used to justify the MRP figure

Some respondents indicated which books, papers… they use as a reference to justify the MRP that they use. The most cited references were: Damodaran, Internal estimate, Historical data, Ibbotson/Morningstar, Duff&Phelps, Fernandez, DMS, Graham-Harvey, Bloomberg, Analysts, Experience, Own judgement, Grabowski , Pratt's & Grabowski, Mckinsey (Copeland), Brealy & Myers, Siegel.

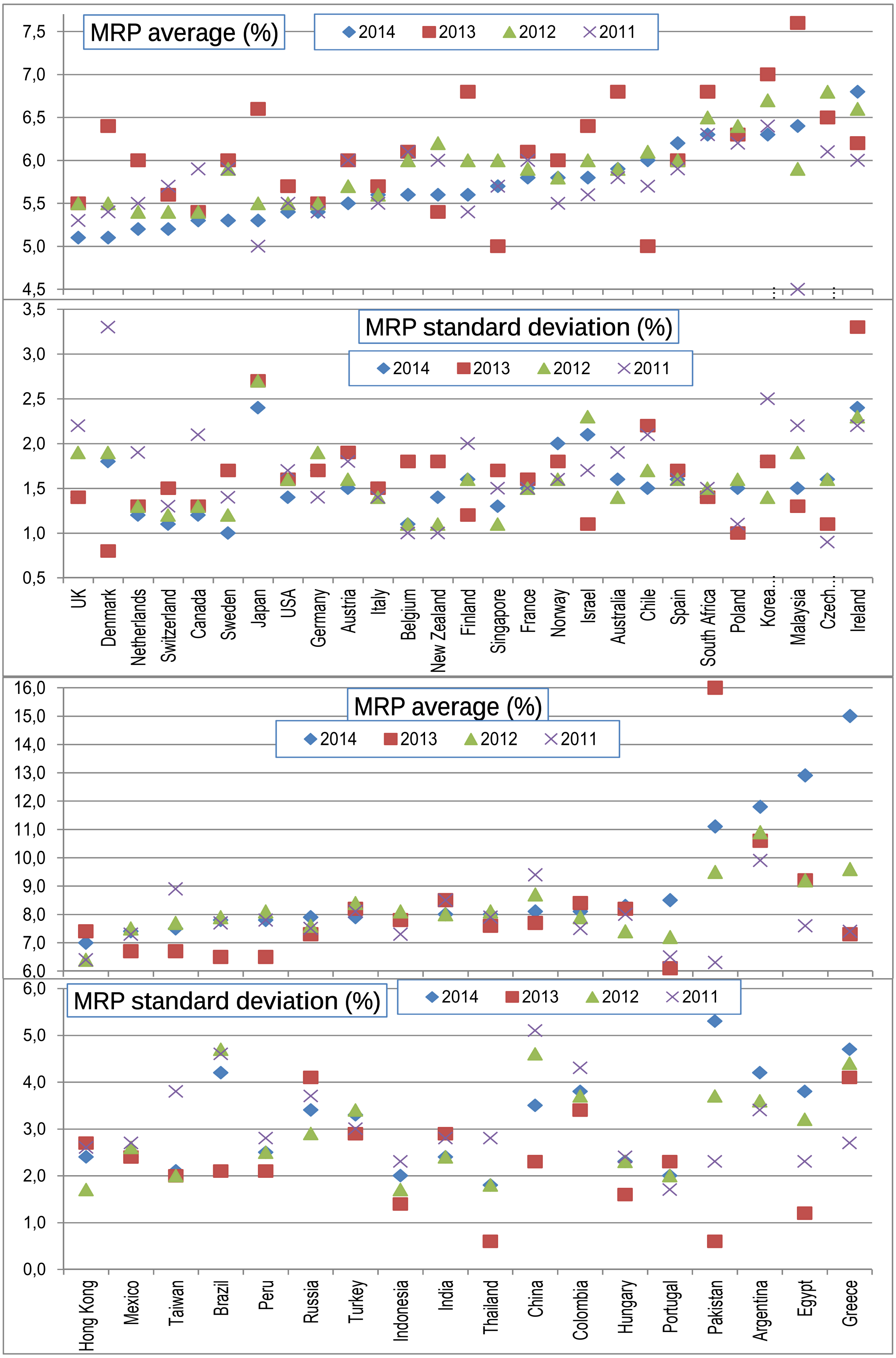
4. Comparison with previous surveys

Table 4 and figure 4 compare some results of this survey with the results of 2011, 2012 and 2013.

Table 4. Comparison of some results of the surveys of 2011, 2012, 2013 and 2014 (%)
(in bold: higher in 2014 than in 2013)

	Average				Median				St. Dev.			
	2014	2013	2012	2011	2014	2013	2012	2011	2014	2013	2012	2011
UK	5,1	5,5	5,5	5,3	5,0	5,0	5,0	5,0	1,4	1,4	1,9	2,2
Denmark	5,1	6,4	5,5	5,4	5,0	5,9	5,0	4,5	1,8	0,8	1,9	3,3
Netherlands	5,2	6,0	5,4	5,5	5,0	5,8	5,5	5,0	1,2	1,3	1,3	1,9
Switzerland	5,2	5,6	5,4	5,7	5,0	5,5	5,3	5,5	1,1	1,5	1,2	1,3
Canada	5,3	5,4	5,4	5,9	5,0	5,3	5,5	5,0	1,2	1,3	1,3	2,1
Sweden	5,3	6,0	5,9	5,9	5,0	5,9	6,0	5,5	1,0	1,7	1,2	1,4
Japan	5,3	6,6	5,5	5,0	5,0	6,4	5,0	3,5	2,4	2,7	2,7	3,7
USA	5,4	5,7	5,5	5,5	5,0	5,5	5,4	5,0	1,4	1,6	1,6	1,7
Germany	5,4	5,5	5,5	5,4	5,0	5,0	5,0	5,0	1,7	1,7	1,9	1,4
Austria	5,5	6,0	5,7	6,0	5,5	5,8	6,0	5,7	1,5	1,9	1,6	1,8
Italy	5,6	5,7	5,6	5,5	5,5	5,5	5,5	5,0	1,5	1,5	1,4	1,4
Belgium	5,6	6,1	6,0	6,1	5,5	6,0	6,0	6,1	1,1	1,8	1,1	1,0
New Zealand	5,6	5,4	6,2	6,0	5,5	5,8	6,0	6,0	1,4	1,8	1,1	1,0
Finland	5,6	6,8	6,0	5,4	5,4	6,0	6,0	4,7	1,6	1,2	1,6	2,0
Singapore	5,7	5,0	6,0	5,7	5,5	5,8	5,7	5,0	1,3	1,7	1,1	1,5
France	5,8	6,1	5,9	6,0	5,9	6,0	6,0	6,0	1,5	1,6	1,5	1,5
Norway	5,8	6,0	5,8	5,5	5,0	6,0	5,5	5,0	2,0	1,8	1,6	1,6
Israel	5,8	6,4	6,0	5,6	5,0	7,0	5,8	5,0	2,1	1,1	2,3	1,7
Australia	5,9	6,8	5,9	5,8	6,0	5,8	6,0	5,2	1,6	4,9	1,4	1,9
Chile	6,0	5,0	6,1	5,7	5,6	5,5	5,6	5,3	1,5	2,2	1,7	2,1
Spain	6,2	6,0	6,0	5,9	6,0	5,5	5,5	5,5	1,6	1,7	1,6	1,6
South Africa	6,3	6,8	6,5	6,3	6,0	7,0	6,0	6,0	1,4	1,4	1,5	1,5
Poland	6,3	6,3	6,4	6,2	6,0	6,5	6,0	6,0	1,5	1,0	1,6	1,1
Korea (South)	6,3	7,0	6,7	6,4	6,3	6,9	7,3	6,5	1,8	1,8	1,4	2,5
Malaysia	6,4	7,6	5,9	4,5	6,8	7,5	6,4	3,5	1,5	1,3	1,9	2,2
Czech Republic	6,5	6,5	6,8	6,1	6,5	7,0	7,0	6,0	1,6	1,1	1,6	0,9
Ireland	6,8	6,2	6,6	6,0	6,3	7,0	6,0	5,1	2,4	3,3	2,3	2,2
Hong Kong	7,0	7,4	6,4	6,4	6,0	6,5	6,2	5,0	2,4	2,7	1,7	2,6
Mexico	7,4	6,7	7,5	7,3	6,7	6,3	6,8	6,4	2,4	2,4	2,6	2,7
Taiwan	7,5	6,7	7,7	8,9	7,0	6,9	7,1	8,0	2,1	2,0	2,0	3,8
Brazil	7,8	6,5	7,9	7,7	7,0	6,0	7,0	7,0	4,2	2,1	4,7	4,6
Peru	7,8	6,5	8,1	7,8	7,5	6,8	8,0	7,5	2,5	2,1	2,5	2,8
Russia	7,9	7,3	7,6	7,5	7,0	7,0	7,0	6,5	3,4	4,1	2,9	3,7
Turkey	7,9	8,2	8,4	8,1	7,0	9,4	9,0	8,2	3,3	2,9	3,4	3,0
Indonesia	7,9	7,8	8,1	7,3	8,0	8,0	8,0	7,5	2,0	1,4	1,7	2,3
India	8,0	8,5	8,0	8,5	8,0	8,8	8,0	7,8	2,4	2,9	2,4	2,8
Thailand	8,0	7,6	8,1	7,9	7,5	8,1	8,1	6,5	1,8	0,6	1,8	2,8
China	8,1	7,7	8,7	9,4	7,0	7,0	7,1	7,8	3,5	2,3	4,6	5,1
Colombia	8,1	8,4	7,9	7,5	7,8	8,8	7,5	7,0	3,8	3,4	3,7	4,3
Hungary	8,3	8,2	7,4	8,0	8,9	8,7	7,0	8,0	2,3	1,6	2,3	2,4
Portugal	8,5	6,1	7,2	6,5	8,5	5,9	6,5	6,1	2,0	2,3	2,0	1,7
Pakistan	11,1	16,0	9,5	6,3	11,5	16,3	9,5	7,5	5,3	0,6	3,7	2,3
Argentina	11,8	10,6	10,9	9,9	11,5	6,8	10,0	9,0	4,2	8,1	3,6	3,4
Egypt	12,9	9,2	9,2	7,6	13,0	9,0	8,0	7,0	3,8	1,2	3,2	2,3
Greece	15,0	7,3	9,6	7,4	16,5	6,0	7,4	7,2	4,7	4,1	4,4	2,7

Figure 4. Comparison of some results of the surveys of 2011, 2012, 2013 and 2014 (%)



Welch (2000) performed two surveys with finance professors in 1997 and 1998, asking them what they thought the Expected MRP would be over the next 30 years. He obtained 226 replies, ranging from 1% to 15%, with an average arithmetic EEP of 7% above T-Bonds.[4] Welch (2001) presented the results of a survey of 510 finance and economics professors performed in August 2001 and the consensus for the 30-year arithmetic EEP was 5.5%, much lower than just 3 years earlier. In an update published in 2008 Welch reports that the MRP "used in class" in December 2007 by about 400 finance professors was on average 5.89%, and 90% of the professors used equity premiums between 4% and 8.5%.

Johnson et al (2007) report the results of a survey of 116 finance professors in North America done in March 2007: 90% of the professors believed the Expected MRP during the next 30 years to range from 3% to 7%.

Graham and Harvey (2007) indicate that U.S. CFOs reduced their average EEP from 4.65% in September 2000 to 2.93% by September 2006 (st. dev. of the 465 responses = 2.47%). In the 2008 survey, they report an average EEP of 3.80%, ranging from 3.1% to 11.5% at the tenth percentile at each end of the spectrum. They show that average EEP changes through time. Goldman Sachs (O'Neill, Wilson and Masih 2002) conducted a survey of its global clients in July 2002 and the average long-run EEP was 3.9%, with most responses between 3.5% and 4.5%.

Ilmanen (2003) argues that surveys tend to be optimistic: *"survey-based expected returns may tell us more about hoped-for returns than about required returns".* Damodaran (2008) points out that *"the risk premiums in academic surveys indicate how far removed most academics are from the real world of valuation and corporate finance and how much of their own thinking is framed by the historical risk premiums... The risk premiums that are presented in classroom settings are not only much higher than the risk premiums in practice but also contradict other academic research".*

Table 5. Comparison of previous surveys

	Surveys of Ivo Welch					Fernandez et al (2009, 2010)			
	Oct 97–Feb 98*	Jan-May 99+	Sep 2001**	Dec. 2007#	January 2009++	US 2008	Europe 2008	US 2009	Europe 2009
Number of answers	226	112	510	360	143	487	224	462	194
Average	7.2	6.8	4.7	5.96	6.2	6.3	5.3	6.0	5.3
Std. Deviation	*2.0*	*2.0*	*2.2*	*1.7*	*1.7*	*2.2*	*1.5*	*1.7*	*1.7*
Max	15	15	20	20		19.0	10.0	12.0	12.0
Q3	8.4	8	6	7.0	7	7.2	6.0	7.0	6.0
Median	7	7	4.5	6.0	6	6.0	5.0	6.0	5.0
Q1	6	5	3	5.0	5	5.0	4.1	5.0	5.3
Min	1.5	1.5	0	2		0.8	1.0	2.0	2.0

* 30-Year Forecast. Welch (2000) First survey + 30-Year Forecast. Welch (2000) Second survey
** 30 year Equity Premium Forecast (Geometric). "The Equity Premium Consensus Forecast Revisited" (2001)
# 30-Year Geo Eq Prem Used in class. Welch, I. (2008), "The Consensus Estimate for the Equity Premium by Academic Financial Economists in December 2007". http://ssrn.com/abstract=1084918
++ In your classes, what is the main number you are recommending for long-term CAPM purposes? "Short Academic Equity Premium Survey for January 2009". http://welch.econ.brown.edu/academics/equpdate-results2009.html

Table 6. Estimates of the EEP (Expected Equity Premium) according to other surveys

Authors	Conclusion about EEP	Respondents
Pensions and Investments (1998)	3%	Institutional investors
Graham and Harvey (2007)	Sep. 2000. Mean: 4.65%. Std. Dev. = 2.7%	CFOs
Graham and Harvey (2007)	Sep. 2006. Mean: 2.93%. Std. Dev. = 2.47%	CFOs
Graham and Harvey (2014)	3.73%.	CFOs
Welch update	December 2007. Mean: 5.69%. Range 2% to 12%	Finance professors
O'Neill, Wilson and Masih (2002)	3.9%	Global clients Goldman

The magazine *Pensions and Investments* (12/1/1998) carried out a survey among professionals working for institutional investors: the average EEP was 3%. Shiller[5] publishes and

[4] At that time, the most recent Ibbotson Associates Yearbook reported an arithmetic HEP versus T-bills of 8.9% (1926–1997).
[5] See http://icf.som.yale.edu/Confidence.Index

updates an index of investor sentiment since the crash of 1987. While neither survey provides a direct measure of the equity risk premium, they yield a broad measure of where investors or professors expect stock prices to go in the near future. The 2004 survey of the Securities Industry Association (SIA) found that the median EEP of 1500 U.S. investors was about 8.3%. Merrill Lynch surveys more than 300 institutional investors globally in July 2008: the average EEP was 3.5%.

A main difference of this survey with previous ones is that this survey asks about the **Required** MRP, while most surveys are interested in the **Expected** MRP.

5. MRP or EP (Equity Premium): 4 different concepts

As Fernandez (2007, 2009b) claims, the term "equity premium" is used to designate four different concepts:

1. **Historical** equity premium (HEP): historical differential return of the stock market over treasuries.
2. **Expected** equity premium (EEP): expected differential return of the stock market over treasuries.
3. **Required** equity premium (REP): incremental return of a diversified portfolio (the market) over the risk-free rate required by an investor. It is used for calculating the required return to equity.
4. **Implied** equity premium (IEP): the required equity premium that arises from assuming that the market price is correct.

The four concepts (HEP, REP, EEP and IEP) designate different realities. The **HEP** is easy to calculate and is equal for all investors, provided they use the same time frame, the same market index, the same risk-free instrument and the same average (arithmetic or geometric). But the **EEP,** the **REP** and the **IEP** may be different for different investors and are not observable.

The **HEP** is the historical average differential return of the market portfolio over the risk-free debt. The most widely cited sources are Ibbotson Associates and Dimson *et al.* (2007).

Numerous papers and books assert or imply that there is a "market" EEP. However, it is obvious that investors and professors do not share "homogeneous expectations" and have different assessments of the **EEP**. As Brealey et al. (2005, page 154) affirm, *"Do not trust anyone who claims to know what returns investors expect".*

The **REP** is the answer to the following question: What incremental return do I require for investing in a diversified portfolio of shares over the risk-free rate? It is a crucial parameter because the REP is the key to determining the company's required return to equity and the WACC. Different companies may use, and in fact do use, different **REPs**.

The **IEP** is the implicit REP used in the valuation of a stock (or market index) that matches the current market price. The most widely used model to calculate the IEP is the dividend discount model: the current price per share (P_0) is the present value of expected dividends discounted at the required rate of return (Ke). If d_1 is the dividend per share expected to be received in year 1, and g the expected long term growth rate in dividends per share,

$$P_0 = d_1 / (Ke - g), \text{ which implies: } IEP = d_1/P_0 + g - R_F \quad (1)$$

The estimates of the IEP depend on the particular assumption made for the expected growth (g). Even if market prices are correct for all investors, there is not an IEP common for all investors: there are many pairs (IEP, g) that accomplish equation (1). Even if equation (1) holds for every investor, there are many *required* returns (as many as expected growths, g) in the market. Many papers in the financial literature report different estimates of the IEP with great dispersion, as for example, Claus and Thomas (2001, IEP = 3%), Harris and Marston (2001, IEP = 7.14%) and Ritter and Warr (2002, IEP = 12% in 1980 and -2% in 1999). There is no a common **IEP** for all investors.

For a particular investor, the **EEP** is not necessary equal to the REP (unless he considers that the market price is equal to the value of the shares). Obviously, an investor will hold a diversified portfolio of shares if his EEP is higher (or equal) than his REP and will not hold it otherwise.

We can find out the REP and the EEP of an investor by asking him, although for many investors the REP is not an explicit parameter but, rather, it is implicit in the price they are prepared to pay for the shares. However, it is not possible to determine the REP for the market as a whole, because it does not exist: even if we knew the REPs of all the investors in the market, it would be meaningless to talk of a REP for the market as a whole. There is a distribution of REPs and we can only say that some percentage of investors have REPs contained in a range. The average of that distribution cannot be interpreted as the REP of the market nor as the REP of a representative investor.

Much confusion arises from not distinguishing among the four concepts that the phrase *equity premium* designates: Historical equity premium, Expected equity premium, Required equity premium and Implied equity premium. 129 of the books reviewed by Fernandez (2009b) identify Expected and Required equity premium and 82 books identify Expected and Historical equity premium.

Finance textbooks should clarify the MRP by incorporating distinguishing definitions of the four different concepts and conveying a clearer message about their sensible magnitudes.

6. Conclusion

Most surveys have been interested in the Expected MRP, but this survey asks about the Required MRP.

We provide the statistics of the Equity Premium or Market Risk Premium (MRP) used in 2014 for **88 countries**.

Most previous surveys have been interested in the Expected MRP, but this survey asks about the Required MRP. The paper also contains the references used to justify the MRP, comments from several persons that do not use MRP, and comments from others that do use MRP. Fernandez et al. (2011a)[6] has additional comments. The comments illustrate the various interpretations of the required MRP and its usefulness.

This survey links with the *Equity Premium Puzzle*: Fernandez et al (2009), argue that the equity premium puzzle may be explained by the fact that many market participants (equity investors, investment banks, analysts, companies…) do not use standard theory (such as a standard representative consumer asset pricing model…) for determining their Required Equity Premium, but rather, they use historical data and advice from textbooks and finance professors. Consequently, ex-ante equity premia have been high, market prices have been consistently undervalued, and the ex-post risk premia has been also high. Many investors use historical data and textbook prescriptions to estimate the required and the expected equity premium.

EXHIBIT 1. Mail sent on May and June 2014

We are doing a survey about the Market Risk Premium (MRP) that companies, analysts and professors use to calculate the required return to equity in different countries.

We will be very grateful to you if you kindly reply to the following 3 questions.

Of course, no companies, individuals or universities will be identified, and only aggregate data will be made public.

Best regards and thanks,

Pablo Fernandez. Professor of Finance. IESE Business School. Spain http://ssrn.com/author=12696

3 questions:

1. The Market Risk Premium that I am using in 2014 for my country _________ is: ________%
2. The Market Risk Premium that I am using in 2014 for USA is: _________%
3. Books or articles that I use to support this number:

Comments:

Estamos realizando una encuesta sobre la Prima de riesgo del mercado que utilizan empresas, analistas y profesores para calcular la rentabilidad exigida a las acciones.

[6] Fernandez, P., J. Aguirreamalloa and L. Corres (2011a), "US Market Risk Premium Used in 2011 by Professors, Analysts and Companies: A Survey...", downloadable in **http://ssrn.com/abstract=1805852**

Te agradeceré muchísimo que me envíes las respuestas a estas 2 preguntas (en caso de que no pudieras, te agradeceré mucho que preguntes a alguien que trabaje contigo que sí los utilice).
Por supuesto, las respuestas serán tratadas anónimamente y, tras agruparlas, te enviaré los resultados.

Preguntas. En junio de 2014, me parece razonable utilizar:
1. Prima de riesgo del mercado:
USA______%
España________%
Otros países:
__________: ______%
__________: ______%

2. (Sólo si procede) Fuentes en las que baso mis números:

Saludos cordiales y muchísimas gracias,
Pablo Fernández. Profesor de finanzas. IESE. http://ssrn.com/author=12696

EXHIBIT 2
COMMENTS OF RESPONDENTS THAT DID NOT PROVIDE THE MRP USED IN 2014

I am not sure why you differentiate between a MRP for a company based in the USA or a company elsewhere. For me the MRP is the same everywhere in the world. Although it is often based on US stocks one should ideally derive the MRP from volatility data based on all stocks listed everywhere. However we add a country risk premium to calculate the cost of equity depending on where the company derives most of its cash flow from.
Different investors have different hurdle rates.
I can't help you since I don't use MRP for valuation purposes.
I consider this as pretty useless numbers. But I consider almost all economic-concepts as pretty useless. E.g. the whole market-efficient discussion.
Our Hedge-Fund invests in different strategies I have developed in the past. An important signal is the IVTS (Implied-Volatility-Term-Structure). If the IVTS gets to high, there is danger ahead, we go to the sideline.
When we are involved with equities, it is usually at the venture stage, with required rates of return on equity in the 20-30% range.
That sort of ERP analysis is only really valuable with large established companies. With newer seed stage companies, it is more important to manage other risks. In other words, what is the point of having a perfect denominator when the errors on your numerator move all over the place? That sort of precision is misleading. There are alternative ways to look at deals and valuation of companies, involving scenarios and ranges.
As we are not using CAPM based CoE (with its known limitations) we cannot contribute to your survey.
I have been using the Morningststar, now Duff & Phelps ERP using the build up Method for USA companies
For us MRP does not exist. We measure risk at an individual company level with it being derived from the certainty of cashflows as the risk free is only risk free because its cashflows are 100% predictable. Like the growth and profitability components of valuation this is a forecast.
I understand your question as a former certified business appraiser and having a master in finance. However, as CEO of an international company doing business in multiple countries, I view this as a distraction for which the accountants waste time and my money. We are a startup company so when raising capital, we look at the transaction and say does this make sense to us to move us forward. We let the investor determine the rate of return he requires, not some number some one pulled out of the air.
MRP is a not a consideration in selecting our investment ideas or building our equity portfolios. Our method of selecting equities is price target driven based on normalized multiple to normal earnings. We expect that the market will advance 10% per annum so our long ideas must usually have price targets greater than 20% higher than current price.
In my country, Market Risk Premium (MRP) is calculated as exceed of market portfolio return minus governmental securities return. Therefore we have not a specific MRP. This year (2014) the rate of governmental securities return is 20% which is based on or parliament act.
We use financial metrics that our clients give us based on their financial and economic advisors...this is not our expertise. We apply whatever they tell us they are using to value deals.
We do not use MRPs per country as we have found that in our experience a country risk investor perception is generally a binary decision making factor for most of our clients, i.e. they chose whether or not to invest in a region rather than what sort of premium they choose to entice them into that region. We have also found that the market is very

immature in assessing this risk – the "Stans" are all lumped together by fund managers despite the fact that they offer very different returns.

After 25 years practicing private equity, I came to some rather radical views (my apologies if this sounds arrogant, I'm just trying to put it in a nutshell) :

Never use DCF… at least when you're investing. From a theoretical standpoint, very weak mixture of past, present and future data. From an experimental standpoint, generated masses of disasters.

When investing in midsized businesses, forget about MRPs. If we spend hundreds of hours to analyse the risks and potential of each company, it precisely is to build our own vision of the valuation multiples we are ready to pay for that investment. The split between beta and risk premium becomes pointless in my opinion: my valuation of company X will not change by even 0.1% because the market RP has moved.

Financial models are failing badly: in my own experience, none (really none) of our investments made since 2000 reached its IRR target, nor even reached anything between -700bp/+700bp of the initial target, which is both humbling and inspiring on what counts in this business (I should add here that over the period we've been solidly into first quartile, so hopefully the latter conclusion is not the consequence of blatant incompetence !). And when I tried to measure correlation between exit multiples on our equity and entry leverage, I found a foggy cloud of dots with a flat regression line whose r2 was 0.0005 - no correlation between my returns and initial leverage.

I use a different methodology termed Decoupled Net Present Value to value investments to avoid precisely that issue, having to estimate a MRP.

I proceed as follows. I take consensus forecasts for stock-market earnings growth over the next two years. Several firms provide these. I make my own assumptions about potential GDP growth in each country and I project forward current inflation rates to get expected long run nominal GDP growth. I assume for year 3 to 10 ahead, earnings will converge from two year forecast growth to the forecast growth of nominal GDP and will continue like that indefinitely. I then calculate the discount rate required to get the current market price level from that projected earnings stream. I subtract from that discount rate the longest run government bond yield available in the country in question. What is left is the equity risk premium. This can be compared across countries and (more tenuously) across time as one component in deciding whether a market is cheap or dear. I never attempt to forecast the equity risk premium and I do not look at assumptions about it made by investment banks or others.

I don't use MRP. It's a flawed model.

Human error, señor f., human error. In the real world, Spain would have sued Argentina and won. Instead, human error occurred and they settled.

I do not use MRP measures in making investment decisions. Rather, I teach individual assessment techniques based on a modified Altman model. a Chanos model, and a Pustylnick model. These models identify for me: overall corporate health, shifts in leverage, and changes in corporate financial well being. These models are applied to not only the entity under study, but also to its largest three customers, competitors, and suppliers. This is the largest environment I use in making investment decisions. My preference however is for Swiss company stocks that address fundamental needs. The Swiss know how important business is, have appropriate tax laws, and host a number of really great companies (Nestle, Novartis, ABB, etc.).

I would suggest in your solicitation you describe the "MRP" a bit more. Do you mean: "the equity of medium and large sized businesses, before any adjustment for size, extra risk, specific industries?"

I would also ask people if they do not use a MRP in their calculations, which may be the case for investors in entrepreneurial firms, or for people that reject the DCF model or the CAPM model for valuation.

I will not be able to help much in your survey as we are a USA and Canada company only and we don't associate any 'market' risk when we evaluate our projects.

I do not do generic premiums for any country. Both the specific industry and location (eg which state or province) can be more significant than a generic country. Ukraine at this time may be a good example of this issue. Also, the company may be situated in one country but operate in other countries. For example, a mining exploration company may be headquartered in Canada, but its ability to raise funds is likely international, and its properties could be in many other countries-in this instance, a risk/opportunity matrix may be useful.

In our country and most that I have worked in, the rate is for a discount rate and not a cap rate. Most of the time that rate will absolutely depend on the risk of the particular type of business. Ibbotson is the main source for information by type of company. For years everyone seems to gravitate to 10% discount rate on various business as the one when everything is generally stable. What is strange about it is that when the finance rate or cost of capital went down and the investment on saving is almost non-existent for interest at almost nothing, the risk must have gone up as the 10% was still being used. For us it changes on ever deal and we go through all of the steps using CAPM and the develop our own including doing it for problem companies using specific company risk added to the CAPM formula. Each deal can have different risks and we have no stable one for Steel or electronics or standard fabrication and so forth if you were to ask about a specific segment of industry. If this is a housing or real estate question, that is not where I do most of my work. I also am not sure you might not be asking about the beta which again we have to measure the market to see if it is 1 or below or above.

EXHIBIT 3
COMMENTS OF RESPONDENTS THAT DID PROVIDE THE MRP USED IN 2014

Historically the actual average since 1900 is 8%. I know people use lower MRP these days but I stick to what I think is the long run premium

In calculating long term EVA/ DCF valuations I take a WACC number of 9% through the years.

7%, historically too high, but taking into account the unnaturally low present day interest rates I rather stick to long term reliable numbers for long term valuations.

Today's bond market is completely distorted by unconventional monetary policy. A traditional ERP is not useful in this environment. To consider an ERP one cannot use the 10 year bond yield as the risk free rate, but must use an adjusted risk free rate. What is that adjusted rate? I have no idea, but it is higher than the rates I see on my screen. As a guess I might use 5% for the UK and the US, and that makes both markets look quite expensive to me. As a result, I do not expect the 10 year real return of equities in the UK and the US to be very substantial.

The older I grow, the more I am puzzled by the MRP concept: polling various people or entities (analysts, professors, firms) seems to be the right approach. Perhaps you could ideally include investors' expectations at some point? End of day, it is all about future, not history ("the past peformance is not a guarantee for future performance", as they keep saying in every IPO prospect...)

The Fed liquidity, and atypical low VIX, make for uncertainties in setting a MRP. IF you go with what you'd prefer, say 4.8% most doesn't make the hurdle. Considering ~ 83% of this yr's IPOs have no earnings (second only to 84% in tech bubble) the market has very loose benchmarks. 3.73% is where analytics say to me it should be; but I've gone with 4.10%.

I base this on my knowledge of the finance academic literature, market information and my own judgment.

I use the S&P 500 as the market index to obtain the US market rate of return for 2014 (approx 6..42 % using daily returns), and the 91 day T-Bill is used as proxy for the risk-free rate (approx 0.02%) for 2014.

I teach that the risk premium varies with respect to the average level of risk aversion and the volatility of the market.

1928-2013 geometric average return of S&P 500 index over 30-year treasury bond yield.

We use basically the same MRP in 2014 for Germany and the US. Risk free rate is higher for the US than in Germany but we assume a somewhat higher equity MRP for Germany (equity markets not so developed as in US, more volatility during crises)

The MRP can be calculated by subtracting historical treasury returns from stock returns. However, there are varying opinions as to which time period (e.g. 1926-2007, or something shorter), which calculation method (arithmetic or geometric mean), and whether bill or bond yields should be used. The arithmetic mean has produced a range of 1.7% to 6.7% depending on the time interval.

During an August 2013 discussion with E&Y they indicated they currently use 6.5%. KPMG indicates they use 6.0%.

Using forecasted stock market returns, treasury returns, and dividend yields the implied Rm can be calculated. Using internal economic assumption of forecasted 8% equity returns and 2.57% treasury yield, and a current S&P500 divided yield of 2.01% the implied Rm is 7.43% (8% - 2.57% + 2.01%). However, this percentage is biased upwards due below average treasury yields.

Tenemos como referencia "Damodaran" y lo penalizamos levemente.

I use a 52 week moving average for the 10-year treasury & the 52 week return for the DJIA from Bloomberg – all easy for the students to access, collect, and understand.

Although may be trivial I would also add the currency. US$ for US and what about the local market? Is there a point in comparing MRP in euros and rubels? At least I would mark to provide MRP for local market in local currency.It would be great you could publish all results on the net (also the historical ones) not just some of them in a paper. Your last paper dropped a lot of partial (probably for you less important) data for example on Hungary. This would be of extremely great value plus I could refer to your database in my lectures just like the Damodaran page.

In my previous role I was an equity research analyst with global investment firm. I use my own implied risk estimates for India. Currently with BSE Sensex at 24,500, implied risk premium is around 6%.

I use less and less the MRP concept for asset allocation advice to clients, since fundamental analysis is now secondary to what I would call 'interventional' analysis – given the increasingly enormous role that central banks and other policy makers play in the market price discovery process.

MRP is a range typically between 4-6% and we use a longer term average

The above request is somewhat confusing. The underlying risk free rate for a country takes care of differential country risk weightings. In RSA this rate is 5,5% while in the US and UK it hovers around 1% or less depending on what measure you use. Or alternatively the differential on 10 year government bonds will address a similar issue. Did I miss something? As regards the above range this relates to the difference between the biggest listed entities and much smaller private companies as a generalisation, but does ignore any number of specialised risk premiums that you may consider adjusting the required equity return by.

We are using the same risk-free rate and equity risk premium for all European countries and have not changed them for at least 10 years. We use these numbers because we believe them to be conservative and based on past observations. We aim to keep them constant as long as reasonable, as we pursue a very long-term oriented investment strategy (investment horizon 5 years +) and try to avoid the possibility of manipulating stock valuations through opportunistic fiddling with discount factors.

4% is the reference. But further adjustments were in place mainly through the main part of the financial crisis. Adjustments were 100% embedded in the Beta. As an example a Beta of 1.3x could be leverage up to 5% and above.

I always assume 10% (for developed markets). But I am not particularly wedded to it – if a client has different views I'm happy to use it.

We calculate MRP as discount rate that equates index value with discounted sum of projected dividend flows.

We use the regression equations for the appropriate portfolios that match the Subject Company.

We used 5.5% ERP for USA papers till 2014, then we increased the rate to 6.5%. For Russian equity shares Eurobond interest parity is used to adjust the equity cost.

Since articles need time to get published, I don't think it is proper to use numbers in available literature to predict 2014 MRP

It is a number that was introduced to the company decades ago and the sources justifying this number are unknown.

Basic financial theory says the return on the stock market is the real rate + inflation + risk premium. Today the real rate remains historically about 2-3%, inflation is hidden due to government manipulation so this is difficult to estimate. The risk free rate, which should be real + inflation is priced at about the real rate (or less in some cases). The historical return on the major U.S stock market should be about 11%. So, I would price the MRP at 9% because of the volatility and the meddling by the central bank (government).

I would like equities to give me a minimum return of 8% so I back into the MRP based on the 10 year yield. 5% assumes current 10 year yield of 3%

For US Equity Premium (ERP), we use the spread between the arithmetic average historical returns of S&P and T.Bonds (10y). In this case we use a long historical series (1928 - 2013). This is one of the suggestions for ERP found on Damodaran materials. For Brazil, we add a Country Risk Premium (CRP). We always update (and lock) this value the day we start a new valuation process. We consider 'Brazilian ERP' as 'US ERP' + 'CRP'. Notice that these are US$ yields.

This number fluctuates with time and the methodologies differ across authors. There are measurement issues of choosing between geometric and arithmetic averages to look at the past and there is the challenge of mining the data to figure out what investors think about the future. I usually negotiate it out with the students. One of my thoughts is that recently the fed has artificially distorted the yield curve and some of the specific interest ranges within it. During the very low interest rate era of the recent past, there has been a threat to the accuracy of corporate valuation because the risk free rate was so nominally low. However, there has been an underlying expectation within the financial community that rates would shift upward at some point in the future. As a result, I have concluded that, either the inflation premium in the yield curve has been artificially low, or we have experienced artificially and distorted low negative real interest rates. Together, these hold down the nominal "risk free" rates that are used in CAPM calculations that lead into value. The result is to over-value corporate cash flows. To offset this impact, when I think the rates are unduly low, I add to the MRP in calculations and move to the higher end of my range (or even above it). When the fed's actions are negligible and it seems that markets are setting the rates without one eye on the fed, I would shift to the bottom half of my range.

Basic financial theory says the return on the stock market is the real rate + inflation + risk premium. Today the real rate remains historically about 2-3%, inflation is hidden due to government manipulation so this is difficult to estimate. The risk free rate, which should be real + inflation is priced at about the real rate (or less in some cases). The historical return on the major U.S stock market should be about 11%. So, I would price the MRP at 9% because of the volatility and the meddling by the central bank (government).

Our MRP is based on an assumption that global equities are 3 times as risky as global bonds, and then adjusted for the global market weights of those respective asset classes.

MRP in my country is 5% (in 2007, a couple brokerage houses used for short time 4,5%). 6% is a maximum risk premium used by brokerage houses.

The theoretical approach with the temporal CAPM of Merton. The probability than the risk free increase, implied a more risk premium since prices will decrease if interest rate increase…

We are much more about employing cost of capital as an opportunity cost that will vary with the perceived risk and volatility of a given entity's cash flows.

We typically adjust the reported "Historical" risk premium to reflect the ex-ante, in contrast to ex-post, risk premium being sought.

The "premium" is based on our cost of capital, which for us as a private equity shop is about 8%. So if you are using the 10-Year Treasury as a benchmark the premium is as stated above.

I do change my MRP over time only for a change in the yield curve (liquidity premium). This may lead to lower market valuation targets vs the market when general expectations are for lower risk and vice versa. Let's keep in mind that markets adjust their expectations in a pro-cyclical way, i.e. market risk and liquidity risk premiums are often lowered while E or CF expectations are raised (and vice versa). Keeping the underlying MRP (without liquidity risk) stable, which also makes sense intuitively, leads to some 'smoothing' in a DDM or similar model. If no major MACRO issues (political, legal) change, I do not play with the MRP.

Based on investing experience. I think MRP is generally understated as there is also risk in the “risk-free” rate and in market “operations” (e.g. manipulation, regulation, technology, etc.) that have been under appreciated.

I agree with with Damodaran's methodology in computing the equity risk premium.

I use the constant growth DDM (dividend yield plus estimated long-term growth rate) to estimate a forward looking expected return on the S&P 500, then subtract the YTM on the 10-yr Treasury.

It is a weighing of numerous book sources, analysing long term market returns, and keeping abreast of current market and economic market factors. All feed into an intuition of a reasonable MRP.

A problem encountered is the risk free rate (3 month T Bill)--effectively 0 in the US. I do not think this is a market rate, but reflects Federal Monetary policy. I think a market risk free rate in the US today would be 3% and (Heaven help me) use that.

“What is the range?” Unconditional ERP Range – The objective is to establish a reasonable range for a normal or unconditional ERP that can be expected over an entire business cycle. Based on an analysis of academic and financial literature and various empirical studies, we have concluded that a reasonable long-term estimate of the normal or unconditional ERP for the U.S. is in the range of 3.5% to 6.0%. “Where are we in the range?” Conditional ERP – The objective is to determine where within the unconditional ERP range the conditional ERP should be, based on current economic conditions. Research has shown that ERP fluctuates during the business cycle. When the economy is near (or in) a recession, the conditional ERP is at the higher end of the normal, or unconditional ERP range. As the economy improves, the conditional ERP moves back toward the middle of the range and at the peak of an economic expansion, the conditional ERP approaches the lower end of the range.

Hasn’t changed for a number of years, no specific reference for it (except your past surveys)

Our team uses Brazilian MRP as of USA MRP (5.7%) + Sovereign spread (“Brazil’s risk”, 230 bps). They don’t use books or articles to support the number. They take into account past market performance (last 10 years), current and also future expectations; thus they make a simple average to reach the market return expected.

In ZZ we don't have equity markets and hence we cannot estimate neither market returns nor betas. I adjust the US ERP with ZZ country risk to have an estimate of the Guatemalan MRP. The 8.6% MRP that I am using for ZZ is in US Dollars (I usually add an inflation differential to discount cash flows in domestic currency)

For Greek equity risk premium I use the MRP (US) plus the Greek Country RP (latest current default spread of the 10yrGrBond over the US 10yr TB = 3.81%* 0.84 which is the relative volatility of the Greek equity market over the Greek bond market over the last year 2013, see also at Damodaran’s references) = 5.8% +(3.81%*0.84) = 9%

My numbers are estimated using historical data for the past 15 years for a broadbased market index. I cross check the numbers, for any major discrepancy, with data sources like Bloomberg, Datastream.

References

Brealey, R.A., S.C. Myers and F. Allen (2005), *Principles of Corporate Finance*, 8th edition, McGraw-Hill/Irwin.

Claus, J.J. and J.K. Thomas (2001), "Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets," *Journal of Finance*. 55, (5), pp. 1629-66.

Damodaran, A. (2008), "Equity Risk Premiums (ERP): Determinants, Estimation and Implications", Working Paper.

Dimson, E., P. Marsh and M. Staunton (2007), "The Worldwide Equity Premium: A Smaller Puzzle," in *Handbook of investments: Equity risk premium*, R. Mehra, Elsevier.

Fernandez, P. (2007), "Equity Premium: Historical, Expected, Required and Implied", http://ssrn.com/abstract=933070

Fernandez, P. (2009a), "Market Risk Premium Used in 2008 by Professors: A Survey with 1,400 Answers", http://ssrn.com/abstract=1344209

Fernandez, P. (2009b), "The Equity Premium in 150 Textbooks", http://ssrn.com/abstract=1473225

Fernandez, P., J. Aguirremalloa and H. Liechtenstein (2009), "The Equity Premium Puzzle: High Required Premium, Undervaluation and Self Fulfilling Prophecy". IESE Business School WP. http://ssrn.com/abstract=1274816

Fernandez, P. and J. del Campo (2010a), "Market Risk Premium used in 2010 by Analysts and Companies: a survey with 2,400 answers", downloadable in http://ssrn.com/abstract=1609563

Fernandez, P. and J. del Campo (2010b), "Market Risk Premium Used in 2010 by Professors: A Survey with 1,500 Answers", downloadable in http://ssrn.com/abstract=1606563

Fernandez, P., J. Aguirreamalloa and L. Corres (2011a), "US Market Risk Premium Used in 2011 by Professors, Analysts and Companies: A Survey with 5.731 Answers", downloadable in http://ssrn.com/abstract=1805852

Fernandez, P., J. Aguirreamalloa and L. Corres (2011b), "The Equity Premium in Spain: Survey 2011 (in Spanish)", downloadable in http://ssrn.com/abstract=1822422

Fernandez, P., J. Aguirreamalloa and L. Corres (2011c), "Market Risk Premium Used in 56 Countries in 2011: A Survey with 6,014 Answers", downloadable in http://ssrn.com/abstract=1822182

Graham, J.R. and C.R. Harvey (2007), "The Equity Risk Premium in January 2007: Evidence from the Global CFO Outlook Survey," *Icfai Journal of Financial Risk Management,* Vol. IV, No. 2, pp. 46-61.

Graham, J.R. and C.R. Harvey (2014), "The Equity Risk Premium in 2014", http://ssrn.com/abstract=2422008

Harris, R.S. and F.C. Marston (2001), "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts," *Journal of Applied Finance*, Vol. 11.

Ilmanen, A. (2003), "Expected returns on stocks and bonds", *Journal of Portfolio Management* 29, pp. 7-27.

Johnson, D. T., T. Kochanek, T and J. Alexander (2007), "The Equity Premium Puzzle: A New Look", *Journal of the Academy of Finance,* Vol. 5, No. 1, pp. 61-71.

O'Neill, J., D. Wilson and R. Masih (2002), "The Equity Risk Premium from an Economics Perspective", Goldman Sachs, Global Economics Paper No. 84.

Ritter, J.R. and R. Warr (2002), "The Decline of Inflation and the Bull Market of 1982 to 1999," *Journal of Financial and Quantitative Analysis*, Vol. 37, No. 1, pp. 29-61.

Welch, I. (2000), "Views of Financial Economists on the Equity Premium and on Professional Controversies", *Journal of Business*, Vol. 73, No. 4, pp. 501-537.

Welch, I. (2001), "The Equity Premium Consensus Forecast Revisited", Cowles Foundation Discussion Paper No. 1325.

Welch, I. (2007), "A Different Way to Estimate the Equity Premium (for CAPM and One-Factor Model Use Only)," SSRN n. 1077876.

CAPM: an absurd model

Pablo Fernandez, Professor of Finance
IESE Business School, University of Navarra
e-mail: fernandezpa@iese.edu and pfernandez@iese.edu
Camino del Cerro del Aguila 3. 28023 Madrid, Spain

xLnATDlsJ October 6, 2014

The CAPM is an absurd[1] model because its assumptions and its predictions/conclusions have no basis in the real world. The use of CAPM is also a source of litigation: many professors, lawyers… get nice fees because many professionals use CAPM instead of common sense to calculate the required return to equity. Users of the CAPM make many illogical errors valuing companies, accepting/rejecting investment projects, evaluating fund performance, pricing goods and services in regulated markets, calculating value creation…

According to the dictionary, a theory is "*an idea or set of ideas that is intended to explain facts or events";* and a model is *"a set of ideas and numbers that describe the past, present, or future state of something*". With the vast amount of information and research that we have, it is quite clear that the CAPM is neither a theory nor a model because it does not "*explain facts or events",* nor does it *"describe the past, present, or future state of something".*

It is important to differentiate between a **fact** *(something that truly exists or happens: something that has actual existence; a true piece of information)* and an **opinion** *(what someone thinks about a particular thing).* The CAPM could be described as an *uninformed opinion,* and not as a *sensible opinion.*

We all should try to explain a portion of "*the world as it is*", not of "*the world according to a wrong theory*" nor of "*the world if men were not men*". Ricardo Yepes, professor of philosophy of my university, wrote: "*Learning means being able to keep perceiving reality as it truly is: complex - and not trying to fit every new experience into a* ***closed and pre-conceived notion*** *or overall scheme*". The definition of **wishful thinking** is also interesting**:** "*an attitude or belief that something you want to happen will happen even though it is not likely or possible*".

We may find out an investor's expected IBM beta and expected market risk premium (MRP) by asking him. However, it is impossible to determine the expected IBM beta and the expected MRP of the market (for the market as a whole), because these two parameters do not exist. Different investors have different cash flow expectations and use different expected (and required) returns to equity (different expected market risk premium and different expected beta). One could only talk of the beta and the market risk premium if all investors had the same expectations. But investors do not have homogeneous expectations.

Sections 11 and 12 show how to calculate required returns in a sensible way and how to use betas being a reasonable person.

[1] Absurd means *1. ridiculously unreasonable, unsound, or incongruous <an absurd argument>. 2: having no rational or orderly relationship to human life. Meaningless. utterly or obviously senseless, illogical, or untrue; contrary to all reason or common sense; laughably foolish or false.* Source: *http://www.merriam-webster.com/dictionary/absurd*

1. Main assumptions of the CAPM

All investors:

a. have homogeneous expectations (same expected return, volatility and correlations for every security) ,
b. can lend and borrow unlimited amounts at the risk-free rate of interest,
c. can short any asset, and hold any fraction of an asset,
d. plan to invest over the same time horizon[2].

2. Main predictions of the CAPM

The CAPM assumptions imply that all investors:

a. will always combine a risk free asset with the market portfolio,
b. will have the same portfolio of risky assets (the market portfolio)[3],
c. agree on the expected return and on the expected variance of the market portfolio and of every asset,
d. agree on the expected MRP and on the beta of every asset,
d. agree on the market portfolio being on the minimum variance frontier and being mean-variance efficient,
e. expect returns from their investments according to the betas.

As there are homogeneous expectations and there is not disagreement about the price or the value of any security:

f. trading volume of financial markets will be very small.

3. Why CAPM is an absurd model?

The CAPM is based on many unrealistic assumptions. It could be said that "*all interesting models involve unrealistic simplifications*". It is true and CAPM has some assumptions that are convenient simplifications, but other assumptions (specially the homogeneous expectations) are obviously senseless (although they could be reasonable in another planet).

None of the CAPM predictions happens in our world (the only one that we cannot test is the market portfolio being mean-variance efficient)[4].

Still, many professors affirm that "*the CAPM is not testable*" or "*it is difficult to test the validity*". CAPM is a model a) based on senseless assumptions, and b) none of its predictions happens in our world. Which other test do we need to reject the model?

4. Why many people still are using CAPM?

Fernandez (2009b)[5] shows that many professors acknowledge that there are problems estimating two ingredients of the CAPM formula (the beta and the MRP [market risk premium]), but, nevertheless, they continue using it for several reasons:

- *"Has received a Nobel Prize in Economics",*
- *"While not perfect, it is used extensively in practice". "Beta is simple and it is used in the real world". "Fortune 500 firms use the CAPM to estimate their cost of equity".*
- *"If one does not use beta then what is there?" "No substitution so far. There are no better alternatives". "There is no other satisfactory tool in finance" "We need another model to substitute CAPM and betas and 3-factor models"*
- *"Calculated betas are on the CFA exam". "Referees want to see them as the underlying model"*
- *"Almost every practitioner book uses betas such as the McKinsey publications" "Regulatory practice often requires it"*
- *"Beta allows you to defend a valuation, impress management and come across as a finance guru". "That point estimate gives the impression of truth".*
- *"In consulting, it is essential to fully support your estimates". "It is a useful tool to compare one stock with another"*

---

[2] Other assumptions are: no transaction costs (no taxes, no commissions…); all information is available at the same time to all investors; each investor is rational and risk-averse, and wants to maximize his expected utility; each investor cares only about return and volatility.

[3] Very risk-averse investors will put most of their wealth in risk-free asset, while risk-tolerant investors will put most of their wealth in the marker portfolio.

[4] Although Roll (1977) concludes that the only legitimate test of the CAPM is whether or not the market portfolio is mean-variance efficient, I think that we have enough evidence to conclude that: 1) the CAPM does not help to explain the financial markets, and 2) users of the CAPM make many errors valuing companies, accepting/rejecting investment projects, evaluating fund performance, pricing goods and services in regulated markets, calculating value creation… But I have to thank some CAPM users that allowed me to participate as expert witness in several trials, arbitrage procedures and consulting projects usually originated by senseless results of the CAPM.

[5] "Betas Used by Professors: A Survey with 2,500 Answers", http://ssrn.com/abstract=1407464

Some professors argue that "*although the empirical evidence does not justify the CAPM, I teach it because it is based on the important concept of diversification and it is an easy recipe for most students*". I think that we can teach diversification without the CAPM and, more important, business and management (which includes investing and valuation) is about common sense, not about recipes.

5. Schizophrenic approach to valuation

Valuation is about expected cash flows and about required returns. We all admit that different investors may have different expected cash flows, but many of us affirm that the required return (discount rate) should be equal for everybody.

That is the schizophrenic approach: to be a "*democrat*" for the expected cash flows but a "*dictator*" for the discount rate.

Most professors teach that the expected cash flows should be computed using common sense and good judgement about the company, its industry, the national economies… However, some professors teach the CAPM to calculate the discount rate (instead of using again common sense[6]): they acknowledge that there are problems estimating two ingredients of the formula (the beta and the MRP), but, nevertheless, continue using it.

We may find out an investor's expected IBM beta by asking him. However, it is impossible to determine the expected IBM beta for the market as a whole, because it does not exist. Even if we knew the expected market risk premiums and the expected IBM betas of the different investors who operated on the market, it would be meaningless to talk of an expected IBM beta for the market as a whole. A rationale for this is to be found in the aggregation theorems of microeconomics, which in actual fact are non-aggregation theorems. A model that works well individually for a number of people may not work for all of the people together[7].

6. Consequences of using the CAPM

Just an example: calculation of the beta of electrical companies done by a European Electricity Regulatory Commission. *"We calculate the betas of all traded European companies. Leveraged betas were calculated using 2 years of weekly data. The Market Index chosen was the Dow Jones STOXX Total Market Index. There is a great dispersion (from -0.24 to 1.16) and some odd betas (negative and higher than one). We decided to maintain all betas… To unlever the betas, we assumed that the beta of the debt is zero for all companies. Then, the Commission calculates the average of the unlevered betas and relever it using an objective debt to equity ratio based on the average debt to equity ratio of comparable companies. The levered beta proposed by the Commission for the transport activity is 0.471870073"*

The Commission acknowledges that calculated betas have a "*great dispersion (from -0.24 to 1.16)*" but calculates the average of all of them and finally provides betas with a precision of 9 figures after the decimal point!

Fernandez and Bilan (2007)[8] contains a collection of errors seen in company valuations performed by analysts, investment banks, consultants and expert witnesses. Some of the errors are *wrong betas and wrong market risk premia.* The most common error consists in using the historical industry beta, or the average of the betas of similar companies, when this magnitude does not make sense. As we have already mentioned, users of the CAPM have made many errors valuing companies, accepting/rejecting investment projects, evaluating fund performance, pricing goods and services in regulated markets, calculating value creation…

7. Papers about the CAPM

Many papers have the explicit or implicit assumption that "*the market*" has a "*true beta*" for each security and an expected MRP (common to all investors): we have to refine our statistical methods to estimate this figures. Other papers find discrepancies between the CAPM and the market and try to explain what is wrong… with the market!

The CAPM of Sharpe (1964), Lintner (1965) and Mossin (1966) asserts that the expected return for any security is a positive function of three variables: expected beta, expected market return, and the risk-free rate. Sharpe (1964) and Lintner (1965) demonstrate that, with some senseless assumptions, a financial asset's return must be positively linearly related to its beta (ß): $E(R_i) = a_1 + a_2 E(ß_i)$, for all assets i, $E(R_i)$ is the expected return on asset i, $E(ß_i)$ is asset i's expected market beta, a_1 is the expected return on a "zero-beta" portfolio, and a_2 is the market risk premium.

---

[6] We mean common sense, experience and some financial knowledge.

[7] Mas-Colell et al. (1995): *"It is not true that whenever aggregate demand can be generated by a representative consumer, this representative consumer's preferences have normative contents. It may even be the case that a positive representative consumer exists but that there is no social welfare function that leads to a normative representative consumer."*

[8] "119 Common Errors in Company Valuations", http://ssrn.com/abstract=1025424

Subsequent work by (among many others) Basu (1977), Banz (1981), Reinganum (1981), Litzenberger and Ramaswamy (1979), Keim (1983, 1985)[9] and Fama and French (1992) suggests that either:

1. expected returns are determined not only by the beta and the expected market risk premium but also by other firm characteristics such as price-to-book value ratio (P/B), firm size, price-earnings ratio and dividend yield (it means that the CAPM requires the addition of factors other than beta to explain security returns), or
2. the historical beta has little (or nothing) to do with the expected beta and the historical market risk premium has little (or nothing) to do with the expected market risk premium, or
3. the heterogeneity of expectations[10] in cross-section returns, volatilities and covariances, and market returns is the reason why it makes no sense to talk about an aggregate market CAPM (although at the individual level expected CAPM could work). Each investor uses an expected beta, an expected market risk premium, and an expected cash flow stream to value each security, and investors do not agree on these three magnitudes for each security. Consequently, it makes no sense to refer to a "market" expected beta for a security or to a "market" expected market risk premium (or to a "market" expected cash flow stream), for the simple reason that they do not exist.

CAPM	Real world
Homogeneous expectations All investors have equal expectations about asset returns	**Heterogeneous** expectations. Investors DO NOT have equal expectations about asset returns.
All investors use the same beta for each share	Investors use **different** betas (required betas) for a share
All investors hold the market portfolio	Investors hold **different** portfolios
All investors have the same expected market risk premium	Investors have **different** expected market risk premia and use **different** required market risk premia
The market risk premium is the difference between the *expected* return on the market portfolio and the risk-free rate	The market risk premium is NOT the difference between the *expected* return on the market portfolio and the risk-free rate

Original tests of the CAPM focused on whether the intercept in a cross-sectional regression was higher or lower than the risk-free rate, and whether stock individual variance entered into cross-sectional regressions.

Miller and Scholes (1972) report that the sample average of the standard error of the beta estimates of all NYSE firms is around 0.32, as compared to the average estimated beta coefficient of 1.00. Thus, a random draw from this distribution of betas is going to produce any number between 0.36 and 1.64 ninety-five percent of the time. It is this imprecision in individual beta estimates (or the better known "errors in variables" problem) that motivated portfolio formation techniques of Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973).

Scholes and Williams (1977) found that with nonsyncronous trading of securities, OLS estimators of beta coefficients using daily data are both biased and inconsistent.

Roll (1977) concludes that the only legitimate test of the CAPM is whether or not the market portfolio (all assets) is mean-variance efficient. Roll (1981) suggests that infrequent trading of shares of small firms may explain much of the measurement error in estimating their betas.

Constantinides (1982) points out that with consumer heterogeneity *"in the intertemporal extension of the Sharpe-Lintner CAPM, an asset's risk premium is determined not only by its covariance with the market return, but also by its covariance with the m-1 state variables"* (m is the number of heterogeneous consumers). He also points out that the assumption of complete markets is needed for demand aggregation.

Lakonishok and Shapiro (1984, 1986) find an insignificant relationship between beta and returns and a significant relationship between market capitalization and returns

Shanken (1992) presents an integrated econometric view of maximum-likelihood methods and two-pass approaches to estimating historical betas.

The poor performance of the CAPM has inspired multiple portfolio based factors.

The hardest blow to the CAPM was published by Fama and French (1992): they showed that in the period 1963-1990, the correlation between stocks' returns and their betas was very small, while the correlation with the companies' size

[9] Basu (1977) found that low price/earnings portfolios have higher returns than could be explained by the CAPM. Banz (1981) and Reinganum (1981) found that smaller firms tend to have high abnormal rates of return. Litzenberger and Ramaswamy (1979) found that the market requires higher rates of return on equities with high dividend yield. Keim (1983, 1985) reports the January effect, that is, seasonality in stock returns. Tinic and West (1984) reject the validity of the CAPM based on intertemporal inconsistencies due to the January effect.

[10] Lintner (1969) argued that the existence of heterogeneous expectations does not critically alter the CAPM in some simplified scenarios and says that "*in the (undoubtedly more realistic) case with different assessments of covariance matrices, the market's assessment of the expected ending price for any security depends on every investor's assessment of the expected ending price for every security and every element in the investor's assessment of his NxN covariance matrix (N is the number of securities), as well as the risk tolerance of every investor."*

and their (P/B) was greater. They concluded *"our tests do not support the most basic prediction of the Sharpe-Lintner-Black CAPM that average stock returns are positively related to market betas".* The authors divided the shares into portfolios and found that the cross-sectional variation in expected returns may be captured within a three-factor model, the factors being: 1) the return on the market portfolio in excess of the risk-free rate; 2) a zero net investment portfolio that is long in low P/B stocks and short in high P/B stocks, and 3) a zero net investment portfolio that is long in small firm stocks and short in large firm stocks. The following table shows the article's main findings.

Main findings of Fama and French's article (1992)

Size of the companies	Average beta	Annual average return	**Beta** of the companies	Average beta	Annual average return	**P/B** Price / book value	Average beta	Annual average return
1 (biggest)	0.93	10.7%	1 (high)	1.68	15.1%	1 (high)	1.35	5.9%
2	1.02	11.4%	2	1.52	16.0%	2	1.32	10.4%
3	1.08	13.2%	3	1.41	14.8%	3	1.30	11.6%
4	1.16	12.8%	4	1.32	14.8%	4	1.28	12.5%
5	1.22	14.0%	5	1.26	15.6%	5	1.27	14.0%
6	1.24	15.5%	6	1.19	15.6%	6	1.27	15.6%
7	1.33	15.0%	7	1.13	15.7%	7	1.27	17.3%
8	1.34	14.9%	8	1.04	15.1%	8	1.27	18.0%
9	1.39	15.5%	9	0.92	15.8%	9	1.29	19.1%
10 (smallest)	1.44	18.2%	10 (low)	0.80	14.4%	10 (low)	1.34	22.6%

Roll and Ross (1994) attribute the observed lack of a systematic relation between risk and return to the possible mean-variance inefficiency of the market portfolio proxies.

Lakonishok, Shleifer and Vishny (1994) argue that the size and P/B effects are due to investor overreaction rather than compensation for risk bearing. According to them, investors systematically overreact to corporate news, unrealistically extrapolating high or low growth into the future. This leads to underpricing of "value" (small capitalization, high P/B stocks) and overpricing of "growth" (large capitalization, low P/B stocks).

Kothary, Shanken and Sloan (1995) point out that using historical betas estimated from annual rather than monthly returns produces a stronger relation between return and beta. They also claim that the relation between P/B and return observed by Fama and French (1992) and others is exaggerated by *survivor bias* in the sample used. They also claim that the Fama and French statistical tests were of such low power that they could not reject a beta-related risk premium of 6% over the post-1940 period. They conclude: *"our examination of the cross-section of expected returns reveals economically and statistically significant compensation (about 6 to 9% per annum) for beta risk."*

Pettengill, Sundaram and Mathur (1995) find *"consistent and highly significant relationship between beta and cross-sectional portfolio returns".* They insist: *"the positive relationship between returns and beta predicted by CAPM is based on expected rather than realized returns".* They remark that their results are similar to those of Lakonishok and Shapiro (1984)

Elsas, El-Shaer and Theissen (2000) "*find a positive and statistically significant relation between beta and return in our sample period 1960-1995 as well as in all subperiods we analyze"* for the German market. They claim, *"Our empirical results provide a justification for the use of betas estimated from historical return data by portfolio managers."*

Fama and French (1996) argue that survivor bias does not explain the relation between P/B and average return. They conclude that historical beta alone cannot explain expected return.

Kothary and Shanken (1999) insist on the fact that Fama and French (1992) tend to ignore the positive evidence on historical beta and to overemphasize the importance of P/B. They claim that, while statistically significant, the incremental benefit of size given beta is surprisingly small. They also claim that P/B is a weak determinant of the cross-sectional variation in average returns among large firms and it fails to account for return differences related to momentum and trading volume.

Berglund and Knif (1999) propose an adjustment of the cross-sectional regressions of excess returns against betas to give larger weights to more reliable beta forecasts. They find a significant positive relationship between returns and the beta forecast when the proposed approach is applied to data from the Helsinki Stock Exchange, while the traditional Fama-MacBeth (1973) approach as such finds no relationship at all.

Cremers (2001) claims that the data do not give clear evidence against the CAPM because it is difficult to reject the joint hypothesis that the CAPM holds and that the CRSP value-weighted index is efficient or a perfect proxy for the market portfolio. He also claims that the poor performance of the CAPM seems often due to measurement problems of the market portfolio and its beta. He concludes that *"according to the data, the CAPM may still be alive."*

Bartholdy and Peare (2001) argue that five years of monthly data and an equal-weighted index provide the most efficient estimate of the historical beta. However, they find that the ability of historical betas to explain differences in returns in subsequent periods ranges from a low of 0.01% to a high of 11.73% across years, and at best 3% on average. Based on these results, they say *"it may well be appropriate to declare beta dead".*

Chung, Johnson and Schill (2001) use size-sorted portfolio returns at daily, weekly, quarterly and semi-annual intervals and find in every case that the distribution of returns differs significantly from normality. They also show that adding systematic co-moments (not standard) of order 3 through 10 reduces the explanatory power of the Fama-French factors to insignificance in almost every case.

Zhang, Kogan, and Gomes (2001) claim that *"size and P/B play separate roles in describing the cross-section of returns. These firm characteristics appear to predict stock returns because they are correlated with the true conditional market beta of returns."*

Avramov and Chordia (2001) test whether the Zhang, Kogan, and Gomes (2001) scaling procedure improves the performance of the CAPM and consumption CAPM. They show that equity characteristics often enter beta significantly. However, "*characteristic scaled factor models*" do not outperform their unscaled counterparts.

Shalit and Yitzhaki (2002) argue that the OLS regression estimator is inappropriate for estimating betas. They suggest alternative estimators for beta. They eliminate the highest four and the lowest four market returns and show that the betas of the 75% of the firms change by more than one standard error.

Avramov (2002) shows that small-cap value stocks appear more predictable than large-cap growth stocks, and that model uncertainty is more important than estimation risk: investors who discard model uncertainty face large utility losses.

Griffin (2002) concludes that country-specific three-factor models are more useful in explaining stock returns than are world and international versions.

Koutmos and Knif (2002) propose a dynamic vector GARCH model for the estimation of time-varying betas. They find that in 50% of the cases betas are higher during market declines (the opposite is true for the remaining 50%). They claim that the static market model overstates unsystematic risk by more than 10% and that dynamic betas follow stationary, mean reverting processes.

Fama and French (2004) affirm that "*the failure of the CAPM in empirical tests implies that most applications of the model are invalid*".

Merrill Lynch and Bloomberg adjust beta estimates in a very simple way: Expected beta = 0.67 historical beta + 0.33. Of course, this "Expected beta" works better than the "historical beta" because "*β = 1 does a better job than calculated betas"*[11].

8. Problems with calculated betas

According with the CAPM "the market" assigns a beta to every company and that beta may be calculated with a regression of historical data. Of course, every investor should use this **"market beta"**. As we have already mentioned, the first problem is that this **"market beta"** does not exist.

When we calculate betas using historical data we encounter several well-known problems:

1. They change considerably from one day to the next[12].
2. They depend very much on which stock index is used as the market reference.
3. They depend very much on the historical period (5 years, 3 years…) used[13].
4. They depend on what returns (monthly, yearly…) are used to calculate them.
5. Very often we do not know if the beta of one company is lower or higher than the beta of another.
6. Calculated betas have little correlation with stock returns.
7. β = 1 has a higher correlation with stock returns than calculated betas for many companies
8. The correlation coefficients of the regressions used to calculate the betas are very small.
9. The relative magnitude of betas often makes very little sense: companies with high risk often have lower calculated betas than companies with lower risk.

[11] Fernandez and Bermejo (2009), "β = 1 Does a Better Job than Calculated β", http://ssrn.com/abstract=1406923.. They compute the correlations of the annual stock returns (1989-2008) of the Dow Jones companies with a) β Rm; and with b) Rm; and find that the 2nd correlation (assuming β = 1 for all companies) is higher than the first one for all companies except Caterpillar and GM. Rm is the return of the S&P 500.

Carvalho and Barajas (2013) study the betas in the Portuguese market and conclude that *"the results could reinforce the position of those who affirm that calculated betas do not work better than beta = 1. In fact, in most of the cases (62.5%) in the sample the beta =1 provides a better correlation than calculated betas"*.

[12] Some authors, such as Damodaran (2001, p. 72), acknowledge that company betas vary considerably, but claim that industry betas (the beta of the portfolio composed of the companies in a given industry) vary very little. They therefore recommend using the calculated beta of an industry. However, although industry betas vary less than company betas, they still vary significantly and using them can lead to serious errors.

[13] Brigham and Gapenski (1977, p. 354, footnote 9) report an illustrative anecdote in this respect: *"A company that supplied betas told the authors that their company, and others, did not know what was the most appropriate period to use, but that they had decided to use 5 years in order to eliminate apparent differences between the betas provided by different companies, because big differences undermined the credibility of all of them"*

Damodaran (1994) calculates the beta of Disney using daily, weekly, monthly and quarterly returns of the last 3, 5 and 10 years, with respect to the Dow 30, the S&P 500 and the Wilshire: the betas ranged from 0.44 to 1.38. Damodaran (2001) calculates different betas for Cisco versus the S&P 500 ranging from 1.45 to 2.7.

Fernandez (2004)[14] shows the calculated betas of Coca-Cola, PepsiCo, AT&T and Merck on September 30, 2003. Betas were calculated with respect to different indexes, and using different frequencies (daily, weekly, biweekly and monthly), and different periods (6 months, 1 year and 5 years). The calculated betas of Coca-Cola varied between -0.08 and 0.82; those of Pepsico between 0.3 and 0.92; those of AT&T between 0.32 and 2.1; and those of Merck between 0.05 and 1.48.

Fernandez (2006)[15] calculated betas of 3,813 US companies using 60 monthly returns each day of December 2001 and reports:

1. The median of the maximum beta divided by the minimum beta was 3.07 for the whole sample (2.11 for the companies in the S&P 500 and 1.77 for the 30 companies in the DJIA).
2. Industry betas are also unstable: on average, the maximum beta of an industry was 2.7 times its minimum beta.
3. Constructing portfolios in the Fama and French (1992) way on December 1 and on December 15, 2001, 71.3% of the companies changed from one portfolio on December 1 to another on December 15.

Different beta sources provide us with different betas. Bruner et al. (1998) found sizeable differences among beta providers. Fernandez (2009b)[16] shows betas provided by 16 webs and databases: the betas of Coca Cola ranged from 0.31 to 0.8; the betas of Walt Disney from 0.72 to 1.39; and the betas of Wall-Mart Stores from 0.13 to 0.71.

Copeland, Koller and Murrin (2000) recommend *"checking several reliable sources because beta estimates vary considerably"*. But about the CAPM, they conclude (see their page 225), *"It takes a better theory to kill an existing theory, and we have not seen the better theory yet. Therefore, we continue to use the CAPM, being wary of all the problems with estimating it."* We do not agree: common sense, experience and some business and financial knowledge are much better that a bad theory.

Fernandez (2009b) reports 2,510 answers from professors from 65 countries: 1,791 respondents used betas. 97.3% of the professors that justify the betas use regressions, webs, databases, textbooks or papers, although many of them admit that calculated betas *"are poorly measured and have many problems"*. Only 0.9% of the professors justified the beta using exclusively personal judgment (named *qualitative betas, common sense betas, intuitive betas, logical magnitude betas and own judgment betas* by different professors). The Webs and Databases most cited by the professors were: Yahoo Finance; Bloomberg; Damodaran Website; Value Line; Google finance; Reuters; DataStream; Morningstar; Barra; MSN.

9. Problems calculating the Market Risk Premium

Other error of many CAPM users is to assume that "*the market*" has an expected MRP (market risk premium). They consider the MRP as a parameter "*of the market*" and not a parameter that is different for different investors.

Fernandez (2009)[17] reviews 150 textbooks on corporate finance and valuation written by authors such as Brealey, Myers, Copeland, Damodaran, Merton, Ross, Bruner, Bodie, Penman, Arzac… and finds that their recommendations regarding the MRP range from 3% to 10%, and that 51 books use different MRP in various pages. Some confusion arises from not distinguishing among the four concepts that the MRP designates: the Historical, the Expected, the Implied and the Required equity premium (incremental return of a diversified portfolio over the risk-free rate required by an investor).

Fernandez, Aguirreamalloa and Corres (2011)[18] show that the average MRP used in 2011 for the USA by professors, analysts and company managers were 5.7%, 5.0% and 5.6% (standard deviations: 1.6%, 1.1% and 2.0%). They also found a great dispersion in the MRP used even if it was justified with the same reference: those that cited Ibbotson as their reference used MRP for USA between 2% and 14.5%, and those that cited Damodaran as their reference used MRP between 2% and 10.8%.

[14] "On the instability of betas: the case of Spain" http://ssrn.com/abstract=510146
[15] "Are Calculated Betas Good for Anything?", http://ssrn.com/abstract=504565
[16] "Betas used by Professors: a survey with 2,500 answers" http://ssrn.com/abstract=1407464
[17] "The Equity Premium in 150 Textbooks", http://ssrn.com/abstract=1473225. 129 of the books identify Expected and Required equity premium and 82 identify Expected and Historical equity premium.
[18] "US Market Risk Premium Used in 2011 by Professors, Analysts and Companies: A Survey", http://ssrn.com/abstract=1805852

10. Expected, required and historical parameters

Fernandez (2006b)[19] claims that *"the equity premium (EP or MRP) designates four different concepts: Historical Equity Premium (HEP); Expected Equity Premium (EEP); Required Equity Premium (REP); and Implied Equity Premium (IEP)… confusing message in the literature.. The confusion arises from not distinguishing among the four concepts and from not recognizing that although the HEP should be equal for all investors, the REP, the EEP and the IEP differ for different investors". "The CAPM assumes that REP and EEP are unique and that REP = EEP".* Different authors claim different relations among the four equity premiums defined. These relationships vary widely:

- **HEP = EEP = REP:** Brealey-Myers (1996); Copeland *et al* (1995); Ross *et al* (2005); Stowe *et al* (2002); Pratt (2002); Bruner (2004); Bodie *et al* (2003); Damodaran (2006); Goyal -Welch (2007); Ibbotson (2006).
- **EEP is smaller than HEP:** Copeland *et al* (2000, HEP-1.5 to 2%); Goedhart *et al* (2005, HEP-1 to 2%); Bodie *et al* (1996, HEP-1%); Mayfield (2004, HEP-2.4%); Booth (1999, HEP-2%); Bostock (2004, 0.6 to 1.8%); Dimson *et al* (2006c, 3 to 3.5%); Siegel (2005b, 2 to 3%); Ibbotson (2002, < 4%); Campbell (2002, 1.5 to 2%); Campbell (2007, 4%).
- **EEP is near zero:** McGrattan and Prescott (2001); Arnott and Ryan (2001); Arnott and Bernstein (2002).
- *"that no one knows what the REP is"*: Penman (2003).
- *"it is impossible to determine the REP for the market as a whole, because it does not exist"*: Fernandez (2002).
- *"different investors have different REPs"*: Fernandez (2004).

The Historical Equity Premium (HEP) is not a good estimator of the EEP. Although Mehra and Prescott (2003) state that *"…over the long horizon the equity premium is likely to be similar to what it has been in the past"*, the magnitude of the error associated with using the HEP as an estimate of the EEP is substantial. Shiller (2000) points out that *"the future will not necessarily be like the past".* Booth (1999) concludes that the HEP is not a good estimator of the EEP and estimates the later in 200 basis points smaller than the HEP[20]. Mayfield (2004) concludes that EEP = HEP – 2.4% = 5.9% over the yield on T-bills (4.1% over yields on T-bonds).

Survivorship bias[21] was identified by Brown, Goetzmann and Ross (1995) as one of the main reasons why the results based on historical analyses can be too optimistic. They pointed out that the observed return, *conditioned on survival* (HEP), can overstate the unconditional expected return (EEP). However, Li and Xu (2002) show that the survival bias fails to explain the equity premium puzzle: *"To have high survival bias, the probability of market survival over the long run has to be extremely small, which seems to be inconsistent with existing historical evidence".*

Pastor and Stambaugh (2001) present an estimation of plus or minus 280 basis points around 4.8%.

Constantinides (2002) says that the conditional EEPs at the end of the 20th century and the beginning of the 21st are substantially lower than the estimates of the unconditional EEP (7%) *"by at least three measures".*

Dimson *et al* (2003) highlight the survivorship bias relative to the market, *"even if we have been successful in avoiding survivor bias within each index, we still focus on markets that survived"* and concluded that the geometric EEP for the world's major markets should be 3% (5% arithmetic). Dimson *et al* (2006c) admit that *"we cannot know today's consensus expectation for the equity premium",* but they conclude that *"investors expect an equity premium (relative to bills) of around 3-3½% on a geometric mean basis",* substantially lower than their HEP.

Regressions to find the EEP. Attempts to predict the MRP typically look for some independent lagged predictors (X) on the MRP: $MRP = a + b \cdot X_{t-1} + \varepsilon_t$ Many predictors have been explored in the literature:

- Dividend yield: Ball (1978), Rozeff (1984), Campbell (1987), Campbell and Shiller (1988), Fama and French (1988), Hodrick (1992), Campbell and Viceira (2002), Campbell and Yogo (2003), Lewellen (2004), and Menzly, Santos, and Veronesi (2004).
- The short term interest rate: Hodrick (1992).
- Earnings price and payout ratio: Campbell and Shiller (1988), Lamont (1998) and Ritter (2005).
- The term spread and the default spread: Avramov (2002), Campbell (1987), Fama and French (1989), and Keim and Stambaugh (1986).
- The inflation rate (money illusion): Fama and Schwert (1977), Fama (1981), and Campbell and Vuolteenaho (2004a,b), and Cohen, Polk and Vuolteenaho (2005).

[19] "Equity Premium: Historical, Expected, Required and Implied" http://ssrn.com/abstract=933070
[20] He also points out that the nominal equity return did not follow a random walk and that the volatility of the bonds increased significantly over the last 20 years.
[21] "Survivorship" or "survival" bias applies not only to the stocks within the market (the fact that databases contain data on companies listed today, but they tend not to have data on companies that went bankrupt or filed for bankruptcy protection in the past), but also for the markets themselves (*"US market's remarkable success over the last century is typical neither of other countries nor of the future for US stocks"* (Dimson *et al* 2004)).

- Interest rate and dividend related variables: Ang and Bekaert (2003).
- Book-to-market ratio: Kothari and Shanken (1997).
- Value of high and low-beta stocks: Polk, Thompson and Vuolteenaho (2006).
- Consumption and wealth: Lettau and Ludvigson (2001).
- Aggregate financing activity: Baker and Wurgler (2000) and Boudoukh *et al* (2006).
- Momentum: Fama and French (2012)

Goyal and Welch (2007) recommended *"assuming that the equity premium is 'like it always has been'".* They also show that most of these models have not performed well for the last thirty years, that are not stable, and that are not useful for market-timing purposes.

Campbell and Thompson (2007) say: *"The basic lesson is that investors should be suspicious of predictive regressions with high R^2 statistics, asking the old question 'If you're so smart, why aren't you rich?'"*

Other estimates of the EEP. Siegel (2002, page 124): "*the future equity premium is likely to be in the range of 2 to 3%, about one-half the level that has prevailed over the past 20 years*"[22]. Siegel (2005a, page 172): *"over the past 200 years, the equity risk premium has averaged about 3%".* Siegel (2005b): *"although the future equity risk premium is apt to be lower than it has been historically, U.S. equity returns of 2-3% over bonds will still amply reward those who will tolerate the short-term risk of stocks".*

McGrattan and Prescott (2001) forecasted that the real returns on debt and equity should both be near 4%. Arnott and Ryan (2001) claim that the expected equity premium is near zero. Arnott and Bernstein (2002) also conclude that *"the current risk premium is approximately zero".* In June 2002, Ibbotson forecasted *"less than 4% in excess of long-term bond yields",* and Campbell *"1.5% to 2%".*

Bostock (2004) concludes that equities should offer a risk premium over government bonds between 0.6% and 1.8%. Grabowski (2006): *"after considering the evidence, any reasonable long-term estimate of the normal EEP as of 2006 should be in the range of 3.5% to 6%".* Maheu and McCurdy (2006) suggest an EEP between 4.02% and 5.1%.

11. How to calculate required returns?

The easiest way is in Fernandez (2013)[23]: *"As the expected equity cash flows (ECF) are riskier than the cash flows promised by the Government bonds and also riskier than the cash flows promised by the Debt of the company the required return to equity (Ke) should be higher than risk-free rate (R_F) and also higher than the required return to Debt: Ke = R_F + RPs (shares risk premium)".*

Company valuation using discounted cash flows is based on the valuation of the Government bonds: it consists of applying the procedure used to value the Government bonds to the debt and shares of a company. This is easy to understand. But company valuations are often complicated by 'additions' (formulae, concepts, theories…) to complicate its understanding and to provide a more *"scientific", "serious", "intriguing", "impenetrable",…* appearance. Among the most commonly used 'additions' are: WACC, beta (β), market risk premium, beta unlevered, value of tax shields… Most of these 'additions' are unnecessary complications and are the source of many errors

12. How to use betas and to be a reasonable person

We may want to calculate RPs (shares risk premium) as a product: RPs = β MRP

The MRP (**market risk premium**) is the "shares risk premium" of the investor applied to the whole market (or to a portfolio with shares of most of the companies traded in the stock markets). The MRP is the answer to the following question: *Knowing that your money invested in long-term Government bonds will provide you a return of R_F% almost for sure, which additional return you require to another investment (in a portfolio with shares of most of the companies with shares traded in the financial markets) for feeling compensated for the extra risk that you assume?* In 2012 about 75% of the MRP used for the USA market were in the range between 4% and 6.5%[24]. The MRP is also called "*equity premium*", "*equity risk premium*", "*market premium*" and "*risk premium*".

The β (**beta**) is a specific parameter for each company. We know that β=0 corresponds to Government bonds (no risk) and β=1 to an investment with a risk similar to that of the market. About 80% of the betas used in valuations are in the interval between 0.7 and 1.5. A beta of 0.7 (or lower) could be applicable to companies with

[22] Siegel also affirms that: *"Although it may seem that stocks are riskier than long-term government bonds, this is not true. The safest investment in the long run (from the point of view of preserving the investor's purchasing power) has been stocks, not Treasury bonds".*

[23] "Cash Flow Discounting: Fundamental Relationships and Unnecessary Complications" http://ssrn.com/abstract=2117765

[24] "MRP Used in 82 Countries in 2012: A Survey with 7,192 Answers", http://ssrn.com/abstract=2084213

Equity Cash Flows highly predictable (electric companies and other utilities in countries with expectations of very few surprises and sensible managers…). A beta of 1.5 (or higher) could be applicable to new companies with high uncertainty about the market acceptance of their products, companies with managers with little common sense…

Using beta and MRP, $Ke = R_F + \beta\ MRP$

Calculating a qualitative beta. According to the capital asset pricing model (CAPM), all investors should use the same β and the same MRP. On top of that, the β of each company and the MRP are parameters that "exist" and we should be able to estimate accurately with appropriate statistical tools. We do not share this view and we think that the β of each company and the MRP should be computed for each company and every investor using common sense and good judgement about the company, its industry, the national economies…[25]

Given the instability and the meaninglessness of historical betas, companies are increasingly resorting to calculating a qualitative beta of companies or investment projects. Example: A company uses the MASCOFLAPEC method (from the initials of the parameters used to evaluate the risk of each project) to estimate the beta. Each parameter is scored from 1 to 5 according to its contribution to the risk. Each factor also has to be weighted. In the attached example, the sum of the scores of each parameter, bearing in mind its weight, was 3.5. Multiplying this number by 0.5, we obtain a beta of 1.75. Note that with this system (owing to the parameter 0.5) the beta can vary between 0.5 and 2.5. If a parameter equal to 0.6 were used, then the beta could vary between 0.6 and 3.0.

Calculation of a "*common sense beta*"

			Risk					
			low	average	substantial	high	very high	*Weighted*
Weight			**1**	**2**	**3**	**4**	**5**	*risk*
10%	**M**	Management	1					*0.1*
25%	**A**	Assets: Business: industry / product ...					5	*1.2*
3%	**S**	Strategy				4		*0.1*
15%	**C**	Country risk				4		*0.6*
10%	**O**	Operating leverage				4		*0.4*
15%	**F**	Financial leverage		2				*0.3*
5%	**L**	Liquidity of investment					5	*0.2*
5%	**A**	Access to sources of funds			3			*0.1*
2%	**P**	Partners				4		*0.0*
5%	**E**	Exposure to other risks (currencies...)		2				*0.1*
5%	**C**	Cash flow stability			3			*0.1*
100%								*3.5*
		Beta of equity =	3.5	x	0.5	=	**1.75**	

Alternatives to the MASCOFLAPEC method: the MARTILLO method and the BAMIFLEX method:
M Management; A Asset quality; R Risk exposure; T Trade analysis: product/market; I IRR of new investments; L Leverage; L Liquidity; O Other relevant factors.

B Business: product / demand / market; A Access to credit: capacity to obtain finance; M Management: managers, shareholders...; I Indebtedness. Solvency and long-term survival; F Flows. Resource generation (capacity to pay debts) and return; L Liquidity of the shares; EX Exposure to other risks: foreign exchange, country, interest rate, raw materials,...

These methods are simply an aid to common sense. The beta that should be used to value a company will depend on the risk that the valuer sees in the expected flows of the company.

13. Conclusion

An anecdote from Merton Miller (2000, page 3) about the expected market return in the Nobel context: *"I still remember the teasing we financial economists, Harry Markowitz, William Sharpe, and I, had to put up with from the physicists and chemists in Stockholm when we conceded that the basic unit of our research, the expected rate of return, was not actually observable. I tried to tease back by reminding them of their neutrino –a particle with no mass whose presence was inferred only as a missing residual from the interactions of other particles. But that was eight years ago. In the meantime, the neutrino has been detected".*

[25] Another method for family business is explained by my friend Guillermo Fraile, IAE professor at Buenos Aires, in his classes: the *HMDYWD* (initials for *How much do you want, Dad?)* method. It is not a joke: it does not make much sense to talk about the Ke as a magnitude shared by all investors; but it does make sense to talk about each investor's Ke, including Dad's.

Fama and French (2004) stated that *"Unfortunately, the empirical record of the model is poor – poor enough to invalidate the way it is used in applications… Evidence mounts that much of the variation in expected return is unrelated to market beta."*

*"Experience doesn´t consist of the number of things one has seen, but of the number of things on which one has **reflected"**.* Pereda, José María. Writer. Santander. Spain

Merriam-Webster dictionary:
Common sense: "sound and **prudent** judgment based on a simple perception of the situation or facts."
Opinion: a belief, judgment, or way of thinking about something:: advice from someone with special knowledge : advice from an expert
Wishful thinking: an attitude or belief that something you want to happen will happen even though it is not likely or possible. The attribution of reality to what one wishes to be true or the tenuous justification of what one wants to believe
Cause: something or someone that produces an effect, result, or condition; something or someone that makes something happen or exist. **Mystery:** something hard to understand or explain

References

Altman E., Jacquillat B. and M. Lavasseur (1974), "Comparative Analysis of Risk Measures: France and United States", *Journal of Finance*, 29, 1495-1511.
Altug, S. and P. Labadie (2008), *Asset Pricing for Dynamic Economies*, Cambridge U Press
Anderson, R.and D. Fraser (2000), "Corporate control, bank risk taking, and the health of the banking industry," *J.of Banking & Finance* 24 (8): 1383-1398.
Annema, M. and M. Goedhart (2003), "Better Betas," *McKinsey on Finance*, Winter, 10-13.
Annema, M. and M. Goedhart (2006), "Betas: Back to normal," *McKinsey on Finance* 20, Summer, 14-16.
Apap, A. (2006), *Portfolio Planning for Individual Investors*, Bosworth-Bradley Publishing
Arnott, R. D. and R. J. Ryan (2001), "The Death of the Risk Premium," *Journal of Portfolio Management*, Spring, 61-74.
Avramov, D. (2002), "Stock Return Predictability and Model Uncertainty," *Journal of Financial Economics*, Vol. 64, no. 3.
Avramov, D. and T. Chordia (2001), "Characteristic Scaled Betas," SSRN Working Paper no. 276654.
Baesel, J.B. (1974), "On the assessment of risk: Some further considerations," *Journal of Finance* 24(5): 1491-94.
Banz, R.W. (1981), "The Relationship Between Return and market Value of Common Stocks," *Journal of Financial Economics* 9, 3-18.
Bartholdy, J. and P. Peare (2000), "Estimating the Cost of Equity," Aarhus School of Business, Working Paper.
Bartholdy, J. and P.Peare (2001), "The Relative Efficiency of Beta Estimates," Aarhus School of Business.
Basu, S. (1977), "Investment Performance of Common Stocks in Relation to their Price-Earnings Ratios: A Test of Efficient Market Hypothesis," *Journal of Finance* 32, 663-682.
Basu, S. (1983), "The Relationship Between Earnings Yield, Market Value and the Return for NYSE Common Stocks: Further Evidence," *Journal of Financial Economics* 12, 129-156.
Beaver, W., P. Kettler, and M. Scholes (1970), "The association between market determined and accounting determined risk measures," *The Accounting Review* 45 (Oct): 654-82.
Beer F.M. (1997), "Estimation of risk on the Brussels S. Exchange: methodological issues and empirical results", Global Finance J, 8, 83-94.
Bekaert, G. and R. J. Hodrick (2008), *International Financial Management*, Pearson Education.
Berglund, T. and J. Knif (1999), "Accounting for the Accuracy of Beta Estimates in CAPM Tests on Assets with Time-Varying Risks," *European Financial Management*, Vol. 5, no. 1.
Berk, J. and P. DeMarzo (2006), *Corporate Finance*. Pearson.
Berk, J., P. DeMarzo, and J. Harford (2008), *Fundamentals of Corporate Finance*, Pearson Education.
Bernstein, P. L. (1992), "If Beta is Dead, Where is the Corpse?" Forbes, July 20, 1992, page 343.
Blake, D.(1999), *Financial Market Analysis*, John Wiley & Sons, 2nd Ed.
Blume, M.E. (1975), "Betas and their regression tendencies," *The Journal of Finance* 30(3): 785-795.
Bodie, Z., A. Kane, and A. J. Marcus (2004), *Investments*, 6th edition. NY: McGraw Hill.
Bodie, Zvi and Robert Merton (2000), *Finance*. New Jersey: Prentice Hall,.
Booth, L. (1999), "Estimating the MRP and equity costs: new ways of looking at old data," *J. of Applied Corporate Finance* 12 (1), 100-112.
Brailsford J. and Josev T. (1997), "The impact of the return on the estimation of systematic risk", Pacific-Basin Finance Journal, 5, 356-376.
Brealey, R. A. and S. C. Myers (2000), *Principles of Corporate Finance*. 6th edition. New York: McGraw-Hill.
Brealey, R.A. and S.C. Myers (2003), *Principles of Corporate Finance*, 7th edition, New York: McGraw-Hill.
Brealey, R.A., S.C. Myers and F. Allen (2005), *Principles of Corporate Finance*, 8th edition, McGraw-Hill/Irwin.
Brennan, M.J. and F. Li (2008), "Agency and Asset Pricing",UCLA Working Paper. Ssrn n. 1104546
Brigham, E. and J. F. Houston (2007), *Fundamentals of Financial Management*, Thomson One, 11th ed.
Brigham, E. and L. C. Gapenski (1977), Financial Management: Theory and Practice, Dryden Press.
Brigham, E. and P. R. Daves (2007), *Intermediate Financial Management*, Thomson OneNE, 9th edition
Broquet, C., R. Cobbaut, R. Gillet and A. van den Bergh (2004), *Gestion de portefeuille*, De Boeck, 4th ed.
Brown, S. J., W. N. Goetzmann and S. A. Ross (1995), "Survival," *The Journal of Finance*, July, 853-873.
Brown, S.J. and J. B. Warner (1985), "Using daily stock returns: The case of event studies," *Journal of Financial Economics*, 14(1): 3-31.
Bruner, R. F. (1999), *Instructor's Resource Manual to accompany Case Studies in Finance*, 3rd ed., McGraw-Hill/Irwin.
Bruner, R. F. (2004), *Applied Mergers and Acquisitions*, NY: John Wiley & Sons.

Bruner, R. F., K. Eades, R. Harris and R. Higgins (1998), "Best Practices in Estimating the Cost of Capital: Survey and Synthesis," *Financial Practice and Education*, Vol. 8(1), 13-28.
Buss, A. and G. Vilkov (2009), "Option-Implied Correlation and Factor Betas Revisited". SSRN WP no. 1301437.
Campbell, J. and J. Mei (1993), "Where Do Betas Come From? Asset Price Dynamics and the Sources of Systematic Risk," *Review of Financial Studies* 6:567–592.
Campbell, J. and T. Vuolteenaho (2004), "Bad Beta, Good Beta," *American Economic Review* 94:1249-1275.
Campbell, J. and Y. Nosbusch (2007), "Intergenerational risksharing and equilibrium asset prices," *J. of Monetary Economics* 54:2251-2268.
Carhart, M. M. (1997), 'On persistence in mutual fund performance'. *Journal of Finance* 52, 57-82.
Carvalho, S. and A. Barajas (2013), Parameters that Provide Higher Explanation Estimating Betas in the Portuguese Stock Market. Ekonomska istraživanja - Economic Research, Volume 26(2): 117-128 (2013). http://ssrn.com/abstract=2283032
Chrissos, J. and Gillet, R. (2008), *Décision d'investissement* , Collection Gestion appliquée, Pearson, Paris, 2nd Ed.
Christoffersen, P., K. Jacobs and G. Vainberg (2006), "Forward-Looking Betas," Working Paper, Faculty of Management, McGill University.
Chung, Y. P., H. Johnson and M. J. Schill (2001), "Asset Pricing When Returns Are Nonnormal: Fama-French Factors vs. Higher-Order Systematic Co-Moments," SSRN no. 270233.
Claus, J. J. and J. K. Thomas (1999), "The Equity Risk Premium Is Much Lower Than You Think It Is: Empirical Estimates From A New Approach," Research paper, Columbia Business School.
Cochrane, J. (2005), *Asset Pricing*, Princeton University Press.
Cohen K., Hawawini G.A., Maier S.F., Schwartz R.A. and Withcomb D.K. (1980), "Implications of Microstructure Theory for Empirical Research on Stock Price Behavior", *Journal of Finance*, 35, 249-257.
Cohen K., Hawawini G.A., Maier S.F., Schwartz R.A. and Withcomb D.K. (1983), "Friction in the Trading Process and the Estimation of Systematic Risk", *Journal of Financial Economics*, 12, 263-278.
Comer, G., N. Larrymore, and J. Rodriguez (2009), "Controlling for fixed income exposure in portfolio evaluation: Evidence from hybrid mutual funds," *Review of Financial Studies* 22, 481-507.
Constantinides, G. (1982), "Intertemporal asset pricing with heterogeneous consumers and without demand aggregation," *Journal of Business*, vol. 55, 253-267.
Copeland and Weston (1988), *Financial Theory and Corporate Policy.* Third Edition. Reading, MA: Addison-Wesley.
Copeland, T., F. Weston and K. Shastri (2005), *Financial Theory and Corporate Policy.* 4th ed., Pearson Addison-Wesley.
Copeland, T., T. Koller, and J. Murrin (2000), *Valuation: Measuring and Managing the Value of Companies.* 3rd ed. New York: Wiley.
Cremers, M. (2001), "Reviving Beta? Bayesian Tests of the CAPM when the Market Portfolio is Unobservable," Stern Working Paper.
Cunningham, L. A. (2001), *How to Think Like Benjamin Graham and Invest Like Warren Buffett*, McGraw-Hill Publishing: New York, NY.
Da, Z., R. Guo, R. Jagannathan (2009), "CAPM for estimating the cost of equity capital: interpreting the empirical evidence", NBER 14889.
Damodaran, A. (2005), *Applied Corporate Finance: A User's Manual*, Wiley; 2nd edition
Damodaran, A. (2006), *Damodaran on Valuation*, 2nd edition. New York: John Wiley and Sons. 1st edition: 1994.
Damodaran, A. (2001), *The Dark Side of Valuation*. New York: Prentice-Hall.
Danthine, J.P. and J.B. Donaldson (2001), *Intermediate Financial Theory*, Prentice-Hall
Daveni, R.A .and A.Y. Ilinitch (1992), "Complex patterns of vertical integration in the forest products industry - systematic and bankruptcy risks," *Academy of Management Journal* 35(3): 596-625
Derrig, R.A. and E.D. Orr (2004), Equity Risk Premium: Expectations Great and Small, *North American Actuarial Journal* 8 (1), 45-69.
Dimson, E. (1979), "Risk Measurement when Shares are Subject to Infrequent Trading", *Journal of Financial Economics*, 7, 197-226.
Dimson, E., P. Marsh and M. Staunton (2002), *Triumph of the optimists: 101 years of global investment returns*, Princeton University Press.
Dimson, E., P. Marsh and M. Staunton (2006), *DMS Global Returns data module*, Chicago, Ibbotson Associates.
Duffie, J. (2001), *Dynamic Asset Pricing Theory*, Princeton University Press, 3rd ed.
Eiteman, D.K., A.I. Stonehill and M.H.Moffett (2006), *Multinational Business Finance*, Addison Wesley, 11th ed.
Elsas, R., M. El-Shaer and E. Theissen (2000), "Beta and Returns Revisited: Evidence from the German Stock Market," SSRN no. 199428.
Elton, E. J., M. J. Gruber, S. J. Brown and W. N. Goetzmann (2006), *Modern Portfolio Theory and Investment Analysis*, Wiley; 7th ed.
Fabozzi, F. and J. Francis (1977), "Stability tests for alphas and betas over bull and bear market conditions," *J. of Finance* 32(4): 1093-1128.
Fama, E. (1970), "The Behavior of Stock Market Prices", *Journal of Business*, 38, 34-105.
Fama, E. (1976), *Foundations of Finance*, Basic Books Inc., New York
Fama, E. F. and K. R. French (1992), "The Cross-Section of Expected Stock Returns," *Journal of Finance* 47, 427-466.
Fama, E. F. and K. R. French (1996), "The CAPM is Wanted, Dead or Alive". *Journal of Finance* 51, 1947-1958.
Fama, E. F. and K. R. French (2000), "The Equity Premium," Center for Research in Security Prices, Working Paper no. 522.
Fama, E. F. and K. R. French (2004), "The CAPM: Theory and Evidence," *Journal of Economic Perspectives* 18 (Summer), 25-46.
Fama, E. and K. French (2012), "Size, Value, and Momentum in international stock returns," *Journal of Financial Economics* 105, 457-472.
Fama, E. F. and K. R. French (1996), "The CAPM is Wanted, Dead or Alive". *Journal of Finance* 51, 1947-1958.
Fama, E. F. and M. H. Miller (1972), *The Theory of Finance*. Illinois: Dryden Press.
Fernandez, P. (2002), *Valuation Methods and Shareholder Value Creation*, Academic Press, San Diego, CA.
Fernandez, P. (2004, 2013), "On the Instability of Betas: The Case of Spain", http://ssrn.com/abstract=510146
Fernandez, P. (2006, 2013), "Are Calculated Betas Good for Anything?", http://ssrn.com/abstract=504565
Fernandez, P. (2006b, 2013), "Equity Premium: Historical, Expected, Required and Implied" http://ssrn.com/abstract=933070
Fernandez, P. (2009, 2013), "The Equity Premium in 150 Textbooks", http://ssrn.com/abstract=1473225
Fernandez, P. (2009b, 2013), "Betas Used by Professors: A Survey with 2,500 Answers", http://ssrn.com/abstract=1407464
Fernandez, P. (2013), "Cash Flow Discounting: Fundamental Relationships and Unnecessary Complications", http://ssrn.com/abstract=2117765
Fernandez, P. and V. Bermejo (2009, 2013), "Beta = 1 Does a Better Job than Calculated Betas", http://ssrn.com/abstract=1406923
Fernandez, P. and A. Bilan (2007, 2913), "119 Common Errors in Company Valuations", http://ssrn.com/abstract=1025424

Fernandez, P.. J. Aguirreamalloa and L. Corres (2012, 2014), "MRP Used in 82 Countries in 2012: A Survey with 7,192 Answers", http://ssrn.com/abstract=2084213

Furman, E. and R. Zitikis (2009), "General Stein-type decompositions of covariances and the CAPM," SSRN n. 1103333.

Genton M. and E. Ronchetti (2008), "Robust Prediction of Beta", in *Computational Methods in Financial Engineering*, eds. E.J. Kontoghiorghes, B. Rustem, P. Winker, Springer, Berlin, 147-161.

Gibbons, M. (1982), "Multivariate Tests of Financial Models: A New Approach," *Journal of Financial Economics* 10, 3-28.

Gitman, L. (2008), *Principles of Managerial Finance*, Addison Wesley, 5th ed.

Glassman, J. and K. A. Hassett (2000), *Dow 36,000: The new strategy for profiting from the coming rise in the stock market,* Three Rivers.

Gooding, A. R. and T.P. O'Malley, (1977), "Market phase and the stationarity of beta," *Journal of Financial and Quant. A.*, Dec., 833-857.

Grabowski, R. J. (2009), Problems with Cost of Capital Estimation in the Current Environment - Update1

Graham, J.R. and C.R. Harvey (2007), "The Equity Risk Premium in January 2007: Evidence from the Global CFO Outlook Survey," *Icfai Journal of Financial Risk Management,* Vol. IV, No. 2, 46-61.

Griffin, J. M. (2002), "Are the Fama and French Factors Global or Country-Specific?" *Review of Financial Studies*,

Grinblatt, M. and S. Titman (2001), *Financial Markets & Corporate Strategy*, McGraw-Hill/Irwin; 2nd ed.

Hamada, R.S. (1972), "The effect of the firm's capital structure on the systematic risk of common stocks," *Journal of Finance*, 27, 435–452

Handa P., Kothari S. and C. Wasley (1989), "The Relation between the Return Interval and Betas: Implications for the Size Effect", *Journal of Financial Economics*, 23, 79-100.

Hawawini G.A. (1980), "Intertemporal Cross Dependence in Securities Daily Returns and the Short-run Intervalling Effect on Systematic Risk", *Journal of Financial and Quantitative Analysis*, 15, 139-149.

Hawawini, G. (1983), "Why Beta Shifts as the Return Interval Changes," *Financial Analysts Journal*, May-June, 73-77.

Higgins, R. (2009), Analysis for Financial Management, McGraw Hill Higher Education; 9th ed.

Hirshey, J. and M. Pappas (1990), *Managerial Economics*, Thomson Learning (1990)

Howard, M. (2008), *Accounting and Business Valuation Methods*, Elsevier.

Huang, C.F. and R. Litzemberger (1988), *Foundations for Financial Economics*, North-Holland.

Hull, J. (2009), Risk Management and Financial Institutions, Prentice Hall; 2nd ed.

Ibbotson, R.G., *Beta Book*, Ibbotson Associates, Chicago.

Ineiche, A. (2000), "Twentieth Century Volatility," *Journal of Portfolio Management*, Fall, 93-102.

Jensen, M. (1968), "The performance of mutual funds in the period 1945-1964," *Journal of Finance* 23 (2), 389-416.

Jordan, B. and T. Miller (2006), *Fundamentals of Investments*, McGraw-Hill/Irwin; 4th ed.

Jorion, P. and W. N. Goetzmann (1999), "Global stock markets in the twentieth century," *Journal of Finance* 54 (June), 953-80.

Kadlec, C. and R. Acampora (1999), *Dow 100,000: Fact or Fiction?* Prentice Hall.

Kahn, R. and R. Grinold (1999), *Active Portfolio Management*, McGraw-Hill; 2nd ed.

Kaplan, S. and G. Andrade (1998), "How Costly is Financial (not Economic) Distress? Evidence from Highly Leveraged Transactions that Became Distressed," *Journal of Finance* 53, 1443-1494.

Keim, D. (1983), "Size related anomalies and stock return seasonality: further empirical evidence," *J. of Financial Economics* 12, 13-32.

Keim, D. B. (1985), "Dividend yields and stock returns: implications of abnormal january returns," *J. of Financial Economics* 14, 473-489.

Keown, A., W. Petty, J. Martin, D. Scott (2006), *Foundations of finance: the logic and practice of finance management*, Prentice Hall, 5th ed.

Kogan, L., J. Gomes and L. Zhang (2003), "Equilibrium Cross-Section of Returns", *Journal of Political Economy* 111, 693-732.

Koller, T.; Goedhart, M. and D. Wessels (2005), *Valuation: Measuring and Managing the Value of Companies*, 4th Edition, McKinsey, Wiley.

Kothary, S. P. and J. Shanken (1995), "In defense of Beta," *Journal of Applied Corporate Finance* 8, 53-58.

Kothary, S. P. and J. Shanken (1999), "Beta and book-to-market: is the glass half full or half empty?" Simon Sc. of Business WP FR 97-20.

Kothary, S., J. Shanken and R. Sloan (1995), "Another look at the cross-section of expected stock returns," *Journal of Finance* 50, 185-224.

Koutmos, G. and J. Knif (2002), "Estimating systematic risk using time varying distributions," *European Financial Management* 8 (1), 59-73.

Lakonishok, J. and A. Shapiro (1984), "Stock returns, beta, variance and size: an empirical analysis," *Financial Analysts Journal* 40, 36-41.

---- (1986), "Systematic risk, total risk and size as determinants of stock market returns," *J.of Banking and Finance* 10, 115-132.

Lakonishok, J., A. Shleifer and R. W. Vishny (1994), "Contrarian investment, Extrapolation, and Risk" *Journal of Finance* 49, 1541-1578.

Lee S.B. and Kim D.J (1997), "Price Limits and Beta", *Review of Quantitative Finance and Accounting*, 9, 35-52.

Levy, H. (1984), "Measuring risk and performance over alternative investment horizons," *Financial Analysts Journal* 40(2): 61-68.

Levy, H. (1998), *Principles of Corporate Finance*, South-Western Educational Publishing.

Levy, M. and H. Levy (1996), "The Danger of Assuming Homogeneous Expectations," *Financial Analysts Journal*, May/June, 65–70.

Li, Haitao and Yuewu Xu (1999), "Can Survival Bias Explain the 'Equity Premium Puzzle'?" SSRN, Working Paper.

Lintner, J. (1965), "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, vol. 47, 13-37.

Lintner, J. (1969), "The Aggregation of Investor's Diverse Judgments and Preferences in Purely Competitive Security Markets," *Journal of Financial and Quantitative Analysis*, December, 347-400.

Litzenberger, R. H and K. Ramaswamy (1979), "The Effects of Personal Taxes and Dividends on Capital Asset Prices: Theory and Empirical Evidence," *Journal of Financial Economics* 7, 163-195.

Lobe, S., T. Niermeier, W. Essler and K. Roder (2008), "Do Managers follow the Shareholder Value Principle when applying Capital Budgeting Methods?" SSRN N. 1089379.

Los, C. (1999), "Galton's error and the under-representation of systematic risk," journal of banking and finance, Vol. 23 (12), 1793 - 1829.

Los, C. A. (2000), *Computational Finance*, World Scientific Publishing Co.

Los, C. A. (2003), *Financial Market Risk: Measurement & Analysis*, Routledge; 2nd ed.

Mamaysky, H., M. Spiegel, and H. Zhang (2007), "Improved Forecasting of Mutual Fund Alphas and Betas," *Review of Finance* 11, 359-400.

Mandelker, G.N. and S.G. Rhee (1984), "The Impact of the Degrees of Operating and Financial Leverage on Systematic Risk of Common Stock," *Journal of Financial and Quantitative Analysis*19 (1), 45-57

Markowitz, Harry (1952), "Portfolio Selection." *Journal of Finance*. 7:1, 77-99.
Markowitz, Harry (1959), *Portfolio Selection: Efficient Diversification of Investments*, Cowles Foundation Monograph No. 16, New York: John Wiley & Sons, Inc.
Markowitz, Harry M. (2005), "Market Efficiency: A Theoretical Distinction & So What?," Working Paper
Mas-Colell, A, M. D. Whinston and J. R. Green (1995), *Microeconomic Theory*, Oxford University Press.
Mayfield, E. S. (1999), "Estimating the Market Risk Premium," Research Paper, Graduate School of Business Administration, Harvard University.
Miller, M. H. (2000), "The History of Finance: An Eyewitness Account," *Journal of Applied Corporate Finance*, Vol. 13-2, 8-14.
Mossin, J. (1966), "Equilibrium in a Capital Asset Market," *Econometrica*, vol. 34, 768-783.
Murphy, A. (2000), *Scientific Investment Analysis*, Quorum Books; 2nd ed.
Nagel, G. L., D. R. Peterson and R. Pratti (2007), "The Effect of Risk Factors on Estimating the Cost of Equity" Quarterly Journal of Business and Economics (Finance and Accounting) v46 n1
Palepu, K. G. and P. M. Healy (2007), *Business Analysis and Valuation: Using Financial Statements*, South-Western College Pub; 4 edition.
Pastor, L. and R. F. Stambaugh (2001), "The Equity Premium and Structural Breaks," *Journal of Finance* 56, 1207-1239.
Pereiro, L. E. (2002), *Valuation of Companies in Emerging Markets*, Wiley; 1st edition.
Pettengill, G. N., Sundaram, S. and I. Mathur (1995), "The Conditional Relation Between Beta and Returns," *Journal of Financial and Quantitative Analysis*, 30, no. 1, 101-116.
Pike, R. and B. Neale (2003), *Corporate Finance & Investment: Decisions & Strategies*, Financial Times Management; Pearson 4th ed.
Porter, Michael (1992), "Capital disadvantage: america's failing capital investment system," *Harvard Business Review*, September-October.
Reilly, F. K. and D. J. Wright (1988), "A comparison of published betas", *The Journal of Portfolio Management*, Spring, 64-69.
Reilly, F. K., D. J. Wright, and K.C. Chan (2000), "Bond Market Volatility Compared to Stock Market Volatility," *Journal of Portfolio Management* (Fall), 82-92.
Reilly, F.K. and K.C. Brown (2002), *Investment Analysis and Portfolio Management,* South-Western Coll. Pub; 7th ed.
Reinganum, M. R (1981), "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings Yields and Market Values," *Journal of Financial Economics*, March, 19-46.
Reinganum, M. R (1981), "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings Yields and Market Values," *Journal of Financial Economics*, March, 19-46.
Reinhart, W. J., "Portfolio Management: Theory, Behavioral Aspects and Applications"
Rohini, S. (2008a), "Beta estimation in the indian market: stability, stationarity and computational cons.," *Decision*, (IIM Calcutta) 35 (2).
Rohini, S. (2008b), "Beta Stationarity over Bull and Bear Markets in India," *ICFAI Journal of Applied Finance*, 14 (4), 32-47.
Rojo, A. (2007), *Valoración de empresas y gestion basada en valor*, Editorial Thompson Paraninfo
Roll, R. (1977), "A Critique of the Asset Pricing Theory's Tests," *Journal of Financial Economics*, March, 129-176.
Roll, R. (1981), "A Possible Explanation of the Small Firm Effect," *Journal of Finance* 36, 879-888.
Roll, R. and S. A. Ross (1994), "On the Cross-Sectional Relation between Expected Returns and Betas," *Journal of Finance* 49, 101-121.
Ross, S. A., R. W. Westerfield and J. F. Jaffe (1993, 2005), *Corporate Finance*, 3rd, 7th ed., Homewood, IL: McGraw-Hill/Irwin.
Scholes, M. and J. Williams (1977), "Estimating Betas from Nonsynchronous Data," *Journal of Financial Economics* 5, 309-327.
Scholes, Myron and Joseph Williams (1977), "Estimating Betas from Nonsynchronous Data," *Journal of Financial Economics* 5, 309-327.
Shalit, H. and S. Yitzhaki (2002), "Estimating Beta," *Review of Quantitative Finance and Accounting* 18 (2).
Shanken, J. (1992), "On the Estimation of Beta-Pricing Models," *The Review of Financial Studies* 5 no. 1, 1-33.
Shapiro, A.C. (2005), *Capital Budgeting and Investment Analysis*, Pearson, Prentice Hall.
Sharpe, W. (1964), "Capital Asset Prices: A Theory of Capital Market Equilibrium under Conditions of Risk," *Journal of Finance* 19, 425-442.
Shenoy, C. and K. McCarthy (2008), *Applied portfolio management: how University of Kansas students generate alpha to beat the Street*, Wiley Finance.
Shirreff, D. (2004), *Dealing with Financial Risk*, The Economist
Siegel, J. (1998), *Stocks for the Long Run*. Second edition. New York: Irwin.
Siegel, J. (1999), "The Shrinking Equity Premium," *Journal of Portfolio Management*, Fall, 10-17.
Smith K.V., 1978, "The Effect of Intervalling on Estimating Parameters of CAPM", *J. of Financial and Quantitative Analysis*, 13, 313-332.
Smith, R.L. and J. Kiholm-Smith (2003), Entrepreneurial Finance, Wiley; 2nd ed.
Statman, M., (1981), "Betas compared: Merrill Lynch vs. Value Line," *Journal of Portfolio Management*, Winter, 41-44.
Tinic, S.M., and R. West (1984), "Risk and Return, January vs. the Rest of the Year," *Journal of Financial Economics* 13 (4): 561-574.
Tole, T.M., (1981), "How to maximize stationarity of beta," *The Journal of Portfolio Management*, Winter, 45-49.
Treynor, J. (1965), "How to rate management of investment funds," *Harvard Business Review* 43, Jan.-Feb., 63-75.
Turner, T. (2005), *Short Term trading in the New Stock Market*, St. Martin's Griffin.
Van Horne, J. C. (1992), *Financial Management and Policy*. Ninth edition. Englewood Cliffs, NJ: Prentice-Hall.
Vasicek, O. (1973), "A note on using cross-sectional information in Bayesean estimation of security betas," *J.of Finance* 28(5): 1233-1239.
Welch, I. (2000), "Views of financial economists on the equity premium and on professional controversies," *J.of Business* 73(4), 501-537.
Weston, J. F., S. Chung, and J. A. Siu (1997), *Takeovers, Restructuring and Corporate Governance*. 2nd edition. Prentice-Hall.
Womack, K. and Y. Zhang (2003),"Understanding risk and return, the CAPM, and the Fama-French 3-factor model," Tuck Case No. 03-111.
Zhang, L., Kogan, L. and J. F. Gomes (2001), "Equilibrium Cross-Section of Returns," SSRN Working Paper no. 264883.

Equity Premium:
Historical, Expected, Required and Implied

Pablo Fernandez
Professor of Finance. IESE Business School, University of Navarra
Camino del Cerro del Aguila 3. 28023 Madrid, Spain
e-mail: fernandezpa@iese.edu

January 29, 2013

The equity premium designates four different concepts: Historical Equity Premium (HEP); Expected Equity Premium (EEP); Required Equity Premium (REP); and Implied Equity Premium (IEP). We highlight the confusing message in the literature regarding the equity premium and its evolution. The confusion arises from not distinguishing among the four concepts and from not recognizing that although the HEP is equal for all investors, the REP, the EEP and the IEP differ for different investors.

A unique IEP requires assuming homogeneous expectations for the expected growth (g), but we show that there are several pairs (IEP, g) that satisfy current prices. We claim that different investors have different REPs and that it is impossible to determine the REP for the market as a whole, because it does not exist. We also investigate the relationship between (IEP – g) and the risk free rate.

There is a kind of schizophrenic approach to valuation: while all authors admit different expectations of equity cash flows, most authors look for a unique discount rate. It seems as if the expectations of equity cash flows are formed in a democratic regime, while the discount rate is determined in a dictatorship.

1. Introduction

The equity premium (also called *market risk premium*, *equity risk premium*, *market premium* and *risk premium*) is one of the most important, but elusive parameters in finance. Some confusion arises from the fact that the term equity premium is used to designate four different concepts:

1. **Historical** Equity Premium (HEP): historical differential return of the stock market over treasuries.
2. **Expected** Equity Premium (EEP): expected differential return of the stock market over treasuries.
3. **Required** Equity Premium (REP): incremental return of the market portfolio over the risk-free rate required by an investor in order to hold the market portfolio[1]. It is needed for calculating the required return to equity (cost of equity). The CAPM assumes that REP and EEP are unique and that **REP = EEP.**
4. **Implied** Equity Premium (IEP): the required equity premium that arises from a pricing model and from assuming that the market price is correct.

The four concepts are different[2]. The **HEP** is easy to calculate and is equal for all investors[3], but the **REP,** the **EEP** and the **IEP** are different for each investor and are not observable magnitudes. We also claim that there is not an **IEP** for the market as a whole: different investors have different **IEPs** and use different **REPs**. A unique IEP requires assuming homogeneous expectations for the expected growth (g), but there are several pairs (IEP, g) that satisfy current prices.

An anecdote from Merton Miller (2000, page 3) about the expected market return in the Nobel context: *"I still remember the teasing we financial economists, Harry Markowitz, William Sharpe, and I, had to put up with from the physicists and chemists in Stockholm when we conceded that the basic unit of our research, the expected rate of return, was not actually observable. I tried to tease back by reminding them of their neutrino –a particle with no mass whose presence was inferred only as a missing residual from the interactions of other particles. But that was eight years ago. In the meantime, the neutrino has been detected"*.

Different authors claim different relations among the four equity premiums defined above. These relationships vary widely:

- **HEP = EEP = REP** according to Brealey and Myers (1996); Copeland *et al* (1995); Ross *et al* (2005); Stowe *et al* (2002); Pratt (2002); Bruner (2004); Bodie *et al* (2003); Damodaran (2006); Goyal and Welch (2007); Ibbotson Ass. (2006).
- **EEP is smaller than HEP** according to Copeland *et al* (2000, HEP-1.5 to 2%); Goedhart *et al* (2005, HEP-1 to 2%); Bodie *et al* (1996, HEP-1%); Mayfield (2004, HEP-2.4%); Booth (1999, HEP-2%); Bostock (2004, 0.6 to 1.8%); Dimson *et al* (2006c, 3 to 3.5%); Siegel (2005b, 2 to 3%); Ibbotson (2002, < 4%); Campbell (2002, 1.5 to 2%); Campbell (2007, 4%)[4].
- **EEP is near zero** according to McGrattan and Prescott (2001); Arnott and Ryan (2001); Arnott and Bernstein (2002).
- Authors that try to find the **EEP doing surveys,** as Welch (2000, 7%); Welch (2001, 5.5%); Graham and Harvey (2007: 4.65% in 2000; 2.39% in nov. 05; 3.21% in nov. 06); O'Neill *et al* (2002, 3.9%).
- There is **a unique IEP and REP = IEP,** according to Damodaran (2001a); Arzac (2005); Jagannathan *et al* (2000); Harris and Marston (2001); Claus and Thomas (2001); Fama and French (2002); Goedhart *et al* (2002); Harris *et al* (2003); Vivian (2005).
- Authors that ***"have no official position"***, as Brealey and Myers (2000, 2003, 2005).
- Authors that claim ***"that no one knows what the REP is"***, as Penman (2003).
- Authors that claim that ***"it is impossible to determine the REP for the market as a whole, because it does not exist"***, as Fernandez (2002).
- Authors that claim that ***"different investors have different REPs"***, as Fernandez (2004).

[1] Or the extra return that the overall stock market must provide over the Government Bonds to compensate for the extra risk.
[2] We agree with Bostock (2004) when he says that *"understanding the equity premium is largely a matter of using clear terms"*.
[3] Provided they use the same time frame, the same market index, the same risk-free instrument and the same average (arithmetic or geometric).
[4] However, his figure 4 shows a world equity premium lower than 2% in the period 1985-2002.

The rest of this paper is organized as follows. In section 2 we revise different estimates of the Historical Equity Premium (HEP), note that not all the authors get the same result for the HEP, and analyze the data. We highlight the change in the market around 1960. Before that date, the dividend yield was higher than the risk-free rate, but after that date has been always smaller. In sections 3 and 4 we discuss different estimates of the Expected Equity Premium (EEP) and of the Required Equity Premium (REP). In section 5 we revise the equity premium puzzle. Section 6 is a revision of the prescriptions of the main finance textbooks about the risk premium. We highlight the confusing message of the textbooks regarding the equity premium and its evolution. In section 7, we show that there are several pairs (IEP, g) that explain current market prices and we argue that there is no a REP for the market as a whole, but rather different investors use different REPs. We also show a positive relationship between (IEP – g) and the risk free rate after 1960. Section 8 explains which REP uses the author. Finally, section 9 concludes.

2. Historical Equity Premium (HEP)

The HEP is the historical average differential return of the market portfolio over the risk-free debt[5]. The most widely cited source is Ibbotson Associates whose U.S. database starts in 1926. Another frequently used source is the Center for Research in Security Prices (CRSP) at the University of Chicago.

2.1. First studies of the historical equity return

Smith (1926) made the first empirical estimate of the long run return on stocks (only price changes) for the most actively traded stocks from 1901 to 1922, and showed that an equity investor (even without market timing or stock selection ability) outperformed a bond investor over this period[6].

Cowles (1939) published the first empirical study carefully done on the performance of the stock market. Cowles calculated the total return to equity from 1872 to 1937 for the NYSE, documenting a positive long term equity performance.

Fisher and Lorie (1964), using for the first time the database of stock prices completed at the University of Chicago's Center for Research in Security Prices (CRSP), showed that the average return from a random investment in NYSE stocks from 1926 to 1964 was 9.1% a year[7].

2.2. Estimates of the historical equity premium of the US

Table 1 contains the 1926-2005 average returns and HEP for the US according to Ibbotson Associates (2006). The HEP in table 1 is the difference between the average return on the S&P 500 and the return of Gov. Bonds or T-Bills. However, Ibbotson Associates (2006, page 73), use the income return (the portion of the total return that results from a periodic bond coupon payment) of the Gov. Bonds (5.2%) and consider that the relevant HEP during the period 1926-2005 is 7.1% (12.3-5.2).

Schwert (1990) and Siegel (1994, 1999, 2002, 2005a) studied the relationship between U.S. equity and bonds before 1926. The data on which they base their studies is less reliable than recent data, but the results are interesting, nevertheless. Table 2 shows their conclusions: the HEP and the inflation in the period 1802-1925 were substantially smaller than in subsequent years[8]. Note that table 1 provides a higher HEP than table 2 for the period after 1926 because Ibbotson do not consider the income return of the bonds.

[5] This average differential return may be arithmetic or geometric. Different stock market indexes are used as the market portfolio, and Government bonds of different maturities are used as risk-free debt. A good discussion of the geometric and arithmetic average is Jacquier, Kane, and Marcus (2003).
[6] Three years after publication, the market crash happened. Benjamin Graham blamed Smith's book for inspiring an *"orgy of uncontrolled speculation"*.
[7] For a more detailed history see Goetzmann and Ibbotson (2006).
[8] Siegel (1999) argues that this is because bond returns were exceptionally low after 1926, while total equity returns were relatively stable over the whole time period.

Wilson and Jones (2002) provide a monthly stock price index from 1871 through 1999. They note that the S&P Index returns have often been misrepresented[9] and reconstruct the weekly S&P Composite for the period 1926-56 containing more than 400 stocks (instead of 90 as the daily S&P Composite). They get some differences versus other used indexes that are summarized on table 3.

Ibbotson and Chen (2003) use 1926-2000 historical equity returns and conclude that the expected long-term equity premium (relative to the long-term government bond yield) is 5.9% arithmetically, and 3.97% geometrically.

Goetzmann and Ibbotson (2006) employ a new NYSE database for 1815–1925[10] to estimate the U.S. equity returns and the HEP since 1792 (but they mention that dividend data is absent pre-1825, and is incomplete in the period 1825–71). Their main results are in table 4.

Table 1. Returns and HEP according to Ibbotson Associates (2006). 1926-2005

	Average return		Standard	Serial
Nominal Returns 1926-2005	Arithmetic	Geometric	deviation	correlation
S&P 500	12,3%	10,4%	20,2%	3%
Income	*4,2%*	*4,2%*	*1,6%*	*89%*
Capital appreciation	*7,8%*	*5,9%*	*19,5%*	*3%*
Long-Term Gov. Bonds	5,8%	5,5%	9,2%	-8%
Income	*5,2%*	*5,2%*	*2,7%*	*96%*
Capital appreciation	*0,5%*	*0,4%*	*4,4%*	*-19%*
T-Bills	3,8%	3,7%	3,1%	91%
Inflation	3,1%	3,0%	4,3%	65%

HEP over Gov. Bonds	6,5%	4,9%
HEP over T-Bills	8,5%	6,7%

Table 2 - Real returns and HEP from Siegel (2005a)

arith. = arithmetic average. geom. = geometric average

	Average real returns (%)						
	Stocks		Bonds		HEP (%)		
	arith.	geom.	arith.	geom.	arith.	geom.	Inflation (%)
1802-1870	8.28	7.02	5.11	4.78	3.17	2.24	0.1
1871-1925	7.92	6.62	3.93	3.73	3.99	2.89	0.6
1926-2004	8.78	6.78	2.77	2.25	6.01	4.53	3.1
1802-2004	8.38	6.82	3.88	3.51	4.50	3.31	1.4

Table 3. Geometric average of the returns of different indexes in selected periods

(%)	Cowles	S&P	Wilson and Jones	Ibbotson	CRSP NYSE
1871-1925	7,24	7,28	7,28		
1926-1940	3,27	4,20	3,23	4,04	3,01
1941-1956		15,60	15,20	16,11	15,36
1957-1999		12,10	12,28	12,24	11,79
1926-1999		11.08	11.00	11.35	10.70
1871-1999		9,51	9,40		

Table 4. Average return of the US according to Goetzmann and Ibbotson (2006)

1792-1925	Arithmetic return	Geometric return	Standard deviation
Stocks	7.93%	6.99%	14.64%
Bonds	4.17%	4.16%	4.17%
Comm. Paper	7.62%	7.57%	3.22%
Inflation	0.85%	0.61%	7.11%
HEP (Bonds)	3.76%	2.83%	

1926-2004	Arithmetic return	Geometric return	Standard deviation
Stocks	12.39%	10.43%	20.32%
Gov. Bonds	5.82%	5.44%	9.30%
T-Bills	3.76%	3.72%	3.14%
Inflation	3.12%	3.04%	4.32%
HEP (Bonds)	6.57%	4.99%	
HEP (Bills)	8.63%	6.71%	

Total returns from 1871 to 1925 are constructed from the Price-Weighted NYSE and the Cowles Income Return Series.

[9] Standard & Poor's first developed stock price indices in 1923 and in 1927 created the Composite Index (90 stocks). On 1 March 1957, the Composite was expanded to 500 stocks and renamed S&P 500 Index (its market value was $173 billion, 85% of the value of all NYSE listed stocks). From 1926 to 1957 there were 2 different S&P Composite indexes: one was weekly and the other was daily. The S&P Composite daily covered 90 stocks until 1957; The S&P Composite weekly covered more than 400.

[10] See Goetzmann, Ibbotson, and Peng (2001), who collected U.S. stock market data by hand from 1815.

In a very interesting article, Siegel and Schwartz (2006) calculate the return of the original S&P 500 companies since 1957 until 2003 and find that their return has been higher than the return of the S&P 500[11]. The average geometric return of the S&P 500 was 10.85% (standard deviation of 17%), while the return of the original 500 companies was 11.31% (standard deviation of 15.7%).

Table 5. Different Historical Equity Premiums (HEP) in the US according to different authors

			Ibbotson	Shiller	WJ	Damodaran	Siegel	Max-min
HEP vs. LT Gov. Bonds	Geometric	1926-2005	4,9%	5,5%	4,4%	5,1%	4,6%	1,0%
		1926-1957	6,0%	7,3%	5,1%	5,8%		2,2%
		1958-2005	4,1%	4,2%	4,0%	4,5%		0,6%
	Arithmetic	1926-2005	6,5%	7,0%	5,8%	6,7%	6,1%	1,2%
		1926-1957	8,8%	10,1%	7,6%	8,7%		2,5%
		1958-2005	4,9%	5,0%	4,7%	5,4%		0,7%
HEP vs. T-Bills	Geometric	1926-2005	6,7%	6,0%	6,2%	6,3%	6,2%	0,7%
		1926-1957	8,2%	8,4%	7,3%	7,6%		1,1%
		1958-2005	5,6%	4,3%	5,4%	5,4%		1,3%
	Arithmetic	1926-2005	8,5%	7,7%	7,9%	8,2%	8,2%	0,8%
		1926-1957	11,1%	11,2%	9,9%	10,5%		1,4%
		1958-2005	6,8%	5,4%	6,6%	6,6%		1,5%

Ibbotson figures come from Ibbotson Associates (2006). Shiller figures come from http://aida.econ.yale.edu/~shiller/data.htm. WJ figures have been updated from Wilson and Jones (2002). Damodaran figures come from http://pages.stern.nyu.edu/~adamodar/. Siegel figures have been updated from Siegel (2005a).

Note that not all the authors get the same result, even for the HEP. Table 5 is a comparison of the HEP in the US according to different authors. The differences are substantial, especially for the period 1926-1957. The differences are mainly due to the stock indexes chosen. It is also important to keep in mind that the data from the 19th century and from the first part of the 20th century is quite poor and questionable. Table 6 shows the differences among the different indexes commonly used.

Table 6. Number of securities in the US indexes commonly used

	S&P composite weekly	Ibbotson	CRSP NYSE
1926-1957	228 stocks in 1927, 410 in 1928, 480 in 1956	S&P Composite daily: 90 stocks	Growing number of stocks: 592 in 1927; 1059 in 1957
1957-2006	abandoned	S&P Composite daily: 500 stocks	Growing number of stocks: 1500 in 1975; 2813 in 1999

2.3. A closer look at the historical data

Figure 1 shows that interest rates were lower than dividend yields until 1958 and than the earnings to price ratio until the 1980s. It suggests that many things have changed in the capital markets and that the last 40 years have been different than the previous ones. It is quite sensible to assume that the portfolio theory, the CAPM, the APT, the VAR analysis, the futures and options markets, the appearance of many mutual and hedge funds, the increase of investors, the legislation to protect investors, financial innovation, electronic trading, portfolio insurance, market participation,… have changed the behaviour and the risk attitudes of today's investors vs. past investors. In fact, financial markets are so different that the relative magnitude of dividend yields to interest rates has been reversed.

It is interesting to look at historical data to know what happened to our grandparents (or to our great grandparents), but it is not sensible to assume that their markets and their investment behaviour were similar to ours[12].

Figure 2 shows the evolution of the 20-year rolling correlation of (dividend yield – R_F) versus R_F (the yield on Government long-term bonds). Again, we may see that something has changed in the

[11] The market value of the S&P 500 companies that have survived from the original 1957 list was only 31% of the 2003 year-end S&P 500's market value. Since the S&P 500 was formulated, more than 900 new companies have been added to the index (and an equal number deleted from).

[12] Neither the exam of Ec1010 in 1932 is very useful for a student today.

markets because that correlation after 1960 has been lower than ever before. Figure 3 shows the raw data used to calculate the correlations of Figure 2 and permits to contrast the different behavior of the markets in the periods 1871-1959 and 1960-2005. In section 7 we analyze this data and derive implications.

Figure 4 shows the evolution of the 20-year rolling HEP (arithmetic and geometric) relative to the T-Bills. It may be seen that the periods with equity returns much higher than the T-Bill rates were the 50s and the 90s.

Figure 5 compares the 20-year rolling HEP with the current T-Bond yield. From 1960 to 2000 the HEP increased when the yield decreased and vice versa. It did not happen so clearly in previous years.

Figure 1. 10-year T-Bond yields, Earnings to Price ratio (E/P) and Dividend yield of the US
Source: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

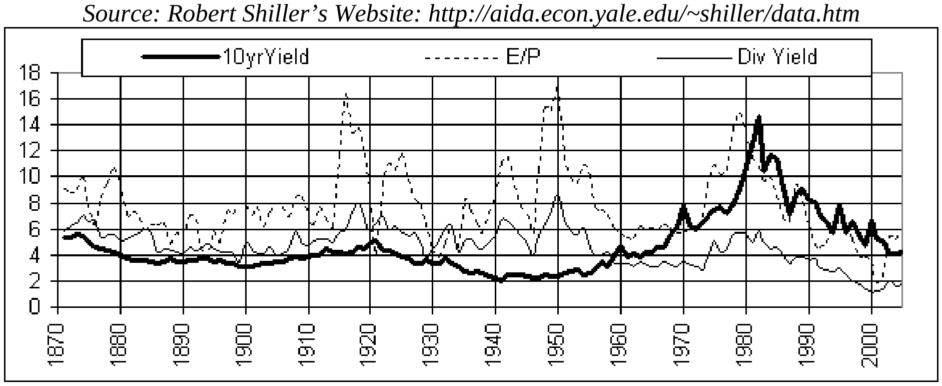


Figure 2. 20-year rolling correlation of (dividend yield – R_F) versus R_F (yield on T-Bonds). Monthly data.
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

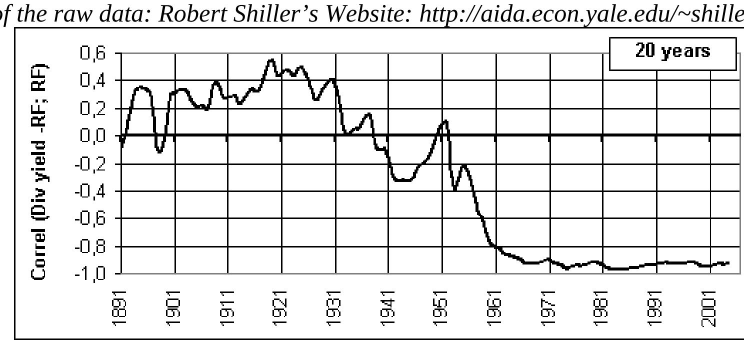


Figure 3. (Dividend yield – R_F) versus R_F (yield on Government long-term bonds)
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

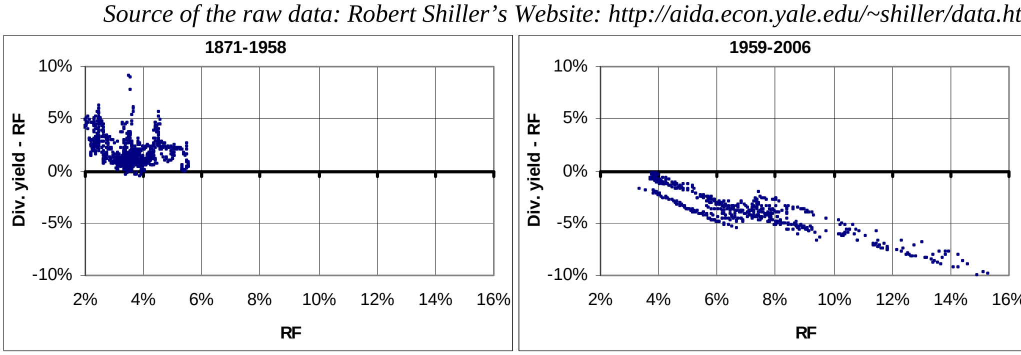


Figure 4. 20-year rolling HEP versus the T-Bills.
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

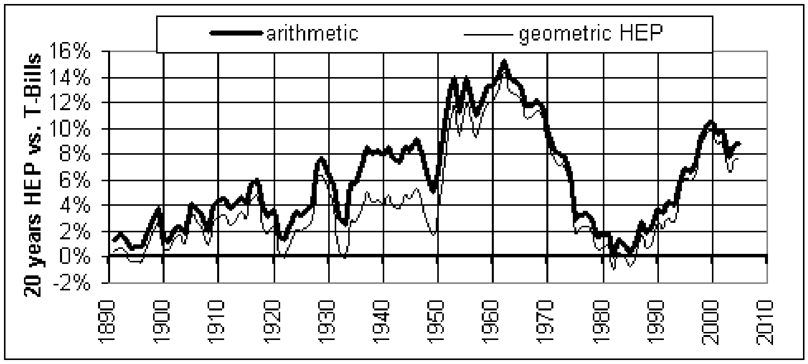
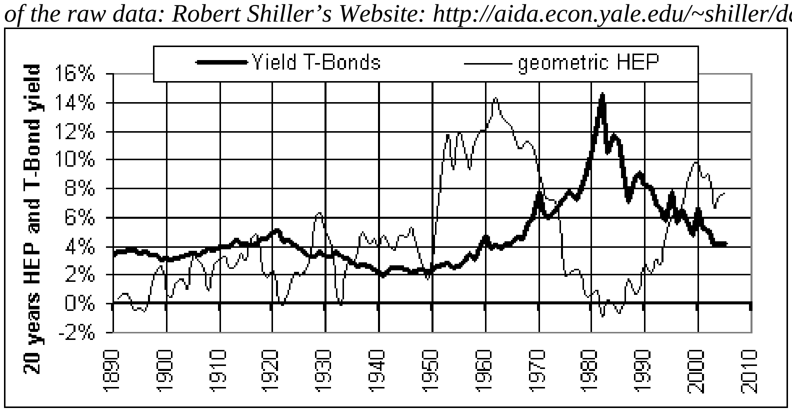


Figure 5. 20-year rolling geometric HEP versus the T-Bills, and T-Bond yield
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm



2.4. Estimates of the Historical Equity Premium (HEP) in other countries

Blanchard (1993) examined the evolution of stock and bonds rates over the period 1978 to 1992 for the US, Japan, Germany, France, Italy and the UK. He constructed 'world' rates of return (using relative GDP weights for the countries) and documented a postwar decline in the dividend yield and in various measures of the HEP.

Table 7. Equity return of selected countries, according to Jorion and Goetzmann (1999)

Country	Period	Nominal Return	Real Return	Dollar Return	Inflation
U.S.	21-96	6.95%	4.32%	6.95%	2.52%
Sweden	21-96	7.42%	4.29%	7.00%	3.00%
Germany	21-96	4.43%	1.91%	5.81%	2.47%
Canada	21-96	5.78%	3.19%	5.35%	2.51%
U.K.	21-96	6.30%	2.35%	5.20%	3.86%
France	21-96	9.09%	0.75%	4.29%	8.28%
Belgium	21-96	4.45%	-0.26%	3.51%	4.73%
Italy	28-96	10.10%	0.15%	3.22%	9.94%
Japan	21-96	7.33%	-0.81%	1.80%	8.21%
Spain	21-96	4.66%	-1.82%	1.53%	6.61%
Median 39 countries			0.75%	4.68%	
11 countries with continuous histories into the 1920s:		Mean	1.88%	5.09%	
		Median	2.35%	5.20%	

Jorion and Goetzmann (1999) constructed a database of capital gain indexes for 39 markets, with 11 of them starting in 1921(see table 7). However, they obtained pre-1970 dividend information only for 6 markets. They concluded that *"for 1921 to 1996, US equities had the highest real return for all countries, at 4.3%, versus a median of 0.8% for other countries. The high equity premium obtained for U.S. equities appears to be the exception rather than the rule"*. According to the authors, "*there are reasons to suspect that [the US] estimates are subject to survivorship*".

However, Dimson and Marsh (2001) do not find survivorship bias for the US. They calculate the geometric HEP for 1955-1999 of US, UK, Germany and Japan and get 6.2%, 6.2%, 6.3% and 7.0%.

Table 8. HEP vs. short (30 days) and long term (10 or 30 years) fixed income in 17 countries. 1900-2005. Annualized returns. *Source: Table 3 of Dimson, Marsh and Staunton (2006c)*

% p.a.	HEP relative to					
	Bills			Bonds		
Country	Geometric Mean	Arithmetic Mean	Standard Error	Geometric Mean	Arithmetic Mean	Standard Error
Australia	7,08	8,49	1,65	6,22	7,81	1,83
Japan	6,67	9,84	2,70	5,91	9,98	3,21
South Africa	6,20	8,25	2,15	5,35	7,03	1,88
Germany	3,83	9,07	3,28	5,28	8,35	2,69
Sweden	5,73	7,98	2,15	5,21	7,51	2,17
U.S.	5,51	7,41	1,91	4,52	6,49	1,96
U.K.	4,43	6,14	1,93	4,06	5,29	1,61
Italy	6,55	10,46	3,12	4,30	7,68	2,89
Canada	4,54	5,88	1,62	4,15	5,67	1,74
France	6,79	9,27	2,35	3,86	6,03	2,16
Netherlands	4,55	6,61	2,17	3,86	5,95	2,10
Ireland	4,09	5,98	1,97	3,62	5,18	1,78
Belgium	2,80	4,99	2,24	2,57	4,37	1,95
Norway	3,07	5,70	2,52	2,55	5,26	2,66
Spain	3,40	5,46	2,08	2,32	4,21	1,96
Denmark	2,87	4,51	1,93	2,07	3,27	1,57
Switzerland	3,63	5,29	1,82	1,80	3,28	1,70
Average	4,81	7,14	2,21	3,98	6,08	2,11
World-ex U.S.	4,23	5,93	1,88	4,10	5,18	1,48

Dimson *et al* (2006c) use a unique database to calculate the historical equity premium for 17 countries over 106 years (1900-2005). Their estimates (see Table 8) are lower than frequently quoted HEPs mainly due to the incorporation of the earlier part of the 20th century as well as the opening years of the 21st century[13].

But, apart from the historical interest, how useful and accurate is that data? As Dimson *et al* (2006c) point out, *"virtually all of the 16 countries experienced trading breaks … often in wartime. The U.K. and European exchanges, and even the NYSE, closed at the start of World War I…Similarly, the Danish, Norwegian, Belgian, Dutch and French markets …when Germany invaded in 1940, and even the Swiss market closed from May to July 1940 for mobilization. … Japan after the Great Tokyo Earthquake of 1923. …Germany and Japan from towards the end of World War II, and Spain during the Civil War"*. They claim that *"we were able to bridge these gaps"*, but this assertion is questionable. They admit that *"the end-year index levels recorded for Germany for 1943–47, Japan for 1945, and Spain for 1936–38 cannot be regarded as market-determined values"*. Dimson *et al* (2006c) explain in their footnote 7 that *"In Spain, trading was suspended during the Civil War from July 1936 to April 1939, and the Madrid exchange remained closed through February 1940; over the closure we assume a zero change in nominal stock prices and zero dividends"*. It is not clear why this assumption is a reasonable one. They also mention one *"unbridgeable discontinuity, namely, bond and bill (but not equity) returns in Germany during the hyperinflation of 1922–23, when German bond and bill investors suffered a total loss of –100%. …bonds and bills can become riskier than equities. When reporting equity premiums for Germany … we thus have no alternative but to exclude the years 1922–23"*.

In a previous work Dimson, Marsh and Staunton (2002) show that the HEP was generally higher for the second half century: the World had 4.7% in the first half, compared to 6.2% in the second half.

Table 9 contains some of the HEPs reported by different authors for the US.

Table 9. Historical Equity Premium (HEP) for the US according to different authors

[13] Their database contains annual returns on stocks, bonds, bills, inflation, and currencies for 17 countries from 1900–2005, and is described in Dimson *et al* (2006a and 2006b). They construct a World equity index (U.S. dollars index of 17 countries weighted by its starting-year market capitalization or by its GDP, before capitalizations were available) and a World bond index, constructed with each country weighted by its GDP. The series were compiled to avoid the survivorship bias that can arise from backfilling. Their choice of international markets was limited by their requirement to have data for the whole century.

Author(s)	Reference/average	Period for HEP	Value
Siegel (2002)	T-Bonds, geo.	1926-2001	4.9%
Ibbotson and Chen (2003)	T-Bonds, geo.	1926-2000	3.97%
Siegel (2005a)	T-Bonds, geo.	1926-2004	4.53%
Ibbotson Associates (2006)	T-Bonds arith. capital aprec. only	1926-2005	7.1%
Goetzmann and Ibbotson (2006)	T-Bonds, geo.	1792-1925	2.83%
Goetzmann and Ibbotson (2006)	T-Bonds, geo.	1926-2004	4.99%
Goyal and Welch (2007)		1872-2004	4.77%
Goyal and Welch (2007)		1927-2004	6.35%
Dimson & al.(2006c)	T-Bonds, geo. US	1900-2005	4.52%
Dimson & al.(2006c)	T-Bonds, geo. World	1900-2005	4.04%

This section has revised different estimates of the Historical Equity Premium (HEP) and permits to note that not all the authors get the same result for the HEP. We highlight the change in the market around 1960. Before that date, the dividend yield was higher than the risk-free rate, but after that date has been always smaller. We question the usefulness of historical data to predict the future.

3. Expected Equity Premium (EEP)

The **Expected** Equity Premium (EEP) is the answer to a question we would all (especially analysts and fund managers) like to answer accurately in the short term, namely: what incremental return do I expect from the market portfolio over the risk-free rate over the next years? Campbell (2007, pg. 1) identifies the EEP with the REP: *"What return should investors expect the stock market to deliver, above the interest rate on a safe short-term investment? In other words, what is a reasonable estimate of the equity premium?"*

Estimates of the EEP based on historical analysis presume that the historical record provides an adequate guide for future expected long-term behaviour. However, the HEP changes over time, and it is not clear why capital market data from the 19th century or from the first half of the 20th century may be useful in estimating expected returns in the 21st century.

Numerous papers assert that there must be **an** EEP common to all investors (to the representative investor). But it is obvious that investors do not share "homogeneous expectations"[14] and, also, that many investors do not hold the market portfolio but, rather, a subgroup of stocks and bonds[15]. Heterogeneous investors do not hold the same portfolio of risky assets; in fact, no investor must hold the market portfolio to clear the market.

We claim in section 7 that without "homogeneous expectations" there is **not one** EEP (but several), and there is **not one** REP (but several).

3.1. The Historical Equity Premium (HEP) is not a good estimator of the EEP

Although many authors consider that the equity premium is a stationary process, and then the HEP is an unbiased estimate of the EEP (*unconditional* mean equity premium), we do not agree with that statement: the HEP is not a good estimator of the EEP. For example, Mehra and Prescott (2003) state that *"…over the long horizon the equity premium is likely to be similar to what it has been in the past"*.

The magnitude of the error associated with using the HEP as an estimate of the EEP is substantial. Shiller (2000) points out that *"the future will not necessarily be like the past"*. Booth (1999) concludes that the HEP is not a good estimator of the EEP and estimates the later in 200 basis points smaller than the HEP[16]. Mayfield (2004) suggest that a structural shift in the process governing the volatility of market returns after the 1930s resulted in a decrease in the expected level of market risk, and concluded that EEP = HEP – 2.4% = 5.9% over the yield on T-bills (4.1% over yields on T-bonds).

[14] Brennan (2004) also admits that "*different classes of investor may have different expectations about the prospective returns on equities which imply different assessments of the risk premium*".
[15] But, even with "homogeneous expectations" (all investors have equal EEP), the REP would not be equal for all investors. In that situation, the investors with lower REP would clear the market.
[16] He also points out that the nominal equity return did not follow a random walk and that the volatility of the bonds increased significantly over the last 20 years.

Survivorship bias[17] was identified by Brown, Goetzmann and Ross (1995) as one of the main reasons why the results based on historical analyses can be too optimistic. They pointed out that the observed return, *conditioned on survival* (HEP), can overstate the unconditional expected return (EEP). However, Li and Xu (2002) show that the survival bias fails to explain the equity premium puzzle: *"To have high survival bias, the probability of market survival over the long run has to be extremely small, which seems to be inconsistent with existing historical evidence"*. Siegel (1999, p. 13) mentions that *"Although stock returns may be lower in foreign countries than in the U.S., the real returns on foreign bonds are substantially lower"*.

Pastor and Stambaugh (2001) present a framework allowing for structural breaks in the risk premium over time and estimate that the EEP fluctuated between 4% and 6% over the period from 1834 to 1999, declined steadily since the 1930s (except for a brief period in the mid-1970s) and had the sharpest drop in the last decade of the 20th century. Using extra information from return volatility and prices, they narrow the confidence interval of their estimation (two standard deviations) to plus or minus 280 basis points around 4.8%.

Constantinides (2002) addresses different ways in which we may account for biases in the sample mean premium in order to estimate the expected premium and draws a sharp distinction between conditional, short-term forecasts of the mean equity premium and estimates of the unconditional mean. He says that the conditional EEPs at the end of the 20th century and the beginning of the 21st are substantially lower than the estimates of the unconditional EEP (7%) *"by at least three measures"*. But he concludes that *"the currently low conditional, short-term forecasts of the equity premium do not necessarily imply that the unconditional estimate of the mean premium is lower than the sample average. Therefore, the low conditional forecasts do not necessarily lessen the burden on economic theory to explain the large sample average of the equity return and premium over the past 130 years"*.

Dimson *et al* (2003) highlight the survivorship bias relative to the market, *"even if we have been successful in avoiding survivor bias within each index, we still focus on markets that survived"* and concluded that the geometric EEP for the world's major markets should be 3% (5% arithmetic). Dimson *et al* (2006c) admit that *"we cannot know today's consensus expectation for the equity premium"*, but they conclude that *"investors expect an equity premium (relative to bills) of around 3-3½% on a geometric mean basis"*, substantially lower than the HEP found in their own study.

3.2. Surveys

A direct way to obtain an expectation of the equity premium is to carry out a survey of analysts or investors although Ilmanen (2003) argues that surveys tend to be optimistic: *"because of behavioural biases, survey-based expected returns may tell us more about hoped-for returns than about required returns"*.

Welch (2000) performed two surveys with finance professors in 1997 and 1998, asking them what they thought the EEP was over the next 30 years. He obtained 226 replies, ranging from 1% to 15%, with an average arithmetic EEP of 7% above T-Bonds.[18] Welch (2001) presented the results of a survey of 510 finance and economics professors performed in August 2001 and the consensus for the 30-year arithmetic EEP was 5.5%, much lower just 3 years earlier.

Graham and Harvey (2005) indicate that U.S. CFOs reduced their average EEP from 4.65% in September 2000 to 2.93% by September 2005. Over this period, the HEP had fallen only 0.4%.

Goldman Sachs (O'Neill, Wilson and Masih, 2002) conducted a survey of its global clients in July 2002 and the average long-run EEP was 3.9%, with most responses between 3.5% and 4.5%. The magazine *Pensions and Investments* (12/1/1998) carried out a survey among professionals working for institutional investors and the average EEP was 3%.

3.3. Regressions

Attempts to predict the equity premium typically look for some independent lagged predictors (X) on the equity premium: $\text{Equity Premium}_t = a + b \cdot X_{t-1} + \varepsilon_t$

[17] "Survivorship" or "survival" bias applies not only to the stocks within the market (the fact that databases contain data on companies listed today, but they tend not to have data on companies that went bankrupt or filed for bankruptcy protection in the past), but also for the markets themselves ("US market's remarkable success over the last century is typical neither of other countries nor of the future for US stocks" (Dimson *et al* 2004)).

[18] The interest rate paid by long-term T-bonds in April 1998 was approximately 6%. At that time, the most recent Ibbotson Associates Yearbook was the 1998 edition, with an arithmetic HEP versus T-bills of 8.9% (1926–1997).

Many predictors have been explored in the literature. Some examples are:

- Dividend yield: Ball (1978), Rozeff (1984), Campbell (1987), Campbell and Shiller (1988), Fama and French (1988), Hodrick (1992), Campbell and Viceira (2002), Campbell and Yogo (2003), Lewellen (2004), and Menzly, Santos, and Veronesi (2004). Cochrane (1997) has a good survey of the dividend yield prediction literature.
- The short term interest rate: Hodrick (1992).
- Earnings price and payout ratio: Campbell and Shiller (1988), Lamont (1998) and Ritter (2005).
- The term spread and the default spread: Avramov (2002), Campbell (1987), Fama and French (1989), and Keim and Stambaugh (1986).
- The inflation rate (money illusion): Fama and Schwert (1977), Fama (1981), and Campbell and Vuolteenaho (2004a,b), and Cohen, Polk and Vuolteenaho (2005).
- Interest rate and dividend related variables: Ang and Bekaert (2003).
- Book-to-market ratio: Kothari and Shanken (1997).
- Value of high and low-beta stocks: Polk, Thompson and Vuolteenaho (2006)[19].
- Consumption and wealth: Lettau and Ludvigson (2001).
- Aggregate financing activity: Baker and Wurgler (2000) and Boudoukh *et al* (2006).

Goyal and Welch (2007) used most of the mentioned predictors and could not identify one that would have been robust for forecasting the equity premium and, after all their analysis, they recommended *"assuming that the equity premium is 'like it always has been'"*. They also show that most of these models have not performed well for the last thirty years, that are not stable, and that are not useful for market-timing purposes.

However, Campbell and Thompson (2007) claim that some variables (ratios, patterns, levels of sort and long term interest rates) are correlated with subsequent market returns and that *"forecasting variables with significant forecasting power insample generally have a better out-of-sample performance than a forecast based on the historical average return"*. They explore the mapping from R^2 statistics in predictive regressions to profits and welfare gains for market timers. *"The basic lesson is that investors should be suspicious of predictive regressions with high R^2 statistics, asking the old question 'If you're so smart, why aren't you rich?'"*

3.4. Other estimates of the expected equity premium

Siegel (2002, page 124) concluded that "the future equity premium is likely to be in the range of 2 to 3%, about one-half the level that has prevailed over the past 20 years" [20]. Siegel (2005a, page 172) affirms that *"over the past 200 years, the equity risk premium has averaged about 3%"*. Siegel (2005b) maintains that *"although the future equity risk premium is apt to be lower than it has been historically, U.S. equity returns of 2-3% over bonds will still amply reward those who will tolerate the short-term risk of stocks"*. However, in a presentation at the SIA annual meeting (November 10, 2005) Siegel maintained that *"equity premium is 4% to 5% now"*.

In the *TIAA-CREF Investment Forum* of June 2002, Ibbotson forecasted *"less than 4% in excess of long-term bond yields"*, and Campbell *"1.5% to 2%"*.

McGrattan and Prescott (2001) did not find corporate equity overvalued in 2000 and forecasted that the real returns on debt and equity should both be near 4%: *"Therefore, barring any institutional changes, we predict a small equity premium in the future"*.

Arnott and Ryan (2001) claim that the expected equity premium is near zero. They base their conclusion on the low dividend yield and their low expectation of dividend growth. Arnott and Bernstein (2002) also conclude that *"the current risk premium is approximately zero"*.

[19] Polk, Thompson, and Vuolteenaho (2006) argue that if the CAPM holds, then a high equity premium implies low prices for stocks that have high betas. Therefore, value stocks should tend to have high betas. This was true from the 1930's through the 1950's, but in recent decades growth stocks have had higher betas than value stocks. Polk, Thompson, and Vuolteenaho argue that this change in cross-sectional stock pricing reflects a decline in the equity premium.

[20] Siegel also affirms that: "Although it may seem that stocks are riskier than long-term government bonds, this is not true. The safest investment in the long run (from the point of view of preserving the investor's purchasing power) has been stocks, not Treasury bonds".

Bostock (2004) concludes that according to historical average data, equities should offer a risk premium over government bonds between 0.6% and 1.8%.

Grabowski (2006) concludes that *"after considering the evidence, any reasonable long-term estimate of the normal EEP as of 2006 should be in the range of 3.5% to 6%"*.

Maheu and McCurdy (2006) claim that the US Market had *"three major structural breaks (1929, 1940 and 1969), and possibly a more recent structural break in the late 1990s"*, and suggest an EEP in 2004 between 4.02% and 5.1%.

Table 10. Estimates of the EEP (Expected Equity Premium) according to different authors

Authors	Conclusion about EEP	Note
Surveys		
Pensions and Investments (1998)	3%	Institutional investors
Graham and Harvey (2000)	4.65%	CFOs
Welch (2000)	7% arithmetically, 5.2% geometrically	Finance professors
Welch (2001)	5.5% arithmetically, 4.7% geometrically	Finance professors
O'Neill, Wilson and Masih (2002)	3.9%	Global clients Goldman
Graham and Harvey (2005)	2.93%	CFOs
Other publications		
Booth (1999)	EEP = HEP - 2%	
Pastor and Stambaugh (2001)	4 -6%	
McGrattan and Prescott (2001)	near zero	
Arnott and Ryan (2001)	near zero	
Arnott and Bernstein (2002)	near zero	
Siegel (2002, 2005b)	2 - 3%	
Ibbotson (2002)	< 4%	
Campbel (2002)	1.5 - 2%	
Mayfield (2004)	EEP = HEP - 2.4%= 5.9% + T-Bill	
Bostock (2004)	0.6 – 1.8%	
Goyal and Welch (2007)	EEP = HEP	
Dimson, Marsh and Stauton (2006c)	3 - 3.5%	
Grabowski (2006)	3.5 – 6%	
Maheu and McCurdy (2006)	4.02% and 5.1%.	
Ibbotson Associates (2006)	EEP = HEP = 7.1%	

4. Required and implied equity premium

The Required Equity Premium (REP) of an investor is the incremental return that she requires, over the risk-free rate, for investing in a diversified portfolio of shares. It is a crucial parameter in valuation and capital budgeting because the REP is the key to determining the company's required return to equity and the required return to any investment project. The HEP is misleading for predicting the REP. If there was a reduction in the REP, this fall in the discount rate led to re-pricing of stocks, thus adding to the magnitude of HEP. The HEP, then, overstates the REP.

The IEP is the implicit REP used in the valuation of a stock (or a market index) that matches the current market value with an estimate of the future cash flows to equity. The IEP is also called the *ex ante* equity premium. However, the existence of *a unique* IEP implies to consider that the equity market can be explained with a representative consumer, or to consider that all investors have at any moment the same expectations about future cash flows and use the same discount rate to value each company.

Two models are widely used to calculate the IEP: the Gordon (1962) model (constant dividend growth model) and the residual income (or abnormal return) model.

According to the Gordon (1962) model, the current price per share (P_0) is the present value of expected dividends discounted at the required rate of return (k). If d_1 is the dividend per share expected to be received at time 1, and g the expected long term growth rate in dividends per share[21],

$P_0 = d_1 / (k - g)$, which implies: $k = d_1/P_0 + g$. $IEP = d_1/P_0 + g - R_F$ (1)

The abnormal return method is another version of the Gordon (1962) model when the "clean surplus" relation holds ($d_t = e_t – (BV_t – BV_{t-1})$, being d the dividends per share, e the earnings per share and bv the book value per share):

$P_0 = bv_0 + (e_1 – k\, bv_0) / (k - g)$, which implies: $k = e_1/P_0 + g (1 - bv_0/ P_0)$[22] (2)

[21] Although we say "dividends per share", we refer to equity cash flow per share: dividends, repurchases and all expected cash for the shareholders.

[22] Comparing the two models, it is clear than in a growing perpetuity, $D_1 = E_1 – g\, BV_0$. The equivalence of the two models may be seen in Fernandez (2005)

Jagannathan, McGrattan and Scherbina (2000) use the Gordon model, assume that dividends will growth as fast as GNP, and come with an estimate of 3.04%. They mention that *"to get the estimate up to Brealey and Myer's 9.2%, we would need to assume nominal dividend growth of 13.2%. This is an unreasonable assumption"*. They also revise Welch (2000) and point out that *"apparently, finance professors do not expect the equity premium to shrink"*.

Claus and Thomas (2001) calculate the equity premium using the Gordon model and the residual income model, assuming that g is the consensus of the analysts' earnings growth forecasts for the next five years and that the dividend payout will be 50%. They also assume that the residual earnings growth after year 5 will be the current 10-year risk-free rate less 3%. With data from 1985 to 1998, they find that the IEP is smaller than the HEP, and they recommend using a REP of about 3% for the US, Canada, France, Germany, Japan and UK.

Harris and Marston (2001), using the dividend discount model and estimations of the financial analysts about long-run growth in earnings, estimate an IEP of 7.14% for the S&P 500 above T-Bonds over the period 1982-1998. They also claim that the IEP move inversely with government interest rates, which is hard to believe.

Easton, Taylor, Shroff and Sougiannis (2002) used the residual income model with IBES data for expected growth[23], and estimated an average IEP of 5.3% over the years 1981-1998.

Goedhart, Koller and Wessels (2002) used the dividend discount model (considering also share repurchases), with GDP growth as a proxy for expected earnings growth and with the average inflation rate of the last 5 years as a proxy for expected inflation. Table 11 contains their results that they report. They conclude that *"we estimate that the real cost of equity has been remarkably stable at about 7% in the US and 6% in the UK since the 1960s. Given current, real long-term bond yields of 3% in the US and 2.5% in the UK, the implied equity risk premium is around 3.5% to 4% for both markets"*.

Table 11. IEP and real cost of equity in the US and the UK according to Goedhart *et al* (2002)

	US		UK	
	1962-1979	1990-2000	1962-1979	1995-2000
Market risk premium	**5.0%**	**3.6%**	**4.3%**	**3.0%**
Real risk-free rate	2.2%	3.1%	1.4%	2.8%
Real cost of equity	7.2%	6.7%	5.7%	5.8%

Fama and French (2002), using the discounted dividend model, estimated the IEP for the period 1951-2000 between 2.55% and 4.32%, far below the HEP (7.43%). For the period 1872-1950, they estimated an IEP (4.17%) similar to the HEP (4.4%). They claimed that in the period 1951-2000 *"a decline in the expected stock return is the prime source of the unexpected capital gain"*, and that *"the unconditional EEP of the last 50 years is probably far below the realized premium"*[24].

Ritter and Warr (2002) claim that in 1979-1997, the IEP declined from +12% to -4%. However, Ritter estimate of the IEP in 2006 is a little over 2% on a geometric basis.

Harris, Marston, Mishra and O'Brien (2003) estimated discount rates for several companies using the dividend discount model and assuming that g was equal to the consensus of the analysts' growth of dividends per share forecasts. They found an IEP of 7.3% (if betas calculated with a domestic index) and 9.7% (when betas calculated with a world index).

Many authors use an expected growth of dividends per share (g) equal to the consensus of the analysts' forecasts, but Doukas, Kim and Pantzalis (2006) find that stock returns are positively associated with analyst's divergence of opinion, and consider the divergence of opinion as risk.

Vivian (2005) replicated Fama and French (2002) to the UK, obtained similar results (see table 12), and concluded that the discount rate (REP) declined in the later part of the 20th Century.

Table 12. REP and HEP in the US and in the UK according to Fama and French (2002) and Vivian (2005)

Table I of Fama and French (2002)

US	REP	HEP
1872-2000	3.54%	5.57%
1872-1950	4.17%	4.40%
1951-2000	2.55%	7.43%

Table 1 of Vivian (2005)

UK	REP	HEP
1901-2002	4.41%	5.68%
1901-1950	4.22%	3.49%
1951-2002	4.60%	7.79%
1966-2002	3.00%	6.79%

[23] Although Chan, Karceski and Lakonishok (2001) report that *"IBES forecasts are too optimistic and have low predictive power for long-term growth"*.

[24] Fama and French (1992) report that in the period 1941-1990 an equally weighted index outperformed the value weighted (average monthly returns of 1.12% and 0.93%) in the whole period and in most sub sample periods.

O'Hanlon and Steele (2000) proposed calculating the REP using accounting figures and got a variety of estimates between 4 and 6%.

Glassman and Hassett (2000) calculated in their book Dow 36,000 that the REP for the U.S. in 1999 was 3%, arguing that stocks should not carry any risk premium at all, and that stock prices will rise dramatically further once investors come to realize this fact[25].

Faugere and Erlach (2006) claimed that the equity premium tracks the value of a put option on the S&P 500. However, their conclusion is not very helpful: *"using an 8.1% premium in valuation formulas and capital budgeting problems may be appropriate, since the observed level of the long-run equity premium is fully consistent with the observed steady-state GDP growth and consistent with risk explanations as well. However, if one believes that the recent 1990's trends in dividend yields, interest rates, taxes and inflation represent permanent regime shifts, our model can be parameterized to yield a 3.5% equity premium"*.

Donaldson, Kamstra and Kramer (2006) simulate the distribution from which interest rates, dividend growth rates, and equity premia are drawn and claim that *"the true ex ante equity premium is 3.5% pus or minus 50 basis points"*. They say that previous studies *"estimate the equity premium with great imprecision: often a 5% to 6% ex post estimate can not be statistically distinguished from an ex ante value as low as 1% or as high as 10%"*.

One problem of all these estimates is that they depend on the particular assumption made for the expected growth.

Table 13. Implied Equity Premium **(IEP)** and Required Equity Premium **(REP)** according to different authors

Author(s)	Method		IEP = REP
O'Hanlon and Steele (2000)	accounting		4 to 6%
Jagannathan & al (2000)	DDM		3.04%
Glassman and Hasset (2000)			3%
Harris and Marston (2001)	DDM		7.14%
Claus and Thomas (2001)	RIM	1985-1998	3%
Fama and French (2002)	DDM	1951-2000	2.55%
Fama and French (2002)	DDM	1872-1950	4.17%
Goedhart, Koller and Wessels (2002)	DDM	1990-2000	3.5 to 4%
Ritter (2002)	DDM	2001	0.7%
Ritter and Warr (2002)	RIM	1979-1997	+12% to -4%.
Harris & al (2003)	DDM		7.3%
Vivian (2005)	DDM & RIM	1951-2002 UK	4.6%
Ibbotson Associates (2006)	REP=EEP=HEP	1926-2005	7.1%
Donaldson, Kamstra and Kramer (2006)	DDM	1952-2004	3.5%

DDM = dividend discount model. RIM = residual income model

5. The equity premium puzzle

The **equity premium puzzle**, a term coined by Mehra and Prescott (1985), is the inability of a *standard representative consumer asset pricing model*, using aggregate data, to reconcile the HEP. To reconcile the model with the HEP, individuals must have implausibly high risk aversion according to standard economics models[26]. Mehra and Prescott (1985) argued that stocks should provide at most a 0.35% premium over bills. Even by stretching the parameter estimates, Mehra and Prescott (2003) concluded that the premium should be no more than 1%. This contrasted starkly with their HEP estimate of 6.2%.

5.1. Attempts to solve the equity premium puzzle

This puzzle has lead to an extensive research effort in both macroeconomics and finance. Over the last 20 years, researchers have tried to resolve the puzzle by generalizing and adapting (weakening one or more of the assumptions) the Mehra-Prescott (1985) model, but still there is not a solution generally accepted by the economics profession. Some of the adapted assumptions include:

- alternative assumptions about preferences (state separability, leisure, precautionary savings) or generalizations to state-dependent utility functions: Abel (1990); Constantinides (1990); Epstein

[25] Not to be outdone, Kadlec and Acampora (1999) gave their book the title, *Dow 100,000: Fact or Fiction?*
[26] Kocherlakota (1996) reduces the models to just 3 assumptions: individuals have preferences associated with the standard utility function, asset markets are complete (individuals can write insurance contracts against any contingency), and asset trading is costless.

and Zin (1991); Benartzi and Thaler (1995); Bakshi and Chen (1996); Campbell and Cochrane (1999); and Barberis, Huang, and Santos (2001),

- narrow framing[27]: Barberis and Huang (2006),
- probability distributions that admit disastrous events such as fear of catastrophic consumption drops: Rietz (1988); Mehra and Prescott (1988), Barro (2005),
- survivorship bias: Brown, Goetzmann, and Ross (1995),
- liquidity premium: Bansal and Coleman (1996),
- taxes and regulation: McGrattan and Prescott (2005),
- the presence of uninsurable income shocks or incomplete markets: Mankiw (1986); Constantinides and Duffie (1996); Heaton and Lucas (1996) and (1997); Storesletten, Telmer, and Yaron (1999),
- relative volatility of stocks and bonds: Asness (2000)
- limited stock market participation and limited diversification: Saito (1995), Basak and Cuocco (1998), Heaton and Lucas (2000), Vissing-Jorgensen (2002), Gomes and Michaelides (2005),
- distinguishing between the cash flows to equity and aggregate consumption: Brennan and Xia (2001), who claim to be able to justify an equity premium of 6%.
- borrowing constraints: Constantinides, Donaldson, and Mehra (2002),
- other market imperfections: Aiyagari and Gertler (1991); Alvarez and Jermann (2000),
- disentangling the equity premium into its cash flow and discounting components: Bakshi and Chen (2006);
- measurement errors and poor consumption growth proxies: Breeden, Gibbons, and Litzenberger (1989), Mankiw and Zeldes (1991), Ferson and Harvey (1992), Ait-Sahalia, Parker, and Yogo (2004).

There are several excellent surveys of this work, including Kocherlakota (1996), Cochrane (1997) and Mehra and Prescott (2003 and 2006). Kocherlakota (1996) says that *"while there are several plausible explanations for the low level of Treasury returns, the large equity premium is still largely a mystery to economists"*.

Rietz (1988) and Barro (2005) suggest that low-probability disasters, such as a small a large "crash" in consumption, may justify a large equity premium. However, Mehra and Prescott (1988) challenge Rietz to identify such catastrophic events and estimate their probabilities.

McGrattan and Prescott (2005) argue that the 1960-2001 HEP is mainly due to changes in taxes and regulatory policy during this period. They also say that *"Allowing for heterogeneous individuals will also help quantify the effects of increased market participation and diversification that has occurred in the past two decades. Until very recently, mutual funds were a very expensive method of creating a diversified equity portfolio"*.

Limited stock market participation can increase the REP by concentrating stock market risk on a subset of the population. To understand why limited participation may have quantitative significance for the REP, it is useful to review basic facts about the distribution of wealth, and its dynamics over time. Mishel, Bernstein and Allegretto (2006) document that wealth and stock holdings in the U.S. remain highly concentrated in dollar terms: in 2004, the wealthiest 10% held 78.8% of the stocks (84% in 1989 and 76.9% in 2001), and the wealthiest 20% held over 90% of all stocks. Only 48.6% of U.S. households held stocks in 2004 (51.9% in 2001 and 31.7% in 1989) and only 34.9% (40.1% in 2001 and 22.6% in 1989) held stock worth more than $5,000. Of this 34.9%, only 13.5% had direct holdings. Mankiw and Zeldes (1991) reported that 72.4% of the 2998 families in their survey held no stocks at all. Among families that held more than $100,000 in other liquid assets, only 48% held stock. The covariance of stock returns and consumption of the families that hold stocks is triple than that of no stockholders ant it may explain part of the puzzle.

Brennan (2004) highlights the "*democratization of Equity Investment*": *"The increase in the number of participants in equity markets was accompanied by a massive increase in the scale of the equity mutual fund industry: the assets under management rose from $870 per capita in 1989 to over $14,000 per capita in 1999, before declining to a little over $12,000 per capita in 2001. On the other hand, holdings of bond mutual funds grew only from $966 per capita in 1989 to $2887 in 1989. In other*

[27] Narrow framing is the phenomenon documented in experimental settings whereby, when people are offered a new gamble, they sometimes evaluate it in isolation, separately from their other risks.

words, while bond funds roughly tripled, equity funds went up by a factor of over 14!" and *"the share of corporate equity held by mutual funds rose from 6.6% in 1990 to 18.3% in 2000"*.

Heaton and Lucas (2000) introduced Limited Participation and Limited Diversification in an overlapping generations model and concluded that the increases in participation of the past two decades are unlikely to cause a significant reduction in the EEP, but that improved portfolio diversification might explain a fall in the EEP of several percentage points.

There is some promising research on heterogeneity. Abel (1991) hoped that *"incorporating differences among investors or more general attitudes toward risk can explain the various statistical properties of asset returns"*. Levy and Levy (1996) mentioned that the introduction of a small degree of diversity in expectations changed the dynamics of their model and produced more realistic results. Constantinides and Duffie (1996) introduced heterogeneity in the form of uninsurable, persistent and heteroscedastic labor income shocks. Bonaparte (2006) used micro data on households' consumption and provides a new method on estimating asset pricing models, considering each household as living on an island and taking into account its lifetime consumption path. Due to the great deal of heterogeneity across households, he replaced the representative agent with an average agent.

Bakshi and Chen (2006) claim that *"disentangling the equity premium into its cash flow and discounting components produces an economic meaningful equity premium of 7.31%"*.

Shalit and Yitzhaki (2006) show that at equilibrium, heterogeneous investors hold different risky assets in portfolios, and no one must hold the market portfolio.

It is interesting the quotation in Siegel and Thaler (1997): *"no economic theorist has been completely successful in resolving the [equity premium] puzzle"* ... but ... *"most economists we know have a very high proportion of their retirement wealth invested in equities (as we do)"*.

6. The equity premium in the textbooks

This section contains the main messages about the equity premium conveyed in the finance textbooks and valuation books. More details may be found in Fernandez (2006). Figure 6 collects the evolution of the Required Equity Premium (REP) used or recommended by the textbooks and by the academic papers mentioned on previous sections. Table 14 contains the equity premium recommended and used in different editions of several textbooks. Ritter (2002) mentions the use of the historical equity risk premium in textbooks as an estimate of the future as one of the "*The Biggest Mistakes We Teach*". Looking at Figure 6 and at Table 14, it is quite obvious that there is not much consensus, creating a lot of confusion among students and practitioners (and finance authors, also) about the Equity Premium.

Brealey and Myers considered REP = EEP = HEP in the 2nd, 3rd, 4th and 5th editions (1984, 1988, 1991 and 1996), using Ibbotson data that ranged from 8.2 to 8.5% (arithmetic HEPs over T-Bills in periods starting in 1926). In the 6th, 7th and 8th editions (2000, 2003 and 2005 with Allen), they said that *"Brealey, Myers and Allen have no official position on the exact market risk premium, but we believe that a range of 5 to 8.5 percent is reasonable for the risk premium in the United States."* (In the previous editions the ranges was 6 to 8.5%).

Copeland, Koller and Murrin (McKinsey) used a REP = geometric HEP versus Government T-Bonds in the two first editions (1990 and 1995). However, they changed criteria in the 3rd and 4th editions: they advised to use the arithmetic HEP of 2-year returns versus Government T-Bonds reduced by a survivorship bias. In the 1st edition (1990), they recommended 5-6%, in the 2nd edition (1995) they recommended 5-6%, in the 3rd edition (2000) they recommended 4.5-5% ("*we substract a 1.5 to 2% survivorship bias from the long-term arithmetic average of 6.5%"*) and in the 4th edition (Koller, Goedhart and Wessels, 2005) they recommended 3.5-4.5% ("*we subtract a 1% to 2% survivorship bias from the long-term arithmetic average of 5.5%"*).

Ross, Westerfield and Jaffe recommended in all editions they REP = EEP = arithmetic HEP vs. T-Bills, using Ibbotson data. In (1988, 2nd edition), (1993, 3rd edition) and (1996, 4th edition) they recommended 8.5%. In (1999, 5th edition) 9.2%; in (2002, 6th edition) 9.5%; and in (2005, 7th edition) 8.4%.

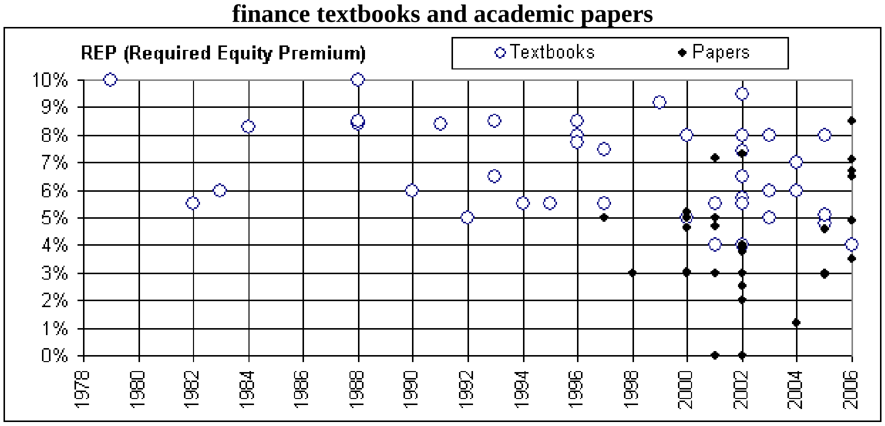
Bodie, Kane and Marcus (1993, 2nd edition) used a REP = EEP = 6.5% to value Hewlett-Packard. In the 3rd edition (1996, page 535), they used a REP = EEP = HEP – 1% = 7.75% to value Motorola. In the 5th edition (2002, page 575), they valued Motorola using a REP = 6.5%. In the 6th edition (2003), they used in the examples different REPs: 8% (pages 426, 431) and 5% (page 415).

Damodaran (1994, 2002) recommended REP = EEP = geometric HEP versus T-bonds. In 1997 he used a REP = arithmetic HEP versus T-Bills. In 2001a and 2006 he recommended REP = EEP = IEP. Damodaran *on Valuation* (1994), recommended an EEP of 5.5%, the geometric HEP using T-bonds for the period 1926-1990. Damodaran (2001a, 2006, 2nd edition) used a REP =IEP of 4% for the US. because *"the implied premium for the US and the average implied equity risk premium has been about 4% over the past 40 years"*. Damodaran (1996, 1997, 2001b, 2001c and 2002), however, used a REP of 5.5%. In (1996. page 48) he shows that 5.5% is the geometric HEP versus T-bonds in the period 1926-90.

Copeland and Weston (1979, 1988) used a REP = 10%. However, Weston and Copeland (1992), used a REP = 5%.

Van Horne (1968, 1st ed.) still did not mention the CAPM or the equity premium. In (1983, 6th ed.), he used a REP = 6% He justified it: *"Suppose, for easy illustration, that the expected risk-free rate is an average of the risk-free rates that prevailed over the ten-year period and that the expected market return is average of market returns over that period"*. In (1992, Fundamentals, 8th ed.), he used a REP = 5% and justified it: *"Assume that a rate of return of about 13% on stocks in general is expected to prevail and that a risk-free rate of 8% is expected"*.

Figure 6. Evolution of the Required Equity Premium (REP) used or recommended in the most important finance textbooks and academic papers



Penman (2001, 1st ed.) said that *"the market risk premium is a big guess. Research papers and textbooks estimate it in the range of 4.5% to 9.2%. … No one knows what the market risk premium is"*. In (2003, 2nd ed.), he admitted that *"we really do not have a sound method to estimate the cost of capital… Estimates [of the equity premium] range, in texts and academic research, from 3.0% to 9.2%"*, and he used 6%.

Weston and Brigham (1968) still did not defined equity premium. In (1982, 6th edition) they said that *"the market risk premium can be considered relatively stable at 5 to 6% for practical application"*. Weston, Chung and Siu (1997) recommended 7.5%. Bodie and Merton (2000) used 8% for USA.

Stowe, Robinson, Pinto and McLeavey (2002), in their book for the CFA (Chartered Financial Analysts) Program use (page 49) a REP = Geometric HEP using T-Bonds during 1926-2000, according to Ibbotson = 5.7%. Pratt (2002) assumes that REP=EEP=HEP and uses 7.4% (page 68) and 8% (page 74). Hawawini and Viallet (2002) use a REP = 6.2% = geometric HEP over T-bonds in the period 1926-1999 according to Ibbotson.

Fernandez (2002) is the only finance textbook claiming that *"it is impossible to determine the premium for the market as a whole, because it does not exist"*. He also mentions that we *"could only talk of a market risk premium if all investors had the same cash flow expectations… However, expectations are not homogeneous"*. Fernandez (2004, 2001) also mentioned that "*the HEP, the EEP and the REP are different concepts*" and that "*different investors have different REPs*". In the examples he uses REP = 4%.

Table 14. Equity premiums recommended and used in textbooks

Author(s) of the Textbook	Assumption	Period for HEP	REP recommended	REP used
Brealey and Myers				

2nd edition. 1984	REP=EEP= arith HEP vs. T-Bills	1926-81	8.3%	8.3%
3rd edition. 1988	REP=EEP= arith HEP vs. T-Bills	1926-85	8.4%	8.4%
4th edition. 1991	REP=EEP= arith HEP vs. T-Bills	1926-88	8.4%	8.4%
5th edition. 1996	REP=EEP= arith HEP vs. T-Bills		8.2 - 8.5%	
6th and 7th edition. 2000 and 2003	No official position		6.0 - 8.5%	8.0%
8th edition. 2005 (with Allen)	No official position		5.0 - 8.5%	
Copeland, Koller and Murrin (McKinsey)				
1st edition. 1990	REP=EEP= geo HEP vs. T-Bonds	1926-88	5 - 6%	6%
2nd ed. 1995	REP=EEP= geo HEP vs. T-Bonds	1926-92	5 - 6%	5.5%
3rd ed. 2000	REP=EEP= arith HEP – 1.5-2%	1926-98	4.5 - 5%	5%
4th ed. 2005. Goedhart, Koller & Wessels	REP=EEP= arith HEP – 1-2%	1903-2002	3.5 – 4.5%	4.8%
Ross, Westerfield and Jaffe				
2nd edition. 1988	REP=EEP= arith HEP vs. T-Bills	1926-88	8.5%	8.5%
3rd edition. 1993	REP=EEP= arith HEP vs. T-Bills	1926-93	8.5%	8.5%
4th edition. 1996	REP=EEP= arith HEP vs. T-Bills	1926-94	8.5%	8.5%
5th edition. 1999	REP=EEP= arith HEP vs. T-Bills	1926-97	9.2%	9.2%
6th edition. 2002	REP=EEP= arith HEP vs. T-Bills	1926-99	9.5%	9.5%
7th edition. 2005	REP=EEP= arith HEP vs. T-Bills	1926-02	8.4%	8%
Van Horne, 6th edition. 1983				6.0%
8th edition. 1992			3 - 7%	5.0%
Copeland and Weston (1979 and 1988)				10%
Weston and Copeland (1992)				5%
Bodie, Kane and Marcus				
2nd edition. 1993	REP=EEP		6.5%	6.5%
3rd edition. 1996	REP=EEP=arith HEP vs. T-Bills - 1%		7.75%	7.75%
5th edition. 2002			6.5%	6.5%
2003	REP=EEP= arith HEP vs. T-Bills	1926-2001		5%; 8%
Damodaran 1994 Valuation. 1st ed.	REP=EEP= geo HEP vs.T-Bonds	1926-90	5.5%	5.5%
1996, 1997, 2001b, 2001c	REP=EEP= geo HEP vs.T-Bonds		5.5%	5.5%
2001a	average IEP	1970-2000	4%	4%
2002	REP=EEP= geo HEP vs.T-Bonds	1928-00	5.51%	5.51%
2006 Valuation. 2nd ed.	REP=EEP= geo HEP vs.T-Bonds	1928-2004	4.84%	4%
Weston & Brigham (1982)			5-6%	
Weston, Chung and Siu (1997)			7.5%	
Bodie and Merton (2000)				8%
Stowe *et al* (2002)	REP=EEP= geo HEP vs.T-Bonds	1926-00	5.7%	5.7%
Hawawini and Viallet (2002)	REP=EEP= geo HEP vs.T-Bonds	1926-99		6.2%
Pratt (2002)	REP=EEP=HEP			7.4%, 8%
Fernandez (2002)	"is impossible to determine the premium for the market as a whole"			
Penman (2003)	"No one knows what the REP is"			6%
Fernandez (2001, 2004)	"different investors have different REPs"			4%
Bruner (2004)	REP=EEP= geo HEP vs.T-Bonds	1926-2000	6%	6%
Palepu, Healy and Bernard (2004)	REP=EEP= arith HEP vs.T-Bonds	1926-2002	7%	7%
Weston, Mitchel & Mulherin (2004)	REP=EEP= arith HEP vs.T-Bonds	1926-2000	7.3%	7%
Arzac (2005)	REP=IEP		5.08%	5.08%

Palepu, Healy and Bernard (2004, page 8-3) mention that the HEP "*constitutes an estimate of the REP"* and use REP = 7% in the examples (page 8-5).

Weston, Mitchel and Mulherin (2004) mention that the arithmetic HEP over T-bonds in the period 1926-2000 according to Ibbotson was 7.3% and (page 260) they use REP = EEP = 7%.

Bruner (2004) used a REP of 6% because *"from 1926 to 2000, the risk premium for common stocks has averaged about 6% when measured geometrically"*.

Arzac (2005) uses a REP = IEP = 5.08% for a valuation done in December 2002 (the IEP equity premium as of that date calculated using the Gordon equation).

In the following section we claim that the confusion comes from the fact that **there is not a REP** for the market as a whole: different investors use different **REPs**. Last sentence may me rewritten as: **there is not an IEP** for the market as a whole: different investors use different **IEPs**. A unique IEP requires assuming homogeneous expectations for the expected growth (g), but there are several pairs (IEP, g) that satisfy current prices.

7. There is not an IEP, but many pairs (IEP, g) which are consistent with market prices

Even if market prices are correct for all investors, there is not a unique REP common for all investors. In a simple Gordon model, there are many pairs (Ke, g) that satisfy equation (1). As Ke is the sum of the Implied Equity Premium (IEP) plus the risk-free rate (R_F), there are many pairs (IEP, g) that satisfy equation (1). A unique IEP requires assuming homogeneous expectations for the expected growth (g). If equation (1) holds, the *expected* return for the shareholders is equal to the *required* return for the shareholders (Ke), but there are many *required* returns (as many as expected growths, g) in the market. On top of that, IEP and g change over time.

If investors' expectations were homogenous, it would make sense to calculate a unique IEP, as all investors would have the market portfolio and the same expectations regarding the portfolio[28]. However, as expectations are not homogenous[29], different investors use different **REPs**: investors who expect higher growth will have a higher REP. Heterogeneous investors do not hold the same portfolio of risky assets; in fact, no investor must hold the market portfolio to clear the market: it does not make sense to search for a common REP because it does not exists.

We can find out an investor's REP by asking him, although for many investors the REP is not an explicit parameter but, rather, an implicit one that manifests in the price they are prepared to pay for shares[30]. However, it is impossible to determine the REP for the market as a whole, because it does not exist. Even if we knew the market premiums of all the investors who operated on the market, it would be meaningless to talk of a premium for the market as a whole.

A rationale for this may be found in the aggregation theorems of microeconomics, which in actual fact are non-aggregation theorems. One model that works well individually for a number of people may not work for all of the people together[31]. For the CAPM, this means that although the CAPM may be a valid model for each investor, it is not valid for the market as a whole, because investors do not have the same return and risk expectations for all shares. Prices are a statement of expected cash flows discounted at a rate that includes the risk premium. Different investors have different cash flow expectations and different future risk expectations. One could only talk of an equity premium if all investors had the same cash flow expectations.

Reallocating terms in equation (1), we get:

$$IEP – g = d_1/P_0 - R_F \qquad (3)$$

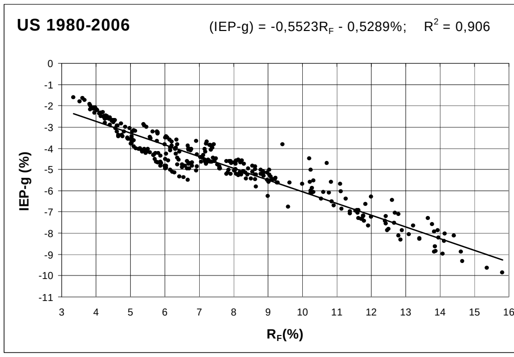
There are many pairs (IEP, g) that satisfy the Gordon equation at any moment. All the papers that we revised on section 5 assume that there is an "expected growth rate for the market" and get an "IEP for the market". But without homogeneous expectations, there is not an "expected growth rate for the market".

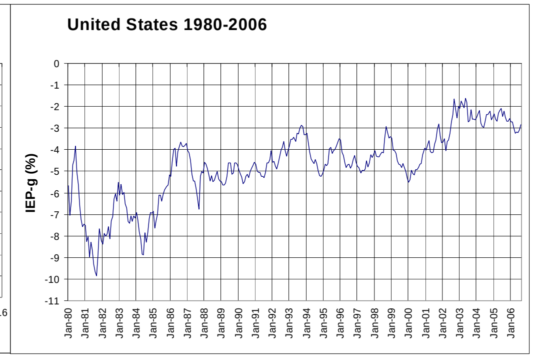
Similarly, for having an EEP common for all investors we need to assume homogeneous expectations (or a representative investor) and, with our knowledge of financial markets, this assumption is not reasonable. A theory with a representative investor cannot explain either why the annual trading volume of most exchanges more than double the market capitalization.

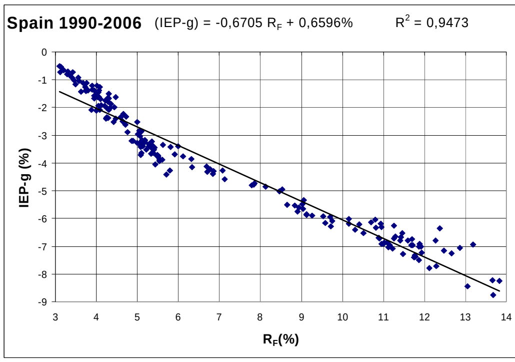
We also find that the difference (IEP – g),[32] is related to the risk free rate in the period after 1960. Figure 7 shows the relationship for the period after 1980 for the US, Spain and the UK. It may be seen the high negative correlation between (IEP – g) and the risk free rate in the three markets. Table 15 presents the regressions for more countries.

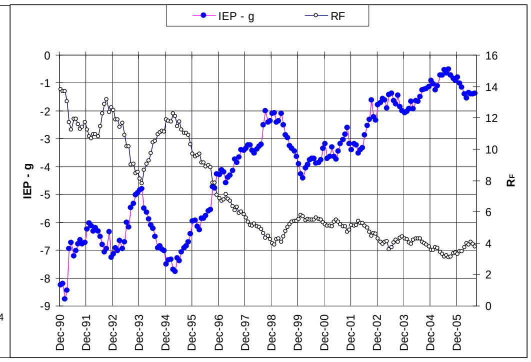
Figure 7. Correlations (d_1/P_0 - R_F) – (R_F) for the US, Spain and the UK. Monthly data.
(d_1/P_0 - R_F) = IEP – g. *Source of the data: Datastream*

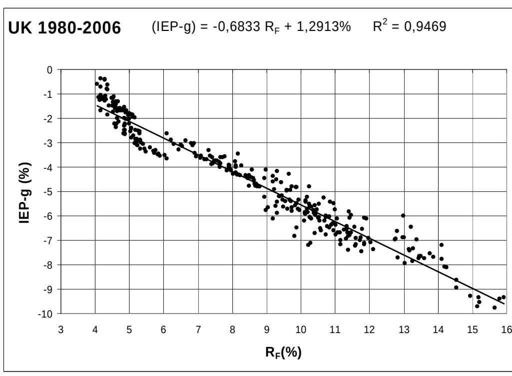
[28] Even then, this method requires knowing the expected growth of dividends. A higher growth estimate implies a higher premium.
[29] Doukas, Kim and Pantzalis (2006) document analysts' divergence of opinion.
[30] An example: An investor is prepared to pay 80 euros for a perpetual annual cash flow of 6 euros in year 1 and growing at an annual rate of 3%, which he expects to obtain from a diversified equity portfolio. This means that his required market return is 10.5% ([6/80] + 0.03).
[31] As Mas-Colell *et al.* (1995, page 120) say, "it is not true that whenever aggregate demand can be generated by a representative consumer, this representative consumer's preferences have normative contents. It may even be the case that a positive representative consumer exists but that there is no social welfare function that leads to a normative representative consumer."
[32] (d_1/P_0 - R_F) is equal to (IEP – g)











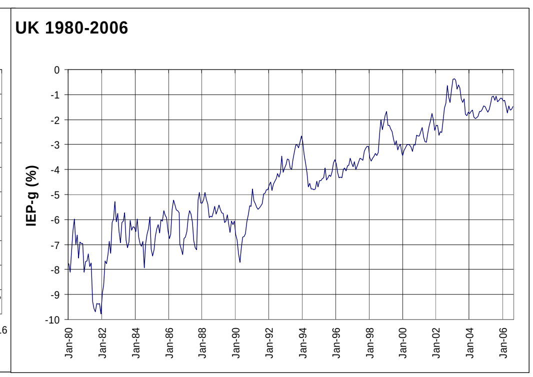


Table 15. Regressions with monthly data of Y (IEP – g) on R_F (10 year Gov. Bond Yield)
Monthly data. $(d_1/P_0 - R_F)$ = IEP – g. *Source of the data: Datastream*

	Full period	(R squared)		Without 1997-02	(R squared)
USA 1980-2006	Y = -0.5523 R_F - 0.5289%	0.9060		Y = -0.5864 R_F - 0.1278%	0.9417
Germany 1980-2006	Y = -0.7192 R_F + 0.5907%	0.8205		Y = -0.7569 R_F + 0.9362%	0.8427
UK 1980-2006	Y = -0.6833 R_F + 1.2913%	0.9469		Y = -0.7195 R_F + 1.7119%	0.9551
France 1988-2006	Y = -0.9587 R_F + 2.5862%	0.9245		Y = -1.0273 R_F + 3.2364%	0.9625
Italy 1991-2006	Y = -1.0693 R_F + 3.0398%	0.9563		Y = -1.1223 R_F + 3.7155%	0.9730
Spain 1991-2006	Y = -0.6705 R_F + 0.6596%	0.9473		Y = -0.7135 R_F + 1.1954%	0.9747

8. How do I calculate the REP?

For calculating the cost of equity (required return to equity cash flows) of a company, a valuator has to answer the following question: which differential rate over current T-Bond yields do I think compensates the risk of holding the shares? If there is only an owner of the shares, we can directly ask him the question. But if it is a traded company, the valuator has to make a prudential judgment. As Grabowski (2006), points out, *"the entire appraisal process is based on applying reasoned judgment to the evidence derived from economic, financial and other information and arriving at a well reasoned opinion of value"*.

We need the cost of equity to discount the expected equity cash flows of the company. Note that there is a kind of schizophrenic approach to valuation: while all authors admit that different valuators and investors may have different expectations of equity cash flows, most authors look for a unique discount rate. It seems as if the expectations of equity cash flows are formed in a democratic regime, while the discount rate is determined in a dictatorship. In any market, different investors may have different expectations of equity cash flows and different evaluations of its risk (that translate into different discount rates). Then, in the case of a traded company, there are investors that think that the company is undervalued (and buy or hold shares), investors that think that the company is overvalued (and sell or not buy shares), and investors that think that the company is fairly valued (and sell or hold shares). The investors that did the last trade, or the rest of the investors that held or did not have shares do not have a common REP (nor common expectations of equity cash flows).

For calculating the REP, we must answer the same question, but thinking in a diversified portfolio of shares, instead in just the shares of a company. In the valuations that I have done in the 21st century I have used REPs between 3.8 and 4% for Europe and for the U.S. Given the yields of the T-Bonds, I think[33] that an additional 4% compensates the additional risk of a diversified portfolio.

9. Conclusion

The equity premium (also called *market risk premium*, *equity risk premium*, *market premium* and *risk premium*), is one of the most important, discussed but elusive parameters in finance. Much of the confusion arises from the fact that the term equity premium is used to designate four different concepts (although many times they are mixed): Historical Equity Premium (HEP), Expected Equity Premium (EEP); Required Equity Premium (REP) and Implied Equity Premium (IEP).

In the finance literature and in valuation textbooks, there are authors that claim different identities among the four equity premiums defined above: some claim that **HEP = EEP = REP**; others claim that **EEP is smaller than HEP;** others claim that there is **a unique IEP and that REP = IEP**; others ***"have no official position"***; others claim that **EEP is near zero;** others try to find the **EEP doing surveys;** others affirm ***"that no one knows what the REP is"***.

The **HEP** is equal for all investors, but the **REP,** the **EEP and** the **IEP** are different for different investors. There is no an **IEP** for the market as a whole: different investors have different **IEPs** and use different **REPs**. A unique IEP requires assuming homogeneous expectations for the expected growth (g), but there several pairs (IEP, g) that satisfy current prices.

We claim that different investors have different REPs and that it is impossible to determine the REP for the market as a whole, because it does not exist. Heterogeneous investors do not hold the same portfolio of risky assets; in fact, no investor must hold the market portfolio to reach equilibrium.

There is a kind of schizophrenic approach to valuation: while all authors admit that different valuators and investors may have different expectations of equity cash flows, most authors look for a unique discount rate. It seems as if the expectations of equity cash flows are formed in a democratic regime, while the discount rate is determined in a dictatorship. In any market, different investors may have different expectations of equity cash flows and different evaluations of its risk (that translate into different discount rates).

It has been argued that, from an economic standpoint, we need to establish the primacy of the EEP, since it is what guides investors' decisions. However, the REP is more important for many important decisions, among others, valuations of projects and companies, acquisitions, and corporate investment decisions. On the other hand, EEP is important only for the investors that hold the market portfolio.

For calculating the cost of equity (required return to equity cash flows) of a company, a valuator has to answer the following question: which differential rate over current T-Bond yields do I think compensates the risk of holding the shares? If there is only an owner of the shares, we can directly ask him the question. But if it is a traded company, the valuator has to make a prudential judgment. There are investors that think that the company is undervalued (and buy or hold shares), investors that

[33] And also my clients that are able to answer to that question.

think that the company is overvalued (and sell or not buy shares), and investors that think that the company is fairly valued (and sell or hold shares). For calculating the REP, we must answer the same question, but thinking in a diversified portfolio of shares, instead in just the shares of a company. Recently, I have used REPs between 3.8 and 4% for Europe and for the U.S. Given the yields of the T-Bonds, I think that an additional 4% compensates the additional risk of a diversified portfolio.

References

Abel, A.B. (1990), “Asset Prices under Habit Formation and Catching Up with the Joneses”, *American Economic Review*, vol. 80, no. 2 (May), pp. 38–42.

Abel, A.B. (1991), “The Equity Premium Puzzle”, *Business Review* (Federal Reserve Bank of Philadelphia), pp. 3-14.

Ait-Sahalia, Y., J. A. Parker and M. Yogo (2004), “Luxury Goods and the Equity Premium”, *Journal of Finance* 59, pp. 2959-3004.

Aiyagari, S.R., and M. Gertler (1991), “Asset Returns with Transactions Costs and Uninsured Individual Risk”, *Journal of Monetary Economics*, vol. 27, no. 3 (June), pp. 311–331.

Alvarez, F., and U. Jermann (2000), “Efficiency, Equilibrium, and Asset Pricing with Risk of Default”, *Econometrica*, vol. 68, no. 4 (July), pp.775–797.

Ang, A. and G. Bekaert (2001), “Stock Return Predictability: Is It There?”, Unpublished paper, Graduate School of Business, Columbia University.

Arnott, R. D. and R. J. Ryan (2001), “The Death of the Risk Premium”, *Journal of Portfolio Management*, Spring, pp. 61-74.

Arnott, Robert D. and Peter L. Bernstein (2002), “What Risk Premium is ‘Normal’?”, *Financial Analysts Journal*, Vol. 58, No. 2, pp. 64-84.

Arzac, Enrique R. (2005), *Valuation for Mergers, Buyouts, and Restructuring*, John Wiley & Sons Inc.

Asness, C.S. (2000), “Stocks versus Bonds: Explaining the Equity Risk Premium”, *Financial Analysts Journal*, March/April, Vol. 56, No. 2, pp.96-113.

Avramov, D. (2002), “Stock Return Predictability and Model Uncertainty”, *Journal of Financial Economics* (3), pp. 423–458.

Baker, M and J. Wurgler (2000), “The Equity Share in New Issues and Aggregate Stock Returns”, *Journal of Finance,* 55, 5, pp. 2219-57.

Bakshi, G. and Z. Chen (1996), “The Spirit of Capitalism and Stock Market Prices”, *American Economic Review* 86, pp.133-157.

Bakshi, G. and Z. Chen (2006), “Cash Flow Risk, Discounting Risk, and the Equity Premium Puzzle”, *Handbook of Investments: Equity Premium*, edited by Rajnish Mehra.

Ball, R. (1978), “Anomalies in Relationships Between Securities’ Yields and Yield Surrogates”, *Journal of Financial Economics* 6, pp. 103—126.

Bansal, R., and J.W. Coleman (1996), “A Monetary Explanation of the Equity Premium, Term Premium, and Risk-Free Rate Puzzles”, *Journal of Political Economy*, vol. 104, no. 6 (December), pp.1135–71.

Barberis, N. and M. Huang (2006), "The Loss Aversion/Narrow Framing Approach to the Equity Premium Puzzle", *Handbook of Investments: Equity Premium*, edited by Rajnish Mehra.

Barberis, N., M. Huang and J. Santos (2001), "Prospect Theory and Asset Prices", *Quarterly Journal of Economics*, vol. 116, pp.1–53.

Barro, R. J. (2005), “Rare Events and the Equity Premium”, NBER Working Paper No. W11310.

Basak, S., and D. Cuoco (1998), “An Equilibrium Model with Restricted Stock Market Participation”, *Review of Financial Studies* 11, pp. 309-341.

Benartzi, S., and R.H. Thaler (1995), “Myopic Loss Aversion and the Equity Premium Puzzle”, *Quarterly Journal of Economics*, vol. 110, no. 1 (February), pp.73–92.

Blanchard, O. (1993), “The Vanishing Equity Premium”, *Finance and the International Economy* 7, pp. 23-39.

Bodie, Z. and R. Merton (2000), *Finance*, New Jersey: Prentice Hall.

Bodie, Z., A. Kane, and A. J. Marcus (2004), *Investments*, 6th edition. NY: McGraw Hill. (6th edition in 2004). Previous editions: 1989, 1993, 1996, 1999, 2002.

Bodie, Z., A. Kane, and A. J. Marcus (2003), *Essentials of Investments*, 5th edition. NY: McGraw Hill.

Bonaparte, Y. (2006), “The Equity Premium Puzzle: A Reconciliation”, The University of Texas at Austin, Available at SSRN: paper n. 889410.

Booth, L. (1999), “Estimating the Equity Risk Premium and Equity Costs: New Ways of Looking at Old Data”, *Journal of Applied Corporate Finance*, Vol. 12 No. 1, pp. 100-112.

Bostock, P. (2004), “The Equity Premium”, *Journal of Portfolio Management* 30(2), pp. 104-111.

Boudoukh, J., R. Michaely, M.P. Richardson and M.R. Roberts (2006),"On the Importance of Measuring Payout Yield: Implications for Empirical Asset Pricing", Forthcoming, *Journal of Finance*

Brealey, R.A. and S.C. Myers (2003), *Principles of Corporate Finance*, 7th edition, New York: McGraw-Hill. Previous editions: 1981, 1984, 1988, 1991, 1996 and 2000.

Brealey, R.A., S.C. Myers and F. Allen (2005), *Principles of Corporate Finance*, 8th edition, McGraw-Hill/Irwin.

Breeden, D., M. Gibbons and R. Litzenberger (1989), "Empirical Test of the Consumption-Oriented CAPM", *Journal of Finance* 44 (2), pp.231-262.

Brennan, M. (2004), "How Did It Happen?", *Economic Notes* by Banca Monte dei Paschi di Siena, vol. 33, no. 1, pp. 3–22.

Brennan, M. and Y. Xia (2001), "Stock Price Volatility and the Equity Premium", *Journal of Monetary Economics* 47, pp. 249-283

Brown, S. J., W. N. Goetzmann and S. A. Ross (1995), "Survival", *Journal of Finance*, July, pp. 853-873.

Bruner, Robert F. (2004), *Applied Mergers and Acquisitions*, NY: John Wiley & Sons.

Campbell, J. Y. (1987), "Stock Returns and the Term Structure", *Journal of Financial Economics* 18, pp. 373—399.

Campbell, J. Y. (2002), *TIAA-CREF Investment Forum,* June.

Campbell, J. Y. (2007), "Estimating the Equity Premium", NBER Working Papers from National Bureau of Economic Research (NBER) n. 13423

Campbell, J.Y. and J.H. Cochrane (1999), "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior", *Journal of Political Economy*, vol. 107, no. 2 (April), pp. 205– 251.

Campbell, J. Y., and R. J. Shiller (1988), "Stock Prices, Earnings, and Expected Dividends", *Journal of Finance*, 43(3), pp. 661-676.

Campbell, J. Y. and S.B. Thompson (2005), "Predicting the Equity Premium Out of Sample: Can Anything Beat the Historical Average?", forthcoming *Review of Financial Studies*

Campbell, J. Y. and L. M. Viceira (2002), *Strategic Asset Allocation: Portfolio Choice for Long-Term Investors,* New York: Oxford University Press.

Campbell, J. Y. and T. Vuolteenaho (2004), "Inflation Illusion and Stock Prices", *American Economic Review*, vol. 94(2), pp. 19-23.

Campbell, J. Y and M. Yogo (2003), "Efficient Tests of Stock Return Predictability", Working Paper, Harvard University and NBER.

Chan, L., J. Karceski and J. Lakonishok (2001), "The Level and Persistence of Growth Rates", NBER Working Paper 8282.

Claus, J.J. and J.K. Thomas (2001), "Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets", *Journal of Finance*. 55, (5), pp. 1629-66.

Cochrane, J.H. (1997), "Where is the Market Going? Uncertain Facts and Novel Theories", *Economic Perspectives*, Vol. 21, pp. 3–37.

Cohen, R.B, C. Polk, and T. Vuolteenaho (2005), "Money Illusion in the Stock Market: The Modigliani-Cohn Hypothesis," *Quarterly Journal of Economics* 120(2), pp. 639–68.

Constantinides, G.M (1990) "Habit Formation: A Resolution of the Equity Premium Puzzle", *Journal of Political Economy*, vol. 98, no. 3 (June), pp.519-543.

Constantinides, G.M. (2002), "Rational Asset Prices", *Journal of Finance* 57(4), pp. 1567-1591.

Constantinides, G. M. and D. Duffie (1996), "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy* 104, 2, pp. 219-240.

Constantinides, G.M., J.B. Donaldson, and R. Mehra (2002), "Junior Can't Borrow: A New Perspective on the Equity Premium Puzzle", *Quarterly Journal of Economics*, vol. 117, no. 1 (February), pp. 269-296.

Copeland, T. E., T. Koller, and J. Murrin (2000), *Valuation: Measuring and Managing the Value of Companies.* 3rd edition. New York: Wiley. Previous editions: 1990 and 1995.

Copeland, T. E., and J. F. Weston (1988), *Financial Theory and Corporate Policy.* 3rd edition, Reading, MA: Addison-Wesley. First edition: 1979.

Cowles, A. (1939), *Common Stock Indexes,* Principia Press, Bloomington, Indiana.

Damodaran, A. (2006), *Damodaran on Valuation*, 2nd edition. New York: John Wiley and Sons. 1st edition: (1994).

Damodaran, A. (2001a), *The Dark Side of Valuation*, New York: Prentice-Hall.

Damodaran, A. (2001b), *Corporate Finance: Theory and Practice*. 2nd edition, New York: John Wiley and Sons.

Damodaran, A. (2001c), *Corporate Finance: Theory and Practice*. 2nd *international* edition, New York: John Wiley and Sons.

Damodaran, A. (2002), *Investment Valuation*, New York: John Wiley and Sons.

Dimson, E. and P. Marsh (2001), "U.K. Financial Market Returns, 1955-2000", *Journal of Business* 74, n.1, pp. 1-31.

Dimson, E., P. Marsh and M. Staunton (2000), The Millennium Book: A Century of Returns. ABN AMRO/London Business School.

Dimson, E., P. Marsh and M. Staunton (2002), *Triumph of the Optimists: 101 Years of Global Investment Returns*. New Jersey: Princeton University Press.

Dimson, E., P. Marsh and M. Staunton (2003), "Global Evidence on the Equity Risk Premium", *Journal of Applied Corporate Finance*, 15:4, pp. 27-38.

Dimson, E., P. Marsh and M. Staunton (2004), "Irrational Optimism", *Financial Analysts Journal*, Vol. 60, No. 1, pp. 15–25.

Dimson, E., P. Marsh and M. Staunton (2006a), *Global Investment Returns Yearbook 2006*. ABN AMRO/London Business School.

Dimson, E., P. Marsh and M. Staunton (2006b), *DMS Global Returns data module*. Chicago, IL: Ibbotson Associates.

Dimson, E., P. Marsh and M. Staunton (2006c), "The Worldwide Equity Premium: A Smaller Puzzle", SSRN Working Paper No. 891620.

Donaldson, G., M. J. Kamstra, and L. A. Kramer (2006), "Estimating the Ex Ante Equity Premium", Rotman School of Management Working Paper. Available at SSRN: http://ssrn.com/abstract=945192

Doukas, J.A., C.F. Kim and C. Pantzalis (2006), "Divergence of Opinion and Equity Returns", *Journal of Financial and Quantitative Analysis* 41 (3), pp. 573-606.

Easton, P., G. Taylor, P. Shroff and T. Sougiannis (2002), "Using Forecasts of Earnings to Simultaneously Estimate Growth and the Rate of Return on Equity Investment", *Journal of Accounting Research* 40(3), pp. 657-676.

Epstein, L. G. and S.E. Zin (1991), "The Independence Axiom and Asset Returns", NBER Working Paper No. T0109.

Fama, E.F. (1981), "Stock Returns, Real Activity, Inflation and Money", *American Economic Review*, 4, pp. 545 - 65.

Fama, E.F. and K. R. French (1988), "Dividend Yields and Expected Stock Returns", *Journal of Financial Economics* 22, pp. 3-27.

Fama, E. F. and K. R. French (1989), "Business Conditions and Expected Returns on Stocks and Bonds", *Journal of Financial Economics* 25, pp. 23-49.

Fama, E.F. and K.R. French (1992), "The Cross-Section of Expected Stock Returns", *Journal of Finance* 47, pp. 427-466.

Fama, E.F. and K.R. French (2002), "The Equity Risk Premium", *Journal of Finance* 57 no. 2, pp. 637-659.

Fama, E.F. and G. W. Schwert (1977), "Asset Returns and Inflation", *Journal of Financial Economics* 5, pp. 115-146

Faugere, C. and J. Van Erlach (2006), "The Equity Premium: Consistent with GDP Growth and Portfolio Insurance", *Financial Review,* Vol. 41, No. 4, November.

Fernandez, P. (2002), *Valuation Methods and Shareholder Value Creation*. Academic Press, San Diego, CA.

Fernandez, P. (2004), *Valoración de Empresas*. 3rd edition. Ediciones Gestion 2000. Spain. 2nd edition: 2001.

Fernandez, P. (2005), "Equivalence of Ten Different Methods for Valuing Companies by Cash Flow Discounting", *International Journal of Finance Education,* Vol. 1 (1), pp. 141-168

Fernandez, P. (2006), "The Equity Premium in Finance and Valuation Textbooks", IESE Working Paper n. 657, 15 pages.

Ferson, W. E., and C. R. Harvey (1992), "Seasonality and Consumption–Based Asset Pricing", *Journal of Finance* 47, pp. 511-552.

Fisher, L. and J. Lorie (1964), "Rates of Return on Investments in Common Stock", *Journal of Business*, vol. 37, pp. 1-21.

Glassman, J. K. and K. A. Hassett (2000), *Dow 36.000: The new strategy for profiting from the coming rise in the stock market*, Three Rivers.

Goedhart, M., T. Koller and D. Wessels (2002), "The Real Cost of Equity", McKinsey & Company, N.5, Autumn, pp. 11-15.

Goetzmann, W.N. and R.G. Ibbotson (2006), "History and the Equity Risk Premium", in R. Mehra (Ed.), *Handbook of Investments: Equity Risk Premium*. Amsterdam: Elsevier.

Goetzmann, W.N., R.G. Ibbotson and L. Peng (2001), "A New Historical Database for the NYSE 1815 to 1925: Performance and Predictability", *Journal of Financial Markets*, Vol. 4, No. 1, pp. 1–32.

Gomes, F. and A. Michaelides (2005), "Asset Pricing with Limited Risk Sharing and Heterogeneous Agents", manuscript, London School of Economics.

Gordon, M. (1962), *The Investment, Financing and Valuation of the Corporation,* Homewood, IL. Irwin.

Goyal, A. and I. Welch (2003), "Predicting the Equity Premium with Dividend Ratios", *Management Science* 49(5), 639–654.

Goyal, A. and I. Welch (2007), "A Comprehensive Look at the Empirical Performance of Equity Premium Prediction", *Review of Financial Studies*, forthcoming.

Graham, J.R. and C.R. Harvey (2005), "The Equity Risk Premium in September 2005: Evidence from the Global CFO Outlook Survey", Working Paper, Duke University, September.

Graham, J.R. and C.R. Harvey (2007), "The Equity Risk Premium in January 2007: Evidence from the Global CFO Outlook Survey", Working Paper, Duke University, Available at SSRN: http://ssrn.com/abstract=959703

Grabowski, R.J. (2006), "Equity Risk Premium: 2006 Update", *Business Valuation Review*, Summer.

Harris, R.S. and F.C. Marston (2001), "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts", *Journal of Applied Finance*, Vol. 11.

Harris, R.S., F.C. Marston, D.R. Mishra and T.J. O'Brien (2003), "Ex Ante Cost of Equity Estimates of S&P 500 Firms: The Choice Between Global and Domestic CAPM", *Financial Management*, Vol. 32, No. 3, Autumn.

Hawawini, G. and C. Viallet (2002), *Finance for Executives*, 2nd edition, South-Western, Thompson Learning.

Heaton, J. and D.J. Lucas (1996), "Evaluating the Effects of Incomplete Markets on Risk Sharing and Asset Pricing", *Journal of Political Economy*, vol. 104, no. 3 (June):443–487.

Heaton, J. and D.J. Lucas (1997), "Market Frictions, Savings Behavior and Portfolio Choice", *Journal of Macroeconomic Dynamics,* vol. 1, no. 1:76–101.

Heaton, J. and D.J. Lucas (2000), "Stock Prices and Fundamentals", *NBER Macroeconomics Annual*.

Hodrick, R. J. (1992), "Dividend Yields and Expected Stock Returns: Alternative Procedures for Inference and Measurement", *Review of Financial Studies* 5, pp. 357—386.

Ibbotson Associates (2006), *Stocks, Bonds, Bills, and Inflation, Valuation Edition, 2006 Yearbook.*

Ibbotson, R. (2002), *TIAA-CREF Investment Forum,* June.

Ibbotson, R. and P. Chen (2003), "Long-Run Stock Returns: Participating in the Real Economy", *Financial Analysts Journal*, Vol. 59, No. 1, pp. 88-98.

Ilmanen, A. (2003), "Expected returns on stocks and bonds", *Journal of Portfolio Management* 29, pp. 7-27.

Jacquier, E., A. Kane, and A.J. Marcus (2003), "Geometric or Arithmetic Mean: A Reconsideration", *Financial Analysts Journal*, Vol. 59, No. 6, pp. 46-53.

Jagannathan, R., E.R. McGrattan, and A.D. Shcherbina (2000), "The Declining U.S. Equity Premium", *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 24, pp. 3–19.

Jorion, P. and W. N. Goetzmann (1999), "Global Stock Markets in the Twentieth Century", *Journal of Finance* 54 (June), pp. 953-80.

Kadlec, C. and R. Acampora (1999), *Dow 100,000: Fact or Fiction?*, New Jersey: Prentice Hall.

Keim, D. and R. Stambaugh (1986), "Predicting Returns in the Stock and Bond Markets", *Journal of Financial Economics* 17, pp. 357—390.

Kocherlakota, N.R. (1996), "The Equity Premium: It's Still a Puzzle", *Journal of Economic Literature*, Vol. 34, pp. 42-71.

Koller, T., M. Goedhart and D. Wessels (2005), *Valuation: Measuring and Managing the Value of Companies*, 4th Edition, McKinsey & Company, Inc. Wiley.

Kothari, S. and J. Shanken (1997), "Book-to-Market, Dividend Yield, and Expected Market Returns: a Time-Series Analysis", *Journal of Financial Economics* 44, pp.169-203.

Lamont, Owen (1998), "Earnings and Expected Returns", *Journal of Finance* 53 (5), pp. 1563-1587.

Lettau, M., and S. C. Ludvigson (2001): "Consumption, Aggregate Wealth and Expected Stock Returns", *Journal of Finance* 56(3), pp. 815-849.

Levy, M. and H. Levy (1996), "The Danger of Assuming Homogeneous Expectations", *Financial Analysts Journal*, May/June, pp. 65-70.

Lewellen, J. (2004), "Predicting Returns with Financial Ratios", *Journal of Financial Economics* 74, pp. 209–235.

Li, H. and Y. Xu (2002), "Survival Bias and the Equity Premium Puzzle", *Journal of Finance* 57, pp. 1981-1993.

Maheu, J. M. and T.H. McCurdy (2006), "How Useful are Historical Data for Forecasting the Long-run Equity Premium?", University of Toronto Working Paper.

Mankiw, N.G. (1986), "The Equity Premium and the Concentration of Aggregate Shocks", *Journal of Financial Economics*, vol. 17, no. 1 (September):211–219.

Mankiw, N. G. and S. P. Zeldes (1991), "The Consumption of Stockholders and Nonstockholders", *Journal of Financial Economics* 29, pp. 97-112.

Mas-Colell, A., M. D. Whinston and J. R. Green (1995), *Microeconomic Theory*, Oxford University Press.

Mayfield, E. S. (2004), "Estimating the Market Risk Premium", *Journal of Financial Economics*.

McGrattan, R. E. and E.C. Prescott (2001), "Is the Stock Market Overvalued?" NBER, Working Paper No. 8077.

McGrattan, R. E. and E.C. Prescott (2005), "Taxes, Regulations, and the Value of U.S. and U.K. Corporations", *Review of Economic Studies* 72, pp. 767–96, July.

Mehra, R. (2003), "The Equity Premium: Why is it a Puzzle?", *Financial Analysts Journal*, Vol. 59, pp. 54–69.

Mehra, R. and E. Prescott (1985), "The Equity Premium: A Puzzle", Journal of Monetary Economics, Vol. 15, pp. 145–161.

Mehra, R. and E. Prescott (1988), "The Equity Risk Premium: A Solution?", Journal of Monetary Economics, Vol. 22, pp. 133–136.

Mehra, R. and E. Prescott (2003), "The Equity Premium in Retrospect", in G.M. Constantinides, M. Harris, and R.M. Stulz (Eds.), Handbook of the Economics of Finance: Volume 1B Financial Markets and Asset Pricing. Amsterdam: Elsevier.

Mehra, R. and E. Prescott (2006), "The Equity Premium: What have we learned in 20 years?", in R. Mehra (Ed.), Handbook of Investments: Equity Risk Premium in the Handbook of the Economics of Finance series. Amsterdam: Elsevier.

Menzly, L., J. Santos and P. Veronesi (2002), "The Time Series of the Cross Section of Asset Prices", CRSP Working Paper No. 541.

Miller, M.H. (2000), "The History of Finance: An Eyewitness Account", *Journal of Applied Corporate Finance*, Vol. 13 No. 2, pp. 8–14.

Mishel, L., J. Bernstein, and S. Allegretto (2006), *The State of Working America*, Cornell University Press.

Modigliani, F. and R. A. Cohn (1979), "Inflation, Rational Valuation and the Market", *Financial Analysts Journal*, Vol. 35, No. 2, pp, 24-44

O'Hanlon, J. and A. Steele (2000), "Estimating the Equity Risk Premium Using Accounting Fundamentals", *Journal of Business Finance & Accounting* 27 (9&10), pp. 1051-1083.

O'Neill, J., D. Wilson and R. Masih (2002), "The Equity Risk Premium from an Economics Perspective", Goldman Sachs, Global Economics Paper No. 84.

Palepu, K.G., P.M. Healy and V.L. Bernard (2004), *Business Analysis and Valuation: Using Financial Statements, Text and Cases*, 3rd ed., South-Western College Pub.

Pastor, L. and R. F. Stambaugh (2001), "The Equity Premium and Structural Breaks", *Journal of Finance*, 56, No. 4, pp. 1207-1239.

Penman, S.H. (2003), *Financial Statement Analysis and Security Valuation*. 2nd edition, McGraw-Hill. 1st ed. in 2001.

Polk, C. K., S. B. Thompson and T. Vuolteenaho (2006) 'Cross-sectional forecasts of the equity premium', *Journal of Financial Economics* 81, 101—141

Pratt, S.P. (2002), *Cost of Capital: Estimation and Applications*, 2nd edition, Wiley.

Rietz, T.A. (1988) "The Equity Risk Premium: A Solution", *Journal of Monetary Economics*, vol. 22, no. 1 (July), pp. 117–131.

Ritter, J.R. (2002), "The Biggest Mistakes We Teach", *Journal of Financial Research,* Vol. 25, pp. 159-168.

Ritter, J.R. (2005), “Economic Growth and Equity Returns”, *Pacific-Basin Finance Journal* 13, pp. 489–503

Ritter, J.R. and R. Warr (2002), "The Decline of Inflation and the Bull Market of 1982 to 1999", *Journal of Financial and Quantitative Analysis*, Vol. 37, No. 1, pp. 29-61.

Ross, S. A., R. W. Westerfield and J. F. Jaffe (2005), *Corporate Finance*, 7th edition, Homewood, IL: McGraw-Hill/Irwin. Previous editions: 1998, 1993, 1996, 1999 and 2002.

Rozeff, M.S. (1984), “Dividend Yields Are Equity Risk Premiums”, *Journal of Portfolio Management*, pp. 68-75,

Saito, M. (1995), “Limited Market Participation and Asset Pricing”, manuscript, University of British Columbia.

Schwert, G.W. (1990), “Indexes of U.S. Stock Prices from 1802 to 1987”, *Journal of Business*, Vol. 63 (1990), pp. 399–426.

Shalit, H. and S. Yitzhaki (2006), "Capital Market Equilibrium with Heterogeneous Investors", SSRN 899276 .

Shiller, R. J. (2000), *Irrational Exuberance*, Princeton University Press, Princeton New Jersey, 2000.

Siegel, J. J. (1999), “The Shrinking Equity Premium”, *Journal of Portfolio Management*, Fall, pp. 10-17.

Siegel, J. J. (2002), *Stocks for the Long Run*, 3rd edition, New York: Irwin. 2nd ed. in 1998, 1st ed. in 1994.

Siegel, J. J. (2005a), “Perspectives on the Equity Risk Premium”, *Financial Analysts Journal*, Vol. 61, No. 6, pp. 61-71.

Siegel, J.J. (2005b), The Future for Investors: Why the Tried and the True Triumph Over the Bold and the New. NY: Crown Business.

Siegel, J.J. and J.D. Schwartz (2006), “The Long-Term Returns on the Original S&P 500 Firms”, *Financial Analysts Journal*, Vol. 62, No. 1, pp. 18-31.

Siegel, J.J. and R. Thaler (1997), “The Equity Premium Puzzle”, *Journal of Economic Perspectives* 11(1), pp. 191-200.

Smith, E. L. (1926), *Common Stocks as Long Term Investments*,

Storesletten, K., C.I. Telmer and A. Yaron (1999), "Asset Pricing with Idiosyncratic Risk and Overlapping Generations", Universitat Pompeu Fabra Working Paper No. 405.

Stowe, J.D., T.R. Robinson, J.E. Pinto and D.W. McLeavey (2002), *Analysis of Equity investments: Valuation.* AIMR (Association for Investment Management and Reasearch).

Van Horne, J. C. (1986), *Fundamentals of Financial Management and Policy*, 6th edition, Englewood Cliffs, NJ: Prentice-Hall. Previous editions: 1971, 1974, 1977, 1980 and 1983.

Van Horne, J. C. (1992), *Financial Management and Policy*, 9th edition, Englewood Cliffs, NJ: Prentice-Hall. Previous editions: 1968, 1971, 1974, 1977, 1980, 1983.

Vissing-Jorgensen, A. (2002), “Limited Asset Market Participation and the Elasticity of Intertemporal Substitution, *Journal of Political Economy* 110, pp. 835-53.

Vivian, A. (2005), “The Equity Premium: 101 Years of Empirical Evidence from the UK”, University of Durham. Available at SSRN number 766184.

Welch, I. (2000), “Views of Financial Economists on the Equity Premium and on Professional Controversies”, *Journal of Business*, Vol. 73, No. 4, pp. 501-537.

Welch, I. (2001), “The Equity Premium Consensus Forecast Revisited”, Cowles Foundation Discussion Paper No. 1325. SSRN n. 285169.

Weston, J. F. and E. F. Brigham (1968), *Essentials of Managerial Finance,* Holt, Rinehart and Winston.

Weston, J. F. and T. E. Copeland (1992), *Managerial Finance,* 9th edition, The Dryden Press.

Weston, J. F., S. Chung and J. A. Siu (1997), *Takeovers, Restructuring and Corporate Governance,* 2nd edition, New Jersey: Prentice-Hall.

Weston, J. F., M.L. Mitchel and J.H. Mulherin (2004), *Takeovers, Restructuring, and Corporate Governance,* 4th edition, Pearson Education, Prentice Hall.

Williams, J.B. (1938), *The Theory of Investment Value*, Harvard University Press, Cambridge, MA.

Wilson, J. and C. Jones (2002), “An Analysis of the S&P 500 Index and Cowles’s Extensions: Price Indexes and Stock Returns, 1870–1999”, *Journal of Business*, Vol. 75, pp. 505–533.

The real cost of equity

The inflation-adjusted cost of equity has been remarkably stable for 40 years, implying a current equity risk premium of 3.5 to 4 percent

Marc H. Goedhart, Timothy M. Koller, and Zane D. Williams

As central as it is to every decision at the heart of corporate finance, there has never been a consensus on how to estimate the cost of equity and the equity risk premium.[1]

Conflicting approaches to calculating risk have led to varying estimates of the equity risk premium from 0 percent to 8 percent—although most practitioners use a narrower range of 3.5 percent to 6 percent. With expected returns from long-term government bonds currently about 5 percent in the US and UK capital markets, the narrower range implies a cost of equity for the typical company of between 8.5 and 11.0 percent. This can change the estimated value of a company by more than 40 percent and have profound implications for financial decision making.

Discussions about the cost of equity are often intertwined with debates about where the stock market is heading and whether it is over- or undervalued. For example, the run-up in stock prices in the late 1990s prompted two contradictory points of view. On the one hand, as prices soared ever higher, some investors expected a new era of higher equity returns driven by increased future productivity and economic growth. On the other hand, some analysts and academics suggested that the rising stock prices meant that the risk premium was declining. Pushed to the extreme, a few analysts even argued that the premium would fall to zero, that the Dow Jones industrial average would reach 36,000 and that stocks would earn the same returns as government bonds. While these views were at the extreme end of the spectrum, it is still easy to get seduced by complex logic and data.

We examined many published analyses and developed a relatively simple methodology that is both stable over time and overcomes the shortcomings of other models. We estimate that the real, inflation-adjusted cost of equity has been remarkably stable at about 7 percent in the US and 6 percent in the UK since the 1960s. Given current, real long-term bond yields of 3 percent in the US and 2.5 percent in the UK, the implied equity risk premium is around 3.5 percent to 4 percent for both markets.

The debate

There are two broad approaches to estimating the cost of equity and market risk premium. The first is historical, based on what equity investors have earned in the past. The second is forward-looking, based on projections implied by current stock prices relative to earnings, cash flows, and expected future growth.

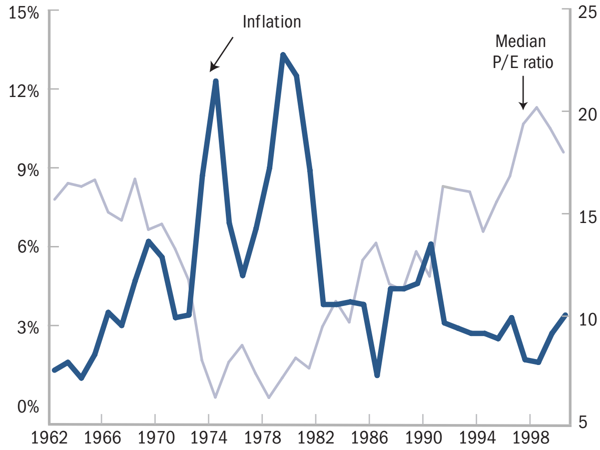
The latter is conceptually preferable. After all, the cost of equity should reflect the return expected (required) by investors. But forward-looking estimates are fraught with problems, the most intractable of which is the difficulty of estimating future dividends or earnings growth. Some theorists have attempted to meet that challenge by surveying equity analysts, but since we know that analyst projections almost always overstate the long-term growth of earnings or dividends,[2] analyst objectivity is hardly beyond question. Others have built elaborate models of forward-looking returns, but such models are typically so complex that it is hard to draw conclusions or generate anything but highly unstable results. Depending on the modeling assumptions, recently published research suggests market risk premiums between 0 and 4 percent.[3]

Unfortunately, the historical approach is just as tricky because of the subjectivity of its assumptions. For example, over what time period should returns be measured—the previous 5, 10, 20, or 80 years or more? Should average returns be reported as arithmetic or geometric means? How frequently should average returns be sampled? Depending on the answers, the market risk premium based on historical returns can be estimated to be as high as 8 percent.[4] It is clear that both historical and forward-looking approaches, as practiced, have been inconclusive.

Overcoming the typical failings of economic models

In modeling the behavior of the stock market over the last 40 years,[5] we observed that many real economic variables were surprisingly stable over time (including long-term growth in corporate profits and returns on capital) and that much of the variability in stock prices related to interest rates and inflation (Exhibit 1). Building on these findings, we developed a simple, objective, forward-looking model that, when applied retrospectively to the cost of equity over the past 40 years, yielded surprisingly stable estimates.

Exhibit 1. US median P/E vs. inflation

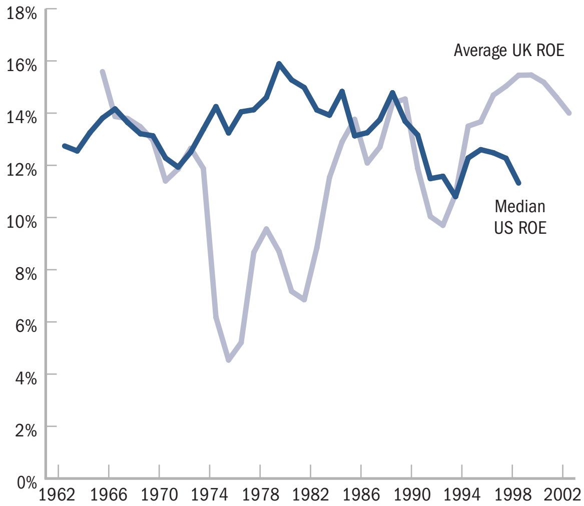


Source: McKinsey analysis

Forward-looking models typically link current stock prices to expected cash flows by discounting the cash flows at the cost of equity. The implied cost of equity thus becomes a function of known current share values and estimated future cash flows (see sidebar, "Estimating the cost of equity"). Using this standard model as the starting point, we then added three unique characteristics that we believe overcome the shortcomings of many other approaches:

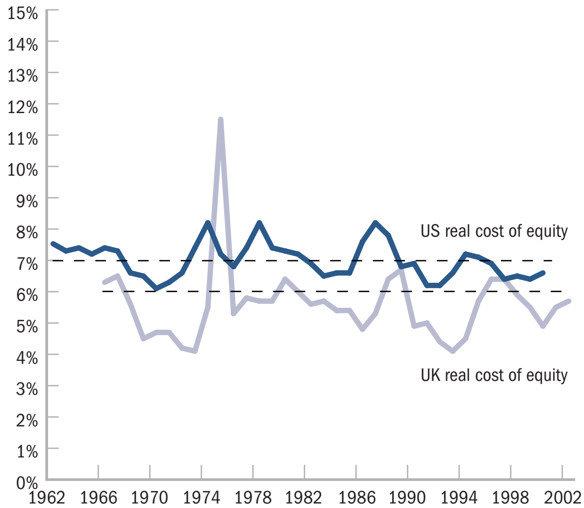
1. *Median stock price valuation.* For the US, we used the value of the median company in the S&P 500 measured by P/E ratio as an estimate of the market's overall valuation at any point in time. Most researchers have used the S&P 500 itself, but we argue that the S&P 500 is a value-weighted index that has been distorted at times by a few highly valued companies, and therefore does not properly

Exhibit 2. Return on book equity (ROE)



Source: McKinsey analysis

Exhibit 3. Annual estimates of the real cost of equity



Source: McKinsey analysis

reflect the market value of typical companies in the US economy. During the 1990s, the median and aggregate P/E levels diverged sharply. Indeed by the end of 1999, nearly 70 percent of the companies in the S&P 500 had P/E ratios below that of the index as a whole. By using the median P/E ratio, we believe we generate estimates that are more representative for the economy as a whole. Since UK indices have not been similarly distorted, our estimates for the UK market are based instead on aggregate UK market P/E levels.

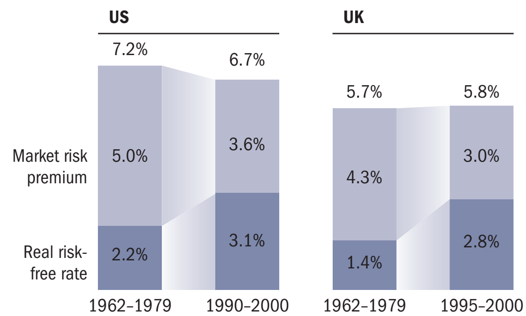
2. *Dividendable cash flows.* Most models use the current level of dividends as a starting point for projecting cash flows to equity. However, many corporations have moved from paying cash dividends to buying back shares and finding other ways to return cash to shareholders, so estimates based on ordinary dividends will miss a substantial portion of what is paid out. We avoid this by discounting not the dividends paid but the cash flows available to shareholders after new investments have been funded. These are what we term "dividendable" cash flows to investors that might be paid out through share repurchases as ordinary dividends, or temporarily held as cash at the corporate level.

We estimate dividendable cash flows by subtracting the investment required to sustain the long-term growth rate from current year profits. This investment can be shown to equal the projected long-term profit growth (See sidebar, "Estimating the cost of equity") divided by the expected return on book equity. To estimate the return on equity (ROE), we were able to take advantage of the fact that US and UK companies have had fairly stable returns over time. As Exhibit 2 shows, the ROE for both US and UK companies has been consistently about 13 percent per year,[6] the only significant exception being found in UK returns of the late 1970s.

3. *Real earnings growth based on long-term trends.* The expected growth rate in cash flow

The stability of the implied inflation-adjusted cost of equity is striking. Despite a handful of recessions and financial crises over the past 40 years . . . equity investors have continued to demand about the same cost of equity in inflation-adjusted terms.

Exhibit 4. Decomposition of the inflation-adjusted cost of equity



Source: McKinsey analysis

and earnings was estimated as the sum of long-term real GDP growth plus expected inflation. Corporate profits have remained a relatively consistent 5.5 percent of US GDP over the past 50 years. Thus, GDP growth rates are a good proxy for long-term corporate profit growth. Real GDP growth has averaged about 3.5 percent per year over the last 80 years for the US and about 2.5 percent over the past 35 years for the UK. Using GDP growth as a proxy for expected earnings growth allows us to avoid using analysts' expected growth rates.

We estimated the expected inflation rate in each year as the average inflation rate experienced over the previous five years.[7] The nominal growth rates used in the model for each year were the real GDP growth combined with the contemporary level of expected inflation for that year.

Results

We used the above model to estimate the inflation-adjusted cost of equity implied by stock market valuations each year from 1963 to 2001 in the US and from 1965 to 2001 for the UK (Exhibit 3). In the US, it consistently remains between 6 and 8 percent with an average of 7 percent. For the UK market, the inflation-adjusted cost of equity has been, with two exceptions, between 4 percent and 7 percent and on average 6 percent.

The stability of the implied inflation-adjusted cost of equity is striking. Despite a handful of recessions and financial crises over the past 40 years including most recently the dot.com bubble, equity investors have continued to demand about the same cost of equity in inflation-adjusted terms. Of course, there are deviations from the long-term averages but they aren't very large and they don't last very long. We interpret this to mean that stock markets ultimately understand that despite ups and downs in the broad economy, corporate earnings and economic growth eventually revert to their long-term trend.

We also dissected the inflation-adjusted cost of equity over time into two components: the inflation-adjusted return on government bonds and the market risk premium. As Exhibit 4 demonstrates, from 1962 to 1979 the expected

Estimating the cost of equity

To estimate the cost of equity, we began with a standard perpetuity model:

$$P_t = \frac{CF_{t+1}}{k_e - g} \quad (1)$$

where P_t is the price of a share at time t, CF_{t+1} is the expected cash flow per share at time $t + 1$, k_e is the cost of equity, and g is the expected growth rate of the cash flows. The cash flows, in turn, can be expressed as earnings, E, multiplied by the payout ratio:

$$CF = E(\text{payout ratio})$$

Since the payout ratio is the share of earnings left after reinvestment, replacing the payout ratio with the reinvestment rate gives:

$$CF = E(1 - \text{reinvestment rate})$$

The reinvestment rate, in turn, can be expressed as the ratio of the growth rate, g, to the expected return on equity:

$$\text{reinvestment rate} = \frac{g}{ROE}$$

And thus the cash flows can be expressed as:

$$CF = E\left(1 - \frac{g}{ROE}\right) \quad (2)$$

We then combined formulas (1) and (2) to get the following:

$$\frac{P_t}{E_{t+1}} = \frac{1 - \frac{g}{ROE}}{k_e - g} \Rightarrow k_e = \frac{E_{t+1}}{P_t}\left(1 - \frac{g}{ROE}\right) + g \quad (3)$$

If the inflation embedded in k_e and g is the same, we can then express equation 3 as:

$$k_{er} = \frac{E_{t+1}}{P_t}\left(1 - \frac{g}{ROE}\right) + g_r \quad (4)$$

Where k_{er} and g_r are the inflation-adjusted cost of equity and real growth rate, respectively. We then solved for k_{er} for each year from 1963 through 2001, using the assumptions described in the text of the article.

inflation-adjusted return on government bonds appears to have fluctuated around 2 percent in the US and around 1.5 percent in the UK. The implied equity risk premium was about 5 percent in both markets.[8] But in the 1990s, it appears that the inflation-adjusted return on both US and UK government bonds may have risen to 3 percent, with the implied equity risk premium falling to 3 percent and 3.6 percent in the UK and US respectively.

We attribute this decline not to equities becoming less risky (the inflation-adjusted cost of equity has not changed) but to investors demanding higher returns in real terms on government bonds after the inflation shocks of the late 1970s and early 1980s. We believe that using an equity risk premium of 3.5 to 4 percent in the current environment better reflects the true long-term opportunity cost for equity capital and hence will yield more accurate valuations for companies. **MoF**

Marc H. Goedhart (Marc_Goedhart@McKinsey.com) *is associate principal in McKinsey's Amsterdam office,* ***Timothy M. Koller*** (Tim_Koller@McKinsey.com) *is a principal in McKinsey's New York office, and* ***Zane D. Williams*** (Zane_Williams @McKinsey.com) *is a consultant in McKinsey's Washington, D.C., office,*

[1] Defined as the difference between the cost of equity and the returns investors can expect from supposedly risk-free government bonds.

[2] *See* Marc H. Goedhart, Brendan Russel, and Zane D. Williams, "Prophets and profits?" *McKinsey on Finance*, Number 2, Autumn 2001.

[3] *See,* for example, Eugene Fama and Kenneth French, "The Equity Premium," *Journal of Finance*, Volume LVII, Number 2, 2002; and Robert Arnott and Peter Bernstein, "What Risk Premium is 'Normal'," *Financial Analysts Journal*, March/April, 2002; James Claus and Jacob Thomas, "Equity premia as low as three percent?" *Journal of Finance*, Volume LVI, Number 5, 2001.

[4] *See,* for example, *Ibbotson and Associates,* Stock, Bonds, Bills and Inflation: 1997 Yearbook.

[5] *See* Timothy Koller and Zane Williams, "What happened to the bull market?" *McKinsey on Finance*, Number 1, Summer 2001.

[6] One consequence of combining a volatile nominal growth rate (due to changing inflationary expectations) with a stable ROE is that the estimated reinvestment rate varies tremendously over time. In the late 1970s, in fact, our estimates are near 100 percent. This is unlikely to be a true representation of actual investor expectations at the time. Instead, we believe it likely that investors viewed the high inflation of those years as temporary. As a result, in all of our estimates, we capped the reinvestment rate at 70 percent.

[7] This assumption is the one that we are least comfortable with, but our analysis seems to suggest that markets build in an expectation that inflation from the recent past will continue (witness the high long-term government bond yields of the late 1970s).

[8] There is some evidence that the market risk premium is higher in periods of high inflation and high interest rates, as was experienced in the late 1970s and early 1980s.

McKinsey on Finance is a quarterly publication written by experts and practitioners in McKinsey & Company's Corporate Finance & Strategy Practice. It offers readers insights into value-creating strategies and the translation of those strategies into stock market performance. This and archive issues of *McKinsey on Finance* are available on line at http://www.corporatefinance.mckinsey.com

---

McKinsey & Company is an international management consulting firm serving corporate and government institutions from 85 offices in 44 countries.

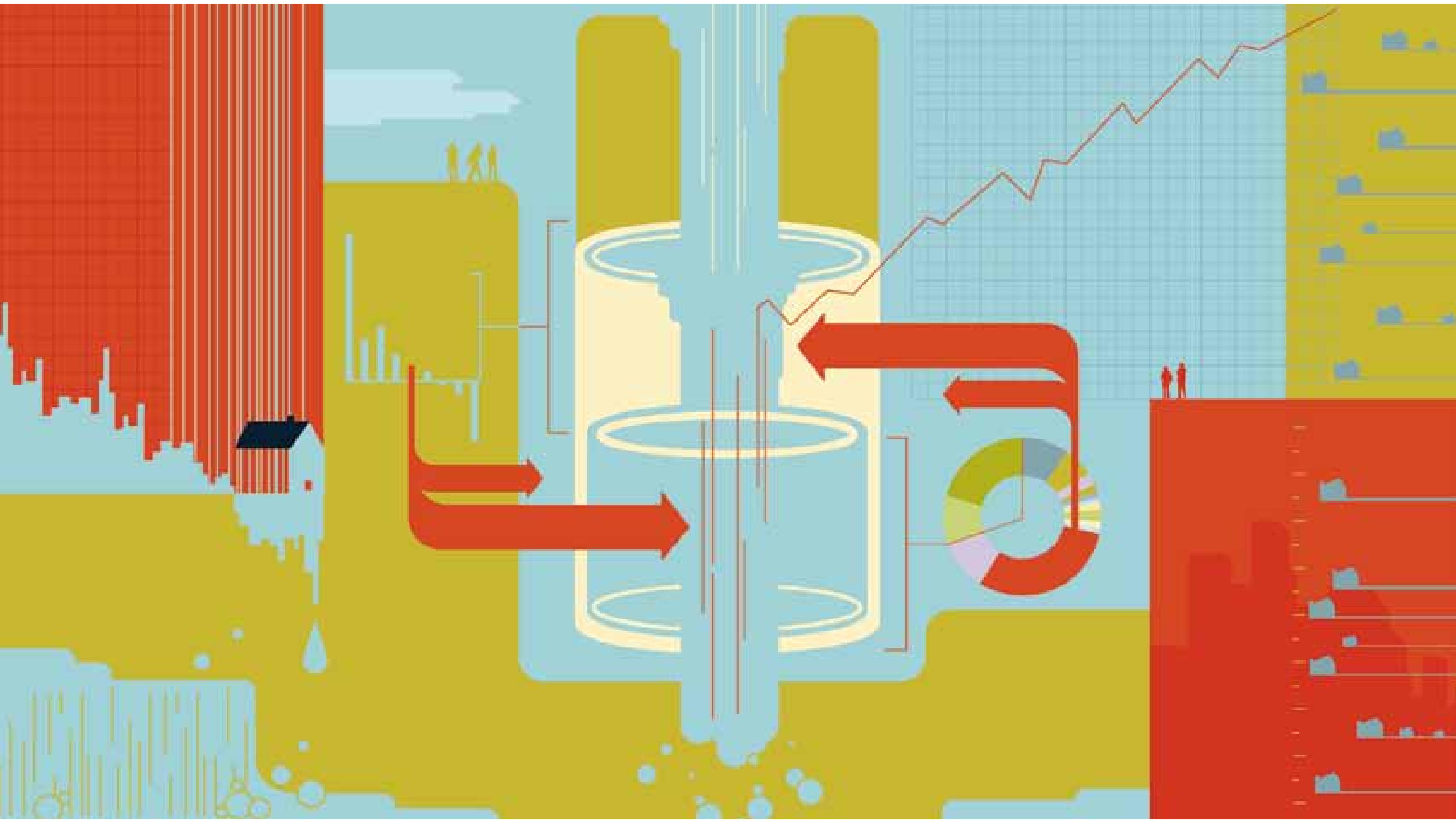
Cover images, left to right: ©Rob Colvin/Artville; © Garrian Manning/Artville; © Stephanie Carter/Artville; © Todd Davidson/The Image Bank, © Jack Star/PhotoLink.

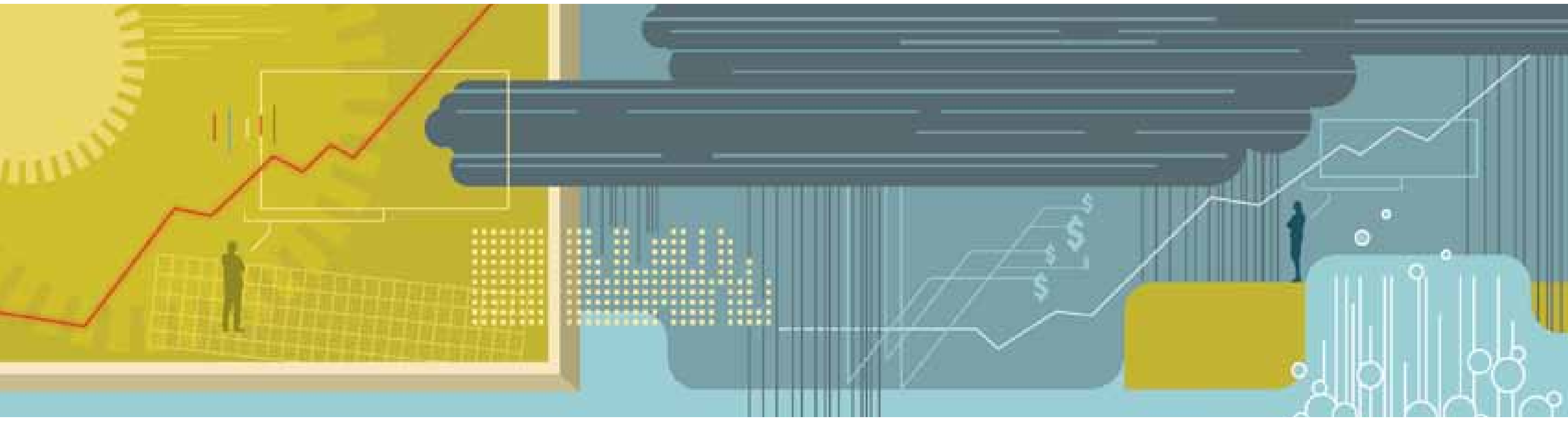
McKinsey&Company

McKinsey on Finance

Number 35,
Spring 2010

Perspectives on Corporate Finance and Strategy





Equity analysts: Still too bullish

After almost a decade of stricter regulation, analysts' earnings forecasts continue to be excessively optimistic.

Marc H. Goedhart, Rishi Raj, and Abhishek Saxena

No executive would dispute that analysts' forecasts serve as an important benchmark of the current and future health of companies. To better understand their accuracy, we undertook research nearly a decade ago that produced sobering results. Analysts, we found, were typically overoptimistic, slow to revise their forecasts to reflect new economic conditions, and prone to making increasingly inaccurate forecasts when economic growth declined.[1]

Alas, a recently completed update of our work only reinforces this view—despite a series of rules and regulations, dating to the last decade, that were intended to improve the quality of the analysts' long-term earnings forecasts, restore investor confidence in them, and prevent conflicts of interest.[2] For executives, many of whom go to great lengths to satisfy Wall Street's expectations in their financial reporting and long-term strategic moves, this is a cautionary tale worth remembering.

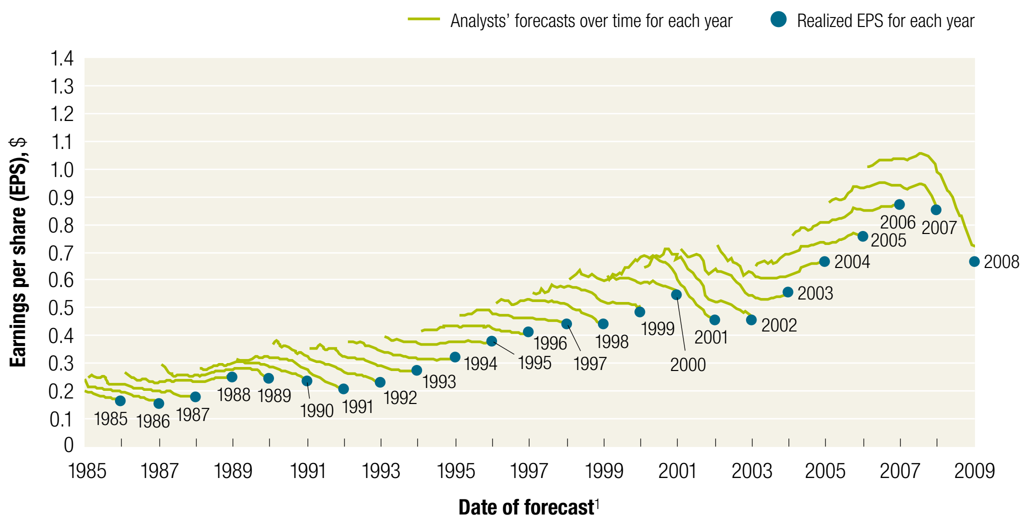
Exceptions to the long pattern of excessively optimistic forecasts are rare, as a progression of consensus earnings estimates for the S&P 500 shows (Exhibit 1). Only in years such as 2003 to 2006, when strong economic growth generated actual earnings that caught up with earlier predictions, do forecasts actually hit the mark.

Exhibit 1

Off the mark

With few exceptions, aggregate earnings forecasts exceed realized earnings per share.

S&P 500 companies



[1]Monthly forecasts.

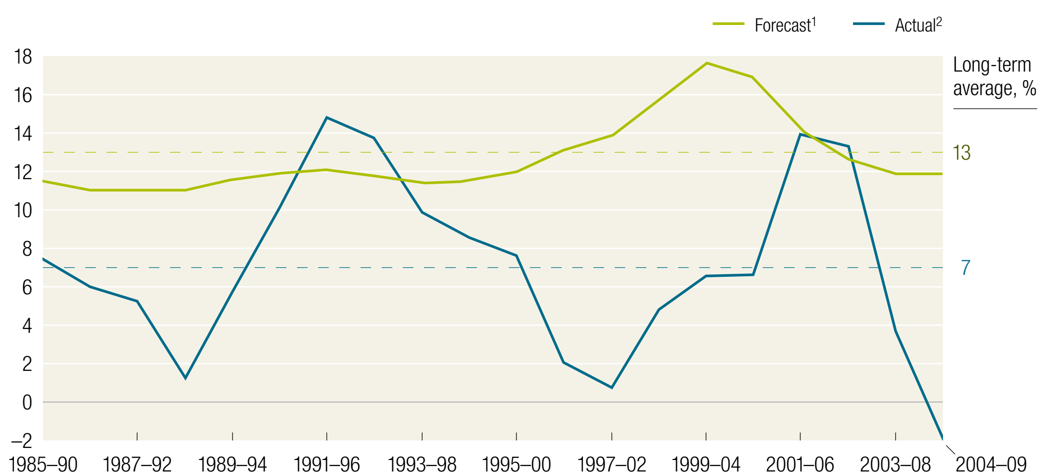
Source: Thomson Reuters I/B/E/S Global Aggregates; McKinsey analysis

Exhibit 2

Overoptimistic

Actual growth surpassed forecasts only twice in 25 years—both times during the recovery following a recession.

Earnings growth for S&P 500 companies, 5-year rolling average, %



[1]Analysts' 5-year forecasts for long-term consensus earnings-per-share (EPS) growth rate. Our conclusions are same for growth based on year-over-year earnings estimates for 3 years.
[2]Actual compound annual growth rate (CAGR) of EPS; 2009 data are not yet available, figures represent consensus estimate as of Nov 2009.

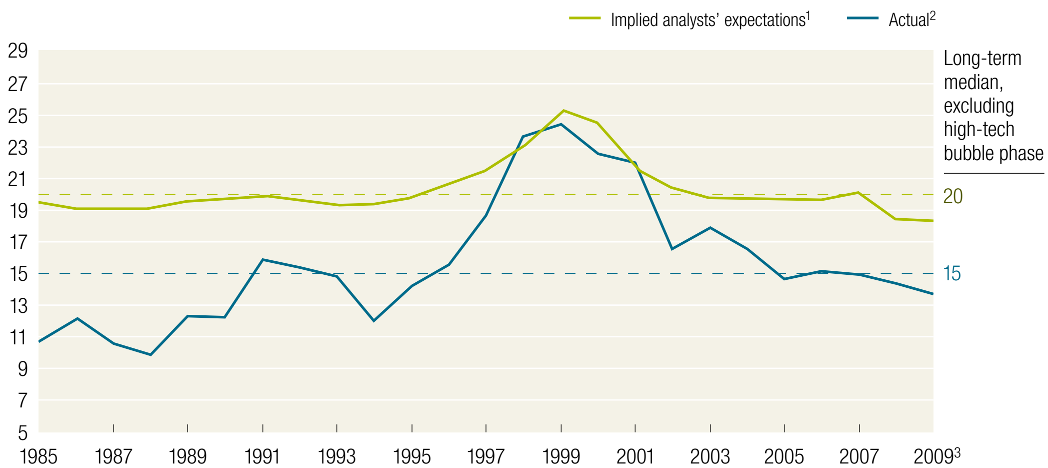
Source: Thomson Reuters I/B/E/S Global Aggregates; McKinsey analysis

Exhibit 3

Less giddy

Capital market expectations are more reasonable.

Actual P/E ratio vs P/E ratio implied by analysts' forecasts, S&P 500 composite index



[1] P/E ratio based on 1-year-forward earnings-per-share (EPS) estimate and estimated value of S&P 500. Estimated value assumes: for first 5 years, EPS growth rate matches analysts' estimates then drops smoothly over next 10 years to long-term continuing-value growth rate; continuing value based on growth rate of 6%; return on equity is 13.5% (long-term historical median for S&P 500), and cost of equity is 9.5% in all periods.
[2] Observed P/E ratio based on S&P 500 value and 1-year-forward EPS estimate.
[3] Based on data as of Nov 2009.

Source: Thomson Reuters I/B/E/S Global Aggregates; McKinsey analysis

This pattern confirms our earlier findings that analysts typically lag behind events in revising their forecasts to reflect new economic conditions. When economic growth accelerates, the size of the forecast error declines; when economic growth slows, it increases.[3] So as economic growth cycles up and down, the actual earnings S&P 500 companies report occasionally coincide with the analysts' forecasts, as they did, for example, in 1988, from 1994 to 1997, and from 2003 to 2006.

Moreover, analysts have been persistently overoptimistic for the past 25 years, with estimates ranging from 10 to 12 percent a year,[4] compared with actual earnings growth of 6 percent.[5] Over this time frame, actual earnings growth surpassed forecasts in only two instances, both during the earnings recovery following a recession (Exhibit 2). On average, analysts' forecasts have been almost 100 percent too high.[6]

Capital markets, on the other hand, are notably less giddy in their predictions. Except during the market bubble of 1999–2001, actual price-to-earnings ratios have been 25 percent lower than implied P/E ratios based on analyst forecasts (Exhibit 3). What's more, an actual forward P/E ratio[7] of the S&P 500 as of November 11, 2009—14—is consistent with long-term earnings growth of 5 percent.[8] This assessment is more reasonable, considering that long-term earnings growth for the market as a whole is unlikely to differ significantly from growth in GDP,[9] as prior McKinsey research has shown.[10] Executives, as the evidence indicates, ought to base their strategic decisions on what they see happening in their industries rather than respond to the pressures of forecasts, since even the market doesn't expect them to do so.

[1] Marc H. Goedhart, Brendan Russell, and Zane D. Williams, "Prophets and profits," mckinseyquarterly.com, October 2001.

[2] US Securities and Exchange Commission (SEC) Regulation Fair Disclosure (FD), passed in 2000, prohibits the selective disclosure of material information to some people but not others. The Sarbanes–Oxley Act of 2002 includes provisions specifically intended to help restore investor confidence in the reporting of securities' analysts, including a code of conduct for them and a requirement to disclose knowable conflicts of interest. The Global Settlement of 2003 between regulators and ten of the largest US investment firms aimed to prevent conflicts of interest between their analyst and investment businesses.

[3] The correlation between the absolute size of the error in forecast earnings growth (S&P 500) and GDP growth is –0.55.

[4] Our analysis of the distribution of five-year earnings growth (as of March 2005) suggests that analysts forecast growth of more than 10 percent for 70 percent of S&P 500 companies.

[5] Except 1998–2001, when the growth outlook became excessively optimistic.

[6] We also analyzed trends for three-year earnings-growth estimates based on year-on-year earnings estimates provided by the analysts, where the sample size of analysts' coverage is bigger. Our conclusions on the trend and the gap vis-à-vis actual earnings growth does not change.

[7] Market-weighted and forward-looking earnings-per-share (EPS) estimate for 2010.

[8] Assuming a return on equity (ROE) of 13.5 percent (the long-term historical average) and a cost of equity of 9.5 percent—the long-term real cost of equity (7 percent) and inflation (2.5 percent).

[9] Real GDP has averaged 3 to 4 percent over past seven or eight decades, which would indeed be consistent with nominal growth of 5 to 7 percent given current inflation of 2 to 3 percent.

[10] Timothy Koller and Zane D. Williams, "What happened to the bull market?" mckinseyquarterly.com, November 2001.

Marc Goedhart (Marc_Goedhart@McKinsey.com) is a consultant in McKinsey's Amsterdam office; **Rishi Raj** (Rishi_Raj@McKinsey.com) and **Abhishek Saxena** (Abhishek_Saxena@McKinsey.com) are consultants in the Delhi office.

BEFORE THE FEDERAL COMMUNICATIONS COMMISSION

IN THE MATTER OF	)	
	)	
AMERICAN TELEPHONE AND TELEGRAPH COMPANY	)	CC DOCKET NO. 79-63
	)	
PETITION FOR MODIFICATION OF	)	
PRESCRIBED RATE OF RETURN	)	

PREPARED DIRECT TESTIMONY

DR. MYRON J. GORDON

AND

DR. LAWRENCE I. GOULD

APRIL, 1980

III. COST OF EQUITY CAPITAL

It is widely accepted that a public utility should earn a return on capital that allows it to raise the capital necessary to meet the demand for its services without an adverse effect on current shareholder stock. Such a rate of return is called the utility's cost of capital. A return in excess of that rate burdens the consumer with prices which are excessive and causes an unjustified transfer of income from the consuming public to the shareholders of the utility. It also encourages the utility to increase costs and prices further by overinvesting in plant facilities. On the other hand, a return on capital below the required return may discourage the utility from raising sufficient capital to meet demands for service, causing consumers to suffer an impairment in the quantity and quality of service. Therefore, if the return allowed by the Commission is either too high or too low, the result is less than satisfactory to the consumer. The testimony which follows is offered with a view to estimating as closely as possible the actual required return on capital (also called the cost of capital) and, with some care, to avoiding any bias in either direction.

In measuring the cost of capital from each source, the cost of debt and the cost of preferred capital pose few problems. It is clear that the utility must pay the embedded interest on its outstanding debt and the prescribed dividend on the preferred stock. Both of these measurements involve perfectly straightforward calculations. Somewhat more controversial is the problem of determining the cost of common equity capital.

A. General Principles

A utility's cost of common equity capital is the return or yield that investors on average require on its common stock as implied in the price that they are willing to pay to hold the stock. This implied yield is the cost of common equity capital, because the existing shareholders neither gain nor lose as a consequence of additional investment and financing, regardless of the method of financing, as long as the return the company earns on its common equity is equal to the return investors require on the stock. By contrast, when the allowed return on common is above the return investors require, each dollar of additional financing raises the value of the existing shares. Conversely, when the utility's operating income less interest on debt, income taxes, and preferred dividends does not leave a return on common equity equal to the return investors require on the stock, we not only have a depressed stock price because of the low return, but, in addition, each dollar of additional investment and financing further depresses the price.

The theoretical basis for the conclusion just stated has been fully developed,[1] but a simple analogy goes a long way in demonstrating the point. Ignoring operating costs, a bank that borrows at 8% and lends at 10% adds 2% of the amount borrowed and loaned to the earnings of the bank's shareholders. The more the bank borrows and lends with this 2% spread, the more it increases future earnings on and the current value of its common stock. The return that investors require on a utility's common stock is, in one form or another, what must be paid for additional equity funds, and if the company earns more on the money than it must pay to get the funds, the excess adds to the earnings on and value of the existing shares. Conversely, if the company earns a lower rate of return than it pays on additional funds, the difference comes out of the pockets of the existing shareholders.

While the management of a utility may not be able to prevent a regulatory agency from allowing it a rate of return on capital below its costs of capital, it will, quite understandably, be reluctant to compound the mis-

---

1 For an extensive discussion, see M.J. Gordon, <u>The Cost of Capital to a Public Utility</u>, Michigan State University, East Lansing, Michigan, 1974.

fortunes of its shareholders by further depressing the stock price through undertaking further investment in the face of an inadequate return on capital. A difference between the return on capital and its cost is fully reflected in the return on common equity, since the bondholders and preferred shareholders are assured of receiving their prescribed returns on capital regardless of the allowed rate on total capital. However, the long-run dependence of the value of a public utility's stock on the service provided to its customers could make it advisable for the company to undertake essential capital expenditures in the face of a small and hopefully temporary unfavorable difference between the allowed rate of return and the cost of capital.

Management's own commitment to continued growth or its reluctance to face the problems of a sharp curtailment in growth may persuade it to continue a high rate of investment in the face of an unsatisfactory rate of return. However, this amounts to an appropriation of shareholder wealth in pursuit of managerial objectives, and sooner or later the shareholders may turn to a new management that is more solicitous of stockholder welfare.

B. <u>Measurement of DCF Cost of Equity Capital</u>

The principles used to measure the cost of common equity are the same as those used in measuring the yield which investors require on debt or the yield required on outstanding preferred stock. However, in the case of debt and preferred stock, the payments to investors are relatively certain and, thus, amenable to objective calculation. However, the future dividend payments on a share of stock are uncertain, and determination of the expected yield required by investors requires the use of a more complex, yet still relatively simple and very reliable, method for dealing with the problem at hand.

This method is called the DCF (Discounted Cash Flow) Method for computing the cost of equity capital.[1] It represents the valuation of a share of stock by the expression:

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \ldots + \frac{D_t}{(1+k)^t} + \ldots + \frac{D_\infty}{(1+k)^\infty} . \qquad (1)$$

In this expression:

P_0 = the current price per share;

D_t = the expected value of the dividend the share will pay at the end of period t; and

k = the yield or return investors require on the share.

---

[1] This method was developed by Myron J. Gordon in an article in <u>Management Science</u> in 1956 and was first introduced in testimony in the American Telephone and Telegraph Co. Case, F.C.C. Docket 16258, 1966.

If the future dividends are expected to grow at the rate of g each period, Equation (1) reduces to:

$$P_0 = \frac{D_1}{k-g} \qquad (2)$$

Solving Equation (2) for k results in an expression for the yield that investors require:

$$k = \frac{D_1}{P_0} + g. \qquad (3)$$

In other words, to measure the expected return that investors require we may take the sume of the dividend yield and the expected rate of growth in the dividend.

An alternate approach to Equation (1) for the price of a share is:

$$P_0 = \frac{D_1 + P_1}{1 + k}. \qquad (4)$$

Here, we take as the future payments the next period's dividend and the end-of-period price. However, $P_1 = P_0(1+g)$, and this substitution plus a little algebra results in Equation (2). Hence, the two approaches to share valuation result in the same measurement equation for share yield.

In order to use Equation (3), we need to measure both the dividend yield and the expected rate of growth in the dividend.

1. <u>Measurement of Dividend Yield</u>

The term for dividend yield in the Eq. (3) expression for a share's yield is the forecast dividend for the coming period, D_1, divided by the current price, P_0. The value assigned to P_0 should be the price of the share at the time the share yield is being estimated. The rationale for using the current price is that at each point in time it reflects all the information available to a company's investors regarding future dividends. Hence, the yield investors require on any date is the discount rate that equates on that date the current price and the expected stream of future dividends. To use an average of share prices over some prior time period for P_0 would result in a value for k without meaning, that is, it would not provide the average value for k over the prior time period. Furthermore, to obtain an average value for k over some prior time period, one must average the values of share yield -- not of share price.

D_1 is the forecast dividend for the coming year if dividends are paid annually. Common practice, however, is to pay dividends quarterly, in which case D_t in Eq. (1), the fundamental expression for share price, is a quarterly dividend. The value of k that satisfies Eq. (1) is the quarterly yield on the share, and the g in Eqs. (2) and (3) is the quarterly rate at which the dividend is expected to grow.

Because it is customary and convenient to think in terms of annual and not quarterly figures for rate of return and growth statistics, annualized figures will be used here. Annualized figures are simply four times quarterly figures. That is, if the current price of a share is P_0=$50,000, and if its forecast dividend for the coming quarter is D_1=$1.25, the quarterly dividend yield is $1.25/$50.00=2.5%, and the annualized dividend yield is 10%.

We all know from bank advertisements that when interest is compounded more frequently than once a year, two annual interest rates may be computed. To illustrate, an interest rate of 15% per year with the interest compounded quarterly means that a dollar left on deposit for a year will have 3.75% added to the balance at the end of each quarter, and the balance in the account at the end of the year will be $1.1587. In other words, a 15% interest rate compounded quarterly will earn interest equal to 15.87% of the balance at the start of the year.

What does this imply for arriving at a rate of return equal to the cost of equity capital? If the quarterly yield at which a public utility share sells is 3.75%, should the utility be allowed to earn for the year a rate of return on common equity of 15% or something more? The answer is: (1) more than 15%, if the rate of return the company earns is calculated on the basis of the common equity at the start of the year; and (2) only 15%, if the rate of return on common equity is calculated by averaging its values at the start and at the end of the year. This statement is proved in Schedule 27. The latter method represents common practice and the practice followed here. Hence, in arriving at the cost of equity capital, the correct figure for the dividend-yield term in Eq. (3) is the annualized value of the forecast dividend for the coming quarter divided by the current price.

2. Measurement of Expected Growth

A difficult problem is the determination of the long-run dividend growth expectations of investors. In other words, what is the expected rate of growth in future dividends per share, g, in which investors on average believe?

To solve the problem, it is essential to understand the determinants of long-run expected dividend growth. If a company is expected to earn a rate of return of r on its common equity, and if it retains the fraction b of its earnings, then each year its earnings per share can be expected to increase by the fraction br of its earnings per share in the previous year. Thus, br is an excellent measure of the expected rate of growth in future earnings per share. If the company is expected to have a stable retention ratio and, therefore, a stable dividend payout ratio, it follows that br is also an excellent measure of the expected rate of growth in future dividends per share. That is:

$$g = br. \tag{5}$$

This relationship is illustrated in Schedule 18. There the hypothetical initial common equity or book value per share = \$10.00, r = .10 and b = .4. The first period earnings are expected to be \$1.00 per share and the expected dividend is \$.60. The retained earnings raise the book value of equity to \$10.40 at the start of the second year, and r times that is \$1.04, which is equal to the earnings per share the second year. The dividend in the second year is expected to be \$.624, and so on through time. The earnings, dividends, and stock price are expected to grow at the rate br = (.4) (.10) = .04 in every future year.

If investors require an 8% return on the stock, the initial price is:

$$P_0 = \frac{D_1}{k-g} = \frac{\$.60}{.08-.04} = \$15.00. \tag{6}$$

Similarly, the expected share price after one year is:

$$P_1 = \frac{D_2}{k-g} = \frac{\$.624}{.08-.04} = \$15.60 \qquad (7)$$

The price in subsequent periods rises by 4% as long as the yield investors require on the share remains equal to 8%.

In fact, a company's return and retention rates do not remain constant over time. However, if investors expect that a company will on average earn a return of r and retain the fraction b of its earnings, they will expect the dividends, earnings, and price to grow at a rate br due to retention of earnings.

Stock financing will be a further cause of expected growth if the company is expected to issue new shares and if the stock's market price is greater than book value. Conversely, when a company is expected to engage in stock financing through the sale of stock at share prices below book value, ignoring the stock financing results in an overestimate of growth and share yield. If the company is expected to engage in little or no stock financing, or if stock financing is expected to occur only when the market value is close to book value, the expected rate of growth in the earnings, dividends, and price per share is g = br. As will be shown later, we may ignore stock financing and only consider growth due to retention of earnings.

If two conditions are satisfied, the best estimate of g is obtained either from the company's current values of b and r or from weighted averages of their recent values. These two conditions are: stock financing may be ignored for either of the reasons stated above, and there is no information other than the past values of b and r which can be used to forecast their future values.

The sharp rise in energy prices and other costs over the past decade have had a disruptive influence on the electric utility industry, and they have created situations in which there are obvious reasons why past values of b and r should not be projected into the future. In two recent cases, the DCF formula was adapted to deal with the peculiar circumstances of each case.[1] Similarly, as will be shown below, the recent dramatic change in anticipated inflation provides information which should be used to modify the past values of b and r in order to obtain a more accurate forecast of expected growth.

3. <u>Altarnative Measures of Expected Growth</u>

It might be thought that past rates of growth in

---

1 Testimony of Myron J. Gordon, Boston Edison Company Case No. DPU 19300, Commonwealth of Massachusetts, Department of Public Utilities, 1977; and Testimony of Myron J. Gordon, Public Service Company of New Mexico Case No. 1419, New Mexico Public Service Commission, 1979.

either earnings, dividends, or price could be used as estimates of g, the forecast rate of future growth in dividends. However, these past rates of growth are most unreliable due to extraneous influences on them, such as changes in the rate of return on common equity, changes in the retention rate, or changes in the yield required by investors in the case of price changes. The potential error in using past growth in earnings to estimate g is illustrated in Schedule 19, where the hypothetical company's return on common equity is 10% in the first three periods and 15% in the last three periods. With a retention rate of 40% and a return rata of 15% the growth rate is 6% in the last three years. This is a reasonable estimate of the expected future growth rate as of the end of the 6th year. However, with the 56% growth rate due to the rise in the return rate in the fourth year, a simple average of the five annual past growth rates in earnings is in excess of 15%. Clearly, this type of estimate of future growth rates cannot be used with any reliability at all, especially now when public utilities have received frequent upward adjustments in their allowed rates of return over the past five years. To do so would be to expect the company's rate of return on common equity to increase by 50% about every five years. This would be a ridiculous forecast, which the use of b and r would make readily apparent.

It can also be demonstrated that a change in the dividend payout rate makes the past rate of growth in dividends an incorrect basis for predicting g. Assume that a company has been earning a rate of return on its common stock of r = .10, that it has been retaining the fraction b = .60 of its earnings, and that, as a consequence, its dividend has been growing at the rate br = (.60)(.10) = .06. If the company were to raise the fraction of earnings it pays in dividends so that b falls to .25, the rate of growth in the dividend would then fall to br = (.25) (.10) = .025. However, over the period that spans the rise in the dividend payout rate, the dividend would have grown at an even higher rate than the prior 6%. It would only be correct to project the past rate of growth in the dividend into the future on the highly implausible assumption that the company is expected periodically to raise its payout rate. Therefore, unless there is convincing evidence to the contrary, <u>current expectations of b and r provide the best basis for forecasting future growth.</u>

C. Cost of Equity Capital for AT&T

Under the method we have advocated for estimating future growth, the DCF formula for a company's cost of equity capital is:

$$k = \frac{D_1}{P_0} + br. \qquad (8)$$

To arrive at a company's current value of k, the current value of each of the quantities on the right-hand side of Equation (8) must be determined. This is done below for AT&T. As we will see, obtaining estimates of these values is extremely difficult in the turbulence of today's capital markets.

1. Dividend Yield

We argued above that the projected dividend yield is appropriate for setting the allowed rate of return on equity. The current quarterly dividend payable on April 1, 1980, is $1.25. The Value Line forecast for dividends over the next 12 months has been reduced from $5.20 in June, 1979, to a current forecast of $5.00.[1] Value Line reduced its forecast dividend even though it was aware of AT&T's stated intent to maintain shareholders real dividend income against inflation.[2] For the last few years AT&T has followed a policy of raising its dividend in the first quarter. With the recent declaration of the dividend to be paid on April 1, 1980 maintained at $1.25,

---

[1] Value Line, March 15, 1980.

[2] Value Line, February 1, 1980.

the Value Line estimate appears reasonable, and we will use a dividend of $5.00, equal to the annualized value of the current quarterly dividend of $1.25.[1]

We have also argued that we should use the share price on the date for which the estimate was made. Since this testimony was finalized on March 29, 1980, we will use the company's closing price on the previous day, that is, P_o = $48.50, which results in a dividend yield of $5.00/ $48.50 = 10.31%.

Ordinarily, for periods of up to a few months, the price of a public utility share only fluctuates in a narrow range, and the choice among the prevailing prices is usually of no particular significance. However, the impact of inflation during the second half of 1979 and the actions and statements of the Federal Reserve Board and other government officials (beginning in October and culminating in President Carter's recent anti-inflation program) have had a striking impact on the capital markets. Short-term interest rates have risen sharply, and the yields and prices on long-term securities have fluctuated dramatically. In particular, as can be seen in Schedule 20, AT&T's stock fell from $57.83 on June 30, 1979, to $55 on September 30, 1979. Since then it has decreased steadily to a low of $45 on March 7, 1980, before rising to the current price of $48.50 on March 28, 1980. During the same period its dividend

[1] Projection of a higher dividend in the current economic environment would require a downward revision in the growth rate forecasts below.

yield rose steadily from 8.99% on June 30, 1979, to the current projected yield of 10.31%. This was due mainly to the effects of its dropping share price, but also to the reduction in its projected dividend from $5.20 to $5.00.

Through their impact on the dividend yield, the date and the share price used to arrive at AT&T's cost of equity capital have a material impact on the value obtained for k. In other words, in a period over which interest rates fluctuate widely, share prices and the cost of equity capital also fluctuate widely. At the time this testimony was prepared, the reaction to President Carter's anti-inflation program was unknown. Although our estimated dividend yield of 10.31% represents our best estimate at this time, the unfolding reaction to the President's program may cause AT&T's dividend yield to vary considerably over the next few months.

2. Growth Rate - Past Financial Data

In order to arrive at AT&T's growth rate, we require the retention rate, b, and the rate of return on common equity, r, that investors may reasonably expect.

As a first step, let us estimate b and r using only historical data. Schedule 21 shows the underlying data for the years 1975 to 1979 that is needed to calculate b and r.

For the rate of return on common equity that investors expect, we first not that a simple average of the five values of r_t (row 5) from 1975 to 1979 is 11.81%. However, inspection of the annual values reveal that although r was abnormally depressed in 1975, its values for the next three years exhibited a definite upward trend, and then only declined slightly in 1979. Investors now might well believe that the material rise in the cost of capital between 1975 and 1979 justifies the rates of return the company realized in the more recent years, in which case they would rely primarily on the 1978 and 1979 figures in forecasting the company's future rate of return. A simple average of these figures is 13.05% and it seems reasonable that investors might conclude that 13% represents the best estimate of the long-term return AT&T is expected to earn on common equity.

For the retention rate that investors expect, we first note that a simple average of the five values of b_t (row 9) from 1975 to 1979 is 37.23%. However, this average is affected by the low retention rate in 1975, and in recent years, 1977-1979, the retention rate has averaged 38.93%. It seems reasonable that on the basis of this data, investors might use these recent years, and arrive at 39% as the best estimate of AT&T's retention ratio.

Combining the above values (obtained by using historical values in Equation (8) for P_0, D_1, b, and r) provides an estimate of AT&T's cost of equity capital as of March 28, 1980, of:

$$k = \frac{D_1}{P_o} + br$$

$$= \frac{\$5.00}{\$48.50} + (.39)(.13)$$

$$= .1031 + .0507 = 15.38\% .$$

However, before accepting this result it may be instructive to pose the following question: What would have been the estimate for k as of June 30, 1979?

3. Growth Rate - Recent Developments

On June 30, 1979, Value Line estimated that AT&T's 1979 earnings would be $8.00 per share. The actual value of earnings per share for 1979 was $8.04. Since we would have been reluctant to estimate k at that time without 1979 data, we would have relied on the Value Line forecast to complete the 1979 annual data, a procedure we have used in the past. Since the Value Line estimates were extremely close to the actual 1979 results, using these estimates and the historical data would have produced the same estimates of b and r obtained previously. It is obvious that if the data and analysis do not change materially, we would obtain the same measurement of the growth rate at any point between June 30, 1979, and March 28, 1980.

The estimates which would have been obtained on two previous dates are provided below:

Date	D_1/P_0	+	br	=	k
June 30, 1979	8.99%		5.07%		14.06%
November 19, 1979	9.39%		5.07%		14.46%

An estimate is provided for November 19, 1979, for comparative purposes, since an estimate of k was obtained for Rochester Telephone Co. on that date of 14.85%.[1] The difference in k between Rochester Telephone and AT&T may be attributed to AT&T's slightly lower business risk due to its greater diversification.

The problem can now be easily seen. The estimate of 15.38% obtained for AT&T is correct only if we assume that the large increase in the expected rate of inflation (which raised the dividend yield on AT&T from 8.99% on June 30, 1979, to 10.31% on March 28, 1980) had no effect on the anticipated growth in the dividend.

It is extremely unlikely that investors believe that to be true. The rise in the expected rate of inflation has not only increased interest rates, but also the expected rate at which AT&T's other costs of production, such as materials and labor, will grow. A continued expectation that the company will earn a return on common of 13% and retain 39% of earnings would require the belief that the rate of growth in its revenues will rise to match

---

1 Myron J. Gordon, Direct Testimony, Before the State of New York Public Utility Commission, In the Matter of Rochester Telephone Co., November 20, 1979.

the rise in the rate of growth of its costs. However, if investors fear that the regulatory process will not be fully responsive to the increase in the rate at which the company's costs are rising, they will revise their growth estimate downward. That is, with any regulatory lag in the pass through of higher costs, a rise in the expected inflation rate would reduce investor estimates of long-run return on common equity, and would, therefore, result in a downward revision of expected growth. In that event, simply raising the estimate of AT&T's cost of equity capital by the increase in the dividend yield would result in an overstatement of the required return.

It is our judgment that the response of investors to the rise in the expected rate of inflation has been a downward revision in expectations regarding AT&T's rate of return on common equity, implying a downward revision in its retention rate also. In support of this position, we note that Value Line lowered its prediction of 1980 earnings per share for AT&T to $7.50, and lowered its predicted 1980 dividend per share to $5.00.[1] This implies for 1980 an estimate for r of 11.60% and an estimate for b of 33.33%.

Under the present turbulent economic conditions it is extremely difficult to estimate with precision the extent

---

[1] Value Line, February 1, 1980.

to which these rates have been revised downward. If the revised figures are a 12.50% return on common equity and a 37% retention rate, then the estimated growth rate must be reduced from 5.07% to 4.63%.[1] Adding the latter figure to the current dividend yield of 10.31% results in a cost of equity capital of 14.94%. On the other hand, the rise in interest rates over the past six months may be taken as evidence that the cost of equity capital has gone up over the same time period. Hence, in some measure, this rise in interest [illegible] will lead to an upward revision in the [illegible] of return allowed by the numerous regulatory commissions that set rates for AT&T. A generous allowance for the favorable impact of increases in the allowed rates of return on invest[illegible] forecasts of the AT&T growth rate is a rise in its value from the above 4.63% to 5.25%. This latter growth rate combined with the 10.31% dividend yield re[illegible] equity capital of 15.56%. In our judgment the AT&T cost of equity capital may well be as low as 15.0%, [illegible] unlikely to be above 15.5%, and 15.25% represents our best estimate as of March 28, 1980.

---

1 Using this reasoning, the growth rate was adjusted downward by 69 basis points for Rochester Telephone. Ibid., Supplemental Prepared Direct Testimony, March 24, 1980.

RFS Advance Access published March 17, 2007

A Comprehensive Look at The Empirical Performance of Equity Premium Prediction*

Amit Goyal
Emory University
Goizueta Business School†

Ivo Welch
Brown University
Department of Economics
NBER‡

January 3, 2007

Abstract

Our paper comprehensively reexamines the performance of variables that have been suggested by the academic literature to be good predictors of the equity premium. We find that by and large, these models have predicted poorly both in-sample and out-of-sample for thirty years now; these models seem unstable, as diagnosed by their out-of-sample predictions and other statistics; and these models would not have helped an investor with access only to available information to profitably time the market.

*Thanks to Malcolm Baker, Ray Ball, John Campbell, John Cochrane, Francis Diebold, Ravi Jagannathan, Owen Lamont, Sydney Ludvigson, Rajnish Mehra, Michael Roberts, Jay Shanken, Samuel Thompson, Jeff Wurgler, and Yihong Xia for comments, and Todd Clark for providing us with some critical McCracken values. We especially appreciate John Campbell and Sam Thompson for challenging our earlier drafts, and iterating mutually over working papers with opposite perspectives.

†http://www.goizueta.emory.edu/agoyal. E-mail: amit_goyal@bus.emory.edu.
‡http://welch.econ.brown.edu. E-mail: ivo_welch@brown.edu.

JEL Classification: G12, G14.

1 Introduction

Attempts to predict stock market returns or the equity premium have a long tradition in finance. As early as 1920, Dow (1920) explored the role of dividend ratios. A typical specification regresses an independent lagged predictor on the stock market rate of return or, as we shall do, on the equity premium,

$$\text{Equity Premium}(t) = \gamma_0 + \gamma_1 \cdot x(t-1) + \epsilon(t) \quad . \tag{1}$$

γ_1 is interpreted as a measure of how significant x is in predicting the equity premium. The most prominent x variables explored in the literature are the dividend price ratio and dividend yield, the earnings price ratio and dividend-earnings (payout) ratio, various interest rates and spreads, the inflation rates, the book-to-market ratio, volatility, the investment-capital ratio, the consumption, wealth, and income ratio (CAY), and aggregate net or equity issuing activity.

The literature is difficult to absorb. Different papers use different techniques, variables, and time periods. Results from papers that were written years ago may change when more recent data is used. Some papers contradict the findings of others. Still, most readers are left with the impression that "prediction works"—though it is unclear exactly what works. The prevailing tone in the literature is perhaps best summarized by Lettau and Ludvigson (2001, p.842)

> It is now widely accepted that excess returns are predictable by variables such as dividend-price ratios, earnings-price ratios, dividend-earnings ratios, and an assortment of other financial indicators.

There are also a healthy number of current papers which further cement this perspective; and a large theoretical and normative literature has developed that stipulates how investors should allocate their wealth as a function of the aforementioned variables.

The goal of our own paper is to comprehensively reexamine the empirical evidence as of early 2006, evaluating each variable using the same methods (mostly, but not only, in linear models), time-periods, and estimation frequencies. The evidence suggests that most models are unstable or even spurious. Most models are no longer significant even in-sample (IS), and the few models that still are usually fail simple regression diagnostics. Most models have performed poorly for over thirty years IS. For many models, any earlier apparent statistical significance was often based exclusively on years up to *and especially on* the years of the Oil Shock of 1973-5. Most models have poor out-of-sample (OOS) performance, but not in a way that merely suggests lower power than IS tests. They predict poorly late in the sample, not early in the sample. (For many variables, we have difficulty finding robust statistical significance even when they are examined only during their most favorable contiguous OOS sub-period.) Finally, the OOS performance is not only a useful model diagnostic for the IS regressions, but also interesting in itself for an investor who had sought to use these models for market-timing. Our evidence suggests that the models would not have helped such an investor.

Therefore, although it is possible to search for, to occasionally stumble upon and then to defend some seemingly statistically significant models, we interpret our results to suggest that a healthy skepticism is appropriate when it comes to predicting the equity premium, at least as of early 2006. The models seem not robust.

Our paper now proceeds as follows. We describe our data—available at the RFS website—in Section 2 and our tests in Section 3. Section 4 explores our base case—predicting equity premia annually using OLS forecasts. In Sections 5 and 6, we predict equity premia on five-year and monthly horizons, the latter with special emphasis on the suggestions in Campbell and Thompson (2005). Section 7 tries earnings and dividend ratios with longer memory as independent variables, corrections for persistence in regressors, and encompassing model forecasts. Section 8 reviews earlier literature. Section 9 concludes.

2 Data Sources and Data Construction

Our dependent variable is always the equity premium, i.e., the total rate of return on the stock market minus the prevailing short-term interest rate.

Stock Returns: We use S&P 500 index returns from 1926 to 2005 from CRSP's month-end values. Stock returns are the continuously compounded returns on the S&P 500 index, including dividends. For yearly and longer data frequencies, we can go back as far as 1871, using data from Robert Shiller's website. For monthly frequency, we can only begin in the CRSP period, i.e., 1927.

Risk-free Rate: The risk-free rate from 1920 to 2005 is the T-bill rate. Because there was no risk-free short-term debt prior to the 1920's, we had to estimate it. Commercial paper rates for New York City are from the NBER's Macrohistory data base. These are available from 1871 to 1970. We estimated a regression from 1920 to 1971, which yielded

$$\text{T-bill Rate} = -0.004 + 0.886 \cdot \text{Commercial Paper Rate}, \qquad (2)$$

with an R^2 of 95.7%. Therefore, we instrumented the risk-free rate from 1871 to 1919 with the predicted regression equation. The correlation for the period 1920 to 1971 between the equity premium computed using the actual T-bill rate and that computed using the predicted T-bill rate (using the commercial paper rate) is 99.8%.

The equity premium had a mean (standard deviation) of 4.85% (17.79%) over the entire sample from 1872 to 2005; 6.04% (19.17%) from 1927 to 2005; and 4.03% (15.70%) from 1965 to 2005.

Our first set of independent variables are primarily stock characteristics:

Dividends: Dividends are twelve-month moving sums of dividends paid on the S&P 500 index. The data are from Robert Shiller's website from 1871 to 1970.

Dividends from 1971 to 2005 are from the S&P Corporation. The **Dividend Price Ratio** (**d/p**) is the difference between the log of dividends and the log of prices. The **Dividend Yield** (**d/y**) is the difference between the log of dividends and the log of *lagged* prices. (See, e.g., Ball (1978), Campbell (1987), Campbell and Shiller (1988a, 1988b), Campbell and Viceira (2002), Campbell and Yogo (2006), the survey in Cochrane (1997), Fama and French (1988), Hodrick (1992), Lewellen (2004), Menzly, Santos, and Veronesi (2004), Rozeff (1984), and Shiller (1984).)

Earnings: Earnings are twelve-month moving sums of earnings on the S&P 500 index. The data are again from Robert Shiller's website from 1871 to June 2003. Earnings from June 2003 to December 2005 are our own estimates based on interpolation of quarterly earnings provided by the S&P Corporation. The **Earnings Price Ratio** (**e/p**) is the difference between the log of earnings and the log of prices. (We also consider variations, in which we explore multi-year moving averages of numerator or denominator, e.g., as in $\mathbf{e}^{10}/\mathbf{p}$, which is the moving ten-year average of earnings divided by price.) The **Dividend Payout Ratio** (**d/e**) is the difference between the log of dividends and the log of earnings. (See, e.g., Campbell and Shiller (1988a, 1998) and Lamont (1998).)

Stock Variance (**svar**): Stock Variance is computed as sum of squared daily returns on the S&P 500. G. William Schwert provided daily returns from 1871 to 1926; data from 1926 to 2005 are from CRSP. (See Guo (2006).)

Cross-Sectional Premium (**csp**): The cross-sectional beta premium measures the relative valuations of high- and low-beta stocks and is proposed in Polk, Thompson, and Vuolteenaho (2006). The **csp** data are from Samuel Thompson from May 1937 to December 2002.

Book Value: Book values from 1920 to 2005 are from Value Line's website, specifically their *Long-Term Perspective Chart* of the Dow Jones Industrial Average. The **Book to Market Ratio** (**b/m**) is the ratio of book value to market value for the Dow Jones Industrial Average. For the months from March to December, this is computed by dividing book value at the end of the previous year by the price at the end of the current month. For the months of January and February, this is computed by dividing book value at the end of two years ago by the price at the end of the current month. (See, e.g, Kothari and Shanken (1997) and Pontiff and Schall (1998).)

Corporate Issuing Activity: We entertain two measures of corporate issuing activity. **Net Equity Expansion** (**ntis**) is the ratio of twelve-month moving sums of net issues by NYSE listed stocks divided by the total end-of-year market capitalization of NYSE stocks. This dollar amount of net equity issuing activity (IPOs, SEOs, stock repurchases, less dividends) for NYSE listed stocks is computed from CRSP data as

$$\text{Net Issue}_t \;=\; \text{Mcap}_t - \text{Mcap}_{t-1} \cdot (1 + \text{vwretx}_t)\ , \tag{3}$$

where Mcap is the total market capitalization, and vwretx is the value weighted return (excluding dividends) on the NYSE index.[1] These data are available from 1926 to 2005. **ntis** is closely related, but not identical, to a variable proposed in Boudoukh, Michaely, Richardson, and Roberts (2005). The second measure, **Percent Equity Issuing** (**eqis**), is the ratio of equity issuing activity as a fraction of total issuing activity. This is the variable proposed in Baker and Wurgler (2000). The authors provided us with the data, except for 2005, which we added ourselves. The first equity issuing measure is relative to aggregate market cap, while the second is relative to aggregate corporate issuing.

Our next set of independent variables is interest-rate related:

Treasury Bills (**tbl**): T-bill rates from 1920 to 1933 are the *U.S. Yields On Short-Term United States Securities, Three-Six Month Treasury Notes and Certificates, Three Month Treasury* series in the NBER Macrohistory data base. T-bill rates from 1934 to 2005 are the *3-Month Treasury Bill: Secondary Market Rate* from the

[1] This calculation implicitly assumes that the delisting return is –100 percent. Using the actual delisting return, where available, or ignoring delistings altogether, has no impact on our results.

economic research data base at the Federal Reserve Bank at St. Louis (FRED). (See, e.g., Campbell (1987) and Hodrick (1992).)

Long Term Yield (**lty**): Our long-term government bond yield data from 1919 to 1925 is the *U.S. Yield On Long-Term United States Bonds* series in the NBER's Macrohistory data base. Yields from 1926 to 2005 are from Ibbotson's *Stocks, Bonds, Bills and Inflation Yearbook*, the same source that provided the **Long Term Rate of Returns** (**ltr**). The **Term Spread** (**tms**) is the difference between the long term yield on government bonds and the T-bill. (See, e.g., Campbell (1987) and Fama and French (1989).)

Corporate Bond Returns: Long-term corporate bond returns from 1926 to 2005 are again from Ibbotson's *Stocks, Bonds, Bills and Inflation Yearbook*. **Corporate Bond Yields** on AAA and BAA-rated bonds from 1919 to 2005 are from FRED. The **Default Yield Spread** (**dfy**) is the difference between BAA and AAA-rated corporate bond *yields*. The **Default Return Spread** (**dfr**) is the difference between long-term corporate bond and long-term government bond *returns*. (See, e.g., Fama and French (1989) and Keim and Stambaugh (1986).)

Inflation (**infl**): Inflation is the *Consumer Price Index (All Urban Consumers)* from 1919 to 2005 from the Bureau of Labor Statistics. Because inflation information is released only in the following month, we wait for one month before using it in our monthly regressions. (See, e.g., Campbell and Vuolteenaho (2004), Fama (1981), Fama and Schwert (1977), and Lintner (1975).)

Like inflation, our next variable is also a common broad macroeconomic indicator.

Investment to Capital Ratio (**i/k**): The investment to capital ratio is the ratio of aggregate (private nonresidential fixed) investment to aggregate capital for the whole economy. This is the variable proposed in Cochrane (1991). John Cochrane kindly provided us with updated data.

Of course, many papers explore multiple variables. For example, Ang and Bekaert (2003) explore both interest rate and dividend related variables. In addition to simple univariate prediction models, we also entertain two methods that rely on multiple variables (**all** and **ms**), and two models that are rolling in their independent variable construction (**cay** and **ms**).

A "Kitchen Sink" Regression (**all**): This includes all the aforementioned variables. (It does not include **cay**, described below, partly due to limited data availability of **cay**.)

Consumption, wealth, income ratio (**cay**): Lettau and Ludvigson (2001) estimate the following equation:

$$c_t = \alpha + \beta_a \cdot a_t + \beta_y \cdot y_t + \sum_{i=-k}^{k} b_{a,i} \cdot \Delta a_{t-i} + \sum_{i=-k}^{k} b_{y,i} \cdot \Delta y_{t-i} + \epsilon_t, \quad t = k+1, \ldots, T-k, \tag{4}$$

where c is the aggregate consumption, a is the aggregate wealth, and y is the aggregate income. Using estimated coefficients from the above equation provides **cay** $\equiv \widehat{\text{cay}}_t = c_t - \hat{\beta}_a \cdot a_t - \hat{\beta}_y \cdot y_t, \quad t = 1, \ldots, T$. Note that, unlike the estimation equation, the fitting equation does not use look-ahead data. Eight leads/lags are used in quarterly estimation ($k = 8$) while two lags are used in annual estimation ($k = 2$). (For further details, see Lettau and Ludvigson (2001).) Data for **cay**'s construction are available from Martin Lettau's website at quarterly frequency from the second quarter of 1952 to the fourth quarter of 2005. Although annual data from 1948 to 2001 is also available from Martin Lettau's website, we reconstruct the data following their procedure as this allows us to expand the time-series from 1945 to 2005 (an addition of 7 observations).

Because the Lettau-Ludvigson measure of **cay** is constructed using look-ahead (in-sample) estimation regression coefficients, we also created an equivalent measure that excludes advance knowledge from the estimation equation and thus uses only prevailing data. In other words, if the current time period is 's', then we estimated equation (4) using only the data up to 's' through

$$c_t = \alpha + \beta_a^s \cdot a_t + \beta_y^s \cdot y_t + \sum_{i=-k}^{k} b_{a,i}^s \cdot \Delta a_{t-i} + \sum_{i=-k}^{k} b_{y,i}^s \cdot \Delta y_{t-i} + \epsilon_t, t = k+1, \ldots, s-k, \quad (5)$$

This measure is called **caya** ("ante") to distinguish it from the traditional variable **cayp** constructed with look-ahead bias ("post"). The superscript on the betas indicates that these are rolling estimates, i.e., a set of coefficients used in the construction of one $\mathbf{caya}_S$ measure in one period.

A **model selection** approach, named "**ms**." If there are K variables, we consider 2^K models essentially consisting of all possible combinations of variables. (As with the kitchen sink model, **cay** is not a part of the **ms** selection.) Every period, we select one of these models that gives the minimum cumulative prediction errors up to time t. This method is based on Rissanen (1986) and is recommended by Bossaerts and Hillion (1999). Essentially, this method uses our criterion of minimum OOS prediction errors to choose amongst competing models *in each time period* t. This is also similar in spirit to the use of a more conventional criterion (like R^2) in Pesaran and Timmerman (1995) (who do not entertain our NULL hypothesis). This selection model also shares a certain flavor with our encompassing tests in Section 7, where we seek to find an optimal rolling combination between each model and an unconditional historical equity premium average, and with the Bayesian model selection approach in Avramov (2002).

The latter two models, **cay** and **ms**, are revised every period, which render in-sample regressions problematic. This is also why we did not include **caya** in the kitchen sink specification.

3 Empirical Procedure

Our base regression coefficients are estimated using OLS, although statistical significance is always computed from bootstrapped F-statistics (taking correlation of independent variables into account).

OOS statistics: The OOS forecast uses only the data available up to the time at which the forecast is made. Let e_{N} denote the vector of rolling OOS errors from the historical mean model and e_{A} denote the vector of rolling OOS errors from the OLS model. Our OOS statistics are computed as

$$\begin{aligned} R^2 &= 1 - \frac{\text{MSE}_{\mathsf{A}}}{\text{MSE}_{\mathsf{N}}} \quad , \quad \overline{R}^2 = R^2 - (1 - R^2) \cdot \left(\frac{T-k}{T-1} \right) \quad , \\ \Delta\text{RMSE} &= \sqrt{\text{MSE}_{\mathsf{N}}} - \sqrt{\text{MSE}_{\mathsf{A}}} \quad , \\ \text{MSE-F} &= (T - h + 1) \cdot \left(\frac{\text{MSE}_{\mathsf{N}} - \text{MSE}_{\mathsf{A}}}{\text{MSE}_{\mathsf{A}}} \right) \quad , \end{aligned} \tag{6}$$

where h is the degree of overlap ($h = 1$ for no overlap). MSE-F is McCracken's (2004) F-statistic. It tests for equal MSE of the unconditional forecast and the conditional forecast (i.e., $\Delta\text{MSE} = 0$).[2] We generally do not report MSE-F statistics, but instead use their bootstrapped critical levels to provide statistical significance levels via stars in the tables.

For our encompassing tests in Section 7, we compute

$$\text{ENC} = \frac{T - h + 1}{T} \cdot \frac{\sum_{t=1}^{T} \left(e_{\mathsf{N}t}^2 - e_{\mathsf{N}t} \cdot e_{\mathsf{A}t} \right)}{\text{MSE}_{\mathsf{A}}} \quad , \tag{7}$$

which is proposed by Clark and McCracken (2001). They also show that the MSE-F and ENC statistics follow non-standard distributions when testing nested models, because the asymptotic difference in squared forecast errors is exactly 0 with 0 variance under the NULL, rendering the standard distributions asymptotically invalid. Because our models are nested, we could use asymptotic critical values for MSE tests provided by McCracken, and asymptotic critical values for ENC tests provided by

[2] Our earlier drafts also entertained another performance metric, the mean absolute error difference ΔMAE. The results were similar. These drafts also described another OOS-statistic, MSE-T $= \sqrt{T + 1 - 2 \cdot h + h \cdot (h-1)/T} \cdot \left[\overline{d} / \widehat{se}\left(\overline{d} \right) \right]$, where $d_t = e_{\mathsf{N}t} - e_{\mathsf{A}t}$, and $\overline{d} = T^{-1} \cdot \sum_t^T d_t = \text{MSE}_{\mathsf{N}} - \text{MSE}_{\mathsf{A}}$ over the entire OOS period, and T is the total number of forecast observations. This is the Diebold and Mariano (1995) t-statistic modified by Harvey, Leybourne, and Newbold (1997). (We still use the latter as bounds in our plots, because we know the full distribution.) Again, the results were similar. We chose to use the MSE-F in this paper because Clark and McCracken (2001) find that MSE-F has higher power than MSE-T.

Clark and McCracken. However, because we use relatively small samples, because our independent variables are often highly serially correlated, and especially because we need critical values for our five-year *overlapping* observations (for which asymptotic critical values are not available), we obtain critical values from the bootstrap procedure described below. (The exceptions are that critical values for **caya**, **cayp**, and **all** models are not calculated using a bootstrap, and critical values for **ms** model are not calculated at all.) The NULL hypothesis is that the unconditional forecast is not inferior to the conditional forecast, so our critical values for OOS test are for a one-sided test (critical values of IS tests are, as usual, based on two-sided tests).[3]

Bootstrap: Our bootstrap follows Mark (1995) and Kilian (1999) and imposes the NULL of no predictability for calculating the critical values. In other words, the data generating process is assumed to be

$$\begin{aligned} y_{t+1} &= \alpha \qquad\qquad + u_{1t+1} \\ x_{t+1} &= \mu + \rho \cdot x_t + u_{2t+1} \qquad . \end{aligned}$$

The bootstrap for calculating power assumes the data generating process is

$$\begin{aligned} y_{t+1} &= \alpha + \beta \cdot x_t + u_{1t+1} \\ x_{t+1} &= \mu + \rho \cdot x_t + u_{2t+1} \qquad , \end{aligned}$$

where both β and ρ are estimated by OLS using the full sample of observations, with the residuals stored for sampling. We then generate 10,000 bootstrapped time series by drawing with replacement from the residuals. The initial observation—preceding the sample of data used to estimate the models—is selected by picking one date from the actual data at random. This bootstrap procedure not only preserves the autocorrelation structure of the predictor variable, thereby being valid under the

[3]If the regression coefficient β is small (so that explanatory power is low or the in-sample R^2 is low), it may happen that our unconditional model outperforms on OOS because of estimation error in the rolling estimates of β. In this case, ΔRMSE might be negative but still significant *because these tests are ultimately tests of whether* β *is equal to zero.*

Stambaugh (1999) specification, but also preserves the cross-correlation structure of the two residuals.[4]

Statistical Power: Our paper entertains both IS and OOS tests. Inoue and Kilian (2004) show that the OOS tests used in this paper are less powerful than IS tests, even though their size properties are roughly the same. Similar critiques of the OOS tests in our paper have been noted by Cochrane (2005) and Campbell and Thompson (2005). We believe this is the wrong way to look at the issue of power for two reasons:

1. It is true that under a well-specified stable underlying model, an IS OLS estimator is more efficient. Therefore, a researcher who has complete confidence in her underlying model specification (but not the underlying model parameters) should indeed rely on IS tests to establish significance—the alternative of OOS tests does have lower power. However, the point of any regression diagnostics, such as those for heteroskedasticity and autocorrelation, is always to subject otherwise seemingly successful regression models to a number of reasonable diagnostics when there is some model uncertainty. Relative to not running the diagnostic, by definition, any diagnostic that can reject the model at this stage sacrifices power *if* the specified underlying model is correct. In our forecasting regression context, OOS performance just happens to be one natural and especially useful diagnostic statistic. It can help determine whether a model is stable and well-specified, or changing over time, either suddenly or gradually.

   This also suggests why the simple power experiment performed in some of the aforementioned critiques of our own paper is wrong. It is unreasonable to propose a model if the IS performance is insignificant, regardless of its OOS performance. Reasonable (though not necessarily statistically significant) OOS performance is not a substitute, but a necessary complement for IS performance in order to establish the quality of the underlying model specification. The thought experiments and analyses in the critiques, which simply compare the power of

[4]We do not bootstrap for **cayp** because it is calculated using ex-post data; for **caya** and **ms** because these variables change each period; and for **all** because of computational burden.

OOS tests to that of IS tests, especially under their assumption of a correctly specified stable model, is therefore incorrect. The correct power experiment instead should explore whether *conditional on observed IS significance*, OOS diagnostics are reasonably powerful. We later show that they are.

Not reported in the tables, we also used the CUSUMQ test to test for model stability. Although this is a weak test, we can reject stability for all monthly models; and for all annual models except for **ntis**, **i/k**, and **cayp**, when we use data beginning in 1927. Thus, the CUSUMQ test sends the same message about the models as the findings that we shall report.

2. All of the OOS tests in our paper do not fail in the way the critics suggest. Low power OOS tests would produce relatively poor predictions early and relatively good predictions late in the sample. Instead, all of our models show the opposite behavior—good OOS performance early, bad OOS performance late.

   A simple alternative OOS estimator, which downweights early OOS predictions relative to late OOS predictions, would have more power than our unweighted OOS prediction test. Such a modified estimator would both be more powerful *and* it would show that all models explored in our paper perform even worse. (We do not use it only to keep it simple and to avoid a "cherry-picking-the-test" critique.)

Estimation Period: It is not clear how to choose the periods over which a regression model is estimated and subsequently evaluated. This is even more important for OOS tests. Although any choice is necessarily ad-hoc in the end, the criteria are clear. It is important to have enough initial data to get a reliable regression estimate at the start of evaluation period, and it is important to have an evaluation period that is long enough to be representative. We explore three time period specifications: the first begins OOS forecasts twenty years after data are available; the second begins OOS forecast in 1965 (or twenty years after data are available, whichever comes later); the third ignores all data prior to 1927 even in the estimation.[5] If a

[5]We also tried estimating our models only with data after World-War II, as recommended by

variable does not have complete data, some of these time-specifications can overlap. Using three different periods reflects different tradeoffs between the desire to obtain statistical power and the desire to obtain results that remain relevant today. In our graphical analysis later, we also evaluate the rolling predictive performance of variables. This analysis helps us identify periods of superior or inferior performance and can be seen as invariance to the choice of the OOS evaluation period (though not the estimation period).

4 Annual Prediction

Table 1: Annual Performance

Figure 1

Figure 2

Table 1 shows the predictive performance of the forecasting models on annual forecasting horizons. Figures 1 and 2 graph the IS and OOS performance of variables in Table 1. For the IS regressions, the performance is the cumulative squared demeaned equity premium minus the cumulative squared regression residual. For the OOS regressions, this is the cumulative squared prediction errors of the prevailing mean minus the cumulative squared prediction error of the predictive variable from the linear historical regression. Whenever a line increases, the ALTERNATIVE predicted better; whenever it decreases, the NULL predicted better. The units in the graphs are not intuitive, but the time-series pattern allows diagnosis of years with good or bad performance. Indeed, the final ΔSSE statistic in the OOS plot is sign-identical with the ΔRMSE statistic in our tables. The standard error of all the observations in the graphs is based on translating MSE-T statistic into symmetric 95% confidence intervals based on the McCracken (2004) critical values; the tables differ in using the MSE-F statistic instead.

The reader can easily adjust perspective to see how variations in starting or ending date would impact the conclusion—by shifting the graph up or down (redrawing the y=0 horizontal zero line). Indeed, a horizontal line and the right-side scale

Lewellen (2004). Some properties in some models change, especially when it comes to statistical significance and the importance of the Oil Shock for one variable, **d/p**. However, the overall conclusions of our paper remain.

indicate the equivalent zero-point for the second time period specification, in which we begin forecasts in 1965 (this is marked "Spec B Zero Val" line). The plots have also vertically shifted the IS errors, so that the IS line begins at zero on the date of our first OOS prediction. The Oil Shock recession of 1973 to 1975, as identified by the NBER, is marked by a vertical (red) bar in the figures.[6]

In addition to the figures and tables, we also summarize models' performances in small in-text summary tables, which give the IS-$\overline{R}^2$ and OOS-$\overline{R}^2$ for two time periods: the most recent 30 years and the entire sample period. The $\overline{R}^2$ for the subperiod is not the $\overline{R}^2$ for a different model estimated only over the most recent three decades, but the residual fit for the overall model over the subset of data points (e.g., computed simply as 1-SSE/SST for the last 360 residuals). The most recent three decades after the Oil Shock can help shed light on whether a model is likely to still perform well nowadays. Generally, it is easiest to understand the data by looking first at the figures, then at the in-text table, and finally at the full table.

A well-specified signal would inspire confidence in a potential investor if it had

1. both significant IS and reasonably good OOS performance over the entire sample period;
2. a generally upward drift (of course, an irregular one);
3. an upward drift which occurs not just in one short or unusual sample period—say just the two years around the Oil Shock;
4. an upward drift that remains positive over the most recent several decades—otherwise, even a reader taking the long view would have to be concerned with the possibility that the underlying model has drifted.

There are also other diagnostics that stable models should pass (heteroskedasticity, residual autocorrelation, etc.), but we do not explore them in our paper.

[6]The actual recession period was from November 1973 to March 1975. We treat both 1973 and 1975 as years of Oil Shock recession in annual prediction.

4.1 In-Sample Insignificant Models

As already mentioned, if a model has no IS performance, its OOS performance is not interesting. However, because some of the IS insignificant models are so prominent, and because it helps to understand why they may have been considered successful forecasters in past papers, we still provide some basic statistics and graph their OOS performance. The most prominent such models are the following:

Dividend Price Ratio: Figure 1 shows that there were four distinct periods for the **d/p** model, and this applies both to IS and OOS performance. **d/p** had mild underperformance from 1905 to WW-II, good performance from WW-II to 1975, neither good nor bad performance until the mid-1990s, and poor performance thereafter. The best sample period for **d/p** was from the mid 1930s to the mid 1980s. For the OOS, it was 1937 to 1984, although over half of the OOS performance was due to the Oil Shock. Moreover, the plot shows that the OOS performance of the **d/p** regression was consistently worse than the performance of its IS counterpart. The distance between the IS and OOS performance increased steadily until the Oil Shock.

Over the most recent 30 years (1976 to 2005), **d/p**'s performance is negative both IS and OOS. Over the entire period, **d/p** underperformed the prevailing mean OOS, too:

d/p	Recent 30 Years	All Years
IS $\bar{R}^2$	−4.80%	0.49%
OOS $\bar{R}^2$	−15.14%	−2.06%

Dividend Yield: Figure 1 shows that the **d/y** model's IS patterns look broadly like those of **d/p**. However, its OOS pattern was much more volatile: **d/y** predicted equity premia well during the Great Depression (1930 to 1933), the period from World War II to 1958, the Oil Shock of 1973-1975, and the market decline of 2000-2002. It had large prediction errors from 1958 to 1965 and from 1995 to 2000, and it had unremarkable performance in other years. The best OOS sample period started around 1925 and ended either in 1957 or 1975. The Oil Shock did not play an important role for **d/y**. Over the most recent 30 years, **d/y**'s performance is again negative IS and OOS. The full-sample OOS performance is also again negative:

d/y	Recent 30 Years	All Years
IS $\overline{R}^2$	−5.52%	0.91%
OOS $\overline{R}^2$	−20.79%	−1.93%

Earnings Price Ratio: Figure 1 shows that **e/p** had inferior performance until WW-II, and superior performance from WW-II to the late 1970s. After the Oil Shock, it had generally non-descript performance (with the exception of the late 1990s and early 2000s). Its best sample period was 1943 to 2002. 2003 and 2004 were bad years for this model. Over the most recent 30 years, **e/p**'s performance is again negative IS and OOS. The full-sample OOS performance is negative too.

e/p	Recent 30 Years	All Years
IS $\overline{R}^2$	−2.08%	1.08%
OOS $\overline{R}^2$	−5.98%	−1.78%

Table 1 shows that these three price ratios are not statistically significant IS at the 90% level. However, some disagreement in the literature can be explained by differences in the estimation period.[7]

[7] For example, the final lines in Table 1 show that **d/y** and **e/p** had positive and statistically significant IS performance at the 90% level if all data prior to 1927 is ignored. Nevertheless, Table 1 also shows that the OOS-$\overline{R}^2$ performance remains negative for both of these. Moreover, when the data begins in 1927 and the forecast begins in 1947 (another popular period choice), we find

(Data Begins in 1927)	**e/p**		**d/y**	
(Forecast Begins in 1947)	Recent 30 Years	All Years	Recent 30 Years	All Years
IS $\overline{R}^2$	−3.83%	3.20%	−5.20%	2.71%
OOS $\overline{R}^2$	−13.58%	3.41%	−28.05%	−16.65%

Finally, and again not reported in the table, another choice of estimation period can also make a difference. The three price models lost statistical significance over the full sample only in the 1990s. This is not because the IS-ΔRMSE has decreased further in the 1990's, but because the 1991–2005 prediction errors were more volatile, which raised the standard errors of point estimates.

Other Variables: The remaining plots in Figure 1 and the remaining IS insignificant models in Table 1 show that **d/e**, **dfy**, and **infl** essentially never had significantly positive OOS periods, and that **svar** had a huge drop in OOS performance from 1930 to 1933. Other variables (that are IS insignificant) often had good sample performance early on, ending somewhere between the Oil Shock and the mid-1980s, followed by poor performance over the most recent three decades. The plots also show that it was generally not just the late 1990s that invalidated them, unlike the case with the aforementioned price ratio models.

In sum, twelve models had insignificant in-sample full-period performance and, not surprisingly, these models generally did not offer good OOS performance.

4.2 In-Sample Significant Models

Five models were significant IS (**b/m**, **i/k**, **ntis**, **eqis**, and **all**) at least at the 10% two-sided level. Table 1 contains more details for these variables, such as the IS performance during the OOS period, and a power statistic. Together with the plots in Figure 2, this information helps the reader to judge the stability of the models—whether poor OOS performance is driven by less accurately estimated parameters (pointing to lower power), and/or by the fact that the model fails IS and/or OOS during the OOS sample period (pointing to a spurious model).

Book-market ratio: **b/m** is statistically significant at the 6% level IS. Figure 2 shows that it had excellent IS and OOS predictive performance right until the Oil Shock. Both its IS and OOS performance were poor from 1975 to 2000, and the recovery in 2000-2002 was not enough to gain back the 1997-2000 performance. Thus, the **b/m** model has negative performance over the most recent three decades, both IS and OOS.

b/m	Recent 30 Years	All Years
IS $\overline{R}^2$	−12.37%	3.20%
OOS $\overline{R}^2$	−29.31%	−1.72%

Over the entire sample period, the OOS performance is negative, too. The "IS for OOS" $\overline{R}^2$ in Table 1 shows how dependent **b/m**'s performance is on the first 20 years of the sample. The IS $\overline{R}^2$ is -7.29% for the 1965-2005 period. The comparable OOS $\overline{R}^2$ even reaches -12.71%.

As with other models, **b/m**'s lack of OOS significance is not just a matter of low test power. Table 1 shows that in the OOS prediction beginning in 1941, under the simulation of a stable model, the OOS statistic came out *statistically significantly* positive in 67%[8] of our (stable-model) simulations in which the IS regression was significant. Not reported in the table, positive performance (significant or insignificant) occurred in 78% of our simulations. A performance as negative as the observed ΔRMSE of -0.01 occurred in *none* of the simulations.

Investment-capital ratio: **i/k** is statistically significant IS at the 5% level. Figure 2 shows that, like **b/m**, it performed well only in the first half of its sample, both IS and OOS. About half of its performance, both IS and OOS, occurs during the Oil Shock. Over the most recent 30 years, **i/k** has underperformed:

i/k	Recent 30 Years	All Years
IS $\overline{R}^2$	-8.09%	6.63%
OOS $\overline{R}^2$	-18.02%	-1.77%

Corporate Issuing Activity: Recall that **ntis** measures equity issuing and repurchasing (plus dividends) relative to the price level; **eqis** measures equity issuing relative to debt issuing. Figure 2 shows that both variables had superior IS performance in the early 1930's, a part of the sample that is not part of the OOS period. **eqis** continues good performance into the late 1930's but gives back the extra gains immediately thereafter. In the OOS period, there is one stark difference between the two variables: **eqis** had superior performance during the Oil Shock, both IS and

[8] The 42% applies to draws that were not statistically significant in-sample at the 90% level. It is the equivalent of the experiment conducted in some other papers. However, because OOS performance is relevant only when the IS performance is significant, this is the wrong measure of power.

OOS. It is this performance that makes **eqis** the only variable that had statistically significant OOS performance in the annual data. In other periods, neither variable had superior performance during the OOS period.

Both variables underperformed over the most recent 30 years

	ntis		**eqis**	
	Recent 30 Years	All Years	Recent 30 Years	All Years
IS $\overline{R}^2$	–5.14%	8.15%	–10.36%	9.15%
OOS $\overline{R}^2$	–8.63%	–5.07%	–15.33%	2.04%

The plot can also help explain dueling perspectives about **eqis** between Butler, Grullon, and Weston (2005) and Baker, Taliaferro, and Wurgler (2004). One part of their disagreement is whether **eqis**'s performance is just random underperformance in sampled observations. Of course, some good years are expected to occur in any regression. Yet **eqis**'s superior performance may not have been so random, because it [a] occurred in consecutive years, and [b] in response to the Oil Shock events that are often considered to have been exogenous, unforecastable, and unusual. Butler, Grullon, and Weston also end their data in 2002, while Baker, Taliaferro, and Wurgler refer to our earlier draft and to Rapach and Wohar (2006), which end in 2003 and 1999, respectively. Our figure shows that small variations in the final year choice can make a difference in whether **eqis** turns out significant or not. In any case, both papers have good points. We agree with Butler, Grullon, and Weston that **eqis** would not have been a profitable and reliable predictor for an external investor, especially over the most recent 30 years. But we also agree with Baker, Taliaferro, and Wurgler that conceptually, it is not the OOS performance, but the IS performance that matters in the sense in which Baker and Wurgler (2000) were proposing **eqis**—not as a third-party predictor, but as documentary evidence of the fund-raising behavior of corporations. Corporations did repurchase profitably in the Great Depression and the Oil Shock era (though not in the "bubble period" collapse of 2001-2002).

all The final model with IS significance is the kitchen sink regression. It had high IS significance, but exceptionally poor OOS performance.

4.3 Time-Changing Models

caya and **ms** have no in-sample analogs, because the models themselves are constantly changing.

Consumption-Wealth-Income: Lettau and Ludvigson (2001) construct their **cay** proxy assuming that agents have some ex-post information. The experiment their study calls OOS is unusual: their representative agent still retains knowledge of the model's full-sample CAY-*construction* coefficients. It is OOS only in that the agent does not have knowledge of the *predictive* coefficient and thus has to update it on a running basis. We call the Lettau and Ludvigson (2001) variable **cayp**. We also construct **caya**, which represents a more genuine OOS experiment, in which investors are not assumed to have advance knowledge of the **cay** construction estimation coefficients.

Figure 2 shows that **cayp** had superior performance until the Oil Shock, and nondescript performance thereafter. It also benefited greatly from its performance during the Oil Shock itself.

cay	Recent 30 Years	All Years
some ex-post knowledge, **cayp** IS $\overline{R}^2$	10.52%	15.72%
some ex-post knowledge, **cayp** OOS $\overline{R}^2$	7.60%	16.78%
no advance knowledge, **caya** OOS $\overline{R}^2$	–12.39%	–4.33%

The full-sample **cayp** result confirms the findings in Lettau and Ludvigson (2001). **cayp** outperforms the benchmark OOS RMSE by 1.61% per annum. It is stable and its OOS performance is almost identical to its IS performance. In contrast to **cayp**, **caya** has had no superior OOS performance, either over the entire sample period or the most recent years. In fact, without advance knowledge, **caya** had the worst OOS $\overline{R}^2$ performance among our single variable models.

Model Selection Finally, **ms** fails with a pattern similar to earlier variables—good performance until 1976, bad performance thereafter.

ms	Recent 30 Years	All Years
IS $\overline{R}^2$	–	–
OOS $\overline{R}^2$	–43.40%	–22.50%

Conclusion: There were a number of periods with sharp stock market changes, such as the Great Depression of 1929–1933 (in which the S&P500 dropped from 24.35 at the end of 1928 to 6.89 at the end of 1932) and the "bubble period" from 1999–2001 (with its subsequent collapse). However, it is the Oil Shock recession of 1973–1975, in which the S&P500 dropped from 108.29 in October 1973 to 63.54 in September 1974—and its recovery back to 95.19 in June 1975—that stands out. Many models depend on it for their apparent forecasting ability, often both IS and OOS. (And none performs well thereafter.) Still, we caution against overreading or underreading this evidence. In favor of discounting this period, the observed source of significance seems unusual, because the important years are consecutive observations during an unusual period. (They do not appear to be merely independent draws.) In favor of not discounting this period, we do not know how one would identify these special multi-year periods ahead of time, except through a model. Thus, good prediction during such a large shock should not be automatically discounted. More importantly and less ambiguously, no model seems to have performed well since—that is, over the last thirty years.

In sum, on an annual prediction basis, there is no single variable that meets all of our four suggested investment criteria from Page 14 (IS significance, OOS performance, reliance not just on some outliers, and good positive performance over the last three decades.) Most models fail on all four criteria.

5 Five-Yearly Prediction

Table 2: Five-Yearly Frequency

Some models may predict long-term returns better than short-term returns. Unfortunately, we do not have many years to explore 5-year predictions thoroughly, and there are difficult econometric issues arising from data overlap. Therefore, we only briefly describe some preliminary and perhaps naive findings. (See, e.g., Boudoukh, Richardson, and Whitelaw (2005) and Lamoureux and Zhou (1996) for more detailed treatments.) Table 2 repeats Table 1 with 5-year returns. As before, we bootstrap all critical significance levels. This is especially important here, because the observations are overlapping and the asymptotic critical values are not available.

Table 2 shows that there are four models that are significant IS over the entire sample period: **ntis**, **d/p**, **i/k**, and **all**. **ntis** and **i/k** were also significant in the annual data (Table 1). Two more variables, **d/y** and **tms**, are IS significant if no data prior to 1927 is used.

Dividend Price Ratio: **d/p** had negative performance OOS regardless of period.

Term Spread: **tms** is significant IS only if the data begins in 1927 rather than 1921. An unreported plot shows that **tms** performed well from 1968–1979, poorly from 1979–1986, and then well again from 1986–2005. Indeed, its better years occur in the OOS period, with an IS $\overline{R}^2$ of 23.54% from 1965-2005. This was sufficient to permit it to turn in a superior OOS ΔRMSE performance of 2.77% per five-years—a meaningful difference. On the negative side, **tms** has positive OOS performance *only* if forecasting begins in 1965. Using 1927–2005 data and starting forecasts in 1947, the OOS ΔRMSE and $\overline{R}^2$ are negative.

The Kitchen Sink: **all** again turned in exceptionally poor OOS performance.

Model selection (**ms**) and **caya** again have no in-sample analogs. **ms** had the worst predictive performance observed in this paper. **caya** had good OOS performance of 2.50% per five-year period. Similarly, the investment-capital ratio, **i/k**, had both positive IS and OOS performance, and both over the most recent three decades as well as over the full sample (where it was also statistically significant).

i/k	Recent 30 Years	All Years
IS $\overline{R}^2$	30.60%	33.99%
OOS $\overline{R}^2$	28.00%	12.99%

i/k's performance is driven by its ability to predict the 2000 crash. In 1997, it had already turned negative on its 1998-2002 equity premium prediction, thus predicting the 2000 collapse, while the unconditional benchmark prediction continued with its 30% plus predictions:

Forecast made in	for years	Actual EqPm	Forecast Unc.	Forecast **i/k**	Forecast made in	for years	Actual EqPm	Forecast Unc.	Forecast **i/k**
1995	1996-2000	0.58	0.30	0.22	1998	1999-2003	−0.19	0.33	−0.09
1996	1997-2001	0.27	0.31	0.09	1999	2000-2004	−0.25	0.34	−0.07
1997	1998-2002	−0.23	0.31	−0.01	2000	2001-2005	−0.08	0.34	−0.06

This model (and perhaps **caya**) seem promising. We hesitate to endorse them further only because our inference is based on a small number of observations, and because statistical significance with overlapping multi-year returns raises a set of issues that we can only tangentially address. We hope more data will allow researchers to explore these models in more detail.

6 Monthly Prediction and Campbell-Thompson

Table 3 describes the performance of models predicting monthly equity premia. It also addresses a number of points brought up by Campbell and Thompson (2005), henceforth CT. We do not have dividend data prior to 1927, and thus no reliable equity premium data before then. This is why even our the estimation period begins only in 1927.

Table 3: Monthly and Campbell and Thompson Analysis

6.1 In-Sample Performance

Table 3 presents the performance of monthly predictions both IS and OOS. The first data column shows the IS performance when the predicted variable is logged (as in the rest of the paper). Eight out of eighteen models are in-sample significant at the 90% level, seven at the 95% level. Because CT use simple rather than log equity premia, the remaining data columns follow their convention. This generally improves the predictive power of most models, and the fourth column (by which rows are sorted) shows that three more models turn in statistically significant IS.[9]

CT argue that a reasonable investor would not have used a models to forecast a negative equity premium. Therefore, they suggest truncation of such predictions at zero. In a sense, this injects caution into the models themselves, a point we agree with. Because there were high equity premium realizations especially in the 1980s and 1990s, a time when many models were bearish, this constraint can improve performance. Of course, it also transforms formerly linear models into non-linear models, which are generally not the subject of our paper. CT do *not* truncate predictions in their in-sample regressions, but there is no reason not to do so. Therefore, the fifth column shows a revised IS $\overline{R}^2$ statistic. Some models now perform better, some perform worse.

6.2 Out-of-Sample Prediction Performance

The remaining columns explore the OOS performance. The sixth column shows that without further manipulation, **eqis** is the only model with both superior IS ($\overline{R}^2$=0.82% and 0.80%) and OOS ($\overline{R}^2$ = 0.14%) untruncated performance. The term-spread, **tms**, has OOS performance that is even better ($\overline{R}^2$ = 0.22%), but it just misses statistical

[9]Geert Bekaert pointed out to us that if returns are truly log-normal, part of their increased explanatory power could be due to the ability of these variables to forecast volatility.

significance IS at the 90% level. **infl** has marginally good OOS performance, but poor IS performance. All other models have negative IS or OOS untruncated $\overline{R}^2$.

The remaining columns show model performance when we implement the Campbell and Thompson (2005) suggestions. The seventh column describes the frequency of truncation of negative equity premium predictions. For example, **d/y**'s equity premium predictions are truncated to zero in 54.2% of all months; **csp**'s predictions are truncated in 44.7% of all months. Truncation is a very effective constraint.

CT also suggest using the unconditional model if the theory offers one coefficient sign and the estimation comes up with the opposite sign. For some variables, such as the dividend ratios, this is easy. For other models, it is not clear what the appropriate sign of the coefficient would be. In any case, this matters little in our data set. The eighth column shows that the coefficient sign constraint matters only for **dfr**, and **ltr** (and mildly for **d/e**). None of these three models has IS performance high enough to make this worthwhile to explore further.

The ninth and tenth columns, $\overline{R}^2{}_{\mathrm{TU}}$ and $\Delta\mathrm{RMSE}_{\mathrm{TU}}$, show the effect of the CT truncations on OOS prediction. For many models, the performance improves. Nevertheless, the OOS $\overline{R}^2$'s remain generally much lower than their IS equivalents. Some models have positive ΔRMSE but negative OOS $\overline{R}^2$. This reflects the number of degrees of freedom: even though we have between 400 and 800 data months, the plain ΔRMSE and R^2 are often so small that the $\overline{R}^2$ turns negative. For example, even with over 400 months of data, the loss of three degrees of freedom is enough for **cay3** to render a positive ΔRMSE of 0.0088 (equivalent to an unreported unadjusted-R^2 of 0.0040) into a negative adjusted-R^2 of -0.0034.

Even after these truncations, ten of the models that had negative plain OOS $\overline{R}^2$'s still have negative CT OOS $\overline{R}^2$'s. Among the eleven IS significant models, seven (**cay3**, **ntis**, **e^{10}/p**, **b/m**, **e/p**, **d/y**, and **dfy**) have negative OOS $\overline{R}^2$ performance even after the truncation. Three of the models (**lty**, **ltr**, and **infl**) that benefit from the OOS truncation are not close to statistical significance IS, and thus can be ignored. All in all, this leaves four models that are both OOS and IS positive and significant:

csp, **eqis**, **d/p**, **tbl**, plus possibly **tms** (which is just barely not IS significant). We investigate these models further below.

6.3 OOS Utility Performance of a Trading Strategy

Like Brennan and Xia (2004), CT also propose to evaluate the OOS usefulness of models based on the certainty equivalence (CEV) measure of a trading strategy. Specifically, they posit a power-utility investor with an assumed risk-aversion parameter, γ, of three. This allows a conditional model to contribute to an investment strategy not just by increasing the mean trading performance, but also by reducing the variance. (Breen, Glosten, and Jagannathan (1989) have shown this to be a potentially important factor.)

Although the focus of our paper is on mean prediction, we know of no better procedure to judge the economic significance of forecasting models, and therefore follow their suggestion here. To prevent extreme investments, there is a 150% maximum equity investment. A positive investment weight is guaranteed by the truncation of equity premium predictions at zero.

CT show that even a small improvement in ΔRMSE by a model over the unconditional benchmark can translate into CEV gains that are ten times as large.[10] We can confirm this—and almost to a fault. **cay3** offers 6.1bp/month performance, even though it had a negative $\overline{R}^2$. Column 12 also shows that even models that have a negative OOS ΔRMSE (not just a negative $\overline{R}^2$), like **dfr**, can produce positive gains in CEV. This is because the risk-aversion parameter gamma of 3 is low enough to favor equity-tilted strategies. Put differently, some strategy CEV gains are due to the fact that the risky equity investment was a better choice than the risk-free rate in our

[10]CT show in equation (8) of their paper that the utility gain is roughly equal to OOS-R^2/γ. This magnification effect occurs only on the monthly horizon, because the difference between OOS-R^2 and the ΔRMSE scales with the square root of the forecasting horizon (for small ΔRMSE, OOS-$R^2 \approx 2 \cdot \Delta\text{RMSE}/\text{StdDev(R)}$). That is, at a monthly frequency, the OOS-R^2 is about 43 times as large as ΔRMSE. On an annual prediction basis, this number drops from 43 to 12. An investor with a risk aversion of 10 would therefore consider the economic significance on annual investment horizon to be roughly the same as the ΔRMSE we consider. (We repeated the CT CEV equivalent at annual frequency to confirm this analysis.)

data. (This applies not only to strategies based on the conditional models, but also to the strategy based on the unconditional mean.) An alternative utility specification that raises the risk-aversion coefficient to 7.48 would have left an investor indifferent between the risk-free and the equity investments. Briefly considering this parameter can help judge the role of equity bias in a strategy; it does seem to matter for the **eqis** and **tms** models, as explained below.

In order, among the IS reasonably significant models, those providing positive CEV gains were **tms** (14bp/month), **eqis** (14bp/month), **tbl** (10bp/month), **csp** (6bp/month), **cay3**(6bp/month), and **ntis** (2bp/month).

6.4 Details

We now look more closely at the set of variables with potentially appealing forecasting characteristics. **csp**, **eqis**, **tbl**, and **tms** have positive IS performance (either statistically significant or close to it), positive OOS $\overline{R}^2$ (truncated), and positive CEV gains. **cay3** and **ntis** have negative OOS $\overline{R}^2$, but very good IS performance and positive CEV gains. **d/p** has a negative CEV gain, but is positive IS and OOS $\overline{R}^2$. Thus, we describe these seven models in more detail (and with equivalent graphs): Figure 3

1. **cay3:** The best CT performer is an alternative **cay** model that also appears in Lettau and Ludvigson (2005). It predicts the equity premium not with the linear **cay**, but with all three of its highly cointegrated ingredients up to date. We name this model **cay3**. In unreported analysis, we found that the **cay** model and **cay3** models are quite different. For most of the sample period, the unrestricted predictive regression coefficients of the **cay3** model wander far off their cointegration-restricted **cay** equivalents. The model may not be as well-founded theoretically as the Lettau and Ludvigson (2001) **cay**, but if its components are known ex-ante, then **cay3** is fair game for prediction.

   Table 3 shows that **cay3** has good performance IS, but only marginal performance OOS (a positive ΔRMSE, but a negative $\overline{R}^2$). It offers good CEV gains among the models considered, an extra 6.10 bp/month. The h superscript indicates that its trading strategy requires an extra 10% more trading turnover than the unconditional model. It also reaches the maximum permitted 150% equity investment in 13.2% of all months.

A first drawback is that the **cay3** model relies on data that may not be immediately available. Its components are publicly released by the BEA about 1-2 months after the fact. Adding just one month delay to trading turns **cay3**'s performance negative:

	ΔRMSE	$\Delta RMSE_{TU}$	ΔCEV
Immediate Availability (CT)	−2.88 bp	+0.88 bp	+6.10 bp
One Month Delayed	−5.10 bp	−1.62 bp	−11.82 bp
Two Months Delayed	−5.38 bp	−1.11 bp	−9.80 bp

A second drawback is visible in Figure 3. Like **caya** and **cayp**, much of **cay3**'s performance occurs around the Oil Shock (most of its OOS performance and between one-half and one-third of its IS performance). Even IS, **cay3** has not performed well for over 30 years now:

cay3 (CT)	Recent 30 Years	All Years
IS $\overline{R}^2$	−0.30%	1.87%
OOS $\overline{R}^2$	−1.60%	−0.34%

Finally, the figure shows that many of **cay3**'s recent equity premium forecasts have been negative and therefore truncated. And, therefore, the information in its current forecasts is limited.

2. **csp:** Table 3 shows that the relative valuations of high- over low-beta stocks had good IS and truncated OOS performance, and offered a market timer 6.12 bp/month superior CEV-equivalent performance. The plot in Figure 3 shows that **csp** had good performance from September 1965 to March 1980. It underperformed by just as much from about April 1980 to October 2000. In fact, from its first OOS prediction in April 1957 to August 2001, **csp**'s total net performance

was zero even after the CT truncations, and both IS and OOS. All of **csp**'s superior OOS performance has occurred since mid-2001. Although it is commendable that it has performed well late rather than early, better performance over its first 45 years would have made us deem this variable more reliable.

The plot raises one other puzzle. The CT truncated version performs better than the plain OLS version because it truncated the **csp** predictions from July 1957 through January 1963. These CT truncations are critically responsible for its superior OOS performance, but make no difference thereafter. It is the truncation treatment of these specific 66 months that would make an investor either believe in superior positive or inferior outright negative performance for **csp** (from August 2001 to December 2005). We do not understand why the particular 66 month period from 1957 to 1963 is so crucial.

Finally, the performance during the Oil Shock recession is not important for IS performance, but it is for the OOS performance. It can practically account for its entire out-of-sample performance. Since the Oil Shock, **csp** has outperformed IS, but not OOS:

csp (CT)	Recent 30 Years	All Years
IS $\overline{R}^2$	0.33%	0.99%
OOS $\overline{R}^2$	−0.41%	0.15%

3. **ntis:** Net issuing activity had good IS performance, but a negative OOS $\overline{R}^2$. Its CEV gain is a tiny 1.53 bp/month. These 1.53 bp are likely to be offset by trading costs to turn over an additional 4.6% of the portfolio every month.[11] The strategy was very optimistic, reaching the maximum 150% investment constraint in 57.4% of all months. We do not report it in the table, but an investor with a higher 7.48 risk-aversion parameter, who would not have been so eager to highly lever herself

[11] Keim and Madhavan (1997) show that one typical roundtrip trade in large stocks for institutional investors would have conservatively cost around 38 bp from 1991–1993. Costs for other investors and earlier time-periods were higher. Futures trading costs are not easy to gauge, but a typical contract for a notional amount of $250,000 costs around $10-$30. A 20% movement in the underlying index—about the annual volatility—would correspond to $50,000, which would come to around 5 bp.

into the market, would have experienced a negative CEV with an **ntis** optimized trading strategy. Finally, the plot shows that almost all of the **csp** model's IS power derives from its performance during the Great Depression. There was really only a very short window from 1982 to 1987 when **csp** could still perform well.

4. **eqis:** Equity Issuing Activity had good IS performance, good OOS performance, and improved the CEV for an investor by a meaningful 13.67 bp/month. It, too, was an optimistic equity-aggressive strategy. With a $\gamma = 3$, trading based on this variable leads to the maximum permitted equity investment of 150% in 56% of all months. Not reported, with the higher risk-aversion coefficient of 7.48, that would leave an investor indifferent between bonds and stocks, the 13.67bp/month gain would shrink to 8.74bp/month.

   As in the annual data, Figure 3 shows that **eqis**'s performance relies heavily on the good Oil Shock years. It has not performed well in the last thirty years.

eqis (CT)	Recent 30 Years	All Years
IS $\overline{R}^2$	−0.88%	0.80%
OOS $\overline{R}^2$	−1.00%	0.30%

5. **d/p:** The dividend price ratio has good IS and OOS $\overline{R}^2$. (The OOS $\overline{R}^2$ is zero when predicting log premia.) An investor trading on **d/p** would have lost the CEV of 10bp/month. (Not reported, a more risk-averse investor might have broken even.) The plot shows that **d/p** has not performed well over the last 30 years; **d/p** has predicted negative equity premia since January 1992.

d/p (CT)	Recent 30 Years	All Years
IS $\overline{R}^2$	−0.39%	0.33%
OOS $\overline{R}^2$	−1.09%	0.17%

6. **tbl**: The short rate is insignificant IS if we forecast log premia. If we forecast unlogged premia, it is statistically significant IS at the 9% level, although this declines further if we apply the CT truncation. In its favor, **tbl**'s full-sample CT-truncated performance is statistically significant OOS, and it offers a respectable 9.53 bp/month market timing advantage. The plot shows that this is again largely Oil Shock dependent. **tbl** has offered no advantage over the last thirty years.

tbl (CT)	Recent 30 Years	All Years
IS $\overline{R}^2$	–0.41%	0.20%
OOS $\overline{R}^2$	–1.06%	0.25%

7. **tms**: The term-spread has IS significance only at the 10.1% level. (With logged returns, this drops to the 14.5% level.) Nevertheless, **tms** had solid OOS performance, either with or without the CT truncation. As a consequence, its CEV gain was a respectable 14.40 bp/month. Not reported in the table, when compared to the CEV gain of an investor with a risk-aversion coefficient of 7.48, we learn that about half of this gain comes from the fact that the term-spread was equity heavy. (It reaches its maximum of 150% equity investment in 59.3% of all months.) The figure shows that TMS performed well in the period from 1970 to the mid-1980s, that TMS has underperformed since then, and that the Oil Shock gain was greater than the overall OOS sample performance of **tms**. Thus,

tms (CT)	Recent 30 Years	All Years
IS $\overline{R}^2$	–0.19%	0.18%
OOS $\overline{R}^2$	–0.81%	0.21%

b/m, **e/p**, **e**^{10}**/p**, **d/y**, and **dfy** have negative OOS $\overline{R}^2$ and/or CT CEV gains, and so are not further considered. The remaining models have low or negative IS $\overline{R}^2$, and therefore should not be considered, either. Not reported, among the models that are IS insignificant, but OOS significant, none had positive performance from 1975 to today.

6.5 Comparing Findings and Perspectives

The numbers we report are slightly different from those in Campbell and Thompson (2005). In particular, they report **cay3** to have a ΔRMSE of 0.0356, more than the 0.0088 we report. This can be traced back to three equally important factors: they end their data 34 months earlier (in 2/2003), they begin their estimation one month later (1/1952), and they use an earlier version of the **cay** data from Martin Lettau's website. Differences in other variables are sometimes due to use of pre-1927 data (relying on price changes because returns are not available) for estimation though not prediction, while we exclude all pre-1927 data.

More importantly, our perspective is different from CT's. We believe that the data suggests not only that these models are not good enough for actual investing, but also that the models are not stable. Therefore, by and large, we consider even their IS significance to be dubious. Because they fail stability diagnostics, we would recommend against their continued use. Still, we can agree with some points CT raise:

1. One can reasonably truncate the models' predictions.

2. On shorter horizons, even a small predictive ΔRMSE difference can gain a risk-averse investor good CEV gains.

3. OOS performance should not be used for primary analysis.

We draw different conclusions from this last point. We view OOS performance not as a substitute but as a necessary complement to IS performance. We consider it to be an important regression *diagnostic*, and *if and only if* the model is significant IS. Consequently, we disagree with the CT analysis of the statistical power of OOS tests. In our view, because the OOS power matters only if the IS regression is statistically significant, the power of the OOS tests is conditional and thus much higher than suggested in CT, Cochrane (2005), and elsewhere. Of course, any additional diagnostic test can only reject a model—if an author is sure that the linear specification is correct, then not running the OOS test surely remains more powerful.

In judging the usefulness of these models, our paper attaches more importance than CT to the following facts:

1. Most models are not IS significant. That is, many variables in the academic literature no longer have IS significance (even at the 90% level). It is our perspective that this disqualifies them as forecasters for researchers without strong priors.
2. After three decades of poor performance, often even IS, one should further doubt the stability of most prediction models.
3. Even after the CT truncation, many models earn negative CEV gains.
4. What we call OOS performance is not truly OOS, because it still relies on the same data that was used to establish the models. (This is especially applicable to **eqis** and **csp**, which were only recently proposed.)
5. For practical use, an investor would have had to have known *ex-ante* which of the models would have held up, and that none of the models had superior performance over the last three decades—in our opinion because the models are unstable.

We believe it is now best left to the reader to concur either with our or CT's perspective. (The data is posted on the website.)

7 Alternative Specifications

We now explore some other models and specifications which have been proposed as improvements over the simple regression specifications.

7.1 Longer-Memory Dividend and Earnings Ratios

Table 4 considers dividend-price ratios, earnings-price ratios, and dividend-earnings ratios with memory (which simply means that we consider sums of multiple year dividends or earnings in these ratios). The table is an excerpt from a complete set of 1-year, 5-year, and 10-year dividend-price ratios, earnings-price ratios, and dividend-earnings ratios. (That is, we tried all 90 possible model combinations.) The table contains *all* 27 IS significant specifications from our monthly regressions that begin forecasting in 1965, and from our annual and five-yearly forecasts that begin forecasting either in 1902 or 1965.

Table 4: Long-Memory Ratios

Even though there were more combinations of dividend-earnings ratios than either dividend-price or earnings-price ratios, not a single dividend-earnings ratio turned out IS statistically significant. The reader can also see that out of our 27 IS significant models, only 5 had OOS positive and statistically significant performance. (For 2 of these models, the OOS significance is modest, not even reaching the 95% significance level.) Unreported graphs show that none of these performed well over the last 3 decades. (We also leave it to the readers to decide whether they believe that real-world investors would have been able to choose the right five models for prediction, and to get out right after the Oil Shock.)

7.2 Different Estimation Methods To Improve Power For Nonstationary Independent Variables

Stambaugh (1999) shows that predictive coefficients in small samples are biased if the independent variable is close to a random walk. Many of our variables have autoregressive coefficients above 0.5 on monthly frequency. Goyal and Welch (2003) show that **d/p** and **d/y**'s auto-correlations are not stable but themselves increase over the sample period, and similar patterns occur with other variables in our study. (The exceptions are **ntis**, **ltr**, and **dfy**.) Our previously reported statistics took stable positive autoregressive coefficients into account, because we bootstrapped for significance levels mimicking the IS autocorrelation of each independent variable.

However, one can use this information itself to also design more powerful tests. Compared to the plain OLS techniques in our preceding tables, the Stambaugh coefficient correction is a more powerful test in non-asymptotic samples. There is also information that the autocorrelation is not constant for the dividend ratios, which we are ignoring in our current paper. Goyal and Welch (2003) use rolling dividend-price ratio and dividend-growth autocorrelation estimates as instruments in their return predictions. This is model specific, and thus can only apply to one model, the dividend price ratio (**d/p**). In contrast, Lewellen (2004) and Campbell and Yogo (2006) introduce two further statistical corrections, extending Stambaugh (1999) and assuming different boundary behavior. This subsection, therefore, explores equity premium forecasts using these corrected coefficients.

Table 5: Stambaugh and Lewellen Estimation Corrections for Non-stationary Independent Variables

In Table 5, we predict with Stambaugh and Lewellen corrected coefficients. Both methods break the link between $\overline{R}^2$ (which is maximized by OLS) and statistical significance. The Lewellen coefficient is often dramatically different from the OLS coefficients, resulting in negative $\overline{R}^2$, even among its IS significant variable estimations. However, it is also tremendously powerful. Given our bootstrapped critical rejection levels under the NULL hypothesis, this technique is able to identify eight (rather than just three) ALTERNATIVE models as different from the NULL. In six of them, it even imputes significance in each and every one of our 10,000 bootstraps!

Unfortunately, neither the Stambaugh nor the Lewellen technique manage s to improve OOS prediction. Of all models, only the **e/p** ratio in the Lewellen specification seems to perform better with a positive ΔRMSE. However, like other variables, it has not performed particularly well over the most recent 30 years—even though it has non-negative OOS ΔRMSE (but not $\overline{R}^2$) performance over the last three decades.

e/p (Lewellen)	Recent 30 Years	All Years
IS $\overline{R}^2$	–0.16%	0.02%
OOS $\overline{R}^2$	–0.08%	–0.01%

7.3 Encompassing Tests

Our next tests use encompassing predictions. A standard encompassing test is a hybrid of ex-ante OOS predictions and an ex-post optimal convex combination of unconditional forecast and conditional forecast. A parameter λ gives the ex-post weight on the conditional forecast for the optimal forecast that minimizes the ex-post MSE. The ENC statistic in equation (7) can be regarded as a test statistic for λ. If λ is between 0 and 1, we can think of the combination model as a "shrinkage" estimator. It produces an optimal combination OOS forecast error, which we denote ΔRMSE*. However, investors would not have known the optimal *ex-post* λ. This means that they would have computed λ based on the best predictive up-to-date combination of the two OOS model (NULL and ALTERNATIVE), and then would have used this λ to forecast one month ahead. We denote the relative OOS forecast error of this rolling λ procedure as ΔRMSE$^{\star r}$.[12]

Table 6: Encompassing Tests

Table 6 shows the results of encompassing forecast estimates. Panel A predicts annual equity premia. Necessarily, all ex-post λ combinations have positive ΔRMSE*— but almost all rolling λ combinations have negative ΔRMSE$^{\star r}$. The exceptions are **d/e** and **cayp** (with OOS knowledge). In some but not all specifications, this also applies to **dfy**, **all**, and **caya**. **d/e**, **dfy**, and **all** can immediately be excluded, because their optimal λ is negative. This leaves **caya**. Again, not reported, **caya** could not outperform over the most recent three decades. In the monthly rolling encompassing tests (not reported), only **svar** and **d/e** (in one specification) are positive, neither with a positive λ.

In sum, "learned shrinking" does not improve any of our models to the point where we would expect them to outperform.

[12]For the first three observations, we presume perfect optimal foresight, resulting in the minimum ΔRMSE. This tilts the rolling statistic slightly in favor of superior performance. The results remain the same if we use reasonable variations.

8 Other Literature

Our paper is not the first to explore or to be critical of equity premium predictions. Many bits and pieces of evidence we report have surfaced elsewhere, and some authors working with the data may already know which models work, and when and why—but this is not easy to systematically determine for a reader of this literature. There is also a publication bias in favor of significant results—non-findings are often deemed less interesting. Thus, the general literature tenet has remained that the empirical evidence and professional consensus is generally supportive of predictability. This is why we believe that it is important for us to review models in a comprehensive fashion—variable-wise, horizon-wise, and time-wise—and to bring all variables up-to-date. The updating is necessary to shed light on post-Oil Shock behavior and explain some otherwise startling disagreements in the literature.

There are many other papers that have critiqued predictive regressions. In the context of dividend ratios, see, e.g., Goetzmann and Jorion (1993) and Ang and Bekaert (2003). A number of papers have also documented low in-sample power (e.g., see Goetzmann and Jorion (1993), Nelson and Kim (1993), and Valkanov (2003)). We must apologize to everyone whose paper we omit to cite here—the literature is simply too voluminous to cover fully.

The papers that explore model instability and/or OOS tests have the closest kinship to our own. The possibility that the underlying model has changed (often through regime shifts) has also been explored in such papers as Heaton and Lucas (2000), Jagannathan, McGrattan, and Scherbina (2000), Bansal, Tauchen, and Zhou (2004), and Kim, Morley, and Nelson (2005), and Lettau and Van Nieuwerburgh (2005). Interestingly, Kim, Morley, and Nelson (2005) cannot find any structural univariate break post WW-II. Bossaerts and Hillion (1999) suggest one particular kind of change in the underlying model—a disconnect between IS and OOS predictability because investors themselves are learning about the economy.

Again, many of the earlier OOS tests have focused on the dividend ratios.

- Fama and French (1988) interpret the OOS performance of dividend ratios to have been a success. Our paper comes to the opposite conclusion primarily because we have access to a longer sample period.
- Bossaerts and Hillion (1999) interpret the OOS performance of the dividend yield (not dividend price ratio) to be a failure, too. However, they rely on a larger cross-section of 14 (correlated) countries and not on a long OOS time period (1990–1995). Because this was a period when the dividend-yield was known to have performed poorly, the findings were difficult to generalize.
- Ang and Bekaert (2003) similarly explore the dividend yield in a more rigorous structural model. They, too, find poor OOS predictability for the dividend yield.
- Goyal and Welch (2003) explore the OOS performance of the dividend ratios in greater detail on annual horizons. (Our current paper has much overlap in perspective, but little overlap in implementation.)

Lettau and Ludvigson (2001) run rolling OOS regressions—but not in the same spirit as our paper: the construction of their CAY variable itself relies on ex-post coefficient knowledge. This thought experiment applies to a representative investor, who knows the full-sample estimation coefficients for CAY, but does not know the full-sample predictive coefficients. This is *not* the experiment our own paper pursues. (Lettau and Ludvigson also do not explore their model's stability, or note its performance since 1975.) Some tests are hybrids between IS and OOS tests (as are our encompassing tests). For example, Fisher and Statman (2005) explore mechanical rules based on P/E and dividend-yield ratios, which are based on pre-specified numerical cutoff values. None works robustly across countries.

Most of the above papers have focused on a relatively small number of models. There are at least three studies in which authors seek to explore more comprehensive sets of variables:

- Pesaran and Timmerman (1995) (and others) have pointed out that our profession has snooped data (and methods) in search of models that seem to predict the equity premium in the same single U.S. or OECD data history. They explore model selection in great detail, exploring dividend-yield, earnings-price ratios, interest rates, and money in $2^9 = 512$ model variations. Their data series is monthly, begins in 1954 and ends (by necessity) twelve years ago in 1992. They conclude that investors could have succeeded, especially in the volatile periods of the 1970s (i.e., the Oil Shock). But they do not entertain the historical equity premium mean as a NULL hypothesis, which makes it difficult to compare their results to our own. Our paper shows that the Oil Shock experience generally is almost unique in making many predictive variables seem to outperform. Still, even including the two-year Oil Shock period in the sample, the overall OOS performance of our ALTERNATIVE models is typically poor.

- Ferson, Sarkissian, and Simin (2003) explore spurious regressions and data mining in the presence of serially correlated independent variables. They suggest increasing the critical t-value of the in-sample regression. The paper concludes that "many of the regressions in the literature, based on individual predictor variables, may be spurious." Torous and Valkanov (2000) disagree with Ferson, Sarkissian, and Simin. They find that a low signal-noise ratio of many predictive variables makes a spurious relation between returns and persistent predictive variables unlikely and, at the same time, would lead to no out-of-sample forecasting power.
- An independent study, Rapach and Wohar (2006), is perhaps closest to our paper. It is also fairly recent, fairly comprehensive, and explores out-of-sample performance for a number of variables. We come to many similar conclusions. Their study ends in 1999, while our data end in 2005—a fairly dramatic five years. Moreover, our study focuses more on diagnosis of weaknesses, rather than just on detection.[13]

[13]Another study by Guo (2006) finds that **svar** has OOS predictive power. However, Guo uses post WW-II sample period and downweights the fourth quarter of 1987 in calculating stock variance. We check that this is why he can find significance where we find none. In the pre-WW2 period, there are many more quarters that have even higher stock variance than the fourth quarter of 1987. If we use a longer sample period, Guo's results also disappear regardless of whether we downweight the highest observation or not.

9 Conclusion

Findings: Our paper systematically investigates the IS and OOS performance of (mostly) linear regressions that predict the equity premium with prominent variables from earlier academic research. Our analysis can be regarded as conservative because we do not even conduct a true OOS test—we select variables from previously published papers and include the very same data that were used to establish the models in the first place. We also ignore the question of how a researcher or investor would have known which among the many models we considered would ultimately have worked.

There is one model for which we feel judgment should be reserved (**eqis**), and some models that deserve more investigation on very-long term frequencies (5 years). None of the remaining models seems to have worked well. To draw this conclusion, our paper relies not only on the printed tables in this final version, but on a much larger set of tables that explored combinations of modified data definitions, data frequencies, time periods, econometric specifications, etc).[14] Our findings are not driven by a few outlier years. Our findings do not disappear if we use different definitions and corrections for the time-series properties of the independent variable. Our findings do not arise because our tests have weak power (which would have manifested itself mostly in poor early predictions). Our findings hold up if we apply statistical corrections, data driven model selection, and encompassing tests.

Instead, our view based on this evidence is now that most models seem unstable or even spurious. Our plots help diagnose when they performed well or poorly, both in-sample and out-of-sample. They shine light on the two most interesting subperiods, the 1973-75 Oil Shock, and the most recent thiry years, 1975 to today. (And we strongly suggest that future papers proposing equity premium predictive models include similar plots.) If we exclude the Oil Shock, most models perform even worse—many were statistically significant in the past only because of the stellar

[14] The tables in this paper have been distilled from a larger set of tables, which are available from our website—and on which we sometimes draw in our text description of results.

model performance during these contiguous unusual years. One can only imagine whether our profession would have been equally comfortable rationalizing away these years “as unusual” if they had been the main negative and not the main positive influence.

As of the end of 2005, most models have lost statistical significance, both in-sample and out-of-sample. Out-of-sample, most models not only fail to beat the unconditional benchmark (the prevailing mean) in a statistically or economically significant manner, but underperform it outright. If we focus on the most recent decades, i.e., the period after 1975, we find that no model had superior performance OOS and few had acceptable performance IS. With 30 years of poor performance, believing in a model today would require strong priors that the model is well specified and that the underlying model has not changed.

Of course, even today, researchers can cherry-pick models—intentionally or unintentionally. Still, this does not seem to be an easy task. It is rare that a choice of sample start, data frequency, and method leads to robust superior statistical performance in-sample. Again, to ignore OOS tests even as a diagnostic, a researcher would have to have supreme confidence that the underlying model is stable. Despite extensive search, we were unsuccessful in identifying any models on annual or shorter frequency that systematically had both good in-sample and out-of-sample performance, at least in the period from 1975 to 2005—although more search might eventually produce one. To place faith in a model, we would want to see genuine superior and stable IS and OOS performance in years after the model identification. Switching perspective from a researcher to an investor, we believe the evidence suggests that none of the academic models we reexamine warrants a strong investment endorsement today. By assuming that the equity premium was “like it always has been,” an investor would have done just as well.

Directions: An academic researcher could explore more variables and/or more sophisticated models (e.g., through structural shifts or Kalman filters). Alternatively, one could predict disaggregated returns, for example, the returns on value-stocks and the returns on growth stocks. The former could respond more strongly to dividends, while the latter could respond more strongly to book-market factors. However, such explorations aggravate the problems arising from (collective) specification search. Some of these models are bound to work both IS or OOS by pure chance. At the very least, researchers should wait for more new OOS data to become available in order to accumulate faith in such new variables or more sophisticated models.

Having stated the obvious, there are promising directions. We are looking forward to accumulating more data. Lettau and Van Nieuwerburgh (2005) model structural change not based on the forecasting regression, but based on mean shifts in the dependent variables. This reduces (but does not eliminate) snooping bias. Another promising method relies on theory—an argument along the line of Cochrane's (2005) observation that the dividend yield must predict future returns eventually if it fails to predict dividend growth.[15]

Broader Implications: Our paper is simple, but we believe its implications are not. The belief that the state variables which we explored in our paper can predict stock returns and/or equity premia is not only widely held, but the basis for two entire literatures: one literature on how these state variables predict the equity premium and one literature on how smart investors should use these state variables in better portfolio allocations. This is not to argue that an investor would not update his estimate of the equity premium as more equity premium realizations come in. Updating will necessarily induce time-varying opportunity sets (see Xia

[15] We do not agree with all of Cochrane's (2005) conclusions. He has strong priors, placing full faith in a stationary specification of the underlying model—even though Goyal and Welch (2003) have documented dramatic increases in the autocorrelation of dividend growth. Therefore, he does not consider whether changes in the model over the last 30 years could lead one to the conclusion that dividend ratios do not predict *as of 2006*. He also draws a stark dichotomy between a NULL (no return prediction, but dividend growth prediction) and an ALTERNATIVE (no dividend growth prediction, but return prediction). He evaluates both hypotheses separately for dividend growth and return predictability. He then proceeds under unconditional confidence in the ALTERNATIVE to show that if dividend growth rates are truly unpredictable, then dividend ratios increase in significance to conventional levels. With residual doubts about the ALTERNATIVE, this conclusion could change.

(2001) and Lewellen and Shanken (2002)). Instead, our paper suggests only that the profession has yet to find some variable that has meaningful and robust empirical equity premium forecasting power, both IS and OOS. We hope that the simplicity of our approach strengthens the credibility of our evidence.

Website Data Sources

Robert Shiller's Website: `http://aida.econ.yale.edu/~shiller/data.htm`.

NBER Macrohistory Data Base:
`http://www.nber.org/databases/macrohistory/contents/chapter13.html`.

FRED: `http://research.stlouisfed.org/fred2/categories/22`.

Value-Line: `http://www.valueline.com/pdf/valueline_2005.pdf`.

Bureau of Labor Statistics Webpage: `http://www.bls.gov/cpi/`

Martin Lettau's Webpage: (**cay**), `http://pages.stern.nyu.edu/~mlettau/`.

William Schwert's Webpage: (**svar**), `http://schwert.ssb.rochester.edu/`.

Jeff Wurgler's Webpage: (**eqis**), `http://pages.stern.nyu.edu/~jwurgler/`

Figure 1: Annual Performance of In-Sample Insignificant Predictors

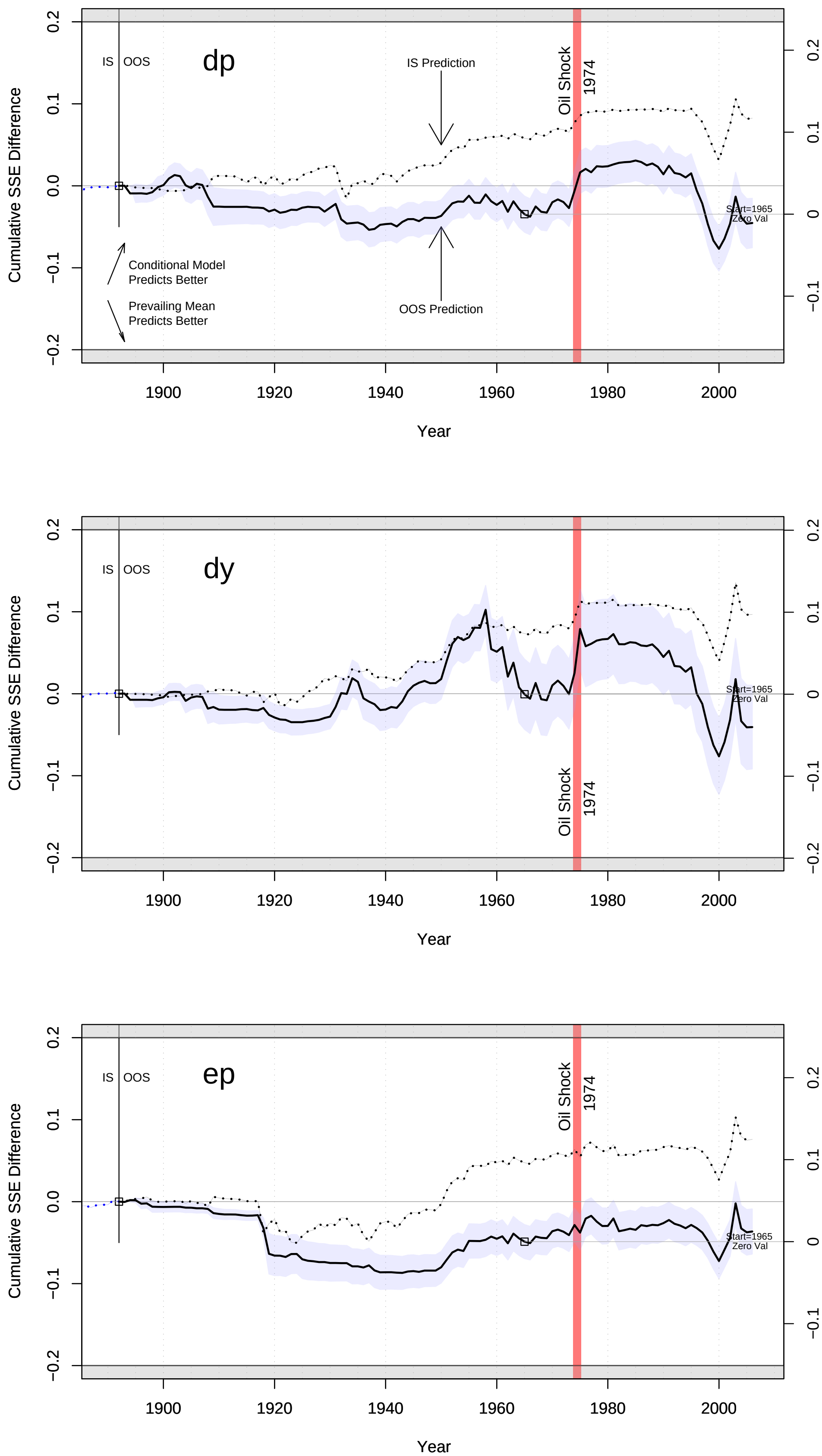


Figure 1: continued

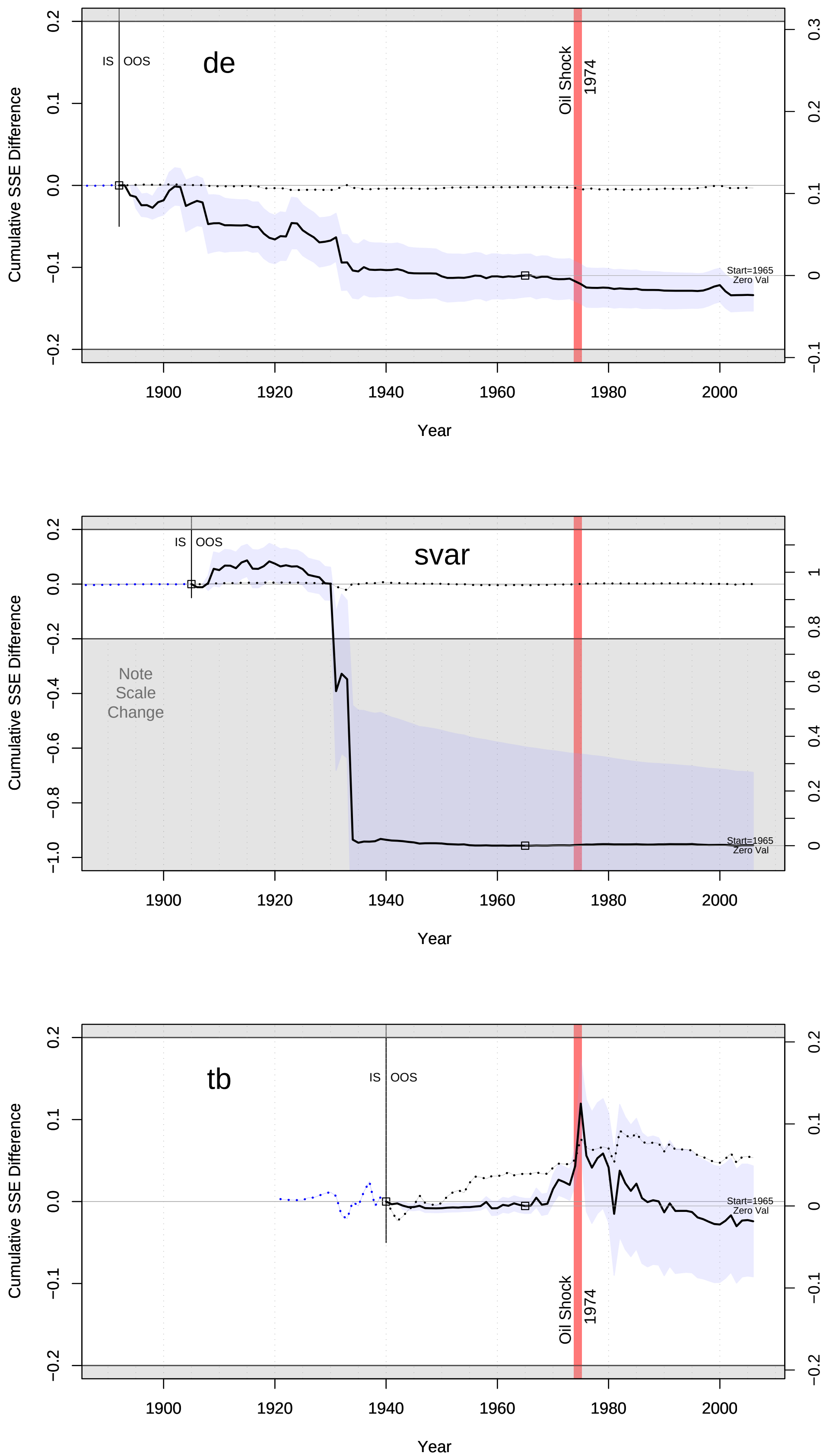


Figure 1: continued

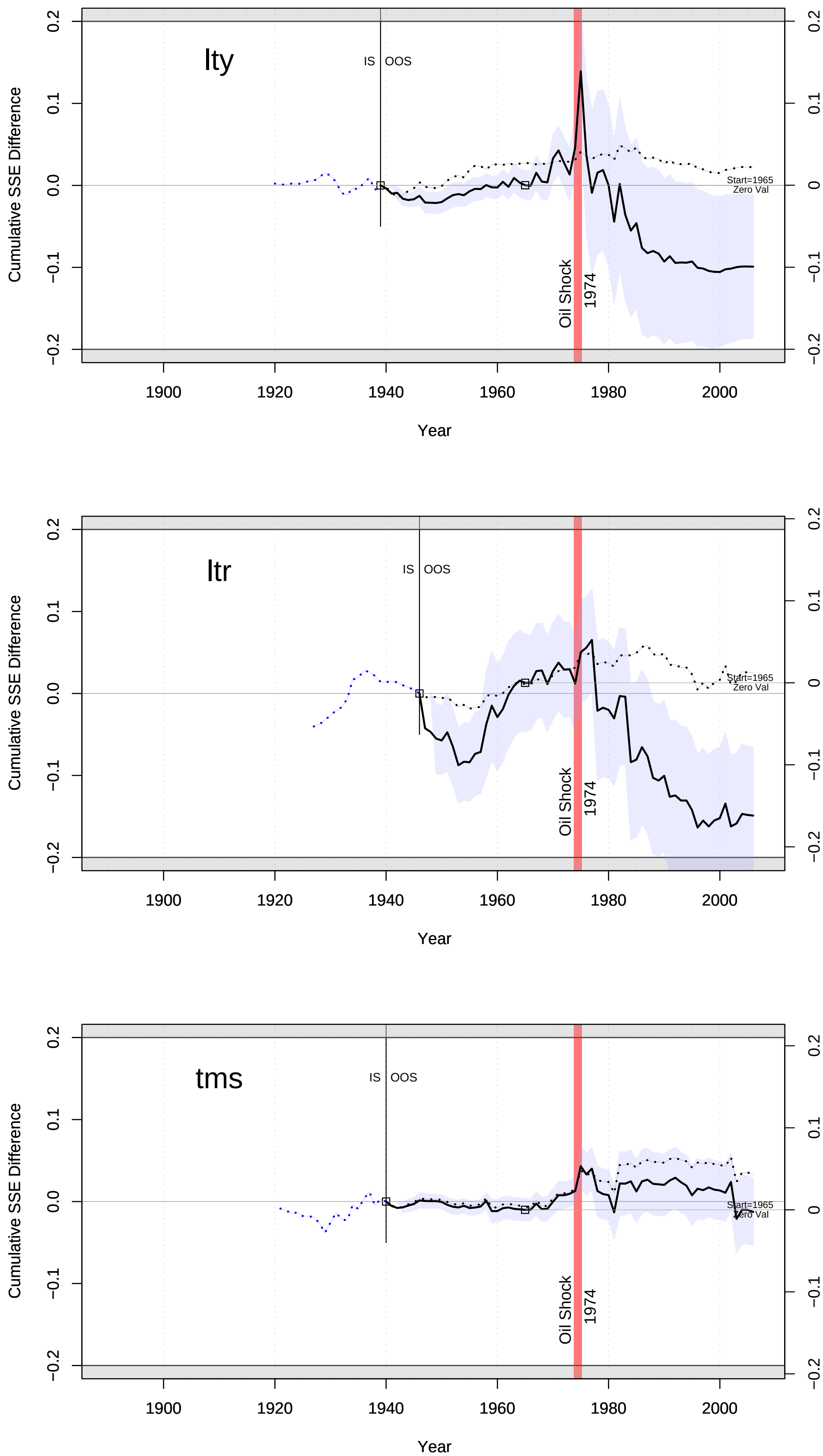
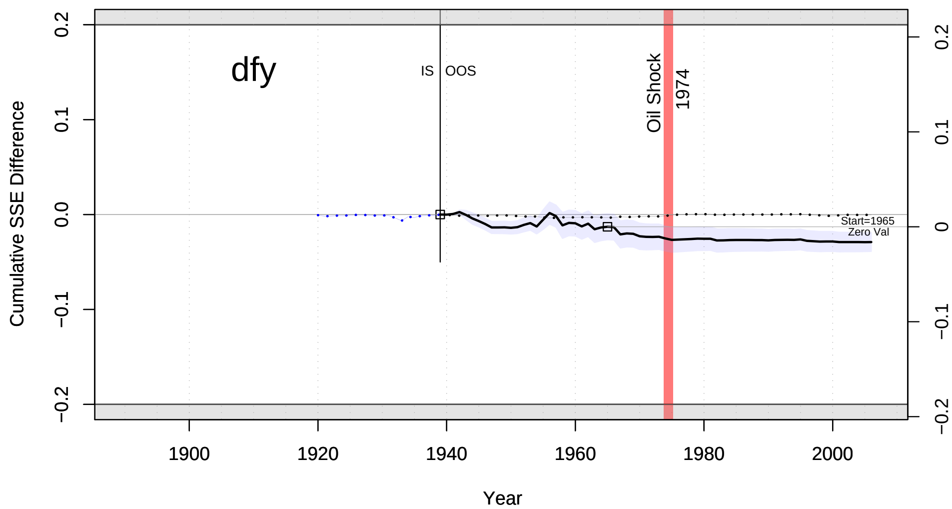
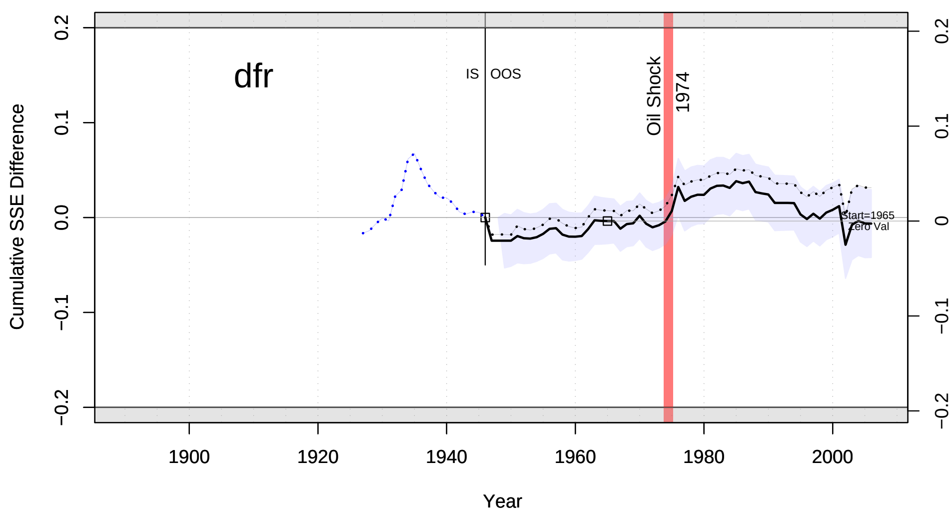
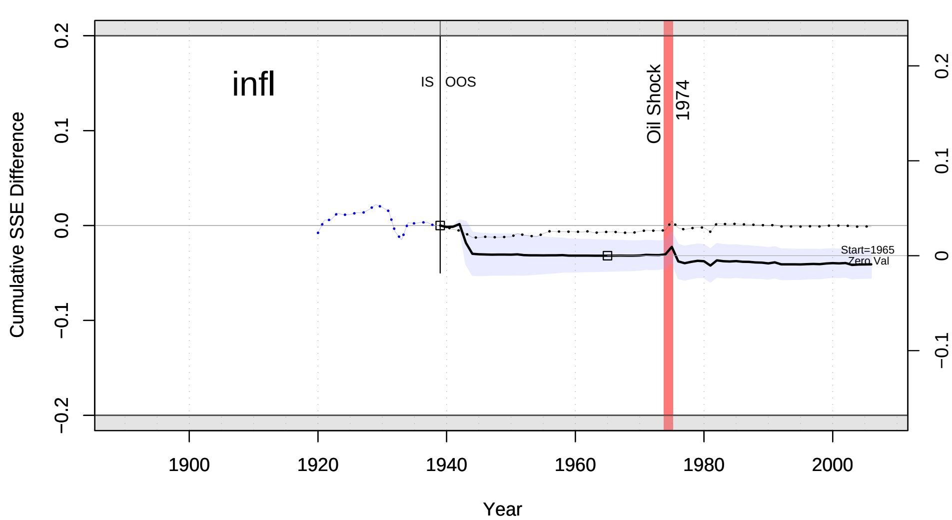


Figure 1: continued

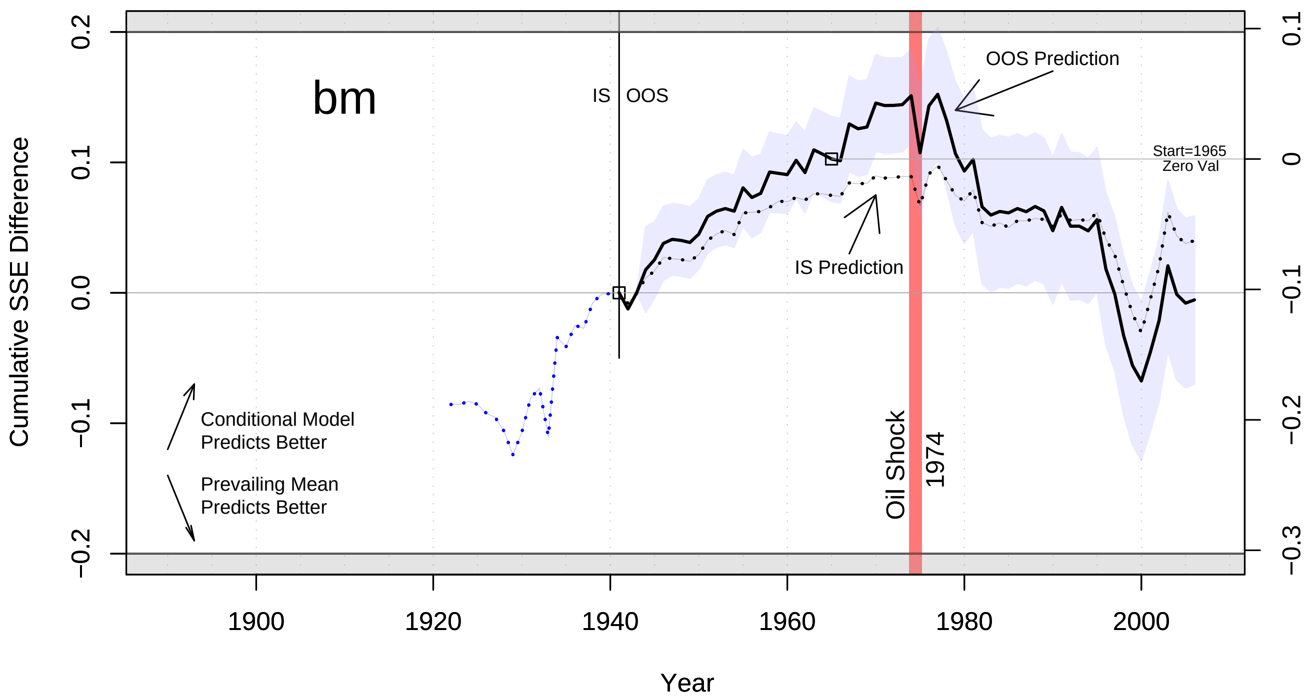






Explanation: These figures plot the IS and OOS performance of annual predictive regressions. Specifically, these are the cumulative squared prediction errors of the NULL minus the cumulative squared prediction error of the ALTERNATIVE. The ALTERNATIVE is a model that relies on predictive variables noted in each graph. The NULL is the prevailing equity premium mean for the OOS graph, and the full-period equity premium mean for the IS graph. The IS prediction relative performance is dotted (and usually above), the OOS prediction relative perfomance is solid. An increase in a line indicates better performance of the named model; a decrease in a line indicates better performance of the NULL. The blue band is the equivalent of 95% two-sided levels, based on MSE-T critical values from McCracken (2004). (MSE-T is the Diebold and Mariano (1995) t-statistic modified by Harvey, Leybourne, and Newbold (1998)). The right axis shifts the zero point to 1965. The Oil Shock is marked by a red vertical line.

Figure 2: Annual Performance of Predictors That Are Not In-Sample Significant



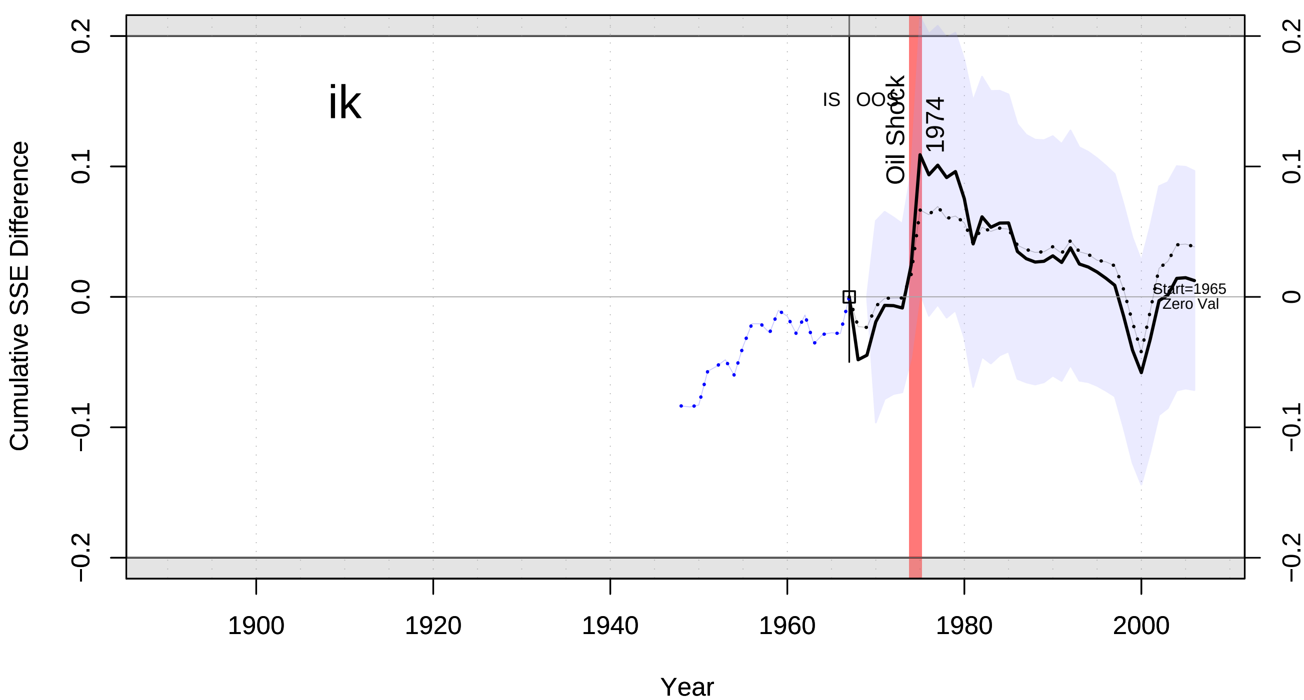
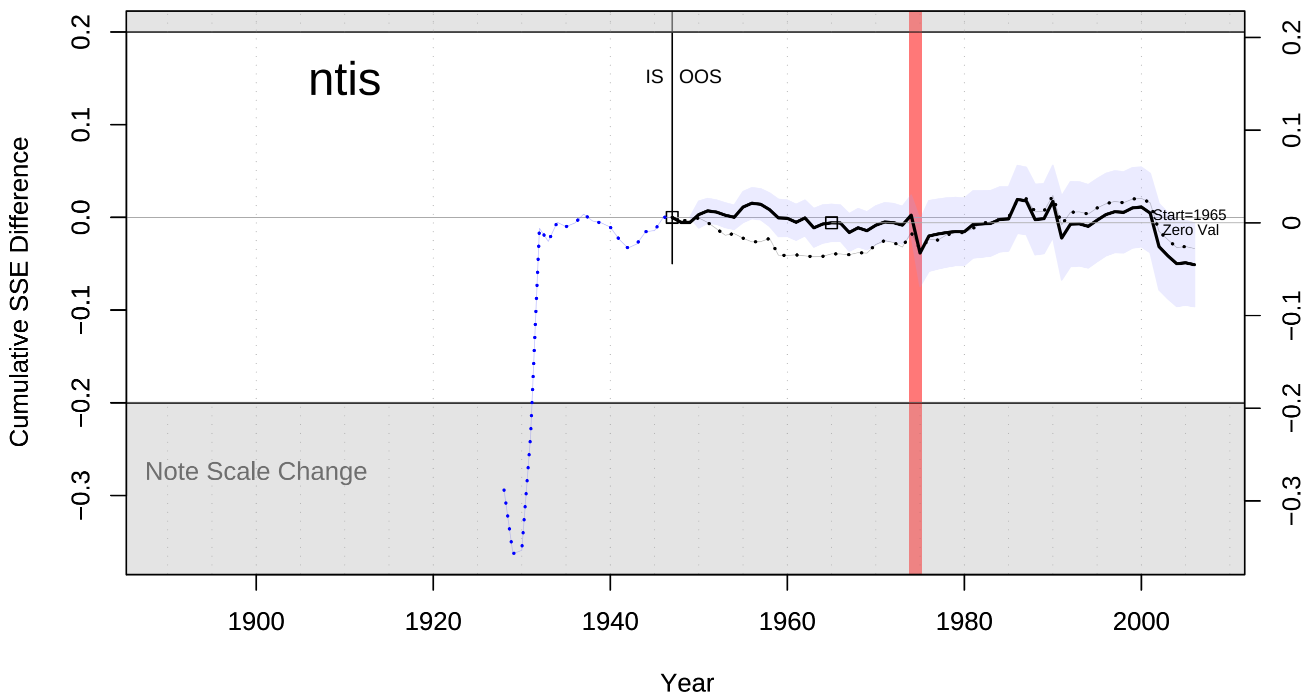


Figure 2: continued



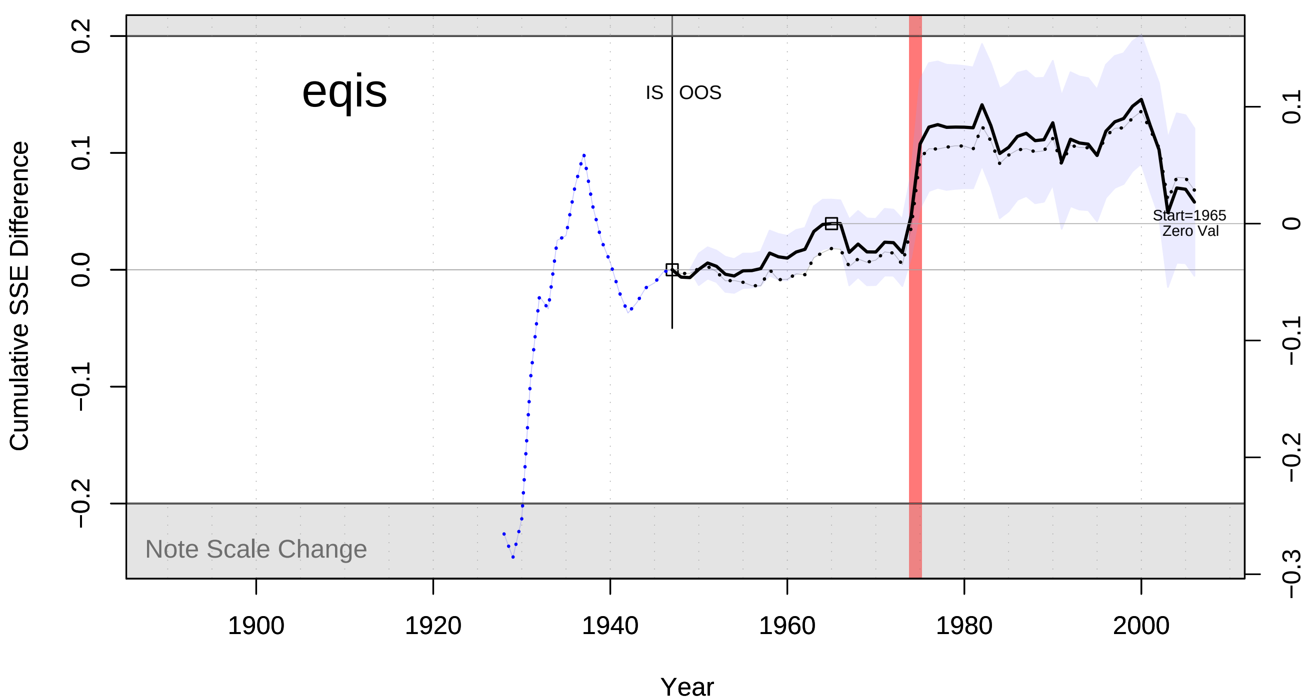


Figure 2: continued

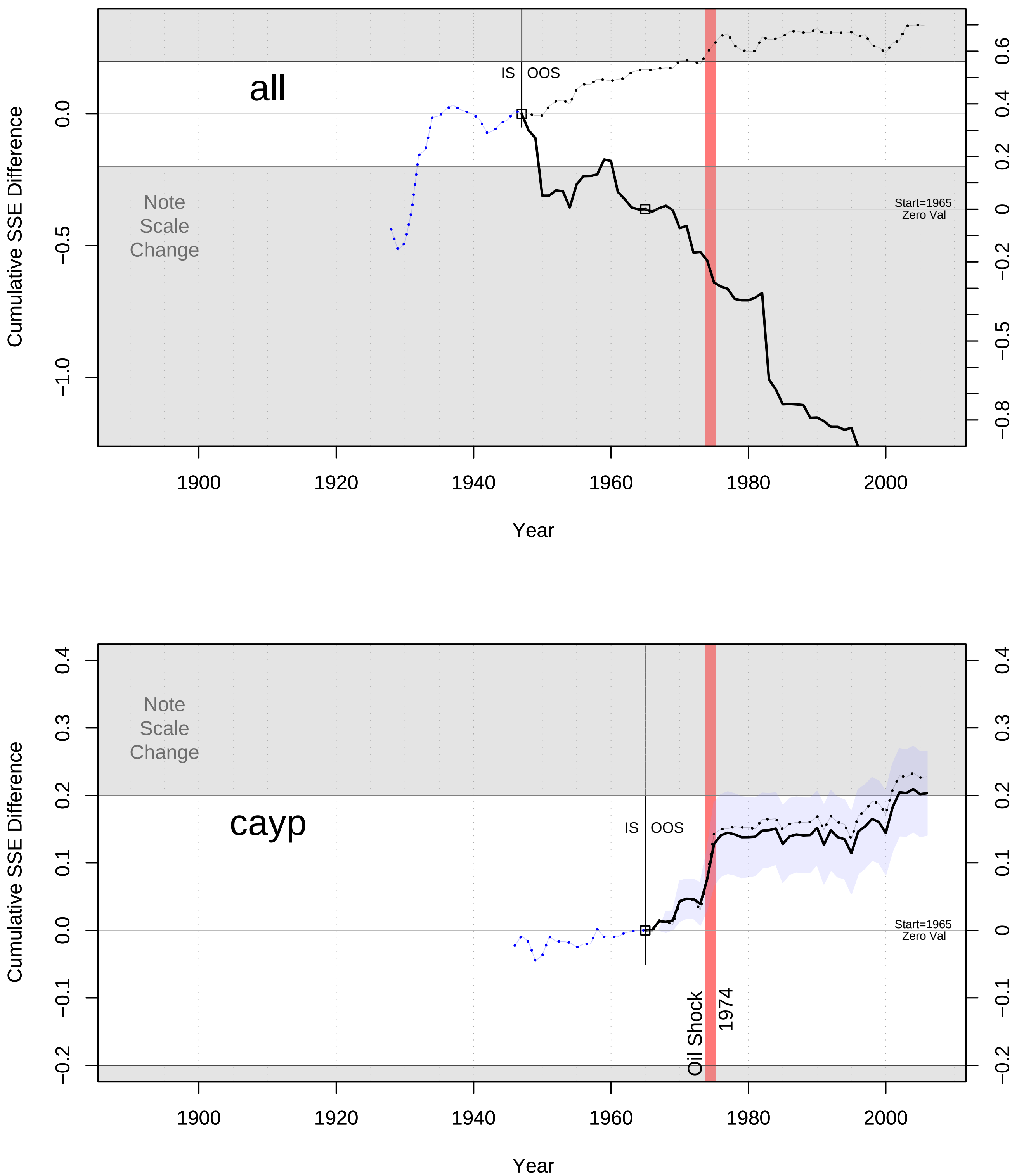
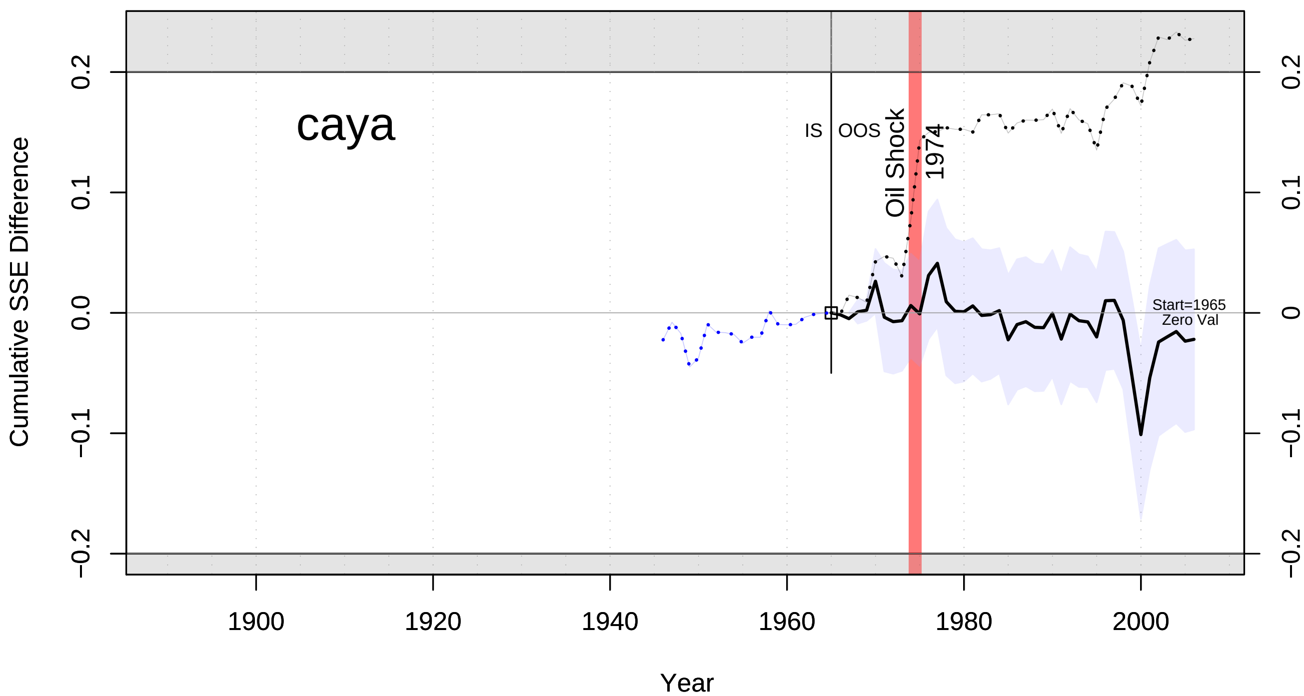
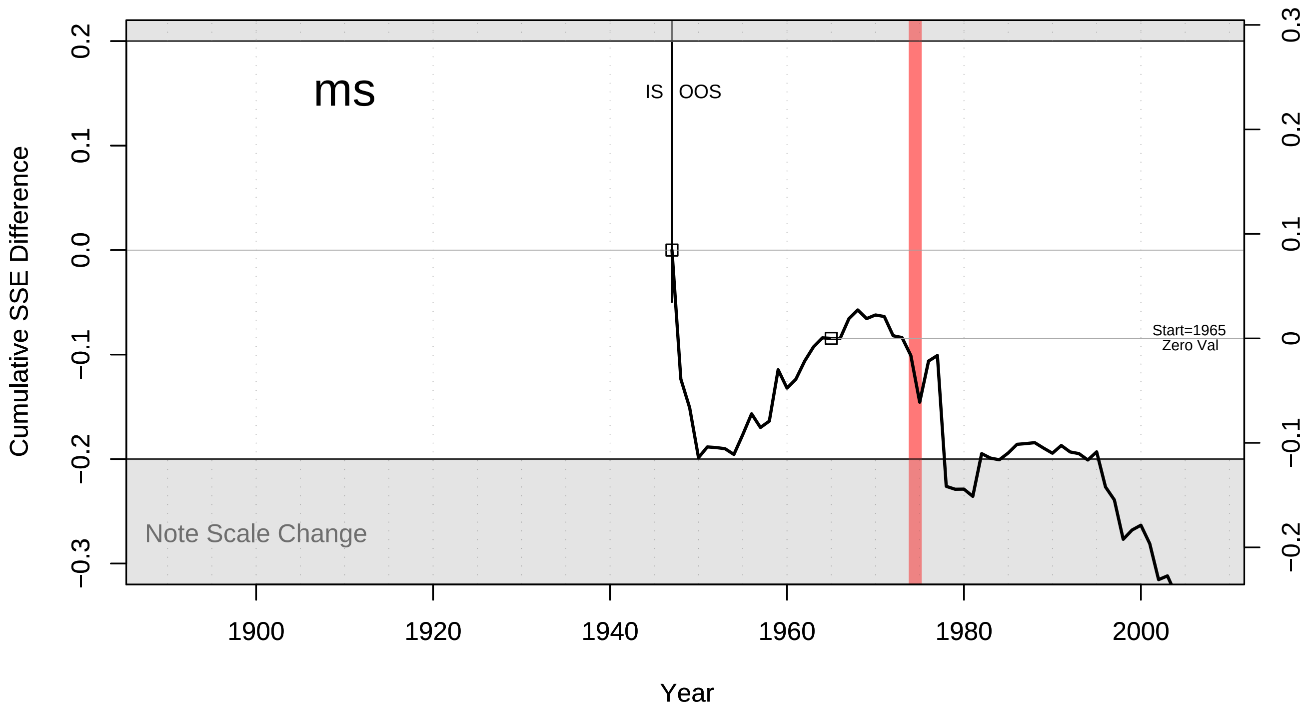


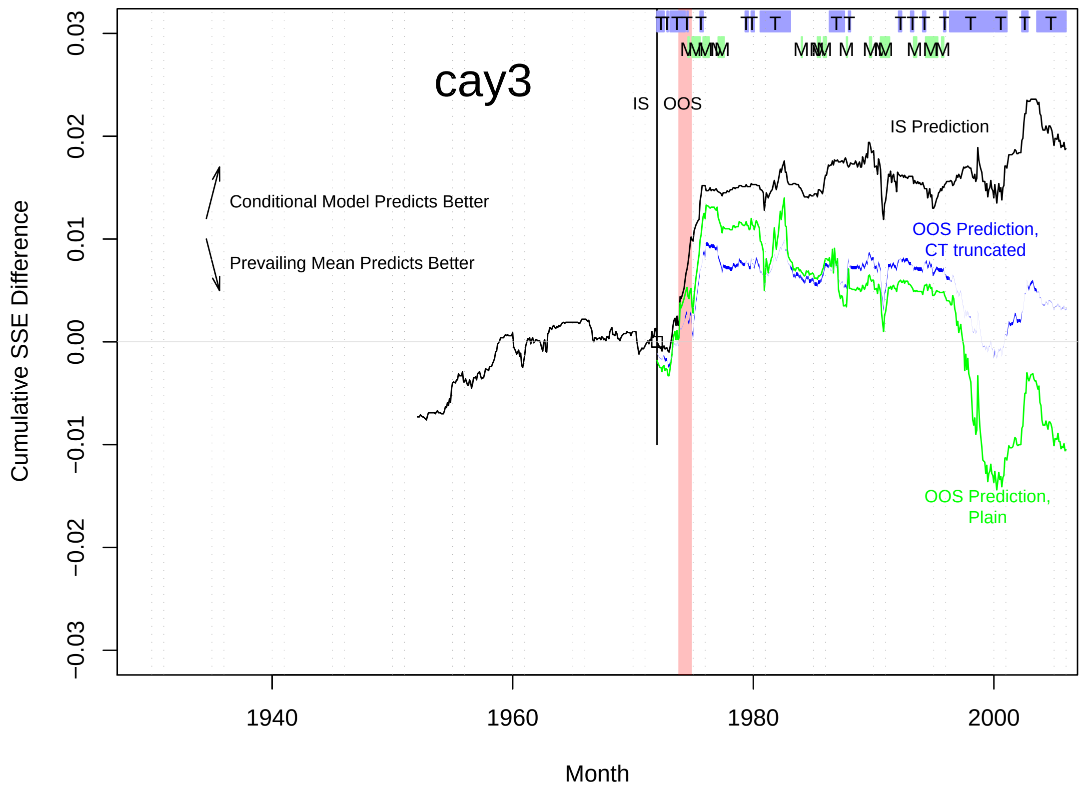
Figure 2: continued





Explanation: See Figure 1.

Figure 3: Monthly Performance of In-Sample Significant Predictors



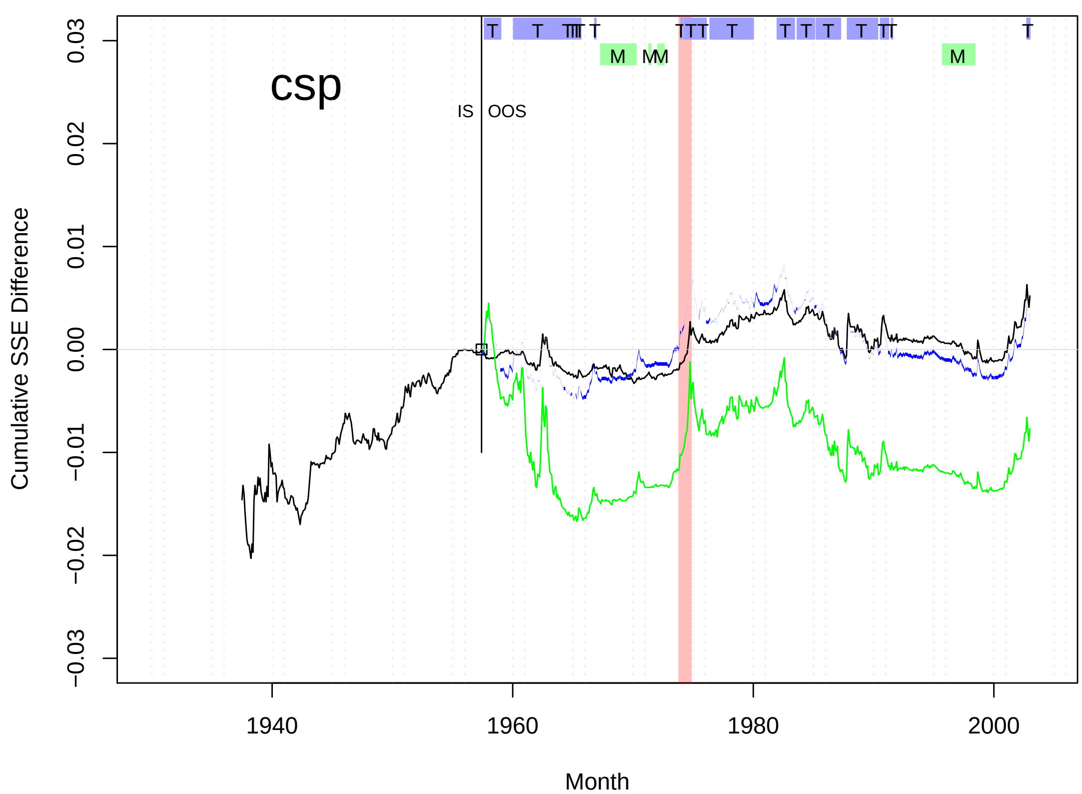
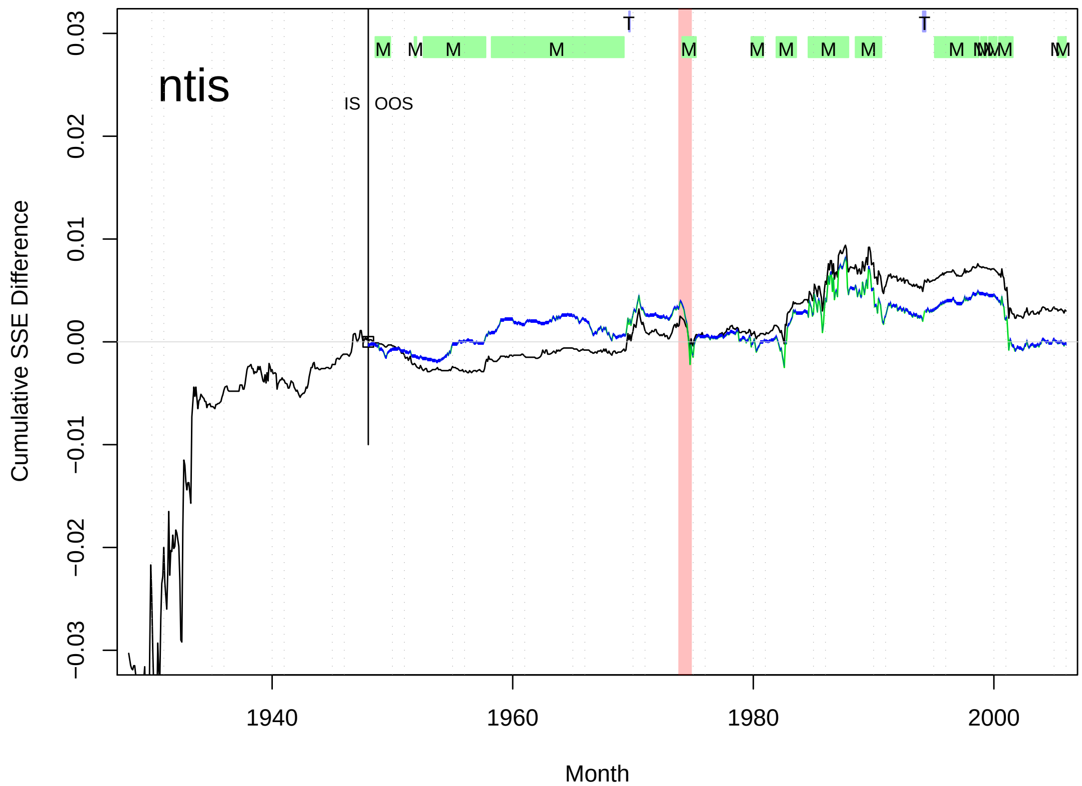


Figure 3: continued



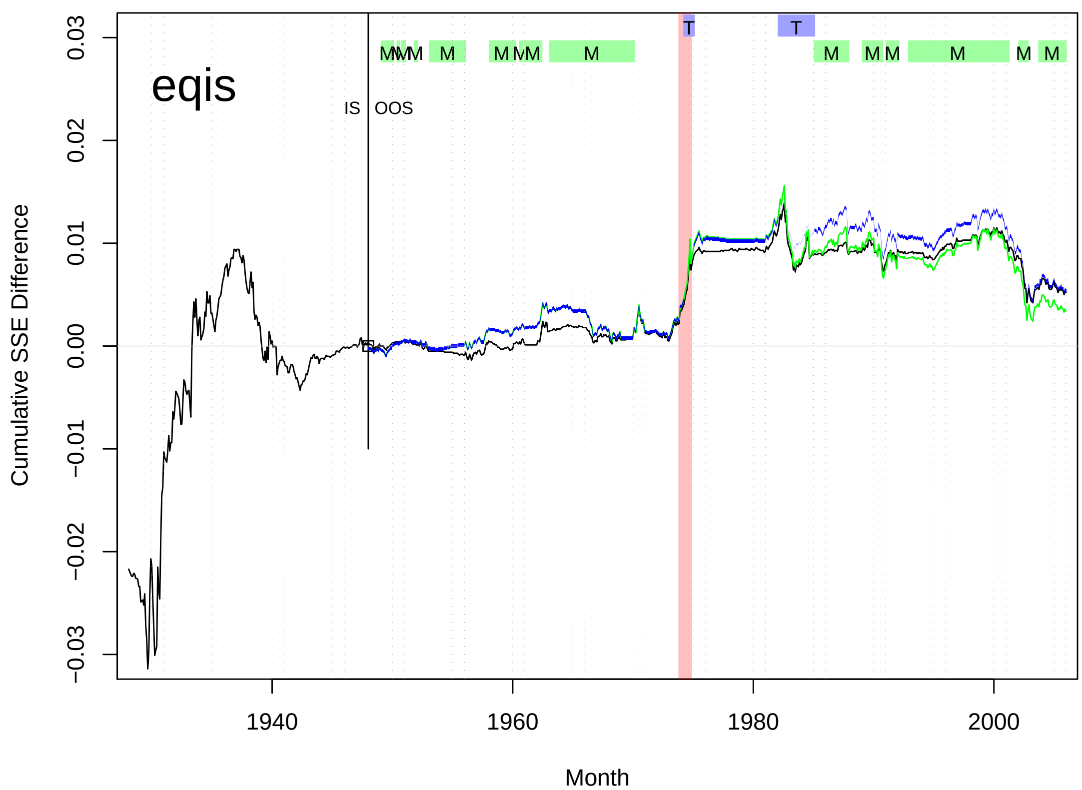
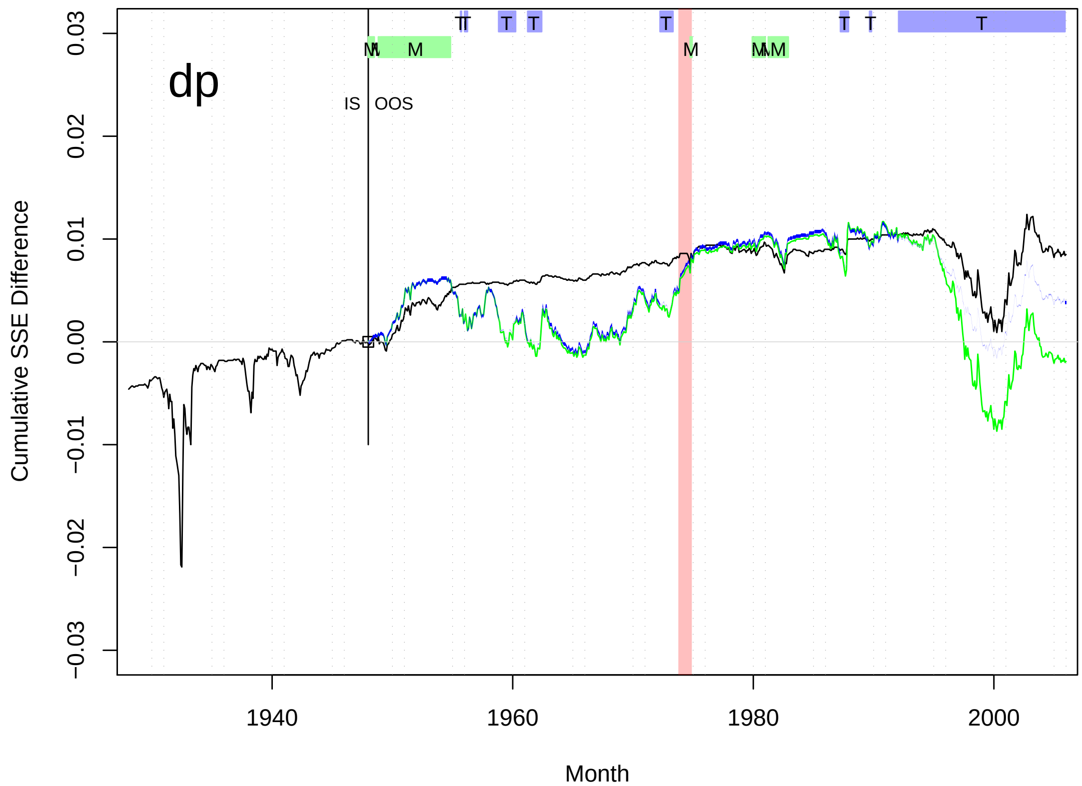


Figure 3: continued



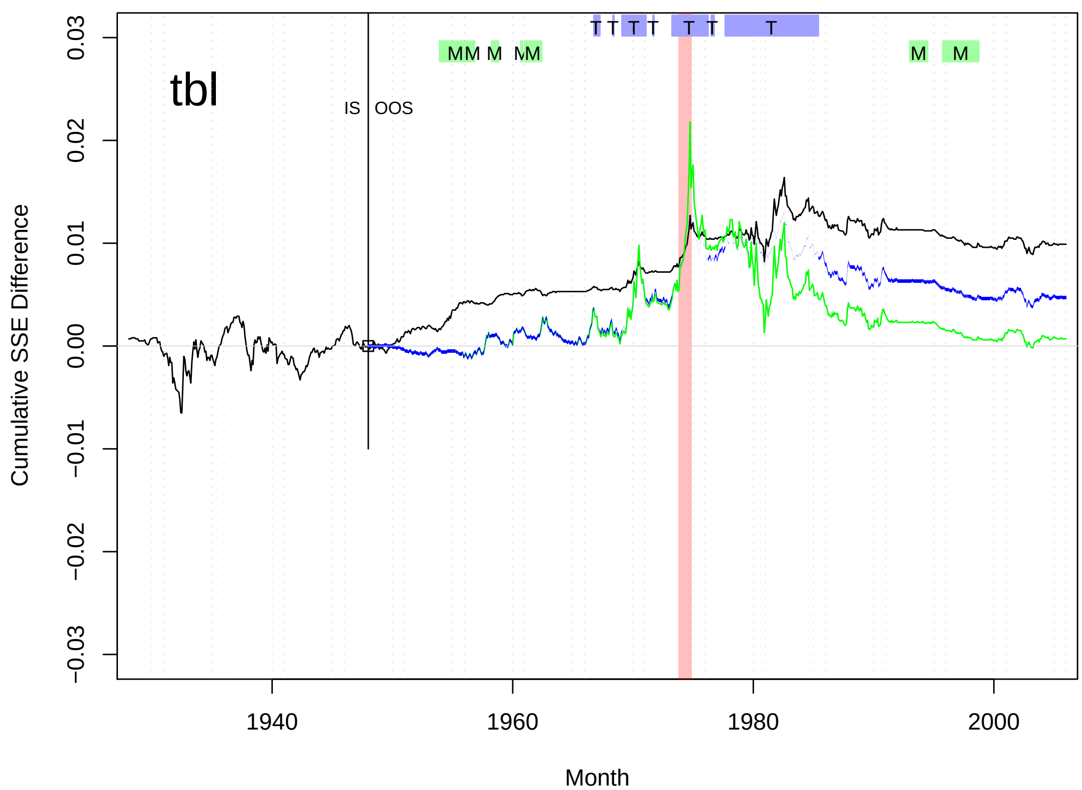
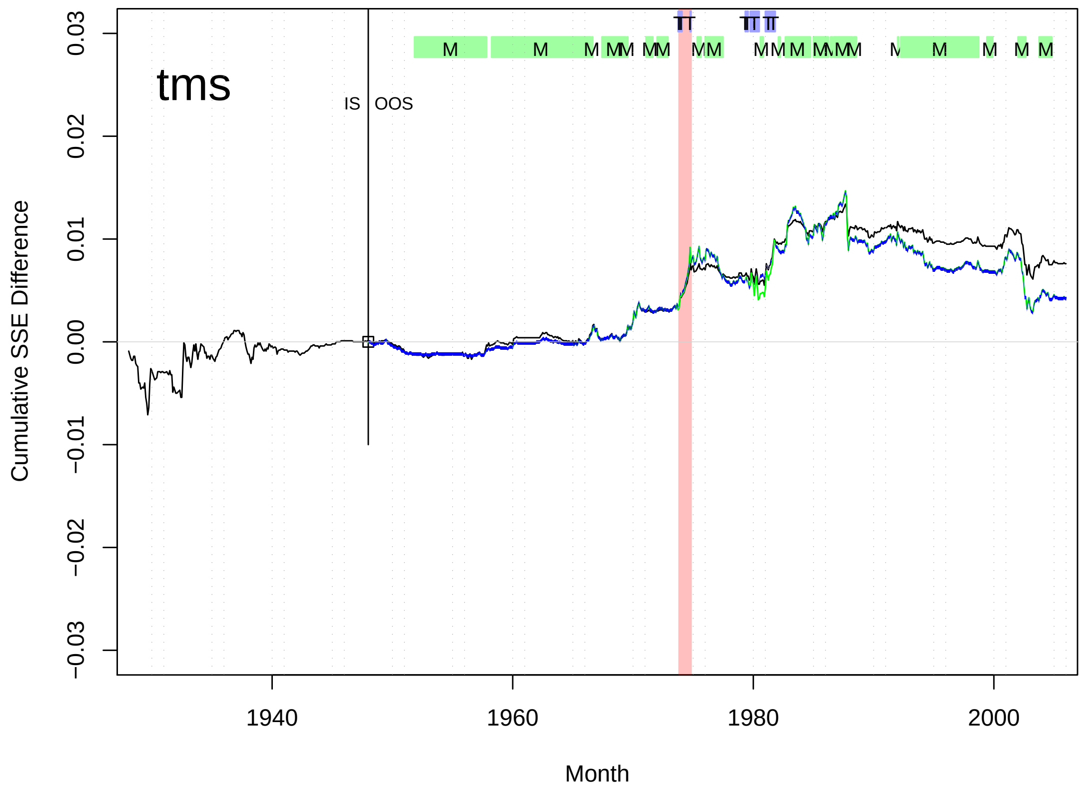


Figure 3: continued



Explanation: These figures are the analogs of Figures 1 and 2, plotting the IS and OOS performance of the named model. However, they use monthly data. The IS performance is in black. The Campbell-Thompson (2005) (CT) OOS model performance is plotted in blue, the plain OOS model performance is plotted in green. The top bars ("T") indicate truncation of the equity prediction at 0, inducing the CT investor to hold the risk-free security. (This also lightens the shade of blue in the CT line.) The lower bars ("M") indicate when the CT risk-averse investor would purchase equities worth 150% of his wealth, the maximum permitted. The Oil Shock (Nov 1973 to Mar 1975) is marked by a red vertical line.

Table 1: Forecasts at Annual Frequency

This table presents statistics on forecast errors in-sample (IS) and out-of-sample (OOS) for log equity premium forecasts at annual frequency (both in the forecasting equation and forecast). Variables are explained in Section 2. Stock returns are price changes, including dividends, of the S&P500. All numbers are in percent per year, except except $\overline{R}^2$ and power which are simple percentages. A star next to IS-$\overline{R}^2$ denotes significance of the in-sample regression as measured by F-statistics (critical values of which are obtained empirically from bootstrapped distributions). The column 'IS for OOS' gives the IS-$\overline{R}^2$ for the OOS period. ΔRMSE is the RMSE (root mean square error) difference between the unconditional forecast and the conditional forecast for the same sample/forecast period. Positive numbers signify superior out-of-sample conditional forecast. The OOS-$\overline{R}^2$ is defined in equation (6). A star next to OOS-$\overline{R}^2$ is based on significance of MSE-F statistic by McCracken (2004), which tests for equal MSE of the unconditional forecast and the conditional forecast. One-sided critical values of MSE statistics are obtained empirically from bootstrapped distributions, except for **caya** and **all** models where they are obtained from McCracken (2004). Critical values for the **ms** model are not calculated. Power is calculated as the fraction of draws where the simulated ΔRMSE is greater than the empirically calculated 95% critical value. The two numbers under the power column are for all simulations and for those simulations in which the in-sample estimate was significant at the 95% level. Significance levels at 90%, 95%, and 99% are denoted by one, two, and three stars, respectively.

	Variable	Data	Full Sample: IS $\overline{R}^2$	Forecasts begin 20 years after sample: IS for OOS $\overline{R}^2$	OOS $\overline{R}^2$	OOS ΔRMSE	Power	Forecasts begin 1965: IS for OOS $\overline{R}^2$	OOS $\overline{R}^2$	OOS ΔRMSE	Power	1927–2005 Sample: IS $\overline{R}^2$
Full Sample, Not Significant IS												
dfy	Default Yield Spread	1919–2005	−1.18		−3.29	−0.14			−4.15	−0.12		−1.31
infl	Inflation	1919–2005	−1.00		−4.07	−0.20			−3.56	−0.08		−0.99
svar	Stock Variance	1885–2005	−0.76		−27.14	−2.33			−2.44	+0.01		−1.32
d/e	Dividend Payout Ratio	1872–2005	−0.75		−4.33	−0.31			−4.99	−0.18		−1.24
lty	Long Term Yield	1919–2005	−0.63		−7.72	−0.47			−12.57	−0.76		−0.94
tms	Term Spread	1920–2005	0.16		−2.42	−0.07			−2.96	−0.03		0.89
tbl	T-Bill Rate	1920–2005	0.34		−3.37	−0.14			−4.90	−0.18		0.15
dfr	Default Return Spread	1926–2005	0.40		−2.16	−0.03			−2.82	−0.02		0.32
d/p	Dividend Price Ratio	1872–2005	0.49		−2.06	−0.11			−3.69	−0.09		1.67
d/y	Dividend Yield	1872–2005	0.91		−1.93	−0.10			−6.68	−0.31		**2.71***
ltr	Long Term Return	1926–2005	0.99		−11.79	−0.76			−18.38	−1.18		0.92
e/p	Earning Price Ratio	1872–2005	1.08		−1.78	−0.08			−1.10	+0.11		**3.20***
Full Sample, Significant IS												
b/m	Book to Market	1921–2005	**3.20***	1.13	−1.72	−0.01	42 (67)	−7.29	−12.71	−0.77	40 (61)	**4.14***
i/k	Invstmnt Capital Ratio	1947–2005	**6.63****	−0.25	−1.77	+0.07	47 (77)		same			same
ntis	Net Equity Expansion	1927–2005	**8.15*****	−4.21	−5.07	−0.26	57 (78)	0.96	−6.79	−0.32	53 (72)	same
eqis	Pct Equity Issuing	1927–2005	**9.15*****	2.81	**2.04****	+0.30	72 (85)	3.64	−1.00	+0.12	66 (77)	same
all	Kitchen Sink	1927–2005	**13.81****	2.62	−139.03	−5.97	- (-)	−20.91	−176.18	−6.19	- (-)	same
Full Sample, No IS Equivalent (caya, ms) or Ex-Post Information (cayp)												
cayp	Cnsmptn, Wlth, Incme	1945–2005	**15.72*****	20.70	**16.78*****	+1.61	- (-)		same			same
caya	Cnsmptn, Wlth, Incme	1945–2005	-	-	−4.33	−0.14	- (-)		same			same
ms	Model Selection	1927–2005	-	-	−22.50	−1.69	- (-)	-	−23.71	−1.79	- (-)	same
1927-2005 Sample, Significant IS												Full Sample
d/y	Dividend Yield	1927–2005	**2.71***					−0.35	−6.44	−0.30	30 (71)	0.91
e/p	Earning Price Ratio	1927–2005	**3.20***					−0.94	−3.15	−0.05	39 (64)	1.08
b/m	Book to Market	1927–2005	**4.14***					−8.65	−19.46	−1.26	45 (64)	**3.20***

Table 2: Forecasts at 5-year Frequency

This table is identical to Table 1, except that we predict overlapping 5-yearly equity premia, rather than annual equity premia.

			Full Sample									1927–2005 Sample
				Forecasts begin 20 years after sample				Forecasts begin 1965				
			IS	IS for	OOS			IS for	OOS			IS
	Variable	Data	$\overline{R}^2$	OOS $\overline{R}^2$	$\overline{R}^2$	ΔRMSE	Power	OOS $\overline{R}^2$	$\overline{R}^2$	ΔRMSE	Power	$\overline{R}^2$
Full Sample, Not Significant IS												
ltr	Long Term Return	1926–2005	−1.36		−7.40	−1.10			−18.92	−2.72		−1.39
dfr	Default Return Spread	1926–2005	−1.36		−5.71	−0.77			−4.01	−0.25		−1.36
infl	Inflation	1919–2005	−1.21		−11.25	−1.70			−7.34	−0.85		−1.21
lty	Long Term Yield	1919–2005	−0.15		−122.13	−17.41			−72.47	−10.96		−0.30
svar	Stock Variance	1885–2005	0.33		−79.33	−13.31			−2.37	+0.03		−0.84
d/e	Dividend Payout Ratio	1872–2005	0.66		−4.87	−0.76			−0.64	+0.31		1.64
dfy	Default Yield Spread	1919–2005	3.54		−59.33	−9.18			**4.97***	+1.38		0.94
tbl	T-Bill Rate	1920–2005	3.83		−17.66	−2.78			−30.19	−4.70		4.91
d/y	Dividend Yield	1872–2005	6.04		−4.45	−0.68			−16.84	−2.19		**14.99***
e/p	Earning Price Ratio	1872–2005	6.24		−1.04	−0.03			−3.03	−0.07		**14.96***
tms	Term Spread	1920–2005	7.84		−26.52	−4.24			**10.46****	+2.44		**12.47***
eqis	Pct Equity Issuing	1927–2005	9.50		−2.35	−0.11			−5.75	−0.56		same
b/m	Book to Market	1921–2005	10.78		−13.06	−2.03			−46.34	−7.17		13.93
Full Sample, Significant IS												
ntis	Net Equity Expansion	1927–2005	**6.59***	−8.28	−3.46	−0.32	21 (70)	1.49	−13.77	−1.92	21 (67)	same
d/p	Dividend Price Ratio	1872–2005	**10.24***	14.35	−1.19*	−0.06	21 (69)	8.30	−26.09	−3.54	20 (51)	**21.24****
i/k	Invstmnt Capital Ratio	1947–2005	**33.99*****	27.42	**12.99****	+3.39	22 (78)		same			same
all	Kitchen Sink	1927–2005	**41.48*****	43.29	−499.83	−45.47	- (-)	19.75	−442.08	−34.19	- (-)	same
Full Sample, No IS Equivalent (caya, ms) or Ex-Post Information (cayp)												
cayp	Cnsmptn, Wlth, Incme	1945–2005	**36.05*****	63.11	**30.35*****	+7.50	- (-)		same			same
caya	Cnsmptn, Wlth, Incme	1945–2005	-	-	**9.10*****	+2.50	- (-)		same			same
ms	Model Selection	1927–2005	-	-	−14465.67	−408.06	- (-)	-	−122.89	−18.03	- (-)	same
1927-2005 Sample, Significant IS												Full Sample
tms	Term Spread	1927–2005	**12.47***					23.24	**12.59****	+2.77	11 (65)	7.84
e/p	Earning Price Ratio	1927–2005	**14.96***					−4.04	−15.33	−2.18	28 (65)	6.24
d/y	Dividend Yield	1927–2005	**14.99***					6.16	−9.47	−1.19	22 (72)	6.04
d/p	Dividend Price Ratio	1927–2005	**21.24****					4.28	−12.69	−1.74	29 (61)	**10.24***

Table 3: Forecasts at Monthly Frequency using Campbell and Thompson (2005) procedure

Refer to Table 1 for basic explanations. This table presents statistics on forecast errors in-sample (IS) and out-of-sample (OOS) for equity premium forecasts at the monthly frequency (both in the forecasting equation and forecast). Variables are explained in Section 2. The data period is December 1927 to December 2004, except for **csp** (May 1937 to December 2002) and **cay**3 (December 1951 to December 2004). Critical values of all statistics are obtained empirically from bootstrapped distributions, except for **cay**3 model where they are obtained from McCracken (2004). The resulting significance levels at 90%, 95%, and 99% are denoted by one, two, and three stars, respectively. They are two-sided for IS model significance, and one-sided for OOS superior model performance. The first data column is the IS $\overline{R}^2$ when returns are logged, as they are in our other tables. The remaining columns are based on predicting simple returns for correspondence with Campbell and Thompson (2005). Certainty Equivalence (CEV) gains are based on the utility of an optimizer with a risk-aversion coefficient of $\gamma = 3$ who trades based on unconditional forecast and conditional forecast. Equity positions are winsorized at 150% ($w = w_{\max}$). At this risk-aversion, the base CEV are 82bp for a market-timer based on the unconditional forecast, 79bp for the market, and 40bp for the risk-free rate. "T" means "truncated" to avoid a negative equity premium prediction. "U" means unconditional, that is, to avoid a forecast that is based on a coefficient that is inverse to what the theory predicts. A superscript h denotes high trading turnover of about 10%/month more than the trading strategy based on unconditional forecasts.

		Log Returns	Simple Returns									
			IS		OOS	Campbell and Thompson (2005) OOS						
	Variable	IS $\overline{R}^2$	$\overline{R}^2$	$\overline{R}^2$ T	$\overline{R}^2$	Frcst= T	Frcst= U	$\overline{R}^2$ TU	ΔRMSE TU	$w = w_{\max}$	ΔCEV	Fig
d/e	Dividend Payout Ratio	0.02	−0.10	−0.10	−0.70	0.0	7.9	−0.69	−0.0114	57.7	-0.01	
svar	Stock Variance	−0.09	−0.07	−0.07	−0.79	0.0	0.0	−0.79	−0.0134	35.4	-0.04	
dfr	Default Return Spread	−0.02	−0.07	−0.08	−0.37	0.0	20.9	−0.29	−0.0030	44.9	0.01	
lty	Long Term Yield	−0.03	0.02	0.02	−0.80	34.1	0.0	**0.26****	+0.0085	19.5	0.06	
ltr	Long Term Return	0.04	0.07	0.08	−0.63	3.0	38.2	**0.11****	+0.0053	51.2^h	0.06	
infl	Inflation	−0.01	0.14	−0.05	**0.01***	1.3	0.0	**0.07****	+0.0045	43.5^h	0.04	
tms	Term Spread	0.12	0.18	0.20	**0.22****	3.7	0.0	**0.21****	+0.0073	59.3	0.14	F3.G
tbl	T-Bill Rate	0.10	**0.20***	0.15	−0.08*	23.1	0.0	**0.25****	+0.0081	16.4	0.10	F3.F
dfy	Default Yield Spread	−0.06	**0.28***	0.28	−0.56	4.0	0.0	−0.49	−0.0071	27.3	-0.08	
d/p	Dividend Price Ratio	0.12	**0.33***	0.29	−0.30	32.3	0.0	**0.17***	+0.0066	16.1	-0.10	F3.E
d/y	Dividend Yield	**0.22***	**0.47****	0.45	−1.12	54.2	0.0	−0.04*	+0.0023	16.4	-0.14	
e/p	Earning Price Ratio	**0.51****	**0.54****	0.45	−1.04	18.1	0.0	−1.03	−0.0183	34.4	-0.04	
eqis	Pct Equity Issuing	**0.82*****	**0.80*****	0.59	**0.14****	6.7	0.0	**0.30*****	+0.0093	55.8	0.14	F3.D
b/m	Book to Market	**0.45****	**0.81*****	0.88	−3.28	44.3	0.0	−2.23	−0.0432	31.3	-0.22	
e^{10}**/p**	Earning(10Y) Price Ratio	**0.46****	**0.86*****	0.96	−2.21	52.4	0.0	−0.48	−0.0071	15.4	-0.13	
csp	Cross-Sectional Prem	**0.92*****	**0.99*****	0.93	−0.94	44.7	0.0	**0.15****	+0.0072	13.5	0.06	F3.B
ntis	Net Equity Expansion	**0.94*****	**1.02*****	0.88	−0.16	0.4	0.0	−0.16	−0.0003	57.4	0.02	F3.C
cay3	Cnsmptn, Wlth, Incme	**1.88*****	**1.87*****	1.57	−2.05	44.7	0.0	−0.34*	+0.0088	13.2	0.06	F3.A

Table 4: Significant Forecasts Using Various d/p, e/p, and d/e Ratios

Refer to Table 1 for basic explanations. The table reports only those combinations of **d/p e/p** and **d/e** that were found to predict equity premia significantly in-sample. This table presents statistics on forecast errors in-sample (IS) and out-of-sample (OOS) for excess stock return forecasts at various frequencies. Variables are explained in Section 2. All ΔRMSE numbers are in percent per frequency corresponding to the column entitled 'Freq'. The 'Freq' column also gives the first year of forecast. A star next to OOS-$\overline{R}^2$ is based on the MSE-F-statistic by McCracken (2004), which tests for equal MSE of the unconditional forecast and the conditional forecast. One-sided critical values of MSE statistics are obtained empirically from bootstrapped distributions. Significance levels at 90%, 95%, and 99% are denoted by one, two, and three stars, respectively.

				IS	OOS	
	Variable	Data	Freq	$\overline{R}^2$	$\overline{R}^2$	ΔRMSE
e/p	Earning(1Y) Price Ratio	1927–2005	M 1965–	**0.54****	−1.20	−0.02
e^5/p	Earning(5Y) Price Ratio	1927–2005	M 1965–	**0.32***	−0.60	−0.01
e^{10}/p	Earning(10Y) Price Ratio	1927–2005	M 1965–	**0.49****	−0.83	−0.01
e^3/p	Earning(3Y) Price Ratio	1882–2005	A 1902–	**2.53****	−1.05*	−0.01
e^5/p	Earning(5Y) Price Ratio	1882–2005	A 1902–	**2.88****	−0.52*	+0.04
e^{10}/p	Earning(10Y) Price Ratio	1882–2005	A 1902–	**4.89****	**2.12****	+0.30
d^3/p	Dividend(3Y) Price Ratio	1882–2005	A 1902–	**1.85***	−1.53	−0.05
d^5/p	Dividend(5Y) Price Ratio	1882–2005	A 1902–	**2.48***	−0.54*	+0.04
d^{10}/p	Dividend(10Y) Price Ratio	1882–2005	A 1902–	**2.11***	−1.07*	−0.01
e^3/p	Earning(3Y) Price Ratio	1882–2005	A 1965–	**2.53****	−3.41	−0.06
e^5/p	Earning(5Y) Price Ratio	1882–2005	A 1965–	**2.88****	−5.01	−0.19
e^{10}/p	Earning(10Y) Price Ratio	1882–2005	A 1965–	**4.89****	−11.45	−0.66
d^3/p	Dividend(3Y) Price Ratio	1882–2005	A 1965–	**1.85***	−6.55	−0.30
d^5/p	Dividend(5Y) Price Ratio	1882–2005	A 1965–	**2.48***	−8.79	−0.47
d^{10}/p	Dividend(10Y) Price Ratio	1882–2005	A 1965–	**2.11***	−8.32	−0.43
e^3/p	Earning(3Y) Price Ratio	1882–2005	5Y 1902–	**11.35***	**3.46****	+0.89
e^5/p	Earning(5Y) Price Ratio	1882–2005	5Y 1902–	**16.16****	**4.76****	+1.16
e^{10}/p	Earning(10Y) Price Ratio	1882–2005	5Y 1902–	**16.47****	−2.85*	−0.37
d/p	Dividend(1Y) Price Ratio	1882–2005	5Y 1902–	**12.30***	−0.66*	+0.06
d^3/p	Dividend(3Y) Price Ratio	1882–2005	5Y 1902–	**13.11***	−2.02*	−0.21
d^5/p	Dividend(5Y) Price Ratio	1882–2005	5Y 1902–	**13.75***	−3.85*	−0.57
e^3/p	Earning(3Y) Price Ratio	1882–2005	5Y 1965–	**11.35***	−12.55	−1.56
e^5/p	Earning(5Y) Price Ratio	1882–2005	5Y 1965–	**16.16****	−21.16	−2.85
e^{10}/p	Earning(10Y) Price Ratio	1882–2005	5Y 1965–	**16.47****	−25.65	−3.51
d/p	Dividend(1Y) Price Ratio	1882–2005	5Y 1965–	**12.30***	−29.33	−4.03
d^3/p	Dividend(3Y) Price Ratio	1882–2005	5Y 1965–	**13.11***	−28.11	−3.86
d^5/p	Dividend(5Y) Price Ratio	1882–2005	5Y 1965–	**13.75***	−30.71	−4.23

Table 5: Forecasts at Monthly Frequency with Alternative Procedures and Total Returns

Refer to Table 1 for basic explanations.Columns under the heading 'OLS' are unadjusted betas, columns under the heading 'Stambaugh' correct for betas following Stambaugh (1999), and columns under the heading 'Lewellen' correct for betas following Lewellen (2004). ρ under the column OLS gives the autoregressive coefficient of the variable over the entire sample period (the variables are sorted in descending order of ρ).

			OLS				Stambaugh			Lewellen		
			IS		OOS		IS	OOS		IS	OOS	
	Variable	Data	ρ	$\overline{R}^2$	$\overline{R}^2$	Power	$\overline{R}^2$	$\overline{R}^2$	Power	$\overline{R}^2$	$\overline{R}^2$	Power
d/e	Dividend Payout Ratio	192701–200512	0.9989	0.01	−2.02	15 **(70)**	0.01	−2.11	15 **(69)**	0.01	−2.05	15 **(69)**
lty	Long Term Yield	192701–200512	0.9963	−0.01	−1.15	9 **(68)**	−0.01	−1.71	9 **(68)**	−0.01	−1.05	10 **(67)**
d/y	Dividend Yield	192701–200512	0.9929	**0.25***	−0.40	33 **(71)**	**0.25***	−0.36	33 **(71)**	**0.25***	−0.26	32 **(72)**
d/p	Dividend Price Ratio	192701–200512	0.9927	0.15	−0.15	29 **(56)**	0.05	−0.31	26 **(69)**	−0.15**	−1.03	3 **(3)**
tbl	T-Bill Rate	192701–200512	0.9922	0.11	−0.18	19 **(69)**	0.11	−0.33	20 **(69)**	0.11	−0.27	20 **(68)**
e/p	Earning Price Ratio	192701–200512	0.9879	**0.54****	−1.21	56 **(64)**	**0.48****	−0.54	59 **(73)**	**0.02*****	−0.01**	41 **(41)**
b/m	Book to Market	192701–200512	0.9843	**0.40****	−2.45	48 **(65)**	**0.36****	−1.61	48 **(71)**	−0.14**	−0.31	19 **(19)**
csp	Cross-Sectional Prem	193705–200212	0.9788	**0.92*****	**0.70*****	65 **(80)**	**0.92*****	**0.70*****	65 **(80)**	**0.91*****	**0.71*****	65 **(81)**
dfy	Default Yield Spread	192701–200512	0.9763	−0.07	−0.14	9 **(59)**	−0.07	−0.33	8 **(59)**	−0.15	−0.71	5 **(43)**
ntis	Net Equity Expansion	192701–200512	0.9680	**0.75*****	−0.28	59 **(76)**	**0.75*****	−0.29	59 **(76)**	**0.74*****	−0.38	58 **(74)**
tms	Term Spread	192701–200512	0.9566	0.07	**0.09***	21 **(66)**	0.07	**0.07***	20 **(65)**	0.07	**0.06***	20 **(65)**
svar	Stock Variance	192701–200512	0.6008	−0.08	−0.34	7 **(53)**	−0.08	−0.34	7 **(53)**	−1.66**	−0.63	7 **(7)**
infl	Inflation	192701–200512	0.5513	−0.00	−0.07	14 **(62)**	−0.00	−0.07	14 **(62)**	−0.03	−0.13	15 **(56)**
ltr	Long Term Return	192701–200512	0.0532	0.04	−0.49	18 **(62)**	0.04	−0.48	18 **(62)**	−1.55***	−6.41	12 **(12)**
dfr	Default Return Spread	192701–200512	-0.1996	−0.02	−0.30	12 **(61)**	−0.02	−0.30	12 **(61)**	−1.32*	−2.64	10 **(38)**

Table 6: Encompassing Tests

This table presents statistics on encompassing tests for excess stock return forecasts at various frequencies. Variables are explained in Section 2. All numbers are in percent per frequency corresponding to the panel. λ gives the ex-post weight on the conditional forecast for the optimal forecast that minimizes the MSE. ENC is the test statistic proposed by Clark and McCracken (2001) for a test of forecast encompassing. One-sided critical values of ENC statistic are obtained empirically from bootstrapped distributions, except for **caya**, **cayp**, and **all** models where they are obtained from Clark and McCracken (2001). Critical values for **ms** model are not calculated. **cayp** uses ex-post information. ΔRMSE* is the RMSE difference between the unconditional forecast and the optimal forecast for the same sample/forecast period. ΔRMSE^{*r} is the RMSE difference between the unconditional forecast and the optimal forecast for the same sample/forecast period using rolling estimates of λ. Significance levels at 90%, 95%, and 99% are denoted by one, two, and three stars, respectively.

Panel A: Annual Data

	Estimation: OOS Forecast:		All Data After 20 years					All Data After 1965				After 1927 After 1965				
		Data	$\overline{R}^2$	λ	ENC	ΔRMSE*	ΔRMSE^{*r}	λ	ENC	ΔRMSE*	ΔRMSE^{*r}	$\overline{R}^2$	λ	ENC	ΔRMSE*	ΔRMSE^{*r}
d/p	Dividend Price Ratio	1872–2005	0.49	0.21	0.48	+0.0084	−0.2583	0.40	**0.87***	+0.0664	−0.4989	1.67	0.54	**2.19****	+0.2297	−0.3539
d/y	Dividend Yield	1872–2005	0.91	0.38	1.94	+0.0614	−0.5713	0.30	**1.24***	+0.0749	−0.5389	**2.71***	0.41	**3.24****	+0.2662	−0.2858
e/p	Earning Price Ratio	1872–2005	1.08	0.22	0.40	+0.0074	−0.2266	0.66	**1.21****	+0.1508	−0.4845	**3.20***	0.48	**2.51****	+0.2346	−0.4049
d/e	Dividend Payout Ratio	1872–2005	−0.75	-1.73	−1.46	+0.2135	+0.0960	-8.46	−0.45	+0.7545	+0.2858	−1.24	-4.57	−1.25	+1.2308	+0.7796
svar	Stock Variance	1885–2005	−0.76	-0.42	−4.74	+0.2387	−0.6475	2.07	0.03	+0.0134	−0.5937	−1.32	-16.73	−0.18	+0.5906	+0.4490
b/m	Book to Market	1921–2005	**3.20***	0.49	**4.16****	+0.2532	−0.0575	0.20	**1.27***	+0.0559	−0.7885	**4.14***	0.18	**1.67***	+0.0689	−0.4821
ntis	Net Equity Expansion	1927–2005	**8.15*****	0.31	1.46	+0.0619	−0.2708	0.31	**1.30***	+0.0805	−0.9310	**8.15*****	0.31	**1.30***	+0.0805	−0.9310
eqis	Pct Equity Issuing	1927–2005	**9.15*****	0.67	**4.45****	+0.3917	−0.0564	0.56	**3.12****	+0.3342	−0.7106	**9.15*****	0.56	**3.12****	+0.3342	−0.7106
tbl	T-Bill Rate	1920–2005	0.34	0.39	**2.14***	+0.1031	−1.2425	0.41	**2.16****	+0.1790	−1.3058	0.15	0.33	**2.72****	+0.1863	−0.5619
lty	Long Term Yield	1919–2005	−0.63	0.29	**2.67***	+0.0971	−0.7012	0.28	**2.39****	+0.1447	−0.9358	−0.94	0.25	**2.39****	+0.1317	−0.5682
ltr	Long Term Return	1926–2005	0.99	0.31	**4.55****	+0.2077	−0.1412	0.24	**2.45****	+0.1300	−8.4290	0.92	0.25	**2.44****	+0.1348	−8.7284
tms	Term Spread	1920–2005	0.16	0.38	0.93	+0.0433	−1.0292	0.47	**1.07***	+0.0977	−0.8750	0.89	0.50	**1.95****	+0.1880	−0.5375
dfy	Default Yield Spread	1919–2005	−1.18	-2.62	−0.48	+0.1503	−0.9718	-10.65	−0.30	+0.6395	+0.4999	−1.31	-11.91	−0.24	+0.5677	+0.4496
dfr	Default Return Spread	1926–2005	0.40	0.44	0.87	+0.0501	−0.3698	0.47	0.78	+0.0710	−0.3808	0.32	0.48	0.74	+0.0692	−0.3877
infl	Inflation	1919–2005	−1.00	-2.46	−0.68	+0.2019	−0.4520	-1.48	−0.15	+0.0429	−15.1368	−0.99	-3.12	−0.86	+0.5541	−0.4697
i/k	Invstmnt Capital Ratio	1947–2005	**6.63****	0.53	**3.01****	+0.3330	−0.1950	0.53	**3.01****	+0.3330	−0.1950	**6.63****	0.53	**3.01****	+0.3330	−0.1950
cayp	Cnsmptn, Wlth, Incme	1945–2005	**15.72*****	1.34	**7.62*****	+1.7225	+0.3315	1.34	**7.62*****	+1.7225	+0.3315	**15.72*****	1.34	**7.62*****	+1.7225	+0.3315
all	Kitchen Sink	1927–2005	**13.81****	0.13	4.86	+0.1607	+0.0160	-0.07	−1.26	+0.0342	−0.4666	**13.81****	-0.07	−1.26	+0.0342	−0.4666
caya	Cnsmptn, Wlth, Incme	1945–2005	-	0.45	**3.39****	+0.3117	−0.3185	0.45	**3.39****	+0.3117	−0.3185	-	0.45	**3.39****	+0.3117	−0.3185
ms	Model Selection	1927–2005	-	0.24	4.82	+0.1870	+0.0739	0.07	0.59	+0.0094	−1.1268	-	0.07	0.59	+0.0094	−1.1268

Panel B: Monthly Data

		OOS Forecast:	After 194701					After 196501			
		Data	$\overline{R}^2$	λ	ENC	ΔRMSE*	ΔRMSE*^{r}	λ	ENC	ΔRMSE*	ΔRMSE*^{r}
d/p	Dividend Price Ratio	192701–200512	0.15	0.53	**4.14****	+0.0065	−0.0134	0.53	**2.67****	+0.0063	−0.0109
d/y	Dividend Yield	192701–200512	**0.25***	0.43	**6.53*****	+0.0083	−0.0115	0.45	**3.90****	+0.0078	−0.0084
e/p	Earning Price Ratio	192701–200512	**0.54****	0.35	**9.27*****	+0.0097	−0.0135	0.28	**3.08****	+0.0039	−0.0172
d/e	Dividend Payout Ratio	192701–200512	0.01	-0.02	−0.22	+0.0000	−0.0146	-1.12	−3.01	+0.0152	+0.0003
svar	Stock Variance	192701–200512	−0.08	-12.30	−0.47	+0.0172	+0.0046	-12.93	−0.32	+0.0184	+0.0060
csp	Cross-Sectional Prem	193705–200212	**0.92*****	0.38	**6.21*****	+0.0093	−0.0138	0.82	**5.50*****	+0.0219	−0.0007
b/m	Book to Market	192701–200512	**0.40****	0.18	**3.04****	+0.0016	−0.0416	0.07	0.89	+0.0003	−0.0260
ntis	Net Equity Expansion	192701–200512	**0.75*****	0.60	**4.28****	+0.0075	−0.0055	0.47	**2.77****	+0.0058	−0.0180
tbl	T-Bill Rate	192701–200512	0.11	0.50	**5.47****	+0.0081	−0.0222	0.51	**4.86*****	+0.0110	−0.0218
lty	Long Term Yield	192701–200512	−0.01	0.35	**7.57*****	+0.0079	−0.0084	0.35	**5.47*****	+0.0086	−0.0161
ltr	Long Term Return	192701–200512	0.04	-0.15	−0.77	+0.0003	−0.0129	0.30	**1.02***	+0.0014	−0.0234
tms	Term Spread	192701–200512	0.07	0.68	**2.51****	+0.0050	−0.0311	0.73	**2.37****	+0.0076	−0.0538
dfy	Default Yield Spread	192701–200512	−0.07	-1.04	−0.27	+0.0008	−0.0070	2.15	0.20	+0.0019	−0.0197
dfr	Default Return Spread	192701–200512	−0.02	-0.85	−0.72	+0.0018	−0.0134	-0.03	−0.01	+0.0000	−0.0221
infl	Inflation	192701–200512	−0.00	1.01	0.69	+0.0021	−0.0114	1.19	0.58	+0.0030	−0.0541
all	Kitchen Sink	192701–200512	**1.98*****	0.05	4.39	+0.0008	−0.0150	0.14	**5.88****	+0.0040	−0.0366
ms	Model Selection	192701–200512	–	0.09	1.51	+0.0004	−0.0232	0.14	1.39	+0.0009	−0.0245

References

Ang, A., and G. Bekaert, 2003, "Stock Return Predictability: Is it There?," Working Paper, Columbia University.

Avramov, D., 2002, "Stock Return Predictability and Model Uncertainty," *Journal of Financial Economics*, 64(3), 423–458.

Baker, M., R. Taliaferro, and J. Wurgler, 2004, "Pseudo Market Timing and Predictive Regressions," NBER Working paper No. 10823.

Baker, M., and J. Wurgler, 2000, "The Equity Share in New Issues and Aggregate Stock Returns," *Journal of Finance*, 55(5), 2219–2257.

Ball, R., 1978, "Anomalies in Relationship Between Securities' Yields and Yield-Surrogates," *Journal of Financial Economics*, 6(2/3), 103–126.

Bansal, R., G. Tauchen, and H. Zhou, 2004, "Regime-Shifts, Risk Premiums in the Term Structure, and the Business Cycle," *Journal of Business and Economic Statistics*, 22(4), 396–409.

Bossaerts, P., and P. Hillion, 1999, "Implementing Statistical Criteria to Select Return Forecasting Models: What Do We Learn?," *Review of Financial Studies*, 12(2), 405–428.

Boudoukh, J., R. Michaely, M. P. Richardson, and M. R. Roberts, 2005, "On the Importance of Measuring Payout Yield: Implications for Empirical Asset Pricing," Working Paper, forthcoming in *Journal of Finance*.

Boudoukh, J., M. Richardson, and R. F. Whitelaw, 2005, "The Myth of Long-Horizon Predictability," NBER Working Paper No. 11841.

Breen, W., L. R. Glosten, and R. Jagannathan, 1989, "Economic Significance of Predictable Variations in Stock Index Returns," *Journal of Finance*, 64(5), 1177–1189.

Brennan, M. J., and Y. Xia, 2004, "Persistence, Predictability, and Portfolio Planning," Working Paper, UCLA and Wharton.

Butler, A. W., G. Grullon, and J. Weston, 2005, "Can Managers Forecast Aggregate Market Returns?," *Journal of Finance*, 60(2), 963–986.

Campbell, J. Y., 1987, "Stock returns and the Term Structure," *Journal of Financial Economics*, 18(2), 373–399.

Campbell, J. Y., and R. J. Shiller, 1988a, "Stock Prices, Earnings, and Expected Dividends," *Journal of Finance*, 43(3), 661–676.

——— , 1988b, "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *Review of Financial Studies*, 1(3), 195–227.

——— , 1998, "Valuation Ratios and the Long-Run Stock Market Outlook," *Journal of Portfolio Management*, 24(2), 11–26.

Campbell, J. Y., and S. B. Thompson, 2005, "Predicting the Equity Premium Out of Sample: Can Anything Beat the Historical Average?," Working Paper, Harvard University.

Campbell, J. Y., and L. M. Viceira, 2002, *Strategic Asset Allocation: Portfolio Choice for Long-Term Investors.* Oxford University Press, Oxford, UK.

Campbell, J. Y., and T. Vuolteenaho, 2004, "Inflation Illusion and Stock Prices," *American Economic Review*, 94(2), 19–23.

Campbell, J. Y., and M. Yogo, 2006, "Efficient Tests of Stock Return Predictability," Working Paper, forthcoming in *Journal of Financial Economics*.

Clark, T. E., and M. W. McCracken, 2001, "Tests of Forecast Accuracy and Encompassing for Nested Models," *Journal of Econometrics*, 105, 85–110.

Cochrane, J. H., 1991, "Production-Based Asset Pricing and the Link Between Stock Returns and Economic Fluctuations," *Journal of Finance*, 46(1), 209–237.

——— , 1997, "Where is the Market Going? Uncertain Facts and Novel Theories," *Federal Reserve Bank of Chicago - Economic Perspectives*, 21(6), 3–37.

——— , 2005, "The Dog That Did Not Bark: A Defense of Return Predictability," Working Paper, University of Chicago.

Diebold, F. X., and R. S. Mariano, 1995, "Comparing Predictive Accuracy," *Journal of Business & Economic Statistics*, 13(3), 253–263.

Dow, C. H., 1920, "Scientific Stock Speculation," The Magazine of Wall Street.

Fama, E. F., 1981, "Stock Returns, Real Activity, Inflation, and Money," *American Economic Review*, 71(4), 545–565.

Fama, E. F., and K. R. French, 1988, "Dividend Yields and Expected Stock Returns," *Journal of Financial Economics*, 22(1), 3–25.

——— , 1989, "Business Conditions and Expected Returns on Stocks and Bonds," *Journal of Financial Economics*, 25(1), 23–49.

Fama, E. F., and G. W. Schwert, 1977, "Asset Returns and Inflation," *Journal of Financial Economics*, 5(2), 115–146.

Ferson, W. E., S. Sarkissian, and T. T. S. Simin, 2003, "Spurious Regressions in Financial Economics," *Journal of Finance*, 58(4), 1393–1413.

Fisher, K. L., and M. Statman, 2005, "Market Timing at Home and Abroad," Working Paper, Santa Clara University.

Goetzmann, W. N., and P. Jorion, 1993, "Testing the Predictive Power of Dividend Yields," *Journal of Finance*, 48(2), 663–679.

Goyal, A., and I. Welch, 2003, "Predicting the Equity Premium with Dividend Ratios," *Management Science*, 49(5), 639–654.

Guo, H., 2006, "On the Out-of-Sample Predictability of Stock Market Returns," *Journal of Business*, 79(2), 645–670.

Harvey, D. I., S. J. Leybourne, and P. Newbold, 1997, "Testing the Equality of Prediction Mean Squared Errors," *International Journal of Forecasting*, 13(2), 281–291.

Heaton, J., and D. J. Lucas, 2000, "Stock Prices and Fundamentals," in *NBER Macroeconomics Annual 1999*, ed. by B. S. Bernanke, and J. Rotemberg. MIT Press/NBER, Cambridge, MA, vol. 14, pp. 213–242.

Hodrick, R. J., 1992, "Dividend Yields and Expected Stock Returns: Alternative Procedures for Inference and Measurement," *Review of Financial Studies*, 5(3), 257–286.

Inoue, A., and L. Kilian, 2004, "In-Sample or Out-of-Sample Tests of Predictability: Which One Should We Use?," *Econometric Reviews*, 23(4), 371–402.

Jagannathan, R., E. R. McGrattan, and A. Scherbina, 2000, "The Declining U.S. Equity Premium," *Federal Reserve Bank of Minneapolis Quarterly Review*, 24(4), 3–19.

Keim, D., and A. Madhavan, 1997, "Transaction Costs and Investment Style: An Inter-Exchange Analysis of Institutional Equity Trades," *Journal of Financial Economics*, 46(3), 265–292.

Keim, D. B., and R. F. Stambaugh, 1986, "Predicting Returns in the Stock and Bond Markets," *Journal of Financial Economics*, 17(2), 357–390.

Kilian, L., 1999, "Exchange Rates and Monetary Fundamentals: What Do We Learn From Long–Horizon Regressions?," *Journal of Applied Econometrics*, 14(5), 491–510.

Kim, C.-J., J. C. Morley, and C. R. Nelson, 2005, "The Structural Break in the Equity Premium," *Journal of Business and Economic Statistics*, 23(2), 181–191.

Kothari, S., and J. Shanken, 1997, "Book-to-market, Dividend Yield, and Expected Market Returns: A Time-Series Analysis," *Journal of Financial Economics*, 44(2), 169–203.

Lamont, O., 1998, "Earnings and Expected Returns," *Journal of Finance*, 53(5), 1563–1587.

Lamoureux, C. G., and G. Zhou, 1996, "Temporary Components of Stock Returns: What Do the Data Tell Us?," *Review of Financial Studies*, 9(4), 1033–1059.

Lettau, M., and S. Ludvigson, 2001, "Consumption, Aggregate Wealth, and Expected Stock Returns," *Journal of Finance*, 56(3), 815–849.

——— , 2005, "Expected Returns and Expected Dividend Growth," *Journal of Financial Economics*, 76(3), 583–626.

Lettau, M., and S. Van Nieuwerburgh, 2005, "Reconciling the Return Predictability Evidence," Working Paper, NYU.

Lewellen, J., 2004, "Predicting Returns with Financial Ratios," *Journal of Financial Economics*, 74(2), 209–235.

Lewellen, J., and J. Shanken, 2002, "Learning, Asset-Pricing Tests, and Market Efficiency," *Journal of Finance*, 57(3), 1113–1145.

Lintner, J., 1975, "Inflation and Security Returns," *Journal of Finance*, 30(2), 259–280.

Mark, N. C., 1995, "Exchange Rates and Fundamentals: Evidence on Long–Horizon Predictability," *American Economic Review*, 85(1), 201–218.

McCracken, M. W., 2004, "Asymptotics for Out-of-Sample Tests of Causality," Working Paper, University of Missouri-Columbia.

Menzly, L., T. Santos, and P. Veronesi, 2004, "Understanding Predictability," *Journal of Political Economy*, 112(1), 1–47.

Nelson, C. R., and M. J. Kim, 1993, "Predictable Stock Returns: The Role of Small Sample Bias," *Journal of Finance*, 48(2), 641–661.

Pesaran, H. M., and A. Timmerman, 1995, "Predictability of Stock Returns: Robustness and Economic Significance," *Journal of Finance*, 50(4), 1201–1228.

Polk, C., S. Thompson, and T. Vuolteenaho, 2006, "Cross-Sectional Forecasts of the Equity Premium," Working Paper, forthcoming in *Journal of Financial Economics*.

Pontiff, J., and L. D. Schall, 1998, "Book-to-Market Ratios as Predictors of Market Returns," *Journal of Financial Economics*, 49(2), 141–160.

Rapach, D. E., and M. E. Wohar, 2006, "In-Sample vs. Out-of-Sample Tests of Stock Return Predictability in the Context of Data Mining," *Journal of Empirical Finance*, 13(2), 231–247.

Rissanen, J., 1986, "Order Estimation by Accumulated Prediction Errors," *Journal of Applied Probability*, 23A, 55–61.

Rozeff, M. S., 1984, "Dividend Yields Are Equity Risk Premiums," *Journal of Portfolio Management*, 11(1), 68–75.

Shiller, R. J., 1984, "Stock Prices and Social Dynamics," *Brookings Papers on Economic Activity*, 2, 457–498.

Stambaugh, R. F., 1999, "Predictive Regressions," *Journal of Financial Economics*, 54(3), 375–421.

Torous, W., and R. Valkanov, 2000, "Boundaries of Predictability: Noisy Predictive Regressions," Working Paper, UCLA.

Valkanov, R., 2003, "Long-Horizon Regressions: Theoretical Results and Applications," *Journal of Financial Economics*, 68(2), 201–232.

Xia, Y., 2001, "Learning about Predictability: The Effects of Parameter Uncertainty on Dynamic Asset Allocation," *Journal of Finance*, 56(1), 205–246.

Equity Risk Premium: 2006 Update

by Roger J. Grabowski, ASA

Are you aware of recent research questioning the use of those realized equity premiums as an estimate of the equity risk premium (ERP)? [1,2] Or do you simply choose to ignore the research?

ERP is a forward-looking concept. ERP is an expectation as of the valuation date for which no "market quotes" are observable. While you can observe premiums realized over time by referring to historical data, such calculated premiums serve only as estimates for the *expected* ERP. If we are to truly mimic the market, then our goal should be to estimate the true expected ERP as of the valuation date. To do that you need to look beyond the realized premiums.

While there is no one universally accepted standard for estimating ERP, you need to be aware of recent research and not blindly continue using the historical realized equity premiums reported in the *SBBI Yearbook*. The methods used can be broadly categorized into one of two approaches: the Realized Return or *ex post* approach and the Forward-looking or *ex ante* approach.

Ex Post Approach

The realized return approach employs the premium that investors have, on the average, realized over some historical holding period (historical realized premium). The underlying theory is that the past provides an indicator of how the market will behave in the future, and investors' expectations are influenced by the historical performance of the market. If periodic (say, monthly) returns are serially independent (i.e., not correlated) and if expected returns are stable through time, the arithmetic average of historical returns provides an unbiased estimate of expected future returns. A more indirect justification for use of the historical approach is the contention that, for whatever reason, securities in the past have been priced in such a way as to earn the returns observed. By using the historical realized premium in applying the income approach to valuation (i.e., in the discounted cash flow valuation method), one may, to some extent, replicate this level of pricing.

Academics often formulate their research in terms of the equity risk premium relative to Treasury bills. But the variability of Treasury bill returns is such that one can hardly consider them riskless. Further we are generally valuing closely held businesses. Those investments are generally thought of as long-term and long-term government bonds are the benchmark security we use in developing discount rates. Therefore, in this article we have reported the research results in terms of the premium over long-term government bonds in calculating the historical realized premium.[3]

In applying the realized return method, the analyst selects the number of years of historical return data to include in the average. One school of thought holds that the future is best estimated using a very long horizon of past returns. Another school of thought holds that the future is best measured by the (relatively) recent past. These differences in opinion result in disagreement as to the number of years to include in the average.

While the *SBBI Yearbook*[4] contains summaries of returns on U.S. stocks and bonds derived from data accumulated by the Center for Research in Security Prices (CRSP) at the University of Chicago since 1926, good stock market data is available back to 1871, and less reliable data is available from various sources back to the end of the eighteenth century. Data for yields on government bonds is also available for these periods.[5] Exhibit 1 displays realized average annual premiums of

---

[1] Readers interested in more detailed information on the ERP issue are invited to attend the American Society of Appraisers' Center for Advanced Business Valuation Studies Cost of Capital course and to read Grabowski and King, Chapter 1, "Equity Risk Premium" in *The Handbook of Business Valuation and Intellectual Property Analysis*, (McGraw-Hill, 2004);"Equity Risk Premium: What Valuation Consultants Need to Know About Current Research" *Valuation Strategies* (Sept/Oct 2003); "Equity Risk Premium: What Valuation Consultants Need to Know About Current Research – 2005 Update" *Valuation Strategies* (Sept/Oct 2005); "Equity Risk Premium – What is the Current Evidence", *Business Valuation Review* (Fall 2005)

[2] The equity risk premium (ERP) (sometimes referred to as the market risk premium) is defined as the extra return (over the expected yield on government securities) that investors expect to receive from an investment in a diversified portfolio of common stocks. ERP = Rm - Rf where Rm is the expected return on a fully diversified portfolio of equity securities and Rf is the rate of return expected on an investment free of default risk.

[3] In applying the ERP in, say, the CAPM, one must use the return on a risk-free security with a term (maturity) consistent with the benchmark security used in developing the ERP. For example, this article measures ERP in terms of the premium over that of long-term government bonds. In CAPM, $ke = Rf + (Beta \times ERP)$. The Rf used as of the valuation date should be the yield on a long-term government bond because the data cited herein has been developed comparing equity returns to the income return (i.e., the yield promised at issue date) of long-term government bonds.

[4] *Stocks, Bonds, Bills and Inflation Valuation Edition 2006 Yearbook* (Ibbotson Associates, 2006)

[5] See Fisher and Lorie, "Rates of Return on Investments in Common Stocks," 37–1 *Journal of Business* (1964); Wilson and Jones, "A Comparison of Annual Stock Market Returns: 1871–1925 with 1926–1985," 60–2 *Journal of Business* 1 (1987); Schwert, "Indexes of Common Stock Returns from 1802 to 1987," 60–3 Journal of Business 239 (1990); Ibbotson and Brinson, *Global Investing* (McGraw-Hill, 1993); Wilson and Jones, "An Analysis of the S&P 500 Index and Cowles's Extensions: Price Indexes and Stock Returns, 1870–1999," 75–3 *Journal of Business* 505 (2002); Wright, "Measures of Stock Market Value and Returns for the US Nonfinancial Corporate Sector, 1900–2000," working paper, 2/1/02.; Goetzmann, Ibbotson and Peng, "A new historical database for the NYSE 1815 to 1925: Performance and Predictability", *Journal of Financial Markets* 4 (2001) 1–32; Dimson, Marsh and Staunton, *Triumph of the Optimists: 101Years of Global Investment Returns* (Princeton University Press, 2002) with annual updates of their Global Returns database for seventeen countries including the U.S. available at www.ibbotson.com.

Exhibit 1
Historical Realized Equity Risk Premiums: Stock Market Returns vs. Treasury Bonds (Income Returns)

Period	Arithmetic (%)	Geometric (%)
20 years (since 1986)	6.4	5.1
30 years (since 1976)	6.0	4.9
40 years (since 1966)	4.2	2.9
50 years (since 1956)	5.0	3.8
80 years (since 1926)	7.1	5.2
106 years (since 1900)	6.7	4.9
134 years (since 1872)	5.9	4.3
208 years (since 1798)	5.1	3.6

Exhibit 2
Historical Realized Returns: Relative Volatility of Stock Returns to Bond Returns

	Realized Equity Risk premiums over Treasury Bond Income Returns Nominal (i.e., without inflation removed)	
	1926–1957	1958–2005
Arithmetic averages (%)	9.5	5.4
Geometric average (%)	6.6	4.2
Standard Deviations		
Stock Market annual returns (%)	24.8	16.7
Long-term Treasury Bond		
Income Returns (%)	0.5	2.4
Total Returns (%)	4.9	11.0
Ratio of Equity to Bond		
Total Return Volatility	5.1	1.5

Source: Ibbotson Associates' data; calculations by author.

stock market returns (relative to the income return on long-term government bonds) for alternative periods through 2005.

The historical realized premium is measured by comparing the stock market returns realized during the period to the income return on bonds. While the stock market return is not known when investing at the beginning of the period, the rate of interest promised on a long-term government bond is known in terms of the yield to maturity. Therefore, analysts measure the stock market returns realized over the expected returns on bonds. An investor makes a decision to invest in the stock market today by comparing the expected return from that investment to the return on a benchmark security (in this case the long-term government bond) given the rate of return today on that benchmark security. The realized return approach is based on the expectation that history will repeat itself and such a premium return will again be realized (on the average) in the future.

Selection of the Observation Period

The historical realized premium derived from realized returns is sensitive to the period chosen for the average. For example, if one includes in the average only observed premiums in the immediate past period, that *ex post* premium may be the inverse of the *ex ante* estimate analysts are looking to develop. Almost all practitioners who use historical data focus on a longer-run view of historical returns. But selection of the period over which to measure those returns is key.

The selection of 1926 as a starting point is a happenstance of the arbitrary selection of that date by the founders of the CRSP database. The average calculated using 1926 return data as a beginning point may be too heavily influenced by the unusually low interest rates during the 1930s to mid-1950s. Some observers have suggested that the period, which includes the 1930s, 1940s, and the immediate post-World War II boom period may have exhibited an unusually high average realized return premium. If we disaggregate the 80 years reported in the *SBBI Yearbook* into two sub-periods, the first covering the periods before and after the mid-1950s, we get the following comparative figures for stock and bond returns as shown in Exhibit 2.

The period since the mid-1950s has been characterized by a more stable stock market and a more volatile bond market compared to the earlier period. Interest rates have become more volatile in the later period.[6] The effect is amplified in the volatility of bond total returns.[7] This data indicates that the *relative* risk of stocks versus bonds is lower today which indicates that the equity risk premium is likely lower today. Thus, the historical arithmetic average realized premium reported in the *SBBI Yearbook* as measured from 1926 likely overstates expected returns as of 2006.

If the average expected return on stocks has changed through time, averages of realized returns using the longest available data become questionable. A short-run horizon may give a better estimate if changes in economic conditions have created a different expected return environment than that of more remote past periods. For example, why not use the average realized return over the past 20-year period? A drawback of using averages over shorter periods is that they are susceptible to large errors in measuring the true ERP due to high volatility of annual stock returns. Also, the average of the realized

[6] As reflected in Ibbotson Associates' Long-term Treasure Bond Income Return statistics.
[7] As reflected in Ibbotson Associates' Long-term Treasure Bond Total Returns which include the capital gains and losses associated with interest rate fluctuations.

premiums over the past 20 years may overstate today's expected returns due to the general downward movement of interest rates since 1981.

Even using long-term observations, the volatility of annual stock returns is high. For example, the standard deviation of the realized average return for the entire 80-year period 1926–2005 is approximately 20%. Even assuming that the 80-year average gives an unbiased estimate, a 95% confidence interval for the unobserved true ERP still spans a range of approximately 2.7% to 11.5%.

Which Average—Arithmetic or Geometric?

Realized return premiums measured using geometric (compound) averages are always less than those using the arithmetic average. The choice between which average to use remains a matter of disagreement among practitioners. The arithmetic average receives the most support in the literature,[8] other authors recommend a geometric average,[9] and still others support something in between.[10] The use of the arithmetic average relies on the assumption that (1) market returns are serially independent (not correlated) and (2) the distribution of market returns is stable (not time-varying). Under these assumptions, an arithmetic average gives an unbiased estimate of expected future returns. Empirical studies generally indicate a fairly low degree of serial correlation, supporting use of the arithmetic average. Moreover, the more observations, the more accurate the estimate will be.

But even if one agrees that stock returns are serially independent, the arithmetic average of one-year realized premiums may not be the best estimate of future premiums. Textbook models of stock returns (e.g., CAPM) are generally single period models that estimate returns over unspecified investment horizons. As the investment horizon increases, the arithmetic average of realized premiums decreases asymptotically to the geometric average of the entire realized premium series. As a result, some recommend using the mid-point of the arithmetic average of one-year realized premiums and the geometric average of the entire realized premium series as the best estimate of the future premiums when one is using historical realized premiums as the basis for their future ERP estimate.[11]

Expected ERP versus Realized Equity Premiums

Much has recently been written comparing the realized returns as reported in sources such as the *SBBI Yearbook* with the ERP that must have been expected by investors given the underlying economics of publicly traded companies (i.e., expected growth in earnings or expected growth in dividends) and the underlying economics of the economy (i.e., expected growth in Gross Domestic Product). Such studies conclude that investors could not have expected as large an ERP as the equity premiums actually realized.

Roger Ibbotson and Peng Chen report on their study of estimated forward looking long-term sustainable equity returns and expected ERPs.[12] They first analyzed historical equity returns by decomposing returns into factors including inflation, earnings, dividends, price-to-earnings ratio, dividend-payout ratio, book value, return on equity, and gross domestic product per capita. They forecast what could have been expected as an ERP through "supply side" models built from historical data. In the most recent update to this study reported in the *SBBI Yearbook*, Ibbotson Associates determined that the long-term ERP that could have been expected given the underlying economics was approximately 6.3% on an arithmetic basis (4.2% on a geometric basis) compared to the historical realized risk premium of 7.1% on an arithmetic basis (5.2% on a geometric basis). The greater-than-expected historical realized equity returns were caused by an unexpected increase in market multiples relative to economic fundamentals (i.e., decline in the discount rates).

What caused the decline in discount rates that led to the unexpected capital gain? The marginal income tax rate declined (the marginal tax rate on corporate distributions averaged 43% in the 1955–1962 period and averaged only 17% in the 1987–2000 period), and equity investments could not be held "tax free" in 1962. By 2000 however, equity investment could be held "tax deferred" in defined benefit and contribution pension plans and in individual retirement accounts. The decrease in income tax rates on corporate distributions and the inflow of retirement plan investment capital into equity

---

[8] E.g., Kaplan, "Why the Expected Rate of Return is an Arithmetic Average," 14–3 Business Valuation Review 126, (September 1995); *Stocks, Bonds, Bills and Inflation Valuation Edition 2005 Yearbook*, (Ibbotson Associates, 2005) pp 75–77; Kritzman, "What Practitioners Need to Know About Future Value," 50–3 *Financial Analysts Journal* 12 (May/June 1994); Bodie, Kane, and Marcus, *Investments* (Richard D. Irwin, Inc.,1989) p. 720.

[9] E.g., Damodaran, *Investment Valuation, 2nd ed*. (John Wiley & Sons, Inc., 2002) p. 161.

[10] Copeland, Koller and Murrin, *Valuation: Measuring and Managing the Value of Companies*, *3rd ed*. (John Wiley & Sons, Inc., 2000) p. 218; Koller, Goedhart and Wessels, *Valuation: Measuring and Managing the Value of Companies, 4th ed.* (John Wiley & Sons, Inc., 2005), p. 299–302; Cornell, *The Equity Risk Premium* (John Wiley & Sons, Inc.,1999) p. 36; Julius, "Market Returns in Rolling Multi-Year Holding Periods: An Alternative Interpretation to Ibbotson Data," 15–2 *Business Valuation Review* 57 (June 1996).

[11] Note 10, *supra*.

[12] Ibbotson and Chen, "Long-Run Stock Returns, Participating in the Real Economy," 591 *Financial Analysts Journal* 88 (January/February 2003) updated in *Stocks, Bonds, Bills and Inflation, Valuation Edition 2006 Yearbook* (Ibbotson Associates, 2006) p 98.

investments combined to lower discount rates and increase market multiples relative to economic fundamentals.[13]

Assuming that investors did not expect such changes, the true ERP during this period has been less than the historical realized premium calculated as the arithmetic average of excess returns realized since 1926. Further, assuming that the likelihood of changes in such factors being repeated are remote and investors do not expect another such decline in discount rates, the true ERP as of today can also be expected to be less than the historical realized premium.

Ex Ante Approaches

Merrill Lynch publishes "bottom-up" expected return estimates for the S&P 500 stock index derived from averaging return estimates for stocks in the S&P 500. While Merrill Lynch does not cover every company in the S&P 500 index, it does cover a high percentage of the companies as measured in market value terms. Merrill Lynch uses a multi-stage dividend discount model (DDM) to calculate expected returns for several hundred companies using projections from its own securities analysts. The resulting data is published monthly in the Merrill Lynch publication *Quantitative Profiles.* The Merrill Lynch expected return estimates have indicated an implied ERP ranging from 3% to 7% in recent years (approximately 6.6% at the end of 2005), with an average over the last 15 years of approximately 4.6%.[14]

Graham and Harvey report the results from a series of surveys of chief financial officers of U.S. corporations conducted from mid-2000 to the end of 2005. They report that the range of ERP given a ten-year investment horizon was 3.6% to 4.7% (premium over ten-year Treasury bonds). The most recent survey reports an ERP given a ten-year investment horizon was 4.7% on an arithmetic average basis (2.4% on a geometric average basis).[15]

Elroy Dimson, Paul Marsh and Mike Staunton studied the realized equity returns and historical equity premiums for 17 countries (including the U.S.) from 1900 to the end of 2005.[16]

These authors report that the historical equity premiums have been 6.5% on an arithmetic basis (4.6% on a geometric basis) for the U.S. (in excess of the total return on bonds) and 5.2% on an arithmetic basis (4.0% on a geometric basis) for the total of the 17 countries.

They observe larger equity returns earned in the second half of the 20th century compared to the first half due to (1) corporate cash flows growing faster than investors anticipated fueled by rapid technological change and unprecedented growth in productivity and efficiency, (2) transaction and monitoring costs falling over the course of the century, (3) inflation rates generally declining over the final two decades of the century and the resulting increase in real interest rates, and (4) required rates of return on equity declining due to diminished business and investment risks. They conclude that the observed increase in the overall price-to-dividend ratio during the century is attributable to the long-term decrease in the required risk premium and that the decrease will not continue into the future. The authors note that:

> Further adjustments should almost certainly be made to historical risk premiums to reflect long-term changes in capital market conditions. Since, in most countries corporate cash flows historically exceeded investors' expectations, a further downward adjustment is in order.

They conclude that a downward adjustment in the expected ERP compared to the historical equity premiums due to the increase in price/dividend ratio is reasonable. Further, they conclude that a further downward adjustment in the expected ERP of approximately 50 to 100 basis points is plausible if one assumes that the current level of dividend yield will continue (versus the greater historical average yield).

Removing the historical increase in the price/dividend ratio and adjusting the historical average dividend yield to today's dividend yield results in an expected equity premium (relative to bonds) of approximately 4.8% - 5.3% on an arithmetic basis (2.8% - 3.3% on a geometric basis) for the U.S. and 3.5% - 4.0% on an arithmetic

---

[13] McGrattan and Prescott, "Is the Market Overvalued?" *Federal Reserve Bank of Minneapolis Quarterly Review* (24,2000) and "Taxes, Regulations and Asset Prices," Federal Reserve Bank of Minneapolis working paper 610 (July, 2001).

[14] Use of analyst projections leads one to the literature on analyst projection bias (i.e., are analyst forecasts overly optimistic?). For example, see Ramnath, Rock and Stone, "*Value Line* and *I/B/E/S* earnings forecasts", working paper (Nov 2001). Those authors reports the results of projected earnings amounts, rather than growth rates (they use the *I/B/E/S* longterm growth rate to project the EPS four years into the future, and compares this with the actual EPS four years in the future. The results indicate that *I/B/E/S* mean forecast error in year 4 EPS is negative. This can be translated into a preliminary typical growth rate adjustment for say a projected 15% growth rate follows: ((1.15^4)(1-.0545))^.25 −1 = 13.4%, implying a ratio of actual to forecast of .134/.15 = .89. This would imply that equity risk premium forecasts using analyst forecasts are biased high. See also, Bonini, Zanetti and Bianchini, "Target Price Accuracy in Equity Research", working paper (Jan 2006).

[15] Graham and Harvey, "Expectations of Equity Risk Premia, Volatility and Asymmetry from a Corporate Finance Perspective," National Bureau of Economic Research working paper, December 2001, updated quarterly by *Duke CFO Outlook Survey* (www.cfosurvey.org); "The Equity Risk Premium in January 2006: Evidence from the Global CFO Outlook Survey", Dec 19, 2005.

[16] Dimson, Marsh and Staunton, "Global Evidence on the Equity Premium," 15–4 The *Journal of Applied Corporate Finance* (Summer 2003); "The Worldwide Equity Premium: A Smaller Puzzle", April 7, 2006; *The Global Investment Returns Yearbook 2006* (ABN-AMRO/London Business School, 2006)

basis (2.4% - 2.9% on a geometric basis) for a world index (denominated in U.S. dollars for 17 countries).[17]

The *SBBI Yearbook* reports on an update to the work authored by Roger Ibbotson and Peng Chen, forecasting ERP based on the contribution of earnings growth to price to earnings ratio growth and on growth in per capital gross domestic product (a "supply side" approach).[18] They remove the increase in historical returns due to the overall increase in price-to-earnings ratio from 1926 to 2005 resulting in an estimate of ERP at the end of 2005 of approximately 6.3% on an arithmetic basis (4.2% on a geometric basis).

William Goetzmann and Roger Ibbotson commenting on the supply side approach of estimating expected risk premiums note:

> These forecasts tend to give somewhat lower forecasts than historical risk premiums, primarily because part of the total returns of the stock market have come from price-earnings ratio expansion. This expansion is not predicted to continue indefinitely,and should logically be removed from the expected risk premium.[19]

Tim Koller, Marc Goedhart, and David Wessels conclude on their assessment of the research and evidence:

> Although many in the finance profession disagree about how to measure the (ERP), we believe 4.5 to 5.5 percent is the appropriate range.[20]

Conclusion

Estimating the ERP is one of the most important issues when you estimate the cost of capital of the subject business. One needs to consider a variety of alternative sources including examining realized returns over various periods and employing forward-looking estimates such as those implied from projections of future prices, dividends, and earnings.

What is a reasonable estimate of ERP in 2006? While giving consideration to long-run historical arithmetic averages realized returns, this author concludes that the post-1925 historical arithmetic average of one-year realized premiums as reported in the *SBBI Yearbook* results in an expected ERP estimate that is too high. I come to that conclusion based on the works of various researchers (e.g., Dimson, Marsh and Staunton, Goetzmann and Ibbotson) and current market expectations (e.g., survey of chief financial officers).

Some appraisers express dismay over the necessity of considering a forward ERP since that would require changing their current "cookbook" practice of relying exclusively on the post-1925 historical arithmetic average of one-year realized premiums reported in the *SBBI Yearbook* as their estimate of the ERP. My reply – valuation is a forward-looking concept, not an exercise in mechanical application of formulas. Correct valuation requires applying value drivers reflected in today's market pricing. Our role is to mimic the market. In the experience of this author, one often cannot match current market pricing for equities using the post-1925 historical arithmetic average of one-year realized premiums as the basis for developing discount rates. The entire appraisal process is based on applying reasoned judgment to the evidence derived from economic, financial and other information and arriving at a well reasoned opinion of value. Estimating the ERP is no different. I challenge all appraisers to look at the evidence.

After considering the evidence, any reasonable long-term estimate of the *normal* ERP as of 2006 should be in the range of 3.5% to 6%.[21]

Roger Grabowski is a Managing Director of Duff & Phelps LLC in Chicago, Il. This author wants to thank Ryan Brown and David Turney of Duff and Phelps and my former colleague, David King, for their assistance. But I accept full responsibility for the final form of the paper. Moreover, this work should not be construed as representing the official organization position of any organization.

[17] Based on this author's converting premium over total returns on bonds as reported by Dimson, Marsh and Staunton, removing the impact of the growth in price-dividend ratios from the geometric average historical premium, reducing the historical average dividend yield to a current dividend yield and converting to an approximate arithmetic average.

One method of converting the geometric average into an arithmetic average is to assume the returns are independently log-normally distributed over time. Then the arithmetic and geometric averages approximately follow the relationship: Arithmetic average of returns for the period = Geometric average of returns for the period + (variance of returns for the period/2).

[18] Note 12, *supra*; Ibbotson, "Equity Risk Premium Forum," AIMR, 11/8/01, pp. 100–104, 108.

[19] Goetzmann and Ibbotson, "History and the Equity Risk Premium", Yale ICF Working Paper No. 05–04 (April 2005), p 8.

[20] Note 10, *supra*: Koller et al., p 306.

[21] Where in this range is the current ERP? Research has shown that ERP is cyclical during the business cycle. When the economy is near or in recession (and reflected in relatively recent low returns on stocks), the *conditional* ERP is more likely at the higher end of the range. When the economy improves (with expectations of improvements reflected in higher stock returns), the *conditional* ERP moves toward the mid-point of the range. When the economy is near its peak (and reflected in relatively recent high stock returns), the *conditional* ERP is more likely at the lower end of the range. This author will let the reader decide where his valuation date lies in the business cycle.

The Equity Risk Premium in 2014

John R. Graham
Fuqua School of Business, Duke University, Durham, NC 27708, USA
National Bureau of Economic Research, Cambridge, MA 02912, USA

Campbell R. Harvey*
Fuqua School of Business, Duke University, Durham, NC 27708, USA
National Bureau of Economic Research, Cambridge, MA 02912, USA

ABSTRACT

We analyze the history of the equity risk premium from surveys of U.S. Chief Financial Officers (CFOs) conducted every quarter from June 2000 to March 2014. The risk premium is the expected 10-year S&P 500 return relative to a 10-year U.S. Treasury bond yield. While the risk premium sharply increased during the financial crisis peaking in February 2009, the premium has decreased to a level of 3.73% which is only slightly higher than the long-term average. However, the total market return forecast is a modest 6.43%. The survey also provides measures of cross-sectional disagreement about the risk premium, skewness, and a measure of individual uncertainty. Consistent with the last four quarters of surveys, CFOs see more downside risks than upside risks. In addition, we find that dispersion of beliefs is above the long-term average as well as individual uncertainty. We also present evidence on the determinants of the long-run risk premium. Our analysis suggests the level of the risk premium closely tracks both market volatility (reflected in the VIX index) as well as credit spreads. However, the most recent data show a divergence between VIX and the risk premium.

JEL Classification: *G11, G31, G12, G14*

Keywords: *Cost of capital, financial crisis, equity premium, long-term market returns, stock return forecasts, long-term equity returns, expected excess returns, disagreement, individual uncertainty, skewness, asymmetry, survey methods, risk and reward, TIPs, VIX, credit spreads*

---

*Corresponding author, Telephone: +1 919.660.7768, Fax: +1 919.660.8030, E-mail: cam.harvey@duke.edu. We appreciate the research assistance of Sergio Correia. Version: April 7, 2014

Introduction

We analyze the results of the most recent survey of Chief Financial Officers (CFOs) conducted by Duke University and *CFO* Magazine. The survey closed on March 4, 2014 and measures expectations beginning in the first quarter of 2014. In particular, we poll CFOs about their long-term expected return on the S&P 500. Given the current U.S. 10-year Treasury bond yield, we provide estimates of the equity risk premium and show how the premium changes through time. We also provide information on the disagreement over the risk premium as well as average confidence intervals.

1. Method

2.1 Design

The quarterly survey of CFOs was initiated in the third quarter of 1996.[1] Every quarter, Duke University polls financial officers with a short survey on important topical issues (Graham and Harvey, 2009). The usual response rate for the quarterly survey is 5%-8%. Starting in June of 2000, a question on expected stock market returns was added to the survey. Fig. 1 summarizes the results from the risk premium question. While the survey asks for both the one-year and ten-year expected returns, we focus on the ten-year expected returns herein, as a proxy for the market risk premium.

The executives have the job title of CFO, Chief Accounting Officer, Treasurer, Assistant Treasurer, Controller, Assistant Controller, or Vice President (VP), Senior VP or Executive VP of Finance. Given that the overwhelming majority of survey respondents hold the CFO title, for simplicity we refer to the entire group as CFOs.

[1] The surveys from 1996Q3-2004Q2 were partnered with a national organization of financial executives. The 2004Q3 and 2004Q4 surveys were solely Duke University surveys, which used Duke mailing lists (previous survey respondents who volunteered their email addresses) and purchased email lists. The surveys from 2005Q1 to present are partnered with *CFO Magazine*. The sample includes both the Duke mailing lists and the *CFO* subscribers that meet the criteria for policy-making positions.

2.2 Delivery and response

In the early years of the survey, the surveys were faxed to executives. The delivery mechanism was changed to the Internet starting with the December 4, 2001 survey. Respondents are given four business days to fill out the survey, and then a reminder is sent allowing another four days. Usually, two-thirds of the surveys are returned within two business days.

The response rate of 5-8% could potentially lead to a non-response bias. There are five reasons why we are not overly concerned with the response rate. First, we do not manage our email list. If we deleted the email addresses that had not responded to the survey in the past 12 quarters, our response rate would be in the 15-20% range – which is a good response rate. Second, Graham and Harvey (2001) conduct a standard test for non-response biases (which involves comparing the results of those that fill out the survey early to the ones that fill it out late) and find no evidence of bias. Third, Brav, Graham, Harvey and Michaely (2005) conduct a captured sample survey at a national conference in addition to an Internet survey. The captured survey responses (to which over two-thirds participated) are qualitatively identical to those for the Internet survey (to which 8% responded), indicating that non-response bias does not significantly affect their results. Fourth, Brav et al. contrast survey responses to archival data from Compustat and find archival evidence for the universe of Compustat firms that is consistent with the responses from the survey sample. Fifth, Campello, Graham, and Harvey (2011) show that the December 2008 response sample is fairly representative of the firms included in the commonly used Compustat database.

2.3 Data integrity

In each quarter, implement a series of rules to ensure the integrity of the data. We have, on average, 349 responses each quarter. There are a total of 19,563 survey observations. There are six key pieces of data: 1) the 10-year forecast (LT); 2) lower 10% of 10-year forecast (LLT); and 3) upper 10% of the 10-year forecast (ULT). We collect the analogous information for the one-year S&P 500 forecasts too (ST). This paper focuses on the 10-year forecasts but the short-term forecasts factor into our data filters.

Our exclusion rules are the following:

1. Delete all missing forecasts, LT, ST
2. Delete all negative LT forecasts (not ST forecasts)
3. Delete all observations that failed to use percentages (forecasts<1.0 for both ST and LT)
4. Delete observations where they failed to annualize, i.e. delete if LT>30% (does not apply to ST)
5. Delete is ST>100%.
6. Delete if lower intervals inconsistent, i.e. LST>=ST or LLT>=LT.
7. Delete if upper intervals inconsistent, i.e. UST<=ST or ULT<=LT.
8. Delete if ST-LST and UST-ST both equal 1 (we call this lazy answer)
9. Delete if LT-LLT and ULT-LT both equal 1 (again, lazy answer)

2.4 The 2014 results

The expected market return questions are a subset of a larger set of questions in the quarterly survey of CFOs. The survey usually contains between eight and ten questions. Some of the questions are repeated every quarter and some change through time depending on economic conditions. The historical surveys can be accessed at http://www.cfosurvey.org. Appendix 1 shows the risk premium question in the most recent survey.

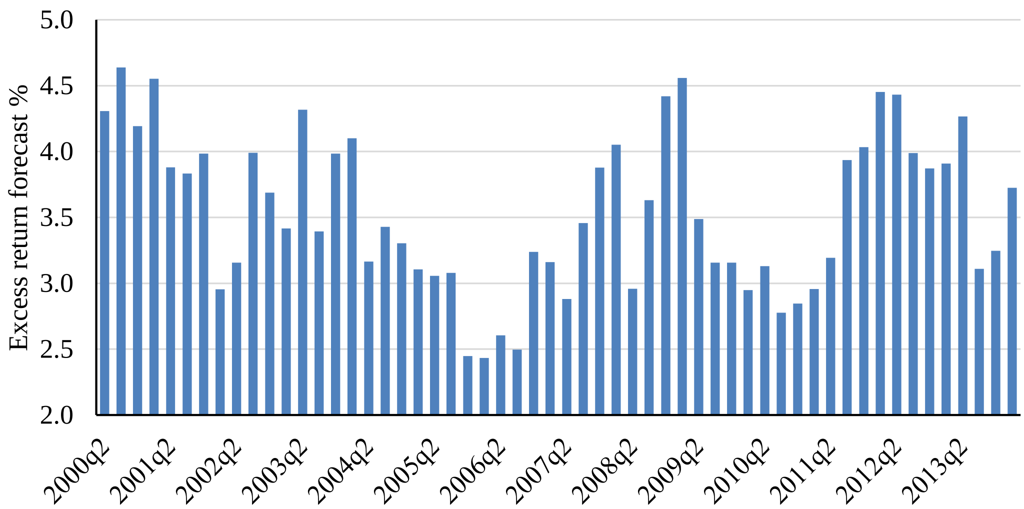
While the survey is anonymous, we collect demographic information on seven firm characteristics, including industry, sales revenue, number of employees, headquarters location, ownership (public or private), and proportion of foreign sales.

During the past ten years, we have collected close to 20,000 responses to the survey. Panel A of Table 1 presents the date that the survey window opened, the number of responses for each survey, the 10-year Treasury bond rate, as well as the average and median expected excess returns. There is relatively little time variation in the risk premium. This is confirmed in Fig. 1a, which displays the historical risk premiums contained in Table 1. The current premium, 3.73%, is well below the premium of 4.56% observed in February 2009. The March 2014 survey shows that the expected annual S&P 500 return is 6.43% (=3.73%+2.70%) which is below the overall average but considerably higher than in the past few years. The total return forecasts are presented in Fig. 1b.[2]

Panel B of Table 1 presents some summary statistics that pool all responses through the history of the survey. The overall average ten-year risk premium return is 3.51%.[3] The standard deviation is 2.87% based on the individual responses (not reported in the Table) and 0.60% based on the quarterly averages.

Figure 1a

10-year forecasted S&P 500 (mean) annual returns over and above the 10-year Treasury bond yield

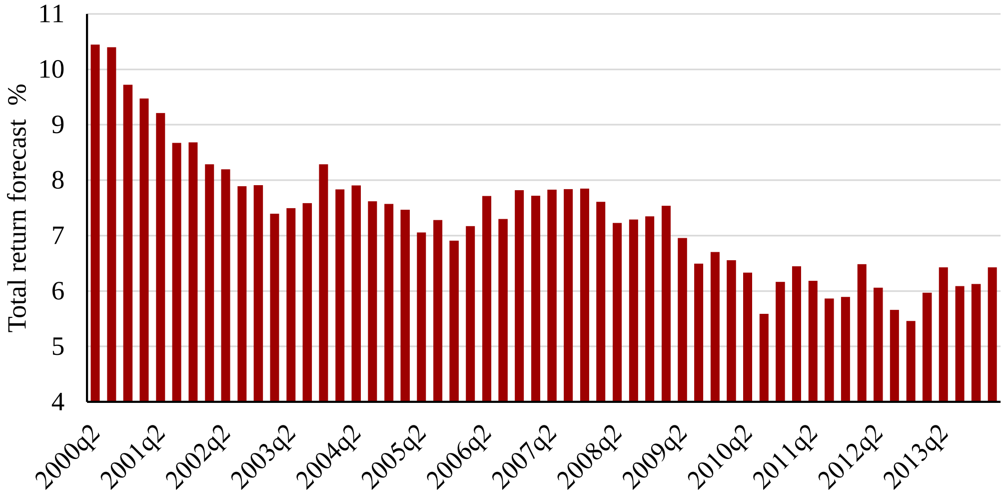


[2] See, for example, Ghysels (1998), Welch (2000, 2001, 2009), Ghysels (1998), Fraser (2001), Harris and Marston (2001), Pástor and Stambaugh (2001), Fama and French (2002), Goyal and Welch (2003), Graham and Harvey (2003), Ang and Bekaert (2005), Fernandez (2004, 2006, 2009) for studies of the risk premium.

[3] Using the Ibbotson Associates data from January 1926 through July 2010, the arithmetic (geometric) average return on the S&P 500 over and above the 30-day U.S. Treasury bill is 7.75% (5.80%). Using data from April 1953-July 2010, the arithmetic (geometric) risk premium is 6.27% (5.12%). The risk premium over the 10 year bond should be reduced by 212 basis points for the arithmetic premium and 174 basis points for the geometric premium. Fama and French (2002) study the risk premium on the S&P 500 from 1872-2000 using fundamental data. They argue that the ex ante risk premia is between 2.55% and 4.32% for 1951-2000 period. Ibbotson and Chen (2001) estimate a long-term risk premium between 4 and 6%. Also see Siegel (1999), Asness (2000), Heaton and Lucas (2000) and Jagannathan, McGratten and Scherbina (2001).

Figure 1b

10-year forecasted S&P 500 total (mean) annualized returns



The cross-sectional standard deviation across the individual CFO forecasts in a quarter is a measure of the disagreement or dispersion of the participants in each survey. Dispersion sharply increased during the global financial crisis. The average disagreement in 2005 was 2.39%. Disagreement increased in 2006 to 2.64%. As the crisis began in 2007, disagreement increased to 2.98 by March 2008. The peak disagreement was recorded in February 2009 (4.13%). The most recent observation is 2.63% which is considerably lower than 2009 and at pre-crisis levels.

We also report information on the average of the CFOs' assessments of the one in ten chance that the market will exceed or fall below a certain level. In the most recent survey, the worst case total return is +1.35% which is slightly lower than the average of 1.70%. The best-case return is 10.13% which is also slightly lower than the average of 11.12%.

With information on the 10% tails, we construct a probability distribution for each respondent. We use Davidson and Cooper's (1976) method to recover each respondent's probability distribution:

$$\text{Variance} = ([x(0.90)-x(0.10)]/2.65)^2$$

where *x*(0.90) and *x*(0.10) represent the 90^{th} and 10^{th} percentiles of the respondent's distribution, ULT and LLT. Keefer and Bodily (1983) show that this simple approximation is the preferred method of estimating the variance of a probability distribution of random variables, given information about the 10^{th} and 90^{th} percentiles. Like disagreement, the average of individual volatilities peaked in February 2009 at 4.29%. The current level, 3.32%, is slightly below the overall average.

There is also a natural measure of asymmetry in each respondent's response. We look at the difference between each individual's 90% tail and the mean forecast and the mean minus the 10% tail. Hence, if the respondent's forecast of the excess return is 6% and the tails are -8% and +11%, then the distribution is negatively skewed with a value of -9% (=5%-14%). As with the usual measure of skewness, we cube this quantity and standardize by dividing by the cube of the individual standard deviation. In every quarter's survey, there is on average negative skewness in the individual forecasts. The average asymmetry -0.69 which is lower than the average of -0.45.

Overall, the survey points to: (a) reduction in the risk premium from peak levels, (b) uncertainty is at pre-crisis levels and (c) CFOs see more downside risk than upside risk.

Table 1

Summary statistics based on the responses from the CFO Outlook Surveys from June 2000 to March 2014

A. By quarter

#	Survey date	Survey quarter	Number of survey responses	10-year bond yield	Total market return forecast	Average risk premium	Median risk premium	Disagreement (standard deviation of risk premium estimates)	Average of individual standard deviations	Average of individuals' worst 10% market return scenario	Average of individuals' best 10% market return scenario	Skewness of risk premium estimates	Average of individuals' asymmetry	% who forecast negative excess return
1	6/6/2000	2000Q2	209	6.14	10.45	4.31	3.86	3.22				0.95		9.09
2	9/7/2000	2000Q3	188	5.76	10.40	4.64	4.24	3.03				0.83		4.79
3	12/4/2000	2000Q4	243	5.53	9.72	4.19	4.47	2.52				0.53		4.12
4	3/12/2001	2001Q1	140	4.92	9.47	4.55	4.58	2.91				0.78		3.57
5	6/7/2001	2001Q2	208	5.33	9.21	3.88	3.67	2.64				0.58		5.77
6	9/10/2001	2001Q3	199	4.84	8.67	3.83	3.16	2.53				0.13		3.52
7	12/4/2001	2001Q4	279	4.70	8.68	3.98	3.30	2.43				0.61		2.15
8	3/11/2002	2002Q1	233	5.33	8.29	2.96	2.67	2.43	3.28	3.68	12.42	1.06	-0.28	11.16
9	6/4/2002	2002Q2	316	5.04	8.20	3.16	2.96	2.61	3.50	3.00	12.28	1.86	-0.39	10.44
10	9/16/2002	2002Q3	361	3.90	7.89	3.99	4.10	2.31	3.39	3.05	12.03	0.86	-0.25	2.77
11	12/2/2002	2002Q4	285	4.22	7.91	3.69	3.78	2.56	3.23	3.32	11.87	1.24	-0.28	4.91
12	3/19/2003	2003Q1	184	3.98	7.40	3.42	3.02	2.37	3.59	1.95	11.47	0.83	-0.62	4.35
13	6/16/2003	2003Q2	366	3.18	7.50	4.32	4.82	2.34	3.74	2.16	12.07	0.90	-0.33	3.28
14	9/18/2003	2003Q3	167	4.19	7.58	3.39	3.81	2.07	2.83	3.31	10.83	0.35	-0.43	6.59
15	12/10/2003	2003Q4	220	4.30	8.29	3.98	3.70	2.66	3.29	3.40	12.10	1.74	-0.45	2.27
16	3/24/2004	2004Q1	206	3.73	7.83	4.10	4.27	2.37	3.46	2.85	12.02	0.50	-0.29	3.88
17	6/16/2004	2004Q2	177	4.74	7.90	3.16	3.26	2.61	3.10	3.14	11.34	2.14	-0.40	6.21
18	9/10/2004	2004Q3	179	4.19	7.62	3.43	3.31	2.92	3.27	2.61	11.29	2.02	-0.52	8.94
19	12/3/2004	2004Q4	287	4.27	7.57	3.30	3.23	2.66	3.05	3.10	11.17	1.89	-0.37	5.92
20	2/28/2005	2005Q1	272	4.36	7.46	3.10	3.39	2.52	3.06	3.13	11.23	1.29	-0.33	6.62
21	5/31/2005	2005Q2	316	4.00	7.06	3.06	3.00	2.22	3.22	2.39	10.93	0.46	-0.26	6.65
22	8/29/2005	2005Q3	321	4.20	7.28	3.08	2.80	2.61	3.36	2.15	11.06	2.42	-0.52	7.48
23	11/21/2005	2005Q4	338	4.46	6.91	2.45	2.54	2.20	3.48	2.23	11.44	0.41	-0.23	9.76
24	3/6/2006	2006Q1	276	4.74	7.17	2.43	2.26	2.40	3.44	2.07	11.18	1.02	-0.37	8.70
25	6/1/2006	2006Q2	494	5.11	7.72	2.61	2.89	2.74	3.29	3.00	11.70	1.84	-0.24	18.02
26	9/11/2006	2006Q3	460	4.80	7.30	2.50	2.20	2.49	3.32	2.53	11.33	1.32	-0.33	7.83
27	11/21/2006	2006Q4	386	4.58	7.82	3.24	3.42	2.93	3.36	2.94	11.82	1.91	-0.30	6.99
28	3/1/2007	2007Q1	380	4.56	7.72	3.16	3.44	2.39	3.38	2.73	11.67	1.80	-0.39	5.53
29	6/1/2007	2007Q2	419	4.95	7.83	2.88	3.05	2.14	3.21	3.08	11.58	0.56	-0.37	3.58
30	9/7/2007	2007Q3	479	4.38	7.84	3.46	3.62	2.82	3.12	3.33	11.59	1.80	-0.34	5.22
31	11/30/2007	2007Q4	458	3.97	7.85	3.88	4.03	2.75	3.31	2.93	11.70	1.38	-0.32	3.28
32	3/7/2008	2008Q1	381	3.56	7.61	4.05	4.44	2.99	3.21	3.08	11.58	2.23	-0.30	3.94
33	6/13/2008	2008Q2	384	4.27	7.23	2.96	2.73	2.60	3.32	2.44	11.24	1.50	-0.41	9.38
34	9/5/2008	2008Q3	432	3.66	7.29	3.63	3.34	2.79	3.31	2.30	11.06	1.71	-0.42	4.63
35	11/28/2008	2008Q4	534	2.93	7.35	4.42	4.07	3.19	3.73	1.77	11.64	1.94	-0.37	2.81
36	2/26/2009	2009Q1	443	2.98	7.54	4.56	4.02	4.13	4.29	1.18	12.54	1.80	-0.47	5.87
37	5/29/2009	2009Q2	427	3.47	6.96	3.49	3.53	3.12	3.73	1.37	11.26	1.79	-0.42	6.56
38	9/11/2009	2009Q3	536	3.34	6.50	3.16	2.66	2.88	3.87	0.62	10.86	1.82	-0.46	10.82
39	12/11/2009	2009Q4	457	3.55	6.71	3.16	2.45	3.56	3.86	0.64	10.88	2.38	-0.52	9.85
40	2/26/2010	2010Q1	478	3.61	6.56	2.95	2.39	3.28	3.96	0.39	10.86	2.31	-0.68	9.41
41	6/4/2010	2010Q2	444	3.20	6.33	3.13	2.80	3.08	3.90	0.33	10.64	2.61	-0.64	9.91
42	9/10/2010	2010Q3	451	2.81	5.59	2.78	2.19	2.53	4.21	-1.16	9.99	0.77	-0.67	8.65
43	12/10/2010	2010Q4	402	3.32	6.17	2.85	2.68	2.62	3.91	0.26	10.63	1.89	-0.55	10.70
44	3/4/2011	2011Q1	429	3.49	6.45	2.96	2.51	2.92	4.16	-0.27	10.76	2.44	-0.70	8.16
45	6/3/2011	2011Q2	406	2.99	6.18	3.19	3.01	2.90	3.90	0.12	10.45	2.09	-0.68	5.17
46	9/9/2011	2011Q3	397	1.93	5.86	3.93	3.07	3.11	3.79	0.04	10.09	2.41	-0.54	2.02
47	12/16/2011	2011Q4	439	1.86	5.89	4.03	3.14	2.98	4.07	-0.11	10.68	1.91	-0.36	3.42
48	3/1/2012	2012Q1	406	2.03	6.48	4.45	3.97	2.97	4.07	0.30	11.08	2.25	-0.59	2.71
49	5/30/2012	2012Q2	338	1.63	6.06	4.43	4.37	2.96	3.94	0.00	10.42	1.96	-0.59	2.37
50	9/7/2012	2012Q3	675	1.67	5.66	3.99	3.33	3.00	3.66	-0.01	9.67	2.04	-0.58	2.37
51	12/6/2012	2012Q4	325	1.59	5.46	3.87	3.41	2.59	3.69	-0.49	9.25	1.42	-0.62	3.08
52	3/8/2013	2013Q1	418	2.06	5.97	3.91	3.94	2.73	3.84	-0.14	10.02	2.01	-0.64	4.55
53	5/31/2013	2013Q2	300	2.16	6.43	4.27	3.84	2.91	4.02	0.10	10.76	1.63	-0.67	2.67
54	9/5/2013	2013Q3	404	2.98	6.09	3.11	3.02	2.73	3.41	0.75	9.77	1.71	-0.53	6.68
55	12/5/2013	2013Q4	320	2.88	6.13	3.25	3.12	2.95	3.81	0.18	10.26	1.69	-0.50	7.19
56	3/4/2014	2014Q1	291	2.70	6.43	3.73	3.30	2.63	3.32	1.35	10.13	0.64	-0.69	5.15
	Average of quarters		349	3.80	7.35	3.54	3.36	2.74	3.56	1.70	11.12	1.48	-0.45	6.10
	Standard deviation			1.12	1.14	0.60	0.65	0.36	0.35	1.37	0.75	0.66	0.14	3.12

B. By individual responses

Survey for	Number of survey responses	10-year bond yield	Total market return forecast	Average risk premium	Median risk premium	Disagreement	Average of individual standard deviations	Average of individuals' worst 10% market return scenario	Average of individuals' best 10% market return scenario	Skewness of risk premium estimates	Average of individuals' asymmetry	% who forecast negative excess return
All dates	19,563	3.63	7.14	3.51	3.26	2.87	3.60	1.52	11.07	1.59	-0.46	6.22

2.5 Recessions, the financial crisis and risk premia

Our survey now spans two recessions: March 2001-September 2001 as well as the recession that begins in December 2007 and ends in June 2009. Financial theory would suggest that risk premia should vary with the business cycle. Premiums should be highest during recessions and lowest during recoveries. Previous research has used a variety of methods including looking at ex post realized returns to investigate whether there is business-cycle like variation in risk premia.

While we only have 56 observations and this limits our statistical analysis, we do see important differences. During recessions, the risk premium is 3.92% and during non-recessions, the premium falls to 3.46%.

2.6 Interviews

To further explore the risk premium, we conduct brief interviews on the topic of the cost of capital and the risk premium to understand the question that CFOs believe they are answering. We conducted 12 interviews over the 2003-2005 period.[4] We gain a number of insights from the interviews. There is remarkable consistency in the CFOs' views.

First, the CFOs closely track both their company's stock and the market. They are often called upon internally (e.g., Board of Directors) or externally (analyst conference calls) to explain their company's stock price. As a result, they need to try to separate out the systematic and idiosyncratic variation in their company's stock returns. To do this, they attempt to understand the forces that might cause systematic variation in the market.

Second, the CFOs believe that the "risk premium" is a longer-term measure of expected excess returns and best covered by our question on the expected excess return over the next ten years – rather than the one-year question. Three-fourths of the interviewees use a form of the Capital Asset Pricing Model (which is consistent with the evidence in Graham and Harvey,

[4] Three of these interviews exclusively focused on the risk premium question. Eight interviews were non-exclusive and based on surplus time available in the interviews in Brav et al. (2005) and Graham, Harvey and Rajgopal (2005). The remaining interview was conducted in 2005.

2001). They use a measure of the risk premium in their implementation of the CAPM. Often their 10-year risk premium is supplemented so that that company's hurdle rate exceeds their expected excess return on the S&P 500. Also, while not specified in the question, CFOs interpret the 10-year expected market return as the return to a buy-and-hold strategy. As a result, our survey measures the geometric rather than arithmetic average return.

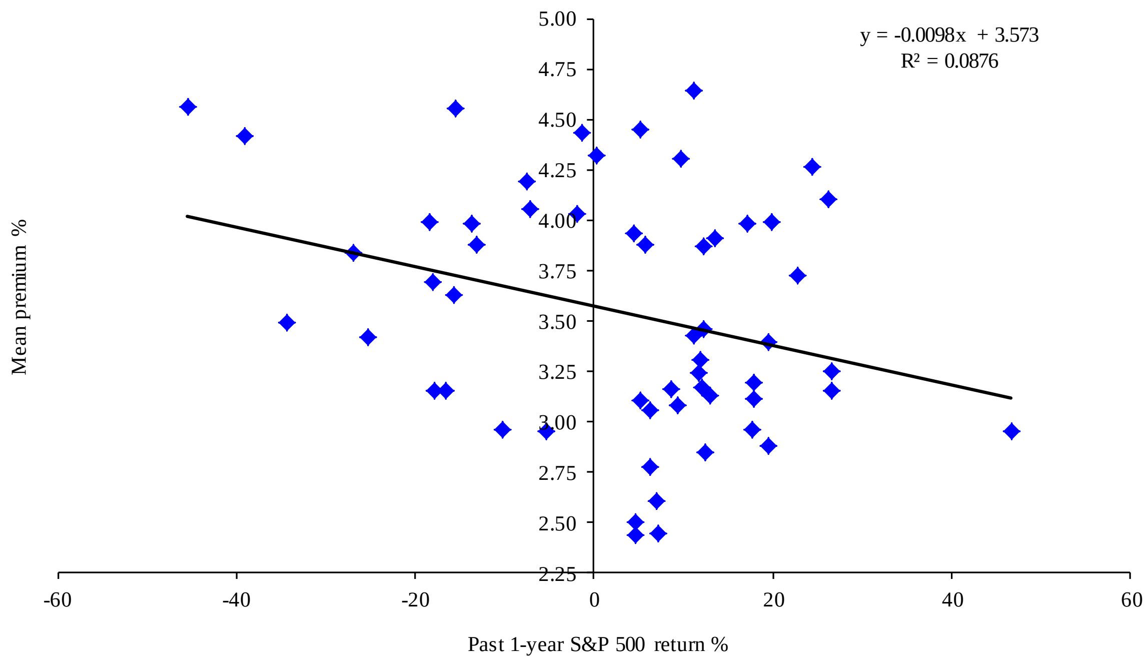
2.7 Explaining variation in the risk premium

While we document the level and a limited time-series of the long-run risk premium, statistical inference is complicated by the fact that the forecasting horizons are overlapping. First, we have no way of measuring the accuracy of the risk premiums as forecasts of equity returns. Second, any inference based on regression analysis is confounded by the fact that from one quarter to the next, there are 44 common quarters being forecasted. This naturally induces a moving-average process.

We do, however, try to characterize the time-variation in the risk premium without formal statistical tests. Figure 2 examines the relation between the mean premium and previous one-year returns on the S&P 500.

Figure 2

The ten-year equity risk premium and past 1-year returns on the S&P 500 index

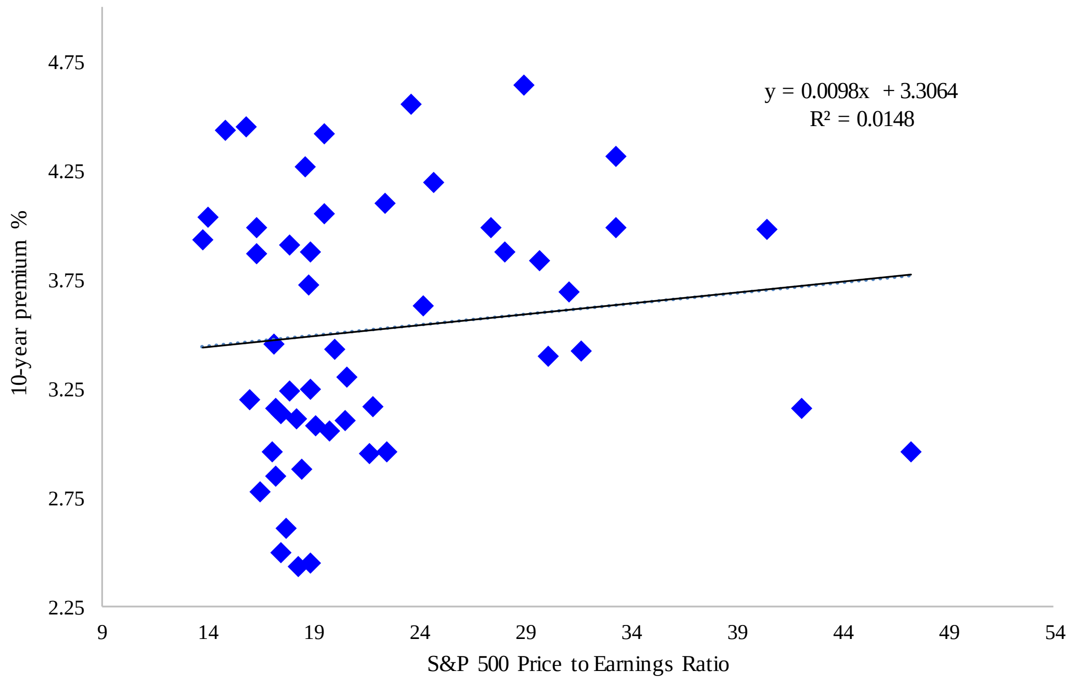


The evidence suggests that there is a weak negative correlation between past returns and the level of the long-run risk premium. This makes economic sense. When prices are low (after negative returns), expected return increase.

An alternative to using past-returns is to examine a measure of valuation. Figure 3 examines a scatter of the mean premium versus the price-to-earnings ratio of the S&P 500.

Figure 3

The equity risk premium and the S&P 500 price-to-earnings ratio: full sample



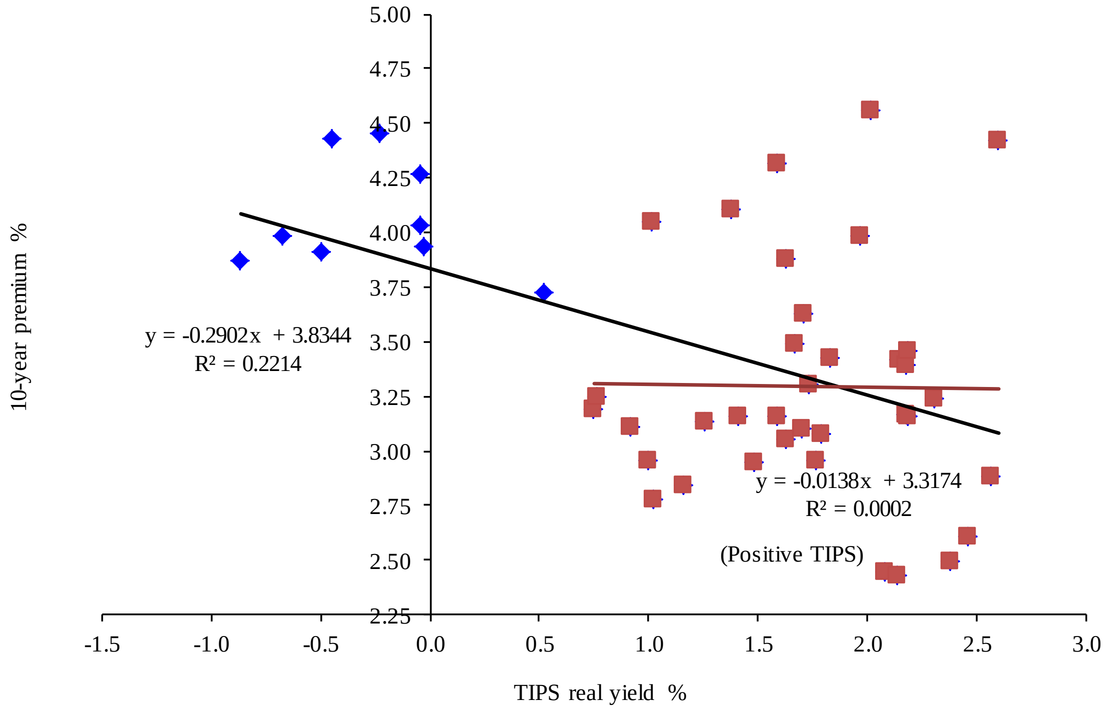
Looking at the data in Figure 3, it appears that the inference is complicated by a non-linear relation. At very high levels of valuation, the expected return (the risk premium) was low. Note, in this graph, three observations are excluded with PE ratio of 85, 123 and 130.

The graph looks much different if we sample the PE ratios when they exceed 25. Very high PE ratios are associated with lower risk premia. The non-linear relation is not a quirk of the PE ratio that we use. In unreported results, we see a similar pattern with forward and actual P/E ratios that S&P constructs from bottom up data.

We also examine the real yield on Treasury Inflation Indexed Notes. The risk premium is like an expected real return on the equity market. It seems reasonable that there could be a correlation between expected real rates of return stocks and bonds. Figure 4 examines the 10-year on the run yield on the Treasury Inflation Indexed Notes.

Figure 4

The equity risk premium and the real yield on Treasury Inflation Indexed Notes

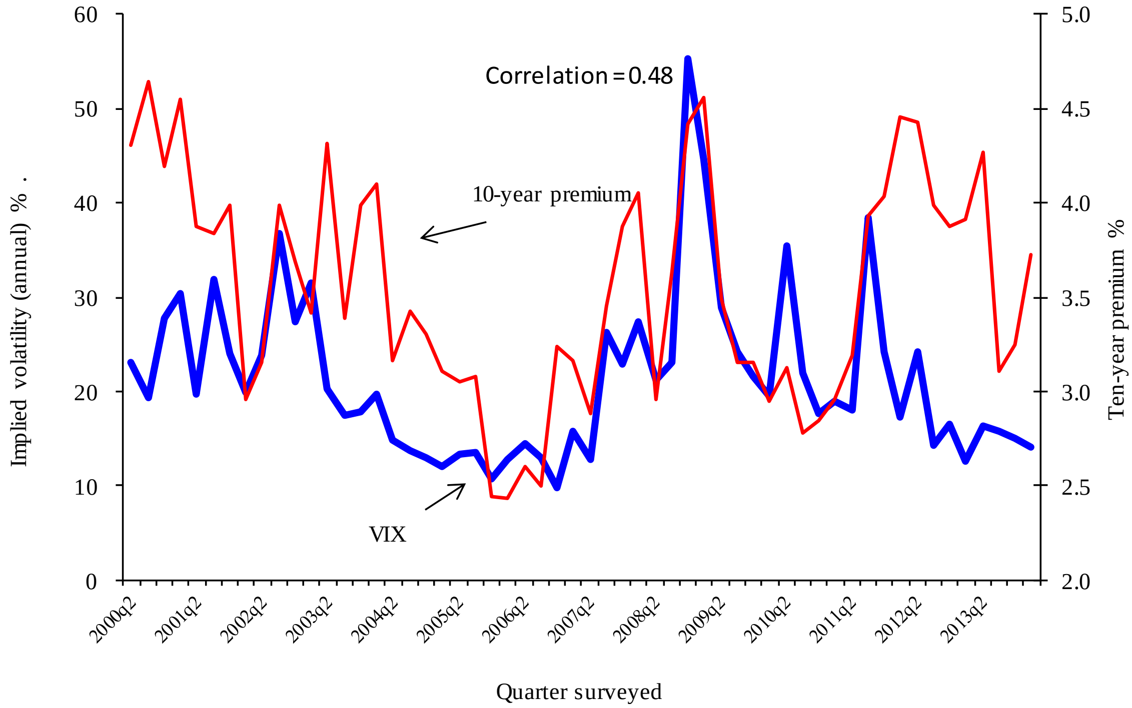


Overall, there is a negative correlation of -0.47. However, this correlation is driven by the negative TIPS yields. This is consistent with the idea that in periods of heightened uncertainty, investors engage in a flight to safety and accept low or negative TIPS yields – and at the same time demand a high risk premium for investing in the equity market.

Finally, we consider two alternative measures of risk and the risk premium. Figure 5 shows that over our sample there is evidence of a strong positive correlation between market volatility and the long-term risk premium. We use a five-day moving average of the implied volatility on the S&P index option (VIX) as our volatility proxy. The correlation between the risk premium and volatility is 0.48. If the closing day of the survey is used, the correlation is roughly the same. Asset pricing theory suggests that there is a positive relation between risk and expected return. While our volatility proxy doesn't match the horizon of the risk premium, the evidence, nevertheless, is suggestive of a positive relation. Figure 5 also highlights a strong recent divergence between the risk premium and the VIX.

Figure 5

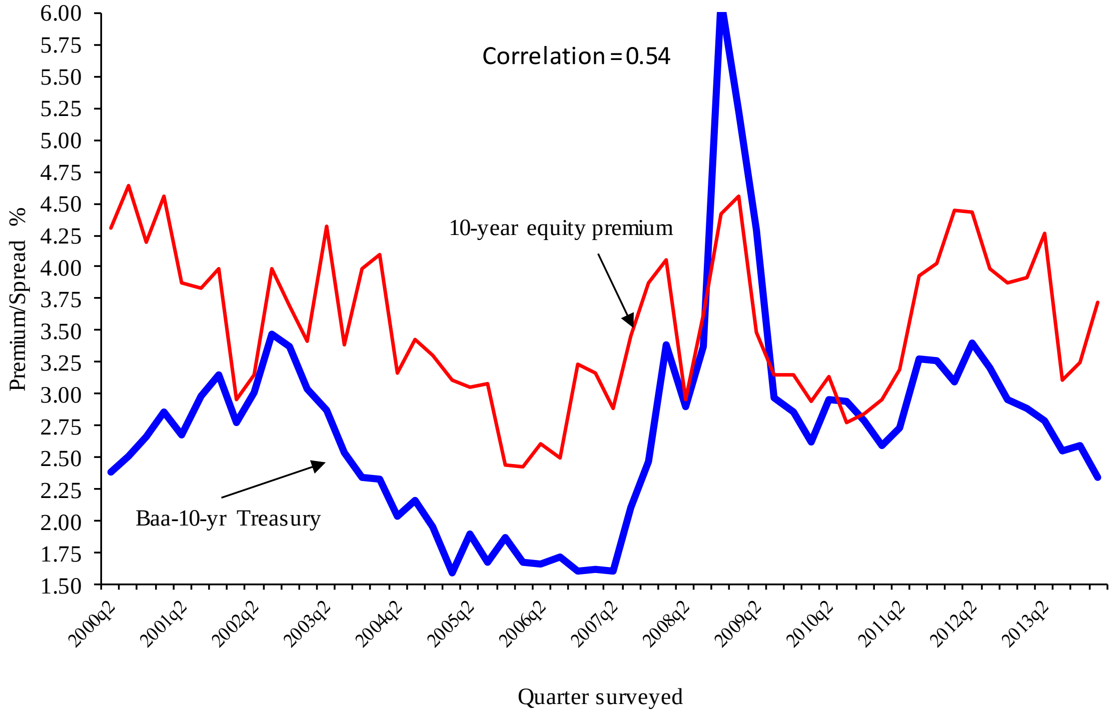
The equity risk premium and the implied volatility on the S&P 500 index option (VIX)



We also consider an alternative risk measure, the credit spread. We look at the correlation between Moody's Baa rated bond yields less the 10-year Treasury bond yield and the risk premium. Figure 6 shows a highly significant relation between the time-series with a correlation of 0.54.

Figure 6

The equity risk premium and credit spreads



2.8 Other survey questions

The March 2014 survey contains a number of other questions. http://www.cfosurvey.org presents the full results of these questions. The site also presents results conditional on demographic firm characteristics. For example, one can examine the CFOs views of the risk premium conditional on the industry in which the CFO works.

2.9 Risk premium data and corporate policies

New research by Ben-David, Graham and Harvey (2013) uses the one-year risk premium forecasts as a measure of optimism and the 80% confidence intervals as a direct measure of overconfidence. By linking email addresses that respondents provide to archival corporate data, Ben-David et al. find that the tightness of the confidence intervals is correlated with corporate investment. Overconfident managers invest more.

Campello, Graham and Harvey (2010) use the survey during the financial crisis and the higher risk premiums to examine the implications of financial constraints on the real activities of the firm. They provide new evidence on the negative impact of financial constraints on firms' investment plans.

Campello, Giambona, Graham and Harvey (2011) use the survey during the financial crisiseto study how firms managed liquidity during the financial crisis.

Graham, Harvey and Puri (2013) administer a psychometric test using the survey instrument and link CEO optimism and risk aversion to corporate financial policies.

Graham, Harvey and Puri (2014) use survey data to study how capital is allocated within the firm and the degree to which CEOs delegate decision making to CFOs.

Graham, Harvey and Rajgopal (2005) use survey data to study how managers manipulate earnings.

2.10 CFO Survey compared to other surveys

Table 2 compares the predictive ability of the Duke-CFO survey with other popular surveys. The table reports the correlations between the current quarter Duke-CFO survey of either optimism about the economy or optimism about the firm's prospects with the subsequent quarter's realization for five surveys: UBS-Gallup, CEO Survey, Conference Board Consumer Confidence, University of Michigan Consumer Confidence and ISM Purchasing Manager's Index. Both of the Duke-CFO optimism measures significantly predict all five of these popular barometers of economic confidence. Related analysis shows that our CFO survey anticipates economic activity sooner (usually one quarter sooner) than do the other surveys.

Table 2
The ability of the Duke CFO survey to predict other surveys

	Predictive correlations	
Survey	Optimism about economy	Optimism about firm's prospects
UBS-Gallup	0.289	0.380
CEO Survey	0.814	0.824
Conference Board Consumer Confidence	0.513	0.767
University of Michigan Consumer Confidence	0.341	0.253
ISM Purchasing Managers Index	0.694	0.497

3. Conclusions

We provide a direct measure of ten-year market returns based on a multi-year survey of Chief Financial Officers. Importantly, we have a 'measure' of expectations. We do not claim it is the true market expectation. Nevertheless, the CFO measure has not been studied before.

While there is relatively little time-variation in the risk premium, a number of patterns emerge. We offer evidence that the risk premium is higher during recessions and non-recessions. Given the recent global economic crisis, the risk premium has hit a record high for our ten years of surveys. We also present evidence on disagreement. With higher disagreement, people often have less confidence in their forecasts. While the risk premium has decreased since the peak during the crisis, our measures of disagreement are still elevated suggesting considerable uncertainty persists.

While we have close to 20,000 survey responses over 15 years, much of our analysis uses summary statistics for each survey. As such, with only 56 unique quarters of predictions and a variable of interest that has a 10-year horizon, it is impossible to evaluate the accuracy of the market excess return forecasts. For example, the December 2, 2002 10-year annual forecast was 7.91% and the realized annual S&P 500 return through December 6, 2012 is 4.23%. The forecast errors are larger for 10-year forecasts beginning in 2000 and 2001. Our analysis shows some weak correlation between past returns, real interest rates and the risk premium. In contrast, there is significant evidence on the relation between two common measures of economic risk and the risk premium. We find that both the implied volatility on the S&P index as well as a commonly used measure of credit spreads are highly correlated with our measured equity risk premium.

References

Asness, C. S., 2000, Stocks vs. bonds: Explaining the equity risk premium, *Financial Analysts Journal*, May/June.

Ben-David, I., J. R. Graham, and C. R. Harvey, 2013, Managerial miscalibration. *Quarterly Journal of Economics*, 128:4, 1547-1584. Available at SSRN: http://ssrn.com/abstract=1640552

Brav, A., J. R. Graham, C. R. Harvey, and R. Michaely, 2005, Payout policy in the 21st century, *Journal of Financial Economics* 77:3, 483-529. Available at SSRN: http://ssrn.com/abstract=571046

Campello, M., J. R. Graham and C. R. Harvey, 2010. The real effects of financial constraints: Evidence from a financial crisis, *Journal of Financial Economics* 97, 470-487. Available at SSRN: http://ssrn.com/abstract=1318355

Campello, M., E. Giambona, J. R. Graham and C. R. Harvey, 2011. Liquidity management and corporate investment during a financial crisis, *Review of Financial Studies* 24:6, 1944-1979. Available at SSRN: http://ssrn.com/abstract=144400

Claus, J. and J. Thomas, 2001, Equity premia as low as three percent: Evidence from analysts' earnings forecasts for domestic and international stock markets, *Journal of Finance* 56, 1629-1666.

Davidson, L. B., and D. O. Cooper, 1976, A simple way of developing a probability distribution of present value, *Journal of Petroleum Technology*, September, 1069-1078.

Fama, E. F. and French, K. R., 2002, The equity premium, *Journal of Finance* 57, 637-659.

Fernandez, P., 2004 Market risk premium: Required, historical and expected, Unpublished working paper, University of Navarra. Available at SSRN: http://ssrn.com/abstract=601761

Fernandez, P., 2006 Market risk premium in 100 textbooks, Unpublished working paper, University of Navarra. Available at SSRN: http://ssrn.com/abstract=1148373

Fernandez, P., 2009 Market risk premium used in 2008 by professors: A survey with 1,400 answers, Unpublished working paper, University of Navarra. Available at SSRN: http://ssrn.com/abstract=1344209

Gebhardt, W. R., C. M. C. Lee, and B. Swaminathan, 2001, Toward an implied cost of capital, *Journal of Accounting Research* 39, 135-176.

Goyal, A. and I. Welch, 2003, Predicting the risk premium, *Management Science* 49, 639-654.

Graham, J. R. and C. R. Harvey, 2001, Theory and practice of corporate finance: Evidence from the field, *Journal of Financial Economics* 60, 187-243. Available at SSRN: http://ssrn.com/abstract=220251

Graham, J. R. and C. R. Harvey, 2003, Expectations of equity risk premia, volatility and asymmetry from a corporate finance perspective, Working paper, Available at SSRN: http://ssrn.com/abstract=292623

Graham, J. R., and C. R. Harvey, 2009, The CFO Global Business Outlook: 1996-2009. http://www.cfosurvey.org.

Graham, J. R., C. R. Harvey and M. Puri, 2013, Managerial attitudes and corporate actions, *Journal of Financial Economics,* 109:1, 103-121. Available at SSRN: http://ssrn.com/abstract=1432641

Graham, J. R., C. R. Harvey and M. Puri, 2014, Capital allocation and delegation of decision-making authority within firms, *Journal of Financial Economics,* forthcoming. Available at SSRN: http://ssrn.com/abstract=1527098

Graham, J. R., C. R. Harvey, and S. Rajgopal, 2005, The economic implications of corporate financial reporting, *Journal of Accounting and Economics* 40, 3-70. Available at SSRN: http://ssrn.com/abstract=491627

Harris, R. S. and F. C. Marston, 2001, The market risk premium: Expectational estimates using analysts' forecasts, *Journal of Applied Finance* 11, 6-16.

Harvey, C. R., 2001, The specification of conditional expectations, *Journal of Empirical Finance* 8, 573-638.

Jagannathan, R., E. R. McGrattan and A. Scherbina, 2001, The declining U.S. equity premium, *Quarterly Review*, Federal Reserve Bank of Mineapolis.

Keefer, D. L. and S. E. Bodily, 1983, Three-point approximations for continuous random variables, *Management Science* 29, 5 595-609.

Pástor, L. And R. Stambaugh, 2001, The equity premium and structural breaks, *Journal of Finance* 56, 1207-1239.

Poterba, J. M. and Summers, L. H., 1995, A CEO survey of U.S. companies' time horizons and hurdle rates, *Sloan Management Review*, Fall, 43-53.

Siegel, J. J., 1999, The shrinking equity premium, *Journal of Portfolio Management*, 10-17.

Welch, I., 2000, Views of financial economists on the equity premium and other issues, *Journal of Business* 73 (October): 501-37.

Welch, I., 2001, The equity premium consensus forecast revisited, Unpublished working paper, Cowles Foundation for Research in Economics, Yale University, New Haven, CT. Available at SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=285169.

Welch, I., 2009, Views of economists about the equity premium and policy, Unpublished working paper, Brown University. Available at http://welch.econ.brown.edu/academics/equpdate-results2009.html

Appendix A

Excerpt from the Survey Instrument

14. On February 17, 2014 the annual yield on 10-yr treasury bonds was 2.7%. Please complete the following:

a. Over the next 10 years, I expect the average annual S&P 500 return will be:

Worst Case: There is a 1-in-10 chance the actual average return will be less than:	**Best Guess**: I expect the return to be:	Best Case: There is a 1-in-10 chance the actual average return will be greater than:
____ %	____ %	____ %

b. During the next year, I expect the S&P 500 return will be:

Worst Case: There is a 1-in-10 chance the actual return will be less than:	**Best Guess**: I expect the return to be:	Best Case: There is a 1-in-10 chance the actual return will be greater than:
____ %	____ %	____ %

Please check one from each category that best describes your company:

a. Industry

- ○ Retail/Wholesale
- ○ Mining/Construction
- ○ Manufacturing
- ○ Transportation/Energy
- ○ Communications/Media
- ○ Tech [Software/Biotech]
- ○ Banking/Finance/Insurance
- ○ Service/Consulting
- ○ Healthcare/Pharmaceutical
- ○ Other: ____

b. Sales Revenue	c. Number of Employees
○ Less than $25 million	○ Fewer than 100
○ $25-$99 million	○ 100-499
○ $100-$499 million	○ 500-999
○ $500-$999 million	○ 1,000-2,499
○ $1-$4.9 billion	○ 2,500-4,999
○ $5-$9.9 billion	○ 5,000-9,999
○ More than $10 billion	○ More than 10,000

d. Where are you personally located?		e. Ownership
Northeast U.S.	Canada	Public, NYSE
Mountain U.S.	Latin America	Public, NASDAQ/AMEX
Midwest U.S.	Europe	Private
South Central U.S.	Asia	Government
South Atlantic U.S.	Africa	Nonprofit
Pacific U.S.	Other	

f. Foreign Sales	g. What is your company's credit rating?
0%	Check here if you do not have a rating, and please estimate what your rating would be.
1-24%	
25-50%	
More than 50%	

h. Return on assets (ROA=operating earnings/assets) (e.g., -5%, 6.2%)	i. Your job title (e.g., CFO, Asst. Treasurer, etc.)
% Approximate ROA in 2013	
% Expected ROA in 2014	

j. In which state do most of your employees work?
-- Select --

Submit

A new perspective on analyst sophistication: Errors and dubious judgments in analysts' DCF valuation models

Jeremiah Green	John R. M. Hand*	X. Frank Zhang
Penn State University	UNC Chapel Hill	Yale University
jrg28@psu.edu	hand@unc.edu	frank.zhang@yale.edu

Abstract

We argue that sell-side equity analysts make a startling number of mistakes and questionable judgments in their DCF equity valuation models. For a sample of 120 analyst reports issued 2012-2013, we estimate that the median analyst makes five DCF theoretic or implementation errors and five dubious DCF modeling judgments. We assess the economic significance of analysts' DCF mistakes by recalculating their target prices after correcting for major errors. Doing so increases analysts' estimated target prices by a median (mean) of 37% (29%). We conclude that with regard to valuing firms' equity, sell-side analysts are less sophisticated, and more optimistic, than prior research has supposed.

This version: June 24, 2014

Keywords: Analyst sophistication; DCF; valuation; errors

JEL codes: G12, G17, G32

* Corresponding author; tel. 919.962.3173, fax 919.962.4727.

We appreciate the helpful comments of Gavin Cassar, Peter Joos, Kalin Kolev, Ed Maydew, Michael Mauboussin, Nathan Sharp, Lakshmanan Shivakumar, Jake Thomas, Irem Tuna, Florin Vasvari, and workshop participants at London Business School, UNC Chapel Hill and the 2014 Yale Accounting Conference. However, all of the errors and dubious judgments present in the paper are our own.

1. Introduction

Sell-side equity analysts are usually viewed by academics and investors as being sophisticated economic agents—intelligent, knowledgeable, competitive, and well incentivized to analyze and predict the levels and risks of the cash flows of the firms they follow in a sophisticated manner. As such, the view that the financial expertise of sell-side equity analysts will be apparent in their written reports to investors would seem to be obvious.

In this study, we argue that at least with respect to constructing and executing a DCF equity valuation model, such a view is markedly wrong. We base this claim on the analyses we conduct on a stratified random sample of 120 sell-side analyst reports containing DCF valuations of various kinds, each of which was issued in 2012 or 2013 by a U.S. brokerage house. After setting out a template of the data and formulae that we define to be the correct approach to constructing and executing a DCF equity valuation model, we grade analysts' DCFs. In our grading, we identify conceptual and implementation errors as well as dubious judgments.

After tallying the grades, we estimate that sell-side analysts make a median of five DCF theoretic and/or implementation errors, and five dubious DCF modeling judgments. Examples of errors include using materially too large or too small of a risk free rate; assuming an impossibly high growth rate in free cash flows beyond the terminal year; failing to apply a mid-year adjustment factor to yearly free cash flows; and not scaling up the estimated equity value from the valuation date to the target price date. Examples of dubious judgments are setting the terminal year far too close to the report date; providing no justification for or detail behind the WACC that is used; and when such detail is provided, assuming an equity weight that is more than 20% away from the weight implied by the equity value obtained from the DCF itself.

Not every aspect of analysts' DCF modeling is rife with errors or dubious judgments. For example, we find evidence that sell-side analysts understand that as they forecast out in time toward the terminal year, the rates of growth in the firm's revenues, EBIT, depreciation, working capital, CAPEX and free cash flows should in expectation decline, and that the firm's effective tax rate should in expectation tend toward the combined stated federal and state tax rate. However, even in these directionally correct results, we observe that most analysts are optimistic (sometimes absurdly so) in that the median rates of growth they forecast to occur in the terminal year are frequently implausibly large. We find that one consequence of this optimism is that analysts' forecasted ROEs increase, not decrease, toward the terminal year, rising to an economically questionable mean of almost 20% in the terminal year itself.

We also report evidence that is partially consistent with the hypothesis that more sophisticated analysts or analyst teams make fewer DCF errors or dubious judgments. When we regress DCF error rates and dubious judgment rates on proxies for analyst sophistication, we observe that some of our proxies (those based on the quantity of information analysts provide as to how they arrive at their WACC, their forecasted free cash flows and equity value, and their forecasts of future financial statements) load significantly in the predicted negative direction.

One criticism of our study could be that we are merely identifying many small errors that in aggregate impart little or no bias into the key output of analysts' DCF valuation models, namely their target prices. We seek to address this concern by calibrating the economic significance of analysts' DCF modeling mistakes after recalculating target prices corrected for five major errors. For the smallish subset of firms where this is feasible, we find that three of the five errors have material mean effects on target prices and the annualized expected return AER embedded in them when corrected: too high risk free rates (14% increase in AER), end of year rather than mid-year discounting (5% increase in AER), and not scaling up equity value from the valuation date to the target price date (12% increase in AER). Overall, we estimate that correcting analysts' major errors in aggregate increases analysts' AERs by a median (mean) of 37% (29%), which we posit is an economically significant amount. We conclude that with regard to valuing firms' equity, not only are sell-side equity analysts markedly less sophisticated than prior research has supposed, but they are also more optimistic since the correct translation of the free cash flow and WACC information they forecast and use in their DCF models yields estimates of the firms' future stock prices that are far higher than those in their stated target prices, which in their uncorrected forms per se have been found to be quite optimistic.

Our study contributes to several literatures. First, by grading how well they convert their financial forecasts and other data into projected future equity values, we add to the research that has studied how equity analysts transform information into target prices (Bandyopadhyay, Brown and Richardson, 1995; Block, 1999; Bradshaw 2002, 2004; Demirakos, Strong and Walker, 2004). In this way, our paper also seeks to respond to the long-standing calls made by Schipper (1991), Brown (1993), Ramnath, Rock and Shane (2008), Bradshaw (2011) and Groysberg and Healy (2013) that researchers look inside the 'black box' of sell-side analysts and illuminate their decision processes. Although we do not conduct the most direct approach to understanding how sophisticated analysts are in constructing and executing their DCF model (for example, we do not employ real-time process tracing on analysts while they are constructing their DCF models, or examine analysts' actual working model files (Markou and Taylor, 2014)), what we do by studying directly and in detail the content of analysts' written DCF models yields new insights as compared to the classic large-scale database approach of indirectly examining the correlations between inputs, outputs and conditioning variables. As such, in our quantitative analysis of analysts' actual DCF models, our study complements work by Asquith, Mikhail and Au (2005) that catalogs the contents of analyst reports, and by Brown, Call, Clement and Sharp (2013) who employ survey data to examine the inputs that sell-side analysts use in their decisions and the incentives that motivate those decisions.

We also add to the research literature on optimism in analysts' forecasts by showing that with regard to target prices, analysts are far more optimistic than previously thought. Prior work has found that analysts' 12-month ahead target prices are upward biased by an average of 15% for U.S. firms and 18% for non-U.S. firms (Bradshaw, Brown and Huang, 2013; Bradshaw, Huang and Tan, 2013). We estimate that the expected returns in the target prices that analysts *should* report based on the free cash flows they forecast and the discount rates they use are far more optimistic, being at least twice those of the target prices they actually do report. Also, relative to most research that studies analyst optimism, such as biases in analysts' short-term earnings forecasts, we argue that not only are we better able to measure the economic magnitude of the particular aspect of optimism we study, but we think there are fewer competing explanations for the optimism we document, such as the conflict-of-interest argument (Francis and Philbrick, 1993; Lin and McNichols, 1998; Ertimur, Muslu and Zhang, 2011) since it is hard to argue that analysts deliberately make as many errors or dubious judgments as they do.

Third, we add to the literature on analyst sophistication. Historically, such research has focused on analysts' earnings forecasts, and has concluded that analysts exhibit financial sophistication in the sense that their short-term earnings forecasts tend to be more accurate than those of time-series models. However, recent work has both challenged this widely held belief (Bradshaw, Drake, Myers and Myers, 2012), and broadened beyond it by starting to indirectly investigate the degree of sophistication reflected in analysts' cash flow and accrual forecasts (Givoly, Hayn and Lehavy, 2013a, 2013b; Call, Chen and Tong, 2013a, 2013b) and target prices (Dechow and You, 2013), using large-scale archival analysis. Our study contributes to these new directions by directly showing that while analysts display certain aspects of what would be expected in competently forecasting long-term financial statement data, they are surprisingly unsophisticated with regard to the basic skill of constructing and executing a DCF equity valuation model. Moreover, we argue that the benchmarks we use for determining if analysts are or are not sophisticated are relatively objective—few would disagree with the economic assumptions underlying DCF, and we seek to be generous in how far we allow analysts to depart from correctly following the contents and mechanics of DCF valuation before we grade them as having made an error or a dubious judgment.

Fourth, we add a new dimension to the literature on implementing equity valuation models. Some prior work in this area has at times heatedly debated how and why large-sample implementations of the free cash flow, residual income and dividend discount models yield at times vastly different results, even though the models are theoretically all isomorphic to the underlying principle of the present value of expected future dividends and should therefore yield the same output equity value given the same inputs (Penman and Sougiannis, 1998; Francis, Olsson and Oswald, 2000; Lundholm and O'Keefe, 2001a, 2001b; Penman, 2001). Other work has emphasized the importance of high quality forecasts of future cash flows to obtaining a high quality estimate of equity value (Palepu, Bernard and Healy, 1996; Brealey and Myers, 2013; Lundholm and Sloan, 2013). Our contribution is to highlight the importance of users implementing their DCF model correctly, regardless of what is input into the model. Our results suggest that even if the fundamental financial statement data that sell-side analysts input into their DCF valuation model is of very high quality, the output target price can be enormously wrong if analysts make simple implementation errors of the kind we document, such as not discounting annual free cash flows mid-year, or not scaling up their initial valuation from the valuation date to the target price date.[1]

Lastly, we contribute to the literature on asset pricing in finance. Although asset pricing is key to many aspects of finance, and DCF valuation key to many aspects of asset pricing, few scholars have explored whether analysts make mistakes in how they arrive at their estimates of equity value, and if so, which kinds of errors. Moreover, the evidence that has been reported by is for the most part anecdotal.[2] Our paper is the first to adopt a conventional academic approach

[1] Brealey and Myers (2013) state that "[I]t's easy for a discounted cash flow business valuation to be mechanically perfect and practically wrong." Based on our empirical results, it seems to be easy for analysts to be both mechanically wrong and practically wrong.

[2] For example, Tham and Velez-Pareja (2004) list nine errors they propose users might make in DCF models, but provide no evidence on how empirically common or important the mistakes are. Mauboussin (2006, pp. 2, 5) details a "list of the most frequent [8] errors we see in DCF models" identified from "various sellside reports" but does not report sample statistics, nor economic significance of the errors. Petersen and Plenborg (2009) study three general and non-public valuation spreadsheets they obtained from Danish brokers. Fernandez (2013) classifies 119 (often overlapping) types of errors in the company valuations performed by financial analysts, investment banks and financial consultants obtained in his capacity as a consultant in company acquisitions, sales, mergers, and arbitrage processes. Lundholm and Sloan (2013, p.239) note with regard to the DCF-to-all-investors model that "Unfortunately, because the computation of the free cash flow to all investors is rather involved and because "all investors" models require a weighted-average cost of capital that is consistent with the other costs of capital, it is the

to evaluating the sophistication with which analysts construct and execute DCF equity valuation models in that we use a stratified, random, recent and reasonably-sized sample, together with a clearly defined set of grading criteria. At the same time, however, we readily acknowledge that in constructing and executing our study, we like the analysts we grade have had to make judgments. Although we seek to clearly define what we grade to be an analyst error versus a dubious judgment, we readily grant that readers may disagree with our grading criteria, and in this sense our results undoubtedly contain a level of subjectivity and even error.

The remainder of our paper proceeds as follows. In section 2 we present our sample selection criteria and provide descriptive statistics on the brokers, analysts and in sampled reports. In section 3 we make clear how we grade analysts' DCF valuation models, and report what we estimate to be present in terms of graded errors and dubious judgments. In section 4 we estimate the effects of correcting five major errors on the annualized expected returns embedded in analysts' target prices. In section 5 we develop and test the hypothesis that more sophisticated analysts make fewer errors and dubious judgments, using proxies we create for analyst sophistication based on the forecasted financial statements that often accompany analysts' DCFs. In section 6 we expand our investigation of analysts' financial sophistication into how well their financial statement forecasts conform to the economic forces that affect firms in the long run. We conclude in section 7 by presenting and discussing the questions that we argue that our findings raise for future research, and conclude our study.

2. Sell-side equity analyst reports that contain DCF equity valuation models

2.1 Sample selection

Table 1 shows the criteria we employed to obtain our sample of 120 DCF-based sell-side equity analyst reports. Since the contents of analysts' reports are not available in machine readable form that we are aware of, we searched Investext to identify analyst reports in 2012-13 that contained the keywords "DCF" or "discounted cash flow" in their Table of Contents (panel A). We then retained only those reports that were for companies, for the U.S., and provided by brokers. From the resulting set of 9,436 analyst reports in 2012-13, we selected five at random from each of the 24 months ending Dec. 2013. After inspecting each report, we determined that a few did not contain sufficient DCF information, or the right kind of DCF information, to be

rare user who can successfully compute the DCF-to-all-investors model without error. By automating the required computations, *eVal* makes sure you don't mess up along the way."

useful. Panel B lists the reasons that led us to make exclusions. After randomly choosing replacements for excluded reports, we converged to 120 DCF-based sell-side equity analyst reports spread evenly by month Jan. 2012 - Dec. 2013.

In panel C of Table 1 we report the frequency with which each of seven types of DCF models was present in the 120 sampled reports. Of DCF models, 109 are built around estimating the cash flows to all investors, with just three directly focused on cash flows to equity investors. In nine reports we judged there to be too little information to readily classify the DCF model. Within the DCF-to-all-investors category of models, over half employ the 'workhorse' NOPAT approach that is commonly taught in MBA finance classes. In the NOPAT approach, forecasted free cash flows are arrived at by first forecasting net operating profit after adjusted taxes, then adding both forecasted depreciation and the forecasted change in working capital, and subtracting forecasted capital expenditures.

2.2 Descriptive statistics on brokers, analysts and firms

In Table 2 we provide descriptive statistics for the brokers, analysts and firms covered in the sample of 120 DCF-based equity analyst reports. Panel A shows that the reports come from a wide range of brokers, 37 in all, with the largest numbers coming from prominent and well known brokers. Panel B indicates that the reports are authored or coauthored by 180 different analysts, of whom 60 hold the CFA professional qualification and 8 have a PhD. Of reports, 90% are updates rather than initiations, and the average number of pages in a report is 14.5. Lastly, panel C shows that the firms in the reports are widely spread across 26 of the 48 Fama-French industries, range greatly in market cap (between \$5 million and \$238 billion), and at the report date have been publicly traded between zero and 88 years.

3. Grading analysts' DCF valuation models

3.1 Prototypical timeline involved in a DCF equity valuation model

In Figure 1 we display the prototypical timeline involved in constructing and executing a DCF valuation model for a 12/31 fiscal year-end firm. The timeline centers on the analyst's report date, which without loss of generality we take to be 9/24/12. Other key dates in the timeline are 9/24/13 (the date the assumed 12-month target price applies to), 12/31/12 (the fiscal year-end of the first year of the forecast horizon that the analyst projects free cash flows for), and

12/31/11 (the most recent fiscal year-end for which actual annual free cash flows are known, and the valuation date of the DCF model).

3.2 Our definition of a condensed correctly structured and executed DCF-to-all-investors equity valuation model

In Figure 2 we lay out what we define for the purposes of this study to be a correctly structured and executed DCF-to-all-investors equity valuation model. We refer to Figure 2 as our condensed DCF model. We emphasize that what we lay out in the condensed DCF model is not 100% correct in that it deliberately differs in several ways from what we do take to be 100% correct, namely the DCF-to-all-investors equity valuation model detailed by Lundholm and Sloan in their textbook *Equity Valuation and Analysis with eVal* (2013, 3rd ed.). We detail out the differences in the Notes to Figure 2.

We adopt a less than fully correct DCF valuation model against which to grade analysts for two main reasons. First, most of the differences (detailed in the Notes to Figure 2) are in expectation likely to occur infrequently and be economically small. Second, it is rare for analysts to include the items represented by these differences in their models, and we wish to avoid biasing our study in favor of concluding that analysts construct and execute DCF valuation models in an unsophisticated manner. Thus, if analysts are aware of the differences but rationally choose to exclude them because they are infrequent and immaterial, then we risk downwardly bias our assessment of analyst sophistication if we were to include the differences in our grading template. Conversely, if analysts are not aware that the differences exist but we grade analysts under the presumption that they should be aware, then we risk concluding that analysts are unsophisticated based on a large number of economically small aspects of DCF modeling and execution, rather than on economically or theoretically important errors.

3.3 Descriptive statistics on key components of analysts' DCF valuation models

Before grading analysts' DCF models, we entered the information underlying the DCF models into Excel templates similarly laid out to those shown in Figure 2.[3] Figure 2 adopts the DCF-to-all-investors approach of valuing equity that is commonly taught in undergraduate and MBA classes and in-house broker training courses. Although not all analysts follow the DCF-to-

[3] In a few cases, an analyst report contains more than one DCF model, typically because the analyst presents multiple DCF-based valuation scenarios for the same firm. If this occurs, we input and use the scenario associated with the target price most emphasized by the analyst.

all-investors approach, where a different approach is used we conform the information provided by the analyst into the template laid out in Figure 2. We record one DCF per analyst report, and place each firm's completed template on a separate tab within our Excel data file. Table 3 then gives descriptive statistics on the key components of the DCF models.

In panel A of Table 3 we describe analysts' stated target prices, target price horizons, and the annualized expected returns embedded in them. In panel B we report when the terminal year occurs and the assumed post-terminal year perpetual growth in annual free cash flows. In panel C we present analysts' assumptions regarding WACC and its components. We focus on these aspects of the full set of DCF information analysts may provide, rather than on free cash flows, terminal values, the components of free cash flows, enterprise value or equity value because these are all denominated in unscaled dollars, not percent.

The first numerical column in each panel is NOBS, the number of valid observations per variable. It can be seen from the dispersion in NOBS that analysts vary greatly in the quantity and type of relevant DCF model information that they report. For example, while all 120 DCF-based analyst reports contain a target price (panel A), just 15 explicitly disclose the horizon underlying the risk free rate assumed within WACC (panel C). We return to analyzing the quantity of analysts' disclosures about and surrounding their DCF models in section 5.

Panel A shows that for the 111 analyst reports that provide both a stated analyst target price and a target price horizon, the mean (median) annualized expected return embedded in stated target prices is 18% (13%). Of individual expected returns, 77% are positive. The mean return of 18% compares to the 24% reported by Bradshaw, Brown and Huang (2013) for U.S. firms during the period 2000-2009, the 16% reported by Joos and Piotroski (2013) for Morgan Stanley reports issued 2007-2012.

Panel B reveals that both WACC and its components vary widely in magnitude across analysts' DCF models. The maximum WACC of 21% is five times that of the minimum WACC of 4.5%; RF varies between 0.2% and 5.0%; betas range between 0.55 and 2.50; the annual market risk premium varies between 4% and 11%; and the weight on equity in calculating WACC ranges from 14% to 100%.

Panel C presents similarly diverse numbers to those in panels A and B. The post-terminal year perpetual annual rates analysts explicitly assume that free cash flows (and implicitly assume all key balance sheet and income statement numbers) will grow by vary between -100% and

15%.[4] Likewise, the number of years in analysts' forecasts of future free cash flows including the terminal year range between a low of 1 year and a high of 16 years, with the median analyst DCF model setting the terminal year 8 years out from the forecast date.

3.4 Identifying errors and dubious judgments in analysts' DCF valuation models

The extremes reported in Table 3 in the components of analysts' DCF valuations point to the possibility that some of them are errors, and/or some are economically dubious judgments. However, without specificity as to what is theoretically correct and what is economically sensible, we cannot appropriately identify which analyst assumptions are errors or dubious judgments, and which are merely aggressive or conservative positions taken by the analyst.

Table 4 lists the errors that we grade analysts on, both with respect to the numerator-oriented level, growth and timing of free cash flows aspects of analysts' DCF models (panel A), and with respect to the denominator-related discount rate aspects of valuation (panel B). The errors identified in Table 4 are following in Table 5 by the list of potential dubious judgments that we grade analysts on, spanning both numerator and denominator aspects of DCF. We identify errors and dubious judgments using only those observations for which there is sufficient data available to make a determination of whether there is error or dubious judgment.

In Tables 4 and 5 we grade analysts' DCF models based on what we define for purposes of this study to be the economically sensible cutoff values (or range of cutoff values) for certain of the condensed DCF model elements shown in Figure 2, and for certain of the theoretically oriented inter-relationships between them. In openly defining what we grade to be an analyst error versus a dubious judgment, we fully concede that at times we are overlaying our judgment into what is versus what is not an error, and what is versus what is not a dubious judgment. This is important to emphasize because we recognize that some readers may disagree with a variety of our grading criteria. In this sense, our results undoubtedly contain a level of subjectivity.

For example, we grade the analyst as having made an error in their risk free rate RF assumption if their RF is more than +/- 30 bps away from the 10-year Treasury rate on the analyst report date (error code 2.1, panel B of Table 4). An example of a cutoff value that leads us to conclude that the analyst has made a dubious judgment is an annual market risk premium in excess of 9% (dubious judgment code 3.2, Table 5). An example of an error based on a theoretic

[4] A post-terminal year perpetual growth rate of -100% is how we code free cash flows that are assumed by the analyst to cease after the terminal year. An example of this can be found in the report on Gilead Sciences done by Deutsche Bank on 11/13/2012.

inter-relationship between elements of the condensed DCF model is that we define an erroneous analyst terminal value as one that is more than +/-3% away from the terminal value that we calculate from the analyst's terminal year free cash flow forecast, given the analyst's WACC and forecasted perpetual growth rate (error code 1.3.2, panel A of Table 4).

Although different types of analyst errors may be positively correlated, our goal is to identify errors that are as much as possible independent of one another.[5] We provide our justifications for the critical values and theoretically oriented interrelationships between DCF elements that are central to Tables 4 and 5 in Appendix 1. In Appendix 2 we illustrate specifics of our error and dubious judgment grades (along with disclosure scores that we develop and discuss in section 5.2) for three different sample analyst reports.[6]

3.5 Errors in analysts' DCF valuation models

3.5.1 Errors having to do with the numerator-oriented level, growth and timing of free cash flows aspects of analysts' DCF models

In panel A of Table 4, we catalog the 15 errors that we grade analysts on with regard to the upper half of Figure 2, namely the numerator-oriented level, growth and timing of free cash flows aspects of their DCF models. The errors range from incorrectly deriving free cash flows from underlying financial statement forecasts, to adding total rather than just non-operating cash to enterprise value, to using too high or too low an effective tax rate in the terminal year. Rather than describing the results of grading analysts on every error, we sample three we consider noteworthy.

First, the most common error analysts make is projecting implausibly large rates of revenue growth in the terminal year (error code 1.8.1). Based on their DCF model annotations, we estimate that analysts make this error 50% of the time. We define the error rate of a graded item as the number of graded errors divided by NOBS, the number of observations for which we can cleanly tell whether an error has or has not taken place. Since NOBS is rarely equal to 120, the number of analyst reports in our sample, when we state that "we estimate that analysts make a given error Z% of the time", we intend this to pertain to the population of all analyst reports that satisfy our sample selection criteria laid out in Table 1. This means that we also assume that

[5] For example, it is not necessarily the case that an analyst whose forecasted revenue growth rate in the terminal year T is excessively high must also have an excessively high forecasted CAPEX growth rate in year T.

[6] Between them, the DCF portions of the three sample reports span 12 of the 15 numerator-related errors listed in Table 4 panel A; 11 of the 13 denominator-related errors listed in Table 4 panel B; and 13 of the 20 dubious judgments listed in Table 5.

the decision by an analyst to report or not report the information we need to determine if an error has been made is uncorrelated with the probability that the analyst has made an error.

Second, the least common error analysts make is converting dollar equity value into per share equity value (error code 1.6.2), which we estimate occurs 4% of the time. Lastly for panel A, the error that ex-ante we propose is most likely to be economically material is overestimating the perpetual growth rate in free cash flows beyond the terminal year (error code 1.3). Based on our maximum allowable terminal growth rate cutoff of 5% per year, we estimate that just 7% of analysts err in what they assume for this important variable.[7] Overall, we note that both the median (mean) error rates across all 15 potential errors listed in panel A are 23% (25%).

3.5.2 Errors having to do with the denominator-related discount rate aspects of valuation

In panel B of Table 4, we catalog the 13 potential errors we propose analysts may make with regard to the lower half of Figure 2, namely those involving the denominator-related discount rate aspects of valuation. The errors range from assuming that the before-tax cost of debt is zero, to using an equity weight in calculating WACC that is inconsistent with the equity value obtained from the analyst's actual DCF valuation, to several types of incorrect discounting of future free cash flows (including not discounting them at all). Rather than discuss the results pertaining to each and every error, we highlight a subset.

The most common error analysts make in discounting is not scaling up their estimated equity value from the valuation date to the target price date (error code 2.8). We estimate that analysts make this error 93% of the time. In contrast, the least common mistake analysts make is assigning no weight to preferred stock in calculating WACC even though the firm has preferred stock outstanding (error code 2.4.2). We estimate this occurs just 3% of the time.[8] We also note three errors that ex-ante we posit will likely be economically material: [1] the already mentioned

[7] We view 5% as conservative in grading errors for the projected rate of growth in post-terminal year free cash flows because 5% is 2% larger than the value assumed by Lundholm and Sloan in *Equity Valuation and Analysis with eVal* (2013, 3rd ed., p.174), the source of our assumed 100% correctly structured and executed DCF-to-all-investors equity valuation model. Lundholm and Sloan state that they use 3% as the default terminal value for sales growth (and therefore free cash flows also). Their reasoning is that "Historically, the annual growth rate in the U.S. economy, as measured by the nominal GDP growth rate, has averaged around 6%, composed of roughly 4% real growth and 2% price inflation. However, the financial crisis of 2007-2008 sent both real growth and inflation plummeting into negative territory, albeit briefly. The long-term forecasts from the Congressional Budget Office and the Federal Reserve at the end of 2010 put real growth at 2-3% and inflation at 1-2%. So, in most cases a terminal sales growth rate forecast should fall between 3% and 5% … We use 3% as the default terminal value for Sales Growth in *eVal*." Also, our sample of analyst reports is from 2012-13, very close in time to 2010. If we use Lundholm and Sloan's cutoff of 3%, then we estimate a much larger analyst error rate of 32%.

[8] This error is rare in large part because firms rarely have preferred stock. If analysts do not mention preferred stock in their DCF models, we assume that this is because they are aware the firm has no preferred stock.

error of not scaling up estimated equity value from the valuation date to the target price date (error code 2.8, error rate = 93%); [2] using an RF is more than +/- 30 bps away from the 10-year Treasury Bill yield on the date of the analyst's report (error code 2.1, error rate = 84%); and [3] discounting annual free cash flows as if they occur at year end rather than mid-year (error code 2.7, error rate = 83%). Lastly, we note that the median and mean error rates across all 13 of the error codes listed in panel B are 32% and 20%, respectively.

3.6 Dubious judgments in analysts' DCF valuation models

In Table 5 we lay out the 20 dubious judgments that we propose analysts may make in executing their DCF models. They range from assuming an implausibly large beta, to not providing the reader of the report with any valuation parameter sensitivity analyses, to providing little or no information about the components of WACC or providing very little in the way of forecasted future financial statement data for the reader of the report. As with Table 4, rather than discuss each and every dubious judgment, we highlight a few examples.

The most common type of dubious judgment occurs in the area of analysts treating all of a firm's cash as a financial asset, rather than their estimating some portion of the cash to be operating in nature (dubious judgment code 3.10.1). We estimate that this dubious judgment happens 95% of the time.[9] Another common type of dubious judgment occurs in the area of the net financial asset/liability adjustments analysts make to enterprise value in order to arrive at equity value (dubious judgment code 3.10.2), which we estimate happens 54% of the time.[10] In contrast, the least common area for a dubious judgment to occur is analysts setting their actual or implied target price date prior to their report date, which we estimate happens only 2% of the time (dubious judgment code 3.11.3). We also note three types of dubious judgment that we posit have the potential to be economically significant. First, we estimate that 18% of the time analysts employ an excessively large market risk premium, which we define as one greater than 9% (dubious judgment code 3.2). Second, 42% of the time the valuation date lies beyond the analyst report date (dubious judgment code 3.11.1). Third, in 26% of analysts' DCF models, the

[9] We note that one reason for the high rate of our grading dubious judgments in the area of cash is that at least one large brokerage in our dataset instructs its analysts to treat all cash as a financial asset and not to attempt to extract an estimate of operating cash. As such, our estimated dubious judgment rate of 95% with regard to analysts treatment of cash may overstate the degree to which they would make a dubious judgment if left to themselves.

[10] Examples of adjustments to enterprise value that we define as dubious judgments include adding more cash of financial assets (or subtracting materially more or less debt or financial liabilities) than shown on the firm's balance sheet at the effective valuation date; adding rather than subtracting debt; not adjusting for minority interest or preferred stock when shown on the firm's balance sheet at the effective valuation date; adding assets or subtracting liabilities that we judge to be operating rather than financial in nature; and subtracting a 'public market discount'.

ROE embedded in forecasts of terminal year financial statements (that typically but not always accompany analysts' DCF models) is less than 5% or greater than 25%, both of which we assume to be economically implausible (dubious judgment code 3.7). Overall, we note that dubious judgments are not uncommon, as the mean and median rates at which they occur per Table 5 are 23% and 16%, respectively.

3.7 Errors and dubious judgments aggregated within and across analysts

Having described the types of errors and dubious judgments we grade individual analysts on in their DCF equity valuation models, and the absolute and relative frequencies with which we estimate each occurs across analysts, we turn to aggregating errors and dubious judgments within and then across analysts, and by broker. The results are reported in Table 6.

Table 6 panel A shows that in our sample of 120 broker reports issued between Jan. 2012 and Dec. 2013, sell-side analysts make an estimated mean (median) of 5.4 (5) errors and 4.5 (5) dubious judgments in constructing and executing their DCF equity valuation models. When scaled by the number of errors and dubious judgments for which analysts provide sufficient information for us to grade them on, we estimate that analysts' mean (median) error rate is 32% (32%) and their mean (median) rate of making dubious judgments is 41% (40%). Panel B lists the mean number of errors and dubious judgments, and the mean error and dubious judgment rates, by broker. Inspection of the means reported in Panel B indicates that the valuation models shown in the sell-side equity analyst reports published by large brokers contain similar numbers and rates of errors and dubious judgments to those of small brokers.

The magnitudes of these statistics lead us to infer that sell-side equity analysts make a disturbingly large number of mistakes in their DCF equity valuation models. Of course, it is unreasonable to suppose that in their DCF models, analysts never make mistakes or dubious judgments. This said, sell-side equity analysts have been widely seen by academics as sophisticated economic agents. Given their responsibilities and the nature of their employers, they are intelligent, knowledgeable, competitive and well incentivized to analyze and predict the levels and risks of the cash flows of the firms they follow. As such, even though we are mindful that we do not have a perfect benchmark to judge analysts' DCF modeling abilities against, we argue that it is very surprising that analysts make as many errors and dubious judgments in their DCF equity valuation models as we estimate they do. We return to discuss some of the implications of our findings, and questions that arise from them, in section 7.

4. Economic magnitude of analysts' errors

One criticism that could legitimately be made against our inference that analysts make a alarmingly large number of errors and dubious judgments in their DCF equity valuation models is that we merely identify a variety of small errors that in aggregate impart little or no bias into the key output of analysts' DCF valuation models, namely target prices. We speak to this concern by calibrating the economic significance of analysts' DCF modeling mistakes after recalculating analysts' stated target prices and the annualized expected returns (AERs) embedded in them to correct for each of five major types of errors.

The errors we correct are those where [i] the analyst's post-terminal year growth rate in free cash flows g exceeds 5%; [ii] the analyst incorrectly includes FCFs that occurred prior to the valuation date, or makes incorrect adjustments to ENTVAL in arriving at EQVAL; [iii] the analyst's RF is more than +/- 30 bps away from the 10-year Treasury Bill yield on analyst's report date; [iv] the analyst's FCF are discounted end-of-year, not mid-year; and [v] the analyst does not scale up EQVALPS from the valuation date to the target date. We focus on these errors because based on the formulae underlying DCF valuation, we judge them to be the most likely to yield material changes in analysts' target prices when the errors are corrected.

Table 7 reports the results of correcting each error in a mutually exclusive manner. In measuring the average effects of correcting a given error, we include both observations where we can identify that analysts have made an error and observations where they have not. For example, in correcting what we judge to be analysts' errors about g, the post-terminal year growth rate in free cash flows, we take the 109 analyst reports that per panel B of Table 3 disclose g, and recalculate the analyst's target price after reducing to 5% all values of g > 5%. This turns out to be feasible for 57 of the initial 109 observations.

We estimate that correcting errors [i] and [ii] yields no materailly positive or negative material changes in the AERs implied by corrected target prices. In contrast, correcting error [iv] increases AERs by a mean and median of 5% (viz., about half the mean value of RE reported in panel C of Table 3), while the largest impacts on AERs come from correcting errors [iii] and [v]. Thus, we estimate that changing RF to the 10-year Treasury yield on the analyst report date when RF is more than +/- 30 bps away from the 10-year Treasury yield on the analyst report date increases AERs by a mean (median) of 14% (21%). We also estimate that scaling up EQVALPS from the valuation date to the target price date for the 93% of the time that this is not done by the analyst increases AERs by a mean (median) of 12% (11%).

Lastly, we provide a crude estimate of what might happen to analysts' AERs if all five errors [i] - [v] were corrected simultaneously. We do so by imposing two additional assumptions. First, we assume that the mean and median AERs we estimate from correcting any one error can be added together to arrive an unbiased estimate of the mean and median AER that would be obtained if all five errors were simultaneously corrected. And second, we assume that the errors we can identify in analysts' DCF models because the analyst shows us enough information to be able to grade them generalize to analyst reports where the analyst does not show us enough information to be able to grade that aspect of their report. Given these assumptions, the last line of Table 7 indicates that we estimate that correcting for all five types of errors where present would increase analysts' target prices by a median (mean) of 37% (29%). We argue this is an economically material amount.

In total, the results we report in Tables 3-7 lead us to conclude that at least with regard to valuing equity, not only are sell-side analysts markedly less sophisticated than prior research has supposed, but they are also more optimistic in that the correct translation of the fundamental free cash flow and WACC information that they place into their DCF valuation models yields estimates of the relevant firms' future stock prices that are far higher than those obtained from analysts' stated target prices, which prior research has found to be quite optimistic to begin with.

5. Explaining variation in error rates and dubious judgment rates in analysts' DCF models

In this section we test the hypothesis that, holding constant analysts' poor average sophistication in constructing and executing DCF valuation models, more sophisticated analysts will nevertheless exhibit lower error rates and dubious judgment rates than will less sophisticated analysts. We first develop several proxies for analyst sophistication, and then use the proxies in cross-sectional regressions. Our proxies center on the quantity of information analysts disclose about the inputs to, and the contents of, their DCF model by leveraging the idea that more sophisticated analysts will seek to separate themselves from less sophisticated analysts by disclosing more information about their DCF models to investors because their knowledge is greater and they are more confident in what they know.

5.1 Scoring the quantity of disclosure about the inputs to, and the contents of, DCF models

We create four DCF disclosure scores, each of which is aimed at measuring how much of several types of information analysts provide in their reports about their DCF models. For each type of score, a higher value captures the notion that the analysts responsible for the higher value are disclosing to investors a greater fraction of the total information the investors wish to see. We argue that by supplying investors with more of what they demand, analysts with higher DCF disclosure scores will be seen as more sophisticated and in equilibrium will indeed be more sophisticated because the degree to which they are sophisticated is, as we have shown earlier in our paper, readily estimable by grading their DCF models.

5.1.1 Forecasted financial statements

We begin with a measure of the quantity of fundamental financial statement data that analysts generate and that is therefore available for input into their DCF models. Our proxy for this is the number of forecasted future financial statements that analysts do (or do not) include in their reports. Many academics and practitioners argue that in-depth and high-quality forecasted financial statements are critical to achieving a sophisticated equity valuation.[11] Along with their DCF models, analysts' commonly provide at least one year's worth of one or more forecasted income statements, balance sheets and statements of cash flow.

Table 8 provides descriptive statistics on the number and type of annual financial statements forecasted by analysts in our sample of 120 reports issued Jan. 2012 - Dec. 2013. Lines 1a and 1b show that for the sample as a whole, analysts forecast a mean of 3.7 years' worth of full annual income statements. The minimum is zero years, the maximum is 11 years, and at least one year of full income statements is forecasted 92% of the time (110 out of 120 reports). We define a full financial statement as one that contains all or almost all of the lines that would be expected to be present in that financial statement as disclosed in the typical 10-K, keeping in mind the firm's industry. In line 1b, we note that for the 10 reports that do not contain one or more forecasted full annual income statements, it is sometimes the case that the analyst forecasts a 'mini' or partial annual income statement, which we define as one that contains only a few of the lines typically present in a full annual income statement.

Although not as prevalent as income statements, lines 2a-3b show that full balance sheets and statements of cash flow are each forecasted in about 56% of reports. Across all 120 sample analyst reports, the mean number of years of both forecasted full balance sheets and statements of cash flow is about 2.3. This is smaller than the 3.7 years' worth of forecasted full annual income statements in part because it is less likely that an analyst will forecast full versions of

[11] For example, Lundholm and Sloan in the preface to their book *Equity Valuation and Analysis with eVal* (2013, pp.xii) state that "Our overriding theme [in this book] is that good forecasts of the future financial statements are the key input to a good valuation … [O]ur main point [is] that the key to good valuations is good forecasts."

these financial statements. Lines 2b and 3b indicate that when no full balance sheets and statements of cash flow are forecasted, the mean number of mini balance sheets and statements of cash flow that are forecasted is small, amounting to one year or less.

5.1.2 DCF disclosure scores

We score analysts on how much information they disclose to investors through their forecasted financial statements by awarding three (one) points for each forecasted annual full (mini) income statement, balance sheet, and statement of cash flows, and then dividing the sum by nine times T, where the number of years ahead to the terminal year in the DCF model. Since T can exceed the number of years the analyst forecasts future financial statements for, the disclosure quality score for forecasted financial statements can exceed 100%. At the same time, because T may not be shown in the analyst's DCF model (e.g., the analyst simply states what WACC is and what their estimated equity value per share is, and no more), there are some reports for which a forecasted financial statements score cannot be calculated.

Next, we score analysts on the quantity of information they provide to investors about how they arrive at their forecasted annual future free cash flows. We award one point for each of the following 10 lines in Figure 2 that are explicitly or implicitly forecasted by the analyst: EBITDA, depreciation & amortization, EBIT, taxes on EBIT, NOPAT, depreciation & amortization (again), Δ working capital, after tax operating cash flows, CAPEX, and free cash flows. We then divide the sum by 10, the maximum number of lines.[12]

Third, we measure the quantity of analysts' disclosures about their WACC. We do so by awarding one point for each of the 11 components used in calculating WACC as shown in the lower right hand side of Figure 2: RF horizon, RF, beta, market risk premium, RE, equity weight, RD before tax, tax rate, RD after tax, debt weight, and WACC. We divide the sum by 11.[13]

Lastly, we score analysts on how much data they provide investors about how they convert their forecasted future free cash flows into equity value per share. In this regard, and in strong though not complete parallel with what is shown in the lower left hand side of Figure 2, we award one point for each of 12 items when explicitly shown on the analyst's DCF: Horizon year (maximum of 1 pt), PV of FCF in each individual year in forecast horizon (maximum of 1

[12] An explicit forecast occurs when the analyst writes a number down for a given line. An implicit forecast occurs when the analyst does not write a number down for a given line, but the number for the given line can be deduced from other lines the analyst has explicitly forecasted.

[13] In the few cases where the firm has preferred stock, we score one additional point for the interest rate on preferred and one point for the weight on preferred, and increase the denominator to 13.

pt), total PV of all forecasted FCFs, terminal value, PV of terminal value, enterprise value, cash, debt, equity value, shares used to deflate equity value, equity value per share, and date that the forecasted equity value per share applies to. The resulting sum is divided by 12.[14]

In Table 9 we provide descriptive statistics on the distribution of the four scores across our sample of analyst reports. Holding constant the large dispersion that is present in all types of score, we observe a separation of scores into two groups: On the one hand, information to do with deriving FCF and then converting the FCF into EQVALPS, where the median disclosure scores are 85% and 78%, respectively. On the other hand, forecasted financial statement and WACC information, with much lower median disclosure scores of 33% and 32%, respectively. In part, these findings indicate that analysts are much more willing to provide investors with information about the numerator aspects of their DCF models (viz., deriving FCF and converting the FCF into EQVALPS) than about the denominator aspects (viz., WACC information). Whether this is because analysts are more confident predicting the levels of future free cash flows than their riskiness, or whether it reflects differential strategic behavior in light of the availability of their reports to competitor analysts, is difficult to determine.

5.2 Do more sophisticated analysts make fewer errors and fewer dubious judgments?

We now turn to using all four of the disclosure scores developed in section 5.1 as proxies for analyst sophistication in testing the hypothesis that more sophisticated analysts will manifest lower DCF error rates and dubious judgment rates than less sophisticated analysts. We do so by regressing DCF error rates and DCF dubious judgment rates on the four disclosure scores and five supplementary variables.[15] We predict that each disclosure score will be negatively associated with analysts' error rates and dubious judgment rates. The supplementary variables we include are a dummy variable for there being at least one CFA on the analyst team, the number of pages in the analyst report, the number of analysts on the analyst team, the number of years the firm had been publicly traded as of the report date, and the prominence of the brokerage firm. We predict a negative coefficient on each of these latter variables.[16]

[14] In the few cases where the firm has preferred stock and/or minority interest, we score one additional point for preferred stock and one additional point for minority interest, and increase the denominator to a maximum of 14.

[15] To maximize the number of regression observations, we replace the nine missing values of the disclosure scores covering forecasted financial statements with the mean score value of 44% (see Table 9, NOBS = 111 not 120).

[16] The reasoning behind our sign predictions is straightforward. We expect analysts with a CFA qualification to be more sophisticated in DCF modeling; more pages in the analyst report to reflect more detailed and therefore more sophisticated analysis; more analysts on the analyst team to increase the probability that team members will match to their sub areas of expertise including DCF modeling; more prominent brokerage firms to employ more financially

We present the results of estimating the two regressions in Table 10. We find that while four of the eight estimated coefficients on the disclosure scores are reliably negative at the 5% one-tailed significance level. Moreover, the adjusted R^2 of 30% in the dubious judgment regression indicates that the disclosure scores in aggregate explain a material fraction of the cross-sectional variation in analysts' DCF dubious judgment rates. We therefore interpret Table 10 as generally supportive of the hypothesis that more sophisticated analysts make fewer mistakes and dubious judgments than do less sophisticated analysts.

6. Analysts' sophistication with regard to long-run economic forces

In this section we conclude our empirical assessment of the sophistication of DCF equity analysts by studying how well the long-run economic forces that are expected to govern firms' activities show up in the forecasted financial statements that we documented in section 5.1.1 often accompany analysts' DCF valuation models. If analysts are only somewhat sophisticated, then we expect to observe that the rates of growth in all the financial statement lines that they forecast going out in time through to their DCF terminal year will on average decline. If analysts are very sophisticated, then we further expect to observe that their forecasted rates of growth in the terminal year will not exceed the expected perpetual rate of worldwide economic growth.

In Figure 3 we display the trajectories of the medians of key ratios extracted from analysts' forecasted financial statements in event time relative to analysts' DCF terminal year (where available). Panel A shows the median rates of growth in certain dollar-denominated financial statements variables, while panel B reports the median values of the percentage-based ROE and the effective tax rate variables.

Looking first at panel A, it can clearly be seen that the median rates of growth in all five dollar-denominated financial statement variables on average decline as the terminal year approaches. This is consistent with analysts being sufficiently sophisticated to recognize the economic reality that in the long run, high rates of projected firm growth and all its correlates must in expectation decline and converge toward a figure no larger than the expected rate of nominal growth in the world economy. Also consistent with such an sophistication view is the result in panel B where the median effective tax rate increases as the terminal year approaches.

---

sophisticated analysts; and more mature firms to be easier to model and so provide fewer opportunities for analysts to make errors or dubious judgments on. We measure broker prominence by the log of the number of times the broker appears in our sample.

However, Figure 3 reports evidence that we view as being inconsistent with many analysts being highly sophisticated in their understanding of long-run economic forces. First, pivoting on our assumption expressed in the cutoff in error code 1.3 (Table 4, panel A) that during our 2012-13 sample period the correct expected perpetual rate of annual worldwide economic growth should not exceed 5%, panel A shows that the median analyst projection of the rate of growth in long-term free cash flows is more than 5%. Second, even where the median rates of projected growth in revenues, depreciation, EBIT and CAPEX are smaller than 5%, less than but still close to 50% of individual analysts' projections exceed 5%. Taken together, the evidence in panel A leads us to conclude that close to 50% of analysts in our sample are optimistic and only partially reflect the realities of long-run economic forces in their DCF forecasts.

The evidence we present in panel B regarding where analysts project ROE will be as time increases from the forecast date toward the terminal year echoes this conclusion.[17] Specifically, panel B shows that median ROE is forecasted to *increase* as the terminal year approaches, rising from a linearly fitted value of 12.5% nine years before the terminal year to 18.4% in the terminal year. We argue that this is not what would be expected to be observed in a random sample of publicly traded firms and given a mean forecasted cost of equity of 11.1% (Table 3, panel C). We interpret the gap of 7.3% between 18.4% and 11.1% as indicating that analysts on average are inappropriately optimistic and partially unsophisticated about the projected long-run profitability of the companies they follow.[18] As such, we also propose that the evidence in Figure 3 is consistent with the results in Table 7 where we estimated that analysts are markedly more optimistic than previously assumed because the correct translation of the fundamental free cash flow and WACC information that they place into their DCF valuation models yielded estimates of the relevant firms' future stock prices that were far higher than those obtained from analysts' stated target prices, which prior research has found to be quite optimistic to begin with.

[17] We define ROE as annual net income divided by end of year shareholder equity.

[18] This would not necessarily be true for a sample heavily concentrated in intangible intensive firms such as pharmaceuticals, or a sample tilted toward newly listed firms. For such firms, it might reasonably be expected that the expensing required of most intangible assets under U.S. GAAP, combined with successful intangible-intensive companies being those that create natural monopolies for themselves, would lead to ROEs that both increased toward the terminal year, and at the terminal year were higher than RE (Lundholm and Sloan, 2013, Ch. 4).

7. Conclusions and questions for future research

In this study, we have sought to determine how well sell-side equity analysts construct and execute the DCF valuation models that they frequently include in their reports to investors. Using a stratified random sample of 120 analyst reports containing DCF valuation models from Investext that were issued during Jan. 2012 - Dec. 2013, we estimate that analysts make a median of five errors and five dubious judgments in their DCF models. As such, and subject to the caveat that our results are to some degree predicated on our judgments as to what is a DCF error and what is not, we conclude that the number of errors and dubious judgments that we estimate sell-side equity analysts make are startlingly high. Most academics and investors see sell-side analysts as being sophisticated economic agents. Although such sophistication may be present in the many and rich non-DCF valuation parts of their reports, we find a marked lack of sophistication in analysts' ability in the DCF valuation part of their reports to construct and execute a DCF equity valuation model.

In order to estimate the economic magnitude of their lack of DCF valuation sophistication, we show that the errors that analysts make are not small and mean zero in their effect on analysts' target prices. Specifically, we estimate that recalculating analysts' stated target prices after correcting for five major and common errors overall increases target prices by about one third. This leads us to conclude that sell-side equity analysts are both less sophisticated and more optimistic than prior research has supposed. This conclusion is bolstered by additional results we find using the forecasted financial statements that analysts often include in their DCF-oriented reports—namely that analysts only partially reflect in their financial forecasts the economic realities that affect long-run forecasts. In particular, analysts are too optimistic about the rates of growth they are forecasting for revenues and free cash flows in the DCF terminal year, with the improper result that the ROEs they forecast increase over time and rise to a level that is implausibly higher than firms' cost of equity capital.

Looking to the future, we suggest that our study raises a number of disquieting questions. For example, why do sell-side analysts make so many mistakes and dubious judgments in their DCF valuation models? How do they continue to do so, given the repeated nature of the task, and the fact that their errors are on display for their clients, their bosses and colleagues at competing sell-side brokerages to see? Do buy-side analysts make similar numbers of errors and dubious judgments (Crawford, Gray, Johnson and Price, 2013; Groysberg, Healy, Serafeim and Sahnthikumar, 2013)? Are analysts just poorly trained—and if so, is that the fault of their academic teachers, or poor in-house training? Or do they not care because the importance of financial models to them and their compensation has fallen over time (Bradshaw, 2011)? Why don't brokerage firms make their analysts use correct and uniform valuation templates, such as those available for little or no cost from websites such as www.lundholmandsloan.com and www.wallstreetprep.com? Would analysts revise and/or reverse engineer their free cash flow and/or cost of capital inputs if they were aware of their mistakes in combining them into a valuation, such that they ended up back at their original error-riddled target price? Do sophisticated consumers of analysts' reports such as institutional investors and corporate CFOs not realize that analysts make so many DCF valuation mistakes and dubious judgments? Or are they quite aware of, and therefore largely discount analysts' DCF models and price targets? But then why do stock prices move when analysts change their price targets? Do investment banks and corporate CFOs make the same kinds of mistakes and dubious judgments as analysts when evaluating M&A targets for their clients or for their own organization? Do hedge funds or other types of sophisticated investors exploit analysts' erroneously executed DCF valuations? And are the brokerage firms that employ analysts who make large numbers of DCF modeling errors exposing themselves to heretofore-unrecognized legal risks? Given the central importance of accurate valuation in economics and finance, we believe that these questions are worthy of future research, particularly because the answers should be useful to both academics and practitioners.

REFERENCES

Asquith, P., Mikhail, M. and A. Au. 2005. Information content of equity analyst reports. *Journal of Financial Economics* 38, 17-39.

Block, S.B. 1999. A study of financial analysts: Practice and theory. *Financial Analysts Journal* 55(4), 86-95.

Bradshaw, M.T. 2002. The use of target prices to justify sell-side analysts' stock recommendations. *Accounting Horizons* 16(1), 27-41.

Bradshaw, M.T. 2004. How do analysts use their earnings forecasts in generating stock recommendations? *The Accounting Review* 79(1), 25-50.

Bradshaw, M.T. 2009. Analyst information processing, financial regulation, and academic research. *The Accounting Review* 84(4), 1073-1083.

Bradshaw, M.T. 2011. Analysts' forecasts: What do we know after decades of work? Working paper, Boston College.

Bradshaw, M.T., Brown, L.D., and K. Huang. 2013. Do sell-side analysts exhibit differential target price forecasting ability? *Review of Accounting Studies* 18: 930-955.

Bradshaw, M.T., Huang, K. and H. Tan. 2013. Analyst target price optimism around the world. Working paper, Boston College.

Brown, L.D. 1993. Earnings forecasting research: Its implications for capital markets research. *International Journal of Forecasting* 9(3), 295-320.

Brown, L.D., Call, A.C., Clement, M.B., and N.Y. Sharp. 2013. Inside the "black box" of sell-side financial analysts. Working paper, UT Austin.

Call, A.C., Chen, S., and Y.H. Tong, 2013. Are analysts' cash flow forecasts naïve extensions of their own earnings forecasts? *Contemporary Accounting Research* 30(2), 438-465.

Courteau, L., Kao, J.L., and G.D. Richardson. 2001. Equity valuation employing the ideal versus ad hoc terminal value expressions. *Contemporary Accounting Research* 18(4), 625-661.

Crawford, S., Gray, W., Johnson, B., and R.A. Price. 2013. The investment value of contrarian buy-side recommendations. Working paper,

Dechow, P.M., and You, H. 2013. 2013. Understanding and predicting target price valuation errors. Working paper, UC Berkeley.

Demirakos, E.G., Strong, N.C., and M. Walker. 2004. What valuation models do analysts use? *Accounting Horizons* 18(4), 221-240.

Ertimur, Y., Muslu, V., and F. Zhang. 2011. Why are recommendations optimistic? Evidence from analysts' coverage initiations. *Review of Accounting Studies* 16, 679-718

Fernandez, P. 2013. 119 common errors in company valuations. Working paper, IESE.

Francis, J., and D. Philbrick. 1993. Analysts' decisions as products of a multi-task environment. *Journal of Accounting Research* 31(2), 216-230.

Francis, J., Olsson, P., and D.R. Oswald. 2000. Comparing the accuracy and explainability of dividend, free cash flow, and abnormal earnings equity value estimates. *Journal of Accounting Research* 38(1), 45-70.

Givoly, D., Hayn, C., and R. Lehavy. 2009. The quality of analysts' cash flow forecasts. *The Accounting Review* 84(6), 1877-1911.

Givoly, D., Hayn, C., and R. Lehavy. 2013. Analysts' cash flow forecasts are not sophisticated: A rebuttal of Call, Chen and Tong (2013). Working paper, Penn State.

Groysberg, B., and Healy, P. 2013. Wall Street Research: Past, present, and future. *Stanford University Press*.

Groysberg, B., Healy, P., Serafeim, G. and D. Shanthikumar. 2013. The stock selection and performance of buy-side analysts. *Management Science* 59(5), 1062-1075.

Joos, P.R., and J.D. Piotroski. 2013. The best of all possible worlds: Analyst ex ante valuation forecast optimism and the distribution of scenario-based valuations. Working paper, Stanford.

Kaplan, S.N., and R.S. Ruback. The valuation of cash flow forecasts: An empirical analysis. *Journal of Finance* 50(4), 1059-1093.

Levin, J., and P. Olsson. 2000. Terminal value techniques in equity valuation – Implications of the steady state assumption. Working paper, Stockholm School of Economics.

Lin, H., and M. McNichols. 1998. Underwriting relationships, analysts' earnings forecasts and investment recommendations. *Journal of Accounting and Economics* 25, 101-127.

Lundholm, R., and T. O'Keefe. 2001a. Reconciling value estimates from the discounted cash flow model and the residual income model. *Contemporary Accounting Research* 18(2), 311-335.

Lundholm, R., and T. O'Keefe. 2001b. On comparing residual income and discounted cash flow models of equity valuation: A response to Penman 2001. *Contemporary Accounting Research* 18(4), 693-696.

Lundholm, R. and R. Sloan. Equity valuation and analysis with *eVal*. 1st, 2nd and 3rd editions (2006, 2007, 2013). McGraw-Hill, New York.

Markou, A., and S. Taylor. 2014. Peering inside the analyst 'Black Box': How do equity analysts model companies? Working paper, Cambridge University.

Mauboussin, M.J. 2006. Common errors in DCF models. Legg Mason Capital Mgmt., March 16.

Penman, S.H. 2001. On comparing residual income and discounted cash flow models of equity valuation: A response to Lundholm and O'Keefe. *Contemporary Accounting Research* 18(4), 681-692.

Penman, S.H., and T. Sougiannis. 1998. A comparison of dividend, cash flow, and earnings approaches to equity valuation. *Contemporary Accounting Research* 15(3), 343-383.

Petersen, C., and T. Plenborg. 2009. The implementation and application of firm valuation models. *Journal of Applied Business Research* 25(1), 1-11.

Previts, G., Bricker, R., Robinson, T., and S.J. Young. 1994. A content analysis of sell side financial analysts company reports. *Accounting Horizons* 8, 55-70.

Ramnath, S., Rock, S., and P. Shane. 2008. Financial analysts' forecasts and stock recommendations: A review of the research. *Foundations and Trends in Finance* 2, 311-420.

Schipper, K. 1991. Analysts' forecasts. *Accounting Horizons* 5(4), 105-121.

Tham, J., and I. Velez-Pareja. 2004. Top 9 (unnecessary and avoidable) mistakes in cash flow valuation. Unpublished manuscript, Duke University.

Twedt, B. and L. Rees. 2013. Reading between the lines: An empirical examination of qualitative attributes of financial analysts' reports. Working paper, Texas A&M.

APPENDIX 1

Justifications for the set of critical values and theoretically oriented interrelationships between DCF elements covered in Tables 4 and 5

In grading analysts' DCF models, on many occasions we employ a +/- 3% cutoff between what the analyst reports and what we calculate based on the raw data analysts' provide on their DCF model page(s) before we assign an error as having occurred. We do not require an exact match to allow for the fact that what analysts show on their DCF model page(s) is often rounded up or down relative to the exact underlying calculations.

<u>*Panel A: Error cutoffs*</u>

1.2 t_0 is the valuation date, defined as the beginning of Year 1 of the analyst's valuation horizon. Thus, in Figure 2 we have t_0 = 12/31/2011 because Year 1 = 2012 and the firm's fiscal year-end is 12/31. We typically identify t_0 based on determining the date that yields us the closest correspondence between what analysts' show PV(FCF[1-T]) to be or calculate to be, and what we calculate PV(FCF[1-T]) to be based on what analysts show on their DCF model page(s) with regard to FCF[1-T], WACC and cash flow timing.

1.3 We use 5% as the cutoff above which we grade analysts as assuming an erroneously high g, the growth rate in post-terminal value FCF (and all other financial statement variables). This is 2% higher than in *Equity Valuation and Analysis with eVal* (2013, 3rd ed., p.174), the source of our assumed 100% correctly structured and executed DCF-to-all-investors equity valuation model. Lundholm and Sloan state that they use 3% as the default terminal value for sales growth (and therefore free cash flows also). Their reasoning is that "Historically, the annual growth rate in the U.S. economy, as measured by the nominal GDP growth rate, has averaged around 6%, composed of roughly 4% real growth and 2% price inflation. However, the financial crisis of 2007-2008 sent both real growth and inflation plummeting into negative territory, albeit briefly. The long-term forecasts from the Congressional Budget Office and the Federal Reserve at the end of 2010 put real growth at 2-3% and inflation at 1-2%. So, in most cases a terminal sales growth rate forecast should fall between 3% and 5% … We use 3% as the default terminal value for Sales Growth in *eVal*." We use 5% rather than 3% in order to seek to be conservative in estimating that analysts make an error in this important area of valuation.

1.8.1 We use min(2g, 6%) as the cutoff above which we deem analysts' terminal year revenue growth,
1.8.2 CAPEX growth, and FCF growth to be erroneous to allow some headroom in the growth rate in
1.8.6 analysts' forecasted financial statements and/or FCF components relative to g.

1.8.4 We use +/- 50% as the cutoff between CAPEX and D&A in the terminal year to allow for the possibility that substantial differences between CAPEX and D&A in the terminal year may not be erroneous because management might still be able or planning to set CAPEX to a level starting the year after the terminal year that would equate CAPEX and D&A.

1.8.5 We set the lower cutoff for terminal year ETR at 25% to conservatively allow for the possibility that the firm will be able to avail itself of permanent U.S. and/or foreign tax benefits.

2.1 We select the 10-year Treasury yield as the correct RF horizon to follow Lundholm and Sloan (2013, p.218). Like Lundholm and Sloan, we judge the 10-year yield to well balance the mix of very short term horizons and very long term horizons in the DCF model. The 10-year rate is also very commonly used in practice. We apply +/- 30 bps as the error determination cutoffs to allow for analysts being slow to update their DCF models if interest rates suddenly change.

2.2 Given that we observe a mean RE of approximately 11%, we use +/- 30 bps as our cutoff bounds to conform to our general +/- 3% cutoff.

2.3.2 We use the same tax rate cutoff bounds as in 1.8.5 because WACC will in large part apply to long term FCF. As such, the tax rate should be that which is expected to apply in the long run, and since in the firm will only exist in the long run if it is profitable, in the long run the most likely tax rate the firm will face is the sum of the statutory federal rate plus a weighted average of state tax rates (net of federal tax benefits).

2.3.4 We use +/- 20 bps as our cutoff bounds rather than +/- 30 bps as in RE because before-tax RD is typically about 2/3rds the size of RE.

2.4.1 We apply cutoffs of +/- 10% rather than 0% to allow for rounding related slippage between analysts' calculations and our own.

Panel B: Dubious judgment cutoffs

We acknowledge that the cutoffs we use in grading analysts as having made a dubious judgment are more subjective than those we use for grading errors. Below we provide explanations for the areas of DCF model judgment that may be less familiar to readers.

3.6 We set the minimum horizon for a non-dubious terminal year horizon at 4 years in light of the arguments made by many academics and practitioners that T needs to be set a fair way out into the future, not close to the valuation date. For example, Lundholm and Sloan (2013) set T to be 11 years in *eVal*. In the earlier 2007 edition of their textbook (in which they set the default T at an even higher 23 years), they state that "you should be very cautious about using the perpetuity formula too soon … Because year T is the starting value for an infinite stream of future values, even a small error in the year T cash flow or residual income gets greatly amplified, resulting in a big mistake in the valuation." (p.222).

3.11.1 Setting the valuation date t_0 after the report date is not necessarily fatal, but is dangerous because
3.11.3 it may be the case that the firm is reasonably forecasted to undertake material operating, financing or investing actions between t_0 and the report date. Ditto with regard to setting t_0 after the target price date.

3.11.2 Setting t_0 more than 400 calendar days prior to the report date is dubious because it compounds the effects of the error that analysts make 93% of the time by not scaling up their EQVALPS from t_0 to the target price date (error code 2.8, Table 4 panel B).

3.12.1 We subjectively set a cutoff of 20% for each of the four disclosure scores we compute, discuss
3.12.2 and use in section5.1.2 and 5.2. We do so based on what we propose is the reasonable argument
3.12.3 that the investor reading the analyst's report will value knowing at least 20% of what could be
3.12.4 disclosed (given the assumed DCF-to-all-investors valuation framework laid out in Figure 2).

APPENDIX 2

Analyst DCF-to-all-investors as-reported example #1: Level 3 Communications (3/16/12, Cowen & Company)

Error and dubious judgment codes as defined in Table 4 and Table 5

Errors		Dubious judgments	
1.8.1		3.2	
1.8.2		3.4	
1.8.5		3.5.2	
1.8.6		3.10.1	
2.1		3.10.2	
2.2			
2.4.1			
2.5			
2.8			
Number	9	Number	5
Rate	43%	Rate	25%

DCF model disclosure quality scores:

Forecasted financial statements	67%
Deriving FCF	40%
WACC	73%
Converting FCF to EQVALPS	92%

Implied date of analyst's DCF model t_0: 20111231

Chart 9: Level 3 DCF

($mn)	2011	2012E	2013E	2014E	2015E	2016E	Terminal Value
Revenue	$4,387	$6,557	$6,934	$7,356	$7,826	$8,349	
EBITDA	959	1,471	1,789	2,064	2,267	2,499	19,988
CFO	388	790	1,072	1,388	1,600	1,833	
Capex	498	787	832	883	978	1,044	
Free Cash Flow	(110)	3	240	506	622	790	
Cash Flow Growth		103.1%	7036.0%	110.5%	23.0%	27.0%	
Year	0.0	0.5	1.5	2.5	3.5	4.5	4.5
Present Value Discount Factor	1.00	1.04	1.13	1.23	1.34	1.46	1.46
Present Value of Free Cash Flow	(110)	3	212	410	463	541	13,682

Today	
Total PV of Free Cash Flow	$1,518
Terminal Value	$13,682
Sum of DCFs	$15,200
less net debt and preferred stock	$7,519
plus other cash	$0
Private market value	$7,681
less 10% public / private discount	$768
Public equity value	$6,913
Shares Outstanding	212
Fair Value Price	**$32.68**

Current Price	$26.60

WACC	8.8%
Terminal EBITDA Multiple	8.0
Risk Free Rate	3.5%
Beta	1.2
Equity Premium	9.2%
Cost of Debt	7.9%
Percentage of Capital	85.8%
Cost of Equity	14.2%
Percentage of Capital	14.2%

APPENDIX 2 (continued)

Analyst DCF-to-all-investors as-reported example #2: Google (1/23/13, Pivotal Research Group)

Error and dubious judgment codes as defined in Table 4 and Table 5

Errors		Dubious judgments	
1.1		3.6	
1.3		3.8	
1.4		3.10.1	
1.5		3.10.2	
1.6.1		3.11.3	
1.8.1		3.12.3	
1.8.2			
1.8.3			
1.8.4			
1.8.5			
1.8.6			
2.6			
2.7			
2.8			
Number	14	Number	7
Rate	74%	Rate	50%

DCF model disclosure quality scores:	
Forecasted financial statements	33%
Deriving FCF	100%
WACC	9%
Converting FCF to EQVALPS	92%

Implied date of analyst's DCF model t_0: 20131231

GOOGLE DISCOUNTED CASH FLOW MODEL

In $mm Except Per Share Data	**FY12A**	**FY13E**	**FY14E**	**FY15E**	**FY16E**	**FY17E**
Ex-MMI						
Operating Income	13,835.0	14,643.5	15,182.9	15,321.1	15,463.4	15,832.5
Net Interest and Other Income	625.0	650.0	700.0	800.0	900.0	1,000.0
Income Before Income Taxes	14,460.0	15,293.5	15,882.9	16,121.1	16,363.4	16,832.5
Provision For Income Taxes	(2,815.2)	(3,211.6)	(3,335.4)	(3,385.4)	(3,436.3)	(3,534.8)
• Assumed Tax Rate	19.5%	21.0%	21.0%	21.0%	21.0%	21.0%
Legacy Google Net Income	11,644.8	12,081.9	12,547.5	12,735.7	12,927.1	13,297.7
D&A	2,445.5	3,122.9	3,720.0	4,464.0	5,356.8	6,428.2
Stock-Based Compensation Expense	2,500.0	3,072.0	3,608.4	4,034.8	4,477.5	4,925.3
Capital Expenditures / Acquisitions	(13,841.0)	(7,000.0)	(7,900.0)	(8,800.0)	(9,700.0)	(10,600.0)
• Total Company CapEx / Acquisitions	(13,841.0)	(7,000.0)	(7,900.0)	(8,800.0)	(9,700.0)	(10,600.0)
Changes in Cash Flows	2,749.3	11,276.7	11,975.9	12,434.4	13,061.4	14,051.1
NPV of Future Cash Flows			11,107.4	10,696.3	10,420.9	10,397.5
Sum of Future Cash Flows		42,622.1				
NPV of Terminal Value		172,025.7				
• Terminal Value:		264,163.1				
Value of Future Cashflows		214,647.7				
Plus: 2013E Cash+ Marketable Securities		59,364.7				
Plus: Motorola Stand-Alone Value		8,000.0				
Value of Cashflows, Cash and Investments		282,012.5				
Less: 2013E Debt		(5,537.0)				
2013E Common Equity Value		276,475.5				
Shares Outstanding 2013E		338.4				
Equity Value 2013E (Per Share)		**820.0**				
Current Equity Value (Per Share)		702.9				
2013E Equity Value Premium Vs. Current Price		**17%**				

KEY ASSUMPTIONS	
Near-Term Discount Rate	*7.8%*
Terminal EV/FCF Multiple	*18.8x*
Long-Term Growth Rate	*6.0%*
Long-Term Discount Rate	*11.3%*

APPENDIX 2 (continued)

Analyst DCF-to-all-investors as-reported example #3: MoSyS (4/19/13, Feltl and Company)

Error and dubious judgment codes as defined in Table 4 and Table 5

Errors		Dubious judgments	
1.7.1		3.1	
1.8.2		3.3	
1.8.4		3.10.1	
1.8.5		3.11.2	
1.8.6		3.12.1	
2.1			
2.2			
2.3.1			
2.3.2			
2.3.3			
2.4.3			
2.5			
2.7			
2.8			
Number	14	Number	5
Rate	54%	Rate	26%

DCF model disclosure quality scores:

Forecasted financial statements	13%
Deriving FCF	100%
WACC	100%
Converting FCF to EQVALPS	83%

Implied date of analyst's DCF model t_0: 20121231

MoSyS (NASDAQ: MOSY)

DCF Valuation

$ in millions, unless otherwise noted

	CY13E	CY14E	CY15E	CY16E	CY17E
	1	*2*	*3*	*4*	*5*
Free cash flow calculation					
Operating Profit (EBIT)	($23)	($24)	($13)	$2	$25
Less: Taxes *(assumes zero taxes)*	$0	$0	$0	$0	$0
NOPAT (Net Operating Profit After Taxes)	**($23)**	**($24)**	**($13)**	**$2**	**$25**
Less: CAPEX	$0	$0	$1	$1	$2
Less: Changes in working capital	$1	$0	($2)	($2)	($2)
Add: Stock compensation	$4	$4	$4	$4	$4
Add: Depreciation & Amortization	$2	$2	$1	$1	$1
Unlevered Free Cash Flow	**($18)**	**($18)**	**($7)**	**$7**	**$29**

DCF Enterprise Value Calculation

Terminal Value Calculation	
Terminal value growth rate	**0.60%**
Projected FCF	$29
Discount Rate (WACC)	**8.00%**
Terminal enterprise value	$397
Implied Term. Value FCF multiple	13.6x

Cost of Capital Assumptions	
Beta	2.00x
Market Return	5.00%
Risk Free Rate (5 yr Treas.)	0.8%
Tax Rate	0.0%
Cost of Debt	0.00%
Cost of Equity	8.00%
% of Debt	**0.00%**
% of Equity	**100.00%**
WACC	**8.00%**

Discounted Cash Flow at WACC		CY13E	CY14E	CY15E	CY16E	CY17E
Unlevered free cash flow		($17)	($16)	($6)	$5	$20
Terminal value						$270
Total Discounted Cash Flows	**$257**	($17)	($16)	($6)	$5	$290

Summary Valuation	
DCF Enterprise Value	$257
Less: Net Debt *(FY14 est.)*	($36)
Equity Value	$293
Diluted shares (FY14 est., incl. est. share offering in 1HCY14)	45
DCF value per diluted share	$6.50
Estimated DCF Value of MOSY	**$6.50**
Current share price	$4.31
Variance from Feltl and Company PT	51%

DCF Value Per Share			
Terminal		WACC	
Growth	7.00%	8.00%	9.00%
0.70%	$7.90	$6.60	$5.60
0.60%	$7.80	**$6.50**	$5.50
0.50%	$7.60	$6.40	$5.50

Source: Feltl and Company estimates

Feltl and Company Research Department MoSys, Inc. (MOSY) Page 4

TABLE 1

Selection criteria used in arriving at 120 DCF-based analyst reports taken from Investext (5 analyst reports per month, all dated Jan. 2012 – Dec. 2013), and the frequency of the general types of DCF models created and used by analysts in the sampled reports.

Panel A: Investext search criteria

Keyword(s):	DCF or ("discounted cash flow*") in **Table of Contents**
Report type:	**Company**
Geography:	**United States**
Contributor:	**Non-broker research excluded**

Panel B: Sample refinement criteria. Where an analyst report was excluded for one of the reasons below, another analyst report adhering to the Investext search criteria in panel A was selected at random from the same month as the excluded report.

Base sample:	139 analyst reports	
Excluded:	No FCF shown in DCF model	7
	DCF covers only part of company	5
	Firm is non-U.S. company	3
	Firm is a financial company	2
	DCF is acquisition-oriented	1
	Other	1
Final sample:	120 analyst reports (5 per month)	

Panel C: Frequency of the general types of DCF models used by analysts in sample reports

DCF to all investors		# reports
1.1	NOPLAT + depn. +/- ΔWCap - CAPEX	60
1.2	Adj. EBITDA - cash taxes +/- ΔWCap - CAPEX	18
1.3	CFOPS + (1 - tax rate)(int exp) - CAPEX	7
1.4	NI +/- adjustments - CAPEX	13
1.5	Unlevered FCFs given, but no derivation	11
DCF to equity		
2.1	Levered FCFs	2
Dividend discount model		
3.1	Dividends to equity	1
Insufficient or no information		
4.1	Usually no FCFs provided at all	8
		120

TABLE 2

Descriptive statistics on the brokers, analysts and firms in the 120 DCF-based analyst reports sampled from Investext; see Table 1 for sample selection criteria.

Panel A: Number of sampled analyst reports by authoring broker

Total = 120 analyst reports from 37 different U.S. brokers that contribute to Investext					
Morgan Stanley	17	Maxim Group	3	Feltl & Company	1
JP Morgan	11	Oppenheimer	3	HSBC Global Research	1
Deutsche Bank	9	Piper Jaffray	3	Indaba Global Research	1
Jefferies	7	Pivotal Research Group	3	Leerink Swann	1
Cowen	7	Susquehanna	3	Miller Tabak	1
Credit Suisse	6	Brean Capital	2	Morgan Keegan	1
BMO Capital Markets	5	Caris	2	National Alliance Securities	1
Barclays	3	Indigo Equity Research	2	Norne Securities	1
Canaccord Genuity	3	KLR Group	2	Sephirin Group	1
Cantor Fitzgerald	3	Ladenburg Thalmann	2	Wedbush	1
Craig Hallum	3	Stonegate Securities	2	Wunderlich Securities	1
Evercore Partners	3	Buckingham Research	1	Zephirin Group	1
Macquarie	3				

Panel B: Number of reports analyst is author on, analyst professional qualifications, and number of analysts on the analyst team

Analyst is author on:	
One report	120
Two reports	34
Three reports	22
Four reports	2
Five reports	1
Six reports	1
# different analysts	180
# analyst-reports	273

Professional qualification	#
CFA	60
CPA	1
MD	3
PhD	8
# analyst-reports	72

# analysts on team	
Min.	1
Mean	2.2
Max.	5

% of reports with ≥ 1 CFA on analyst team	42%

Type of report	#
Update / revision	108
Initiation	12

# pages in analyst report	
Min.	5
Mean	14.5
Max.	40

Panel C: Industry, market cap and publicly traded age of firms covered in analyst reports

Industry	#
Business services	25
Pharmaceuticals	16
Communications	7
Avg. per other (23)	3.1

Market cap ($ mil)		
Min.	$	5
Median	$	5,648
Mean	$	19,129
Max.	$	237,851

# years firm listed	
Min.	0
Median	14
Mean	19
Max.	88

TABLE 3

Descriptive statistics on key valuation components disclosed in the DCF models in 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013. In the panels, NOBS is the number of analyst reports for which there is valid data; T is the terminal year in the analyst's DCF model; and g the analyst's stated post-terminal year perpetuity growth rate.

Panel A: Analysts' reported target prices, target price horizons, and the annualized expected stock returns embedded in analysts' reported target prices

	NOBS	Min.	10th pctile	50th pctile	Mean	90th pctile	Max.
Current stock price	120	$ 0.26	$ 8.87	$ 33.71	$ 61.10	$ 85.07	$ 726.71
Target stock price	120	$ 2.00	$ 10.00	$ 34.20	$ 70.23	$ 95.00	$ 850.00
Horizon (months)	111	3.5	10	12	12	12	15
Annualized expected return embedded in target stock price	111	-51%	-12%	13%	18%	36%	411%

Panel B: When the terminal year occurs (T), and the annual growth rate in free cash flows assumed by the analyst to occur in perpetuity after the terminal year (g)

TV element	NOBS	Min.	10th pctile	50th pctile	Mean	90th pctile	Max.
T	111	1	4	8	8	11	16
g	109	-100%	0%	3.0%	1.7%	5.0%	15%

Panel C: Analysts' assumed WACC and components of WACC

WACC component	NOBS	Min.	10th pctile	50th pctile	Mean	90th pctile	Max.
RF horizon (yrs)	15	5	10	10	11	10	30
RF	58	0.2%	1.8%	3.3%	3.1%	4.0%	5.0%
BETA	56	0.55	0.72	1.20	1.18	1.50	2.50
MKTPREM	55	4%	4.5%	6.5%	6.8%	10%	11%
RE	57	7.8%	8.4%	11%	11%	14%	23%
EQWEIGHT	58	14%	60%	83%	82%	100%	100%
RD (before-tax)	42	0%	0%	5.0%	5.1%	8.0%	11.2%
Tax rate on RD	44	0%	15%	35%	31%	40%	40%
RD (after-tax)	42	0%	0%	3.5%	3.7%	6.3%	8.3%
DEBTWEIGHT	55	0%	0%	18%	19%	40%	86%
WACC	120	4.5%	7.5%	10%	10%	13%	21%

TABLE 4

Types and frequency of errors made in the DCF models of 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013

Panel A: Errors having to do with the numerator-oriented level, growth and timing of free cash flows in analysts' DCF models

#	Error code	Error category	Description of error having to do with level, growth and timing of free cash flows in analyst's DCF model.	NOBS	Error rate
1.	1.1	FCF derivation	Analyst's derivation of FCF from their underlying financial statement forecasts has ≥ 1 error. For example, analyst's DCF always shows ΔWCAP = zero or no ΔWCAP each year 1-T when adjusting NOPLAT to derive FCF[1-T].	98	15%
2.	1.2	FCF[1-T]	Analyst includes FCF[0] in the calculation of EQVAL at t_0	110	16%
3.	1.3	TV_g	Analyst's assumed post-terminal year T perpetual growth rate in free cash flows g > 5%	109	7%
4.	1.4	TV_$	Analyst's TV is more than +/- 3% away from the TV obtained by correctly using the FCF[T], WACC and g information provided by the analyst.	73	25%
5.	1.5	ENTVAL	Analyst's ENTVAL is more than +/- 3% away from the ENTVAL obtained by correctly using the FCF[1-T], TV, WACC and g provided by the analyst.	61	26%
6.	1.6.1	EQVAL	Analyst's EQVAL is more than +/- 3% away from the EQVAL obtained by correctly using the ENTVAL and ADJ to ENTVAL provided by the analyst.	62	31%
7.	1.6.2	EQVALPS	Analyst's EQVALPS is more than +/- 3% away from the EQVALPS obtained by correctly using the EQVAL and SHS provided by the analyst.	113	4%
8.	1.7.1	SHS	Analyst's SHS is more than +/- 3% away from outstanding [fully diluted] common shares per Compustat at end of fiscal period prior to date of analyst's report when analyst's DCF they are using outstanding [fully diluted] common shares.	93	15%
9.	1.7.2	DILUTION	Analyst's SHS in DCF model is not fully diluted, and is more than +/- 3% away from the fully diluted SHS per firm's most recent financial statements as of the analyst's report date.	113	6%
10.	1.8.1	At T	Analyst's % revenue growth in year T > min(2g, 6%)	76	50%
11.	1.8.2	At T	Analyst's % growth in CAPEX in year T > min(2g, 6%)	87	39%
12.	1.8.3	At T	Analyst's % revenue growth in year T > (analyst's % growth in CAPEX in year T + 3%)	67	33%
13.	1.8.4	At T	CAPEX[T] > (1.5 x D&A[T]) or < (0.5 x D&A[T])	66	32%
14.	1.8.5	At T	Analyst's ETR[T] is < 25% or > 40%	71	30%
15.	1.8.6	At T	Analyst's % FCF growth in year T > min(2g, 6%)		

Mean	23%
Median	25%

Notes: i. FCF = unlevered free cash flow; FCF[1-T] = FCF for years 1 - terminal year T out from the valuation date; ΔWCAP = annual change in non-cash working capital.
ii. TV = analyst's terminal value; ENTVAL = analyst's enterprise value; EQVAL = analyst's equity value; EQVALPS = EQVAL per common share.
iii. SHS = shares used by analyst in deflating EQVAL to arrive at EQVALPS; CAPEX = annual capital expenditures forecasted by analyst.
iv. D&A = annual depreciation + amortization forecasted by analyst; ETR = firm's effective tax rate implicit in analyst's financial statement or DCF forecasts.

TABLE 4 (continued)

Panel B: Errors having to do with the denominator-related discount rate aspects of analysts' DCF models

#	Error code	Error category	Description of error having to do with the discount rates and discounting methods in analyst's DCF model.	NOBS	Error rate
1.	2.1	RF	Analyst's RF is more than +/- 30 bps away from the 10-year Treasury yield on the date of the analyst's report.	58	84%
2.	2.2	RE	Analyst's RE is more than +/- 30 bps from the RE obtained by correctly using CAPM components provided by analyst.	48	13%
3.	2.3.1	RD	Analyst's before-tax RD is zero.	42	14%
4.	2.3.2	RD	Analyst's tax rate applied to before-tax RD < 25% or > 40%	44	20%
5.	2.3.3	RD	Analyst's after-tax RD is zero.	42	17%
6.	2.3.4	RD	Analyst's RD is more than +/- 20 bps from the RD obtained by correctly using the components provided by the analyst.	34	3%
7.	2.4.1	WACC	Analyst's EQWEIGHT is more than +/- 10% away from the EQWEIGHT implied by the ratio of the analyst's EQVAL to the analyst's [ENTVAL - EQVAL].	56	30%
8.	2.4.2	WACC	Analyst assigns no weight to preferred stock in calculating WACC, even though the firm's financial statements show that the firm has preferred stock.	62	3%
9.	2.4.3	WACC	Analyst's WACC is more than +/- 30 bps away from the WACC obtained by correctly using the RE, RD, EQWEIGHT and DEBTWEIGHT information provided by the analyst.	37	22%
10.	2.5	PV(FCF[1-T])	Analyst's PV(FCF[1-T]) is more than +/- 3% away from the PV(FCF[1-T]) obtained by correctly using the analyst's FCF[1-T] and WACC.	75	13%
11.	2.6	PV(TV)	Analyst's PV(TV) is more than +/- 3% away from the PV(TV) obtained by correctly using the analyst's TV and WACC, and the T stated by the analyst or inferred from the analyst's FCF[1-T] and stated PV(FCF[1-T]).	76	24%
12.	2.7	MID_YEAR	Analyst's FCF are discounted explicitly at the end of the year or as if the FCF occur at the end of the year, not evenly over the year.	111	83%
13.	2.8	SCALE_UP	Analyst does not grow EQVALPS from the valuation date to the target date using RE.	103	93%
				Mean	32%
				Median	20%

Notes: v. RF = risk-free rate; RE = cost of equity; RD = cost of debt; WACC = after-tax weighted average cost of capital.
vi. EQWEIGHT = weight applied to RE in calculating WACC; DEBTWEIGHT = weight applied to after-tax RD in calculating WACC.
vii. PV(z) = present value of z, using WACC.

TABLE 5

Types and frequency of the dubious judgments made in the DCF models of 120 analyst reports from Investext, Jan. 2012 – Dec. 2013

#	Dubious judgments: Code	Label	Description of dubious judgment having to do analyst's DCF model.	NOBS	Dubious judgment rate
1.	3.1	BETA	Analyst's beta > 2.0	56	4%
2.	3.2	MKTPREM	Analyst's market risk premium > 9%	55	18%
3.	3.3	RE	Analyst's cost of equity < 8%	57	5%
4.	3.4	EQWEIGHT	Analyst's weight applied to RE in calculating WACC < 50%	58	5%
5.	3.5.1	WACC	Analyst's WACC < 7%	120	6%
6.	3.5.2	WACC	Analyst's WACC is constant over time when analyst's EQWEIGHT is more than +/- 20% away from the EQWEIGHT implied by the ratio of the analyst's EQVAL to the analyst's [ENTVAL - EQVAL].	56	14%
7.	3.6	TV_T	Analyst's terminal year is 4 years or less from valuation date t_0	111	14%
8.	3.7	LRROE	ROE[T] implicit in analyst's forecasted financial statements or DCF model < 5% or > 25%	19	26%
9.	3.8	TVFRAC	Analyst's TV accounts for > 85% of ENTVAL.	106	22%
10.	3.9	SENSITIVITY	Analyst provides no sensitivity analysis of effects of WACC, g or future FCF on EQVALPS.	120	48%
11.	3.10.1	CASH	Analyst adds total cash, not the operating component of total cash, to ENTVAL.	109	95%
12.	3.10.2	NET_FA	Analyst's adjustments to ENTVAL for net financial assets, contingent equity claims, minority interest and preferred stock in arriving at EQVAL are dubious (e.g., not subtracting minority interest, or adding rather than subtracting debt).	112	54%
13.	3.11.1	TIMING	$t_0 > t_{report}$	111	42%
14.	3.11.2	TIMING	$t_{report} > t_0$ + 400 calendar days.	111	3%
15.	3.11.3	TIMING	$t_0 > t_{tpx}$	103	2%
16.	3.11.4	TIMING	No t_{tpx} date provided by analyst in DCF or broker in disclosure section of analyst's report.	120	8%
17.	3.12.1	DISCLOSURE	Analyst's disclosure score regarding forecasted financial statements < 20%	111	27%
18.	3.12.2	DISCLOSURE	Analyst's disclosure score regarding derivation of FCF < 20%	120	19%
19.	3.12.3	DISCLOSURE	Analyst's disclosure score regarding WACC < 20%	120	48%
20.	3.12.4	DISCLOSURE	Analyst's disclosure score regarding converting FCF to EQVALPS < 20%	120	4%
				Mean	23%
				Median	16%

Notes:
i. Valuation date t_0 is the date that best reconciles the analyst's forecasted FCF and TV with their present values and the analyst's ENTVAL.
ii. ROE[T] = implicit ROE in terminal year T, defined as net income in year T ÷ shareholder equity at end of year T.
iii. ENTVAL = analyst's enterprise value; EQVAL = analyst's equity value.
iv. t_0 = Effective date on which analyst's valuation is centered (viz., beginnning of Year 0 in Figure 2 = 12/31/11).
v. t_{report} = Date of analyst's report (viz., 9/24/12 in Figure 2).
vi. t_{tpx} = Date to which analyst's price target applies (viz., 6/30/13 in Figure 2).
v. Disclosure scores are defined and tabulated in Table 9.

TABLE 6

Numbers and rates of errors and dubious judgments made in the DCF models of 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013. Rates are calculated per analyst report based on the numbers of error or judgment categories (see Tables 4 and 5) for which determining whether an error or dubious judgment has been made is possible.

Panel A: Errors and dubious judgments across all 120 observations

	NOBS	Min.	10^{th} pctile	50^{th} pctile	Mean	90^{th} pctile	Max.
Number of errors per analyst	120	0	2	5	5.4	8	14
Number of gradeable errors per analyst	120	1	10	17	17.5	26	28
Error rate	120	0%	15%	32%	32%	47%	100%
Number of dubious judgments per analyst	120	1	2	5	4.5	6	8
Number of gradeable dubious judgments per analyst	120	7	13	15	15.8	19	20
Dubious judgment rate	120	5%	15%	29%	29%	43%	62%

Panel B: Errors and dubious judgments averaged by broker

Broker	Number of reports in sample	Mean number of errors	Mean number of dubious judgments	Mean error rate	Mean dubious judgment rate
Morgan Stanley	17	4.4	3.7	27%	25%
JP Morgan	11	5.4	3.7	38%	24%
Deutsche Bank	9	7.0	4.9	33%	30%
Jefferies	7	5.3	4.1	42%	30%
Cowen	7	5.9	5.1	32%	33%
Credit Suisse	6	5.3	5.2	30%	31%
BMO Capital Markets	5	4.4	4.4	30%	34%
Barclays	3	6.3	5.3	29%	32%
Canaccord Genuity	3	4.3	5.7	30%	38%
Cantor Fitzgerald	3	5.3	6.0	35%	40%
Craig Hallum	3	4.3	5.0	23%	36%
Evercore Partners	3	6.7	2.3	24%	12%
Macquarie	3	6.0	7.0	34%	42%
Maxim Group	3	5.0	4.0	34%	31%
Oppenheimer	3	5.3	2.3	25%	12%
Piper Jaffray	3	8.7	4.3	43%	25%
Pivotal Research Gp	3	7.3	6.7	39%	48%
Susquehanna	3	5.0	5.3	40%	38%
Brean Capital	2	5.5	7.0	29%	37%

Broker	Number of reports in sample	Mean number of errors	Mean number of dubious judgments	Mean error rate	Mean dubious judgment rate
Caris	2	4.5	5.5	25%	39%
Indigo Equity Research	2	2.5	3.0	31%	30%
KLR Group	2	3.0	2.0	20%	13%
Ladenburg Thalmann	2	7.0	3.5	45%	27%
Stonegate Securities	2	5.0	4.5	20%	29%
Buckingham Research	1	4.0	7.0	50%	50%
Feltl & Company	1	14.0	5.0	54%	26%
HSBC Global Research	1	1.0	5.0	11%	38%
Indaba Global Research	1	5.0	5.0	21%	26%
Leerink Swann	1	5.0	6.0	42%	43%
Miller Tabak	1	6.0	4.0	33%	29%
Morgan Keegan	1	4.0	5.0	15%	26%
National Alliance Sec.	1	6.0	3.0	35%	20%
Norne Securities	1	6.0	4.0	25%	21%
Sephirin Group	1	4.0	3.0	33%	21%
Wedbush	1	4.0	2.0	20%	13%
Wunderlich Securities	1	7.0	4.0	28%	21%
Zephirin Group	1	3.0	2.0	20%	14%

TABLE 7

Estimated impacts on the annualized expected return implied by the target prices in 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013, before versus after major errors in analysts' DCF models are corrected.

Annualized expected return (AER):	NOBS	Median	Mean	Std.dev.
AER embedded in uncorrected target price	111	13%	18%	48%
Δ AER from correcting target price for these errors:				
i. Analyst's post-terminal year growth rate g > 5%	57	0%	-2%	20%
ii. Analyst incorrectly includes FCF prior to valuation date, or makes incorrect adjustments to ENTVAL in arriving at EQVAL.	120	0%	0%	23%
iii. Analyst's RF is more than +/- 30 bps away from the 10-year Treasury Bill yield on analyst's report date.	18	21%	14%	29%
iv. Analyst's FCF are discounted end-of-year, not mid-year.	111	5%	5%	3%
v. Analyst does not scale up EQVALPS from the valuation date to the target date.	103	11%	12%	8%
All errors i. - v. combined by summing the median and mean percentages columns.		37%	29%	

TABLE 8

Distribution of the type and number of forecasted annual financial statements in 120 analyst reports containing DCF models sampled from Investext, Jan. 2012 – Dec. 2013.

			Number of years forecasted					
#	Type of forecasted annual financial statement	NOBS	Min.	10^{th} pctile	50^{th} pctile	Mean	90^{th} pctile	Max.
1a.	Full I/S	120	0	2	3	3.7	8	11
1b.	Mini or partial I/S (when no full I/S provided)	10	0	0	3	2.1	3	3
2a.	Full B/S	120	0	0	2	2.3	6	11
2b.	Mini or partial B/S (when no full B/S provided)	54	0	0	0	0.7	3	3
3a.	Full SCF	120	0	0	2	2.2	6	11
3b.	Mini or partial SCF (when no full SCF provided)	52	0	0	0	1.0	3	6
4.	≥ 1 full set of {B/S, I/S, SCF}	120	49% of firms have ≥ 1 full set of {B/S, I/S, SCF}					

Note: We define a mini financial statement as one that contains only a few of the lines that would typically be present in a full financial statement. One example of a mini SCF would be an SCF that presents only net income, cash from operations, cash from investing, and cash from financing lines.

TABLE 9

Distribution of disclosure quality scores of the inputs to, and the contents of, DCF equity valuation models in 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013, and the correlations between the scores.

Panel A: Descriptive statistics on disclosure quality scores

#	Disclosure quality score for:	NOBS	Min.	10th pctile	50th pctile	90th pctile	Max.
A.	Forecasted financial statements	111	4%	9%	33%	100%	233%
B.	Deriving FCF	120	0%	10%	85%	100%	100%
C.	WACC	120	9%	9%	36%	91%	100%
D.	Converting FCF to EQVALPS	120	0%	66%	81%	92%	92%
	Total disclosure quality score (equally-weighted avg. of A-D)	120	9%	34%	57%	78%	110%

Panel B: Pearson correlations between the scores

	Pearson correlations	B.	C.	D.
A.	Forecasted financial statements	-0.01	0.04	-0.21
B.	Deriving FCF		0.13	0.31
C.	WACC			-0.03
D.	Converting FCF to EQVALPS			

Notes: Disclosure quality scores are computed as follows:

A. Forecasted financial statements: 3 (1) points are scored for each annual full (mini) B/S, I/S and SCF forecasted by the analyst. The sum is then divided by 3 x 3 x T. Since T sometimes exceeds the number of years the analyst forecasts future financial statements for, the disclosure quality score for forecasted financial statements can exceed 100%. Also, because T may not be shown in the analyst's DCF model (e.g., the analyst simply states what WACC is and what their estimated equity value per share is), there are some reports for which the score cannot be calculated.

B. Deriving FCF: 1 point is scored for each of the following 10 lines that are explicitly or implicitly forecasted by the analyst in their DCF-to-all-investors model: EBITDA, depreciation & amortization, EBIT, taxes on EBIT, NOPAT, depreciation & amortization (again), Δ working capital, after tax operating cash flows, CAPEX, and free cash flows. The sum is then divided by 10. An explicit forecast occurs when the analyst writes a number down for a given line. An implicit forecast occurs when the analyst does not write a number down for a given line, but the number for the given line can be deduced from other lines the analyst has explicitly forecasted.

C. WACC: 1 point is scored for each of the 11 components used in calculating WACC per panel C of Table 3. The sum is then divided by 11.

D. Converting FCF to EQVALPS. 1 point is scored for each of the following 12 items when explicitly shown on the analyst's DCF: Horizon year (max of 1 pt), PV of FCF in each individual year in forecast horizon (max of 1 pt), total PV of all forecasted FCFs, terminal value, PV of terminal value, enterprise value, cash, debt, equity value, shares used to deflate equity value, equity value per share, and date that the forecasted equity value per share applies to. The sum is then divided by 12.

TABLE 10

Regressions of the error rates and dubious judgment rates made by analysts in their DCF models in 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013, on hypothesized explanatory variables.

		Dependent variable			
	Pred. coef	DCF model error rate		DCF model dubious judment rate	
Independent variables	sign	Coef.	t-stat.	Coef.	t-stat.
Forecasted financial statements disclosure score	-	0.00	0.02	-0.05	-1.85
Deriving FCF disclosure score	-	0.06	1.54	-0.05	-1.85
WACC disclosure score	-	-0.11	-3.04	-0.15	-6.09
Converting FCF to EQVALPS disclosure score	-	-0.08	-1.12	-0.02	-0.35
CFA on analyst team? (y=1, n=0)	-	-0.01	-0.50	0.01	0.76
# pages in analyst report	-	0.00	-0.15	0.00	-1.13
# analysts on analyst team	-	0.02	0.99	0.00	0.09
ln(1 + # years firm has been publicly listed)	-	-0.02	-1.49	0.01	1.10
Prominence of brokerage firm	-	-0.01	-0.56	-0.02	-1.10
Adjusted R-squared		5%		30%	
F-stat (significance)		1.7 (0.10)		6.6 (< 0.001)	
# obs.		120		120	

FIGURE 1

Prototypical timeline in DCF valuation model in a sell-side equity analyst company report. Dates are illustrative only, and assume a 12-month ahead target price horizon.

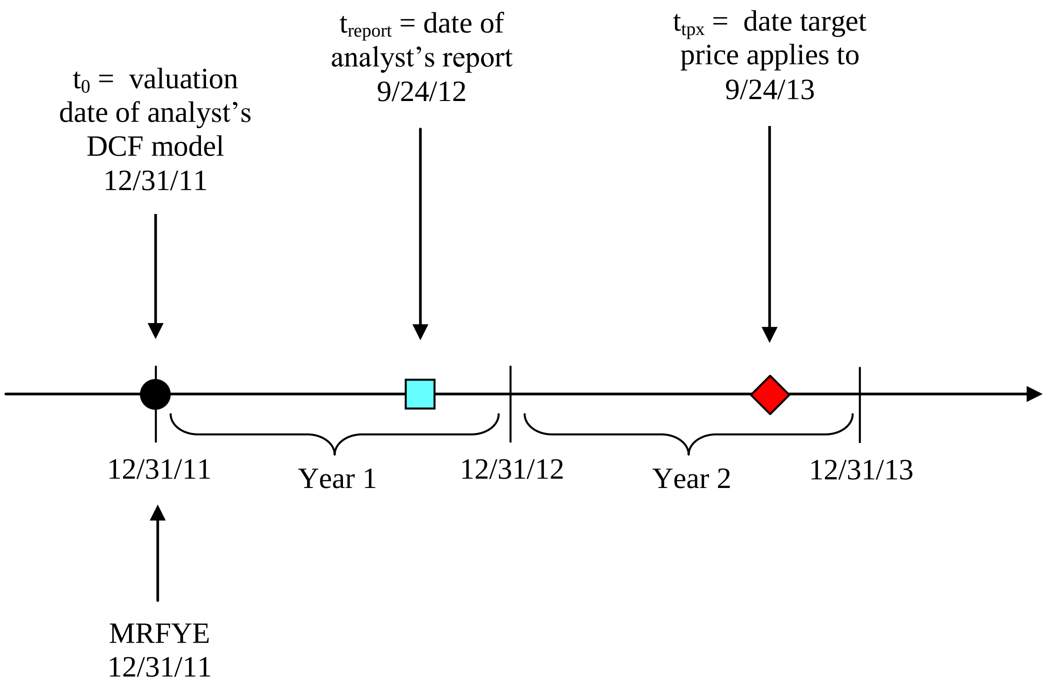


FIGURE 2

Illustration of our definition of a correctly structured and executed condensed DCF-to-all-investors equity valuation model

Fiscal year of forecast (FYE = 12/31)	Year 1 2012	Year 2 2013	Year 3 2014	Year 4 2015	Year 5 2016	Year 6 2017	Year 7 2018	Year 8 2019	Year 9 2020	Year 10 = T 2021
Revenues	$ 11,000	$ 11,990	$ 12,949	$ 13,856	$ 14,687	$ 15,421	$ 16,038	$ 16,519	$ 16,850	$ 17,018
Earnings before interest, taxes, and depn, depln & amortzn (EBITDA)	$ 2,200	$ 2,398	$ 2,590	$ 2,771	$ 2,937	$ 3,084	$ 3,208	$ 3,304	$ 3,370	$ 3,404
- Depn, depln & amortzn	$ (220)	$ (240)	$ (259)	$ (277)	$ (294)	$ (308)	$ (321)	$ (330)	$ (337)	$ (340)
= Operating income (EBIT)	$ 1,980	$ 2,158	$ 2,331	$ 2,494	$ 2,644	$ 2,776	$ 2,887	$ 2,973	$ 3,033	$ 3,063
- Taxes on EBIT	$ (436)	$ (518)	$ (606)	$ (698)	$ (793)	$ (888)	$ (982)	$ (1,070)	$ (1,153)	$ (1,225)
= Unlevered net income (NOPAT)	$ 1,544	$ 1,640	$ 1,725	$ 1,796	$ 1,851	$ 1,888	$ 1,905	$ 1,903	$ 1,880	$ 1,838
+ Depn, depln & amortzn	$ 220	$ 240	$ 259	$ 277	$ 294	$ 308	$ 321	$ 330	$ 337	$ 340
- Δ Working capital	$ (50)	$ (50)	$ (48)	$ (45)	$ (42)	$ (37)	$ (31)	$ (24)	$ (17)	$ (8)
= After-tax operating cash flow	$ 1,714	$ 1,831	$ 1,936	$ 2,027	$ 2,103	$ 2,159	$ 2,195	$ 2,209	$ 2,201	$ 2,170
- CAPEX	$ (313)	$ (328)	$ (341)	$ (352)	$ (359)	$ (362)	$ (362)	$ (359)	$ (352)	$ (341)
= Free cash flow (FCF) to all investors	$ 1,402	$ 1,502	$ 1,594	$ 1,676	$ 1,744	$ 1,797	$ 1,833	$ 1,851	$ 1,849	$ 1,829
Terminal value of FCF beyond T										$ 20,493
PV of yearly FCFs years 1-T	$ 1,274	$ 1,241	$ 1,197	$ 1,144	$ 1,082	$ 1,014	$ 940	$ 862	$ 783	$ 704

PV of total FCFs years 1-T	$ 10,242
+ PV of terminal value	$ 7,891
= Enterprise value	$ 18,133
- Interest bearing debt & financial liabilities	$ (2,370)
+ Non-operating ("excess") cash & other financial assets	$ 130
- Contingent equity claims	$ (160)
- Minority interest	$ (20)
- Preferred stock	$ (100)
= Equity value at analyst valuation date before time adjustments	$ 15,613
x Adjustment factor to recognize that cash flows are mid-year	5.4%
x Adjustment to scale up equity value from valuation date to report date	7.9%
= Equity value at analyst valuation date	$ 17,749
Common shs outstanding at analyst report date	1,000
= Equity value per share at analyst report date	$ 17.75
x Adjustment to scale up equity value from report date to target price date	8.2%
= Forecasted equity value per share at analyst target price date	$ 19.21

RF Horizon (years):	10
RF:	1.7%
Beta:	1.50
Market risk premium:	6.0%
RE:	10.7%
Equity weight:	90.0%
RD (before tax):	5.8%
Tax rate:	40%
RD (after tax):	3.5%
Debt weight:	10.0%
WACC:	10.0%

Valuation date:	12/31/2011
Analyst report date:	9/24/2012
Target price date:	6/30/2013
Perpetuity growth rate in annual FCF after terminal year:	1.0%
Current stock price:	$ 17.02
Target stock price:	$ 19.21
Annualized expected return in target price:	17.1%

Note: Some numbers reflect the effects of rounding.

FIGURE 2 (continued)

Notes: i. The DCF-to-all-investors equity valuation model in Figure 2 is stylized in that it is a deliberately condensed version of what we assume to be 100% correct, namely the DCF-to-all-investors valuation model detailed by Lundholm and Sloan in their book *Equity Valuation and Analysis with eVal* (3rd edition, 2013, especially p.154-155; p.225; pp.239-243). We adopt a less than fully correct DCF valuation model against which to grade analysts for two main reasons. First, most of the differences detailed in the Notes to Figure 2 are in expectation likely to occur infrequently and be economically small. Second, it is rare for analysts to include the items represented by these differences in their models, and we wish to avoid biasing our study in favor of concluding that analysts construct and execute DCF valuation models in an unsophisticated manner. Thus, if analysts are aware of the differences but rationally choose to exclude them because they are infrequent and immaterial, then we risk downwardly bias our assessment of analyst sophistication if we include the differences in our grading template. Conversely, if analysts are not aware that the differences exist but we grade analysts under the presumption that they should be aware, then we risk concluding that analysts are unsophisticated based on a large number of economically small aspects of DCF modeling and execution, rather than on economically or theoretically important errors.

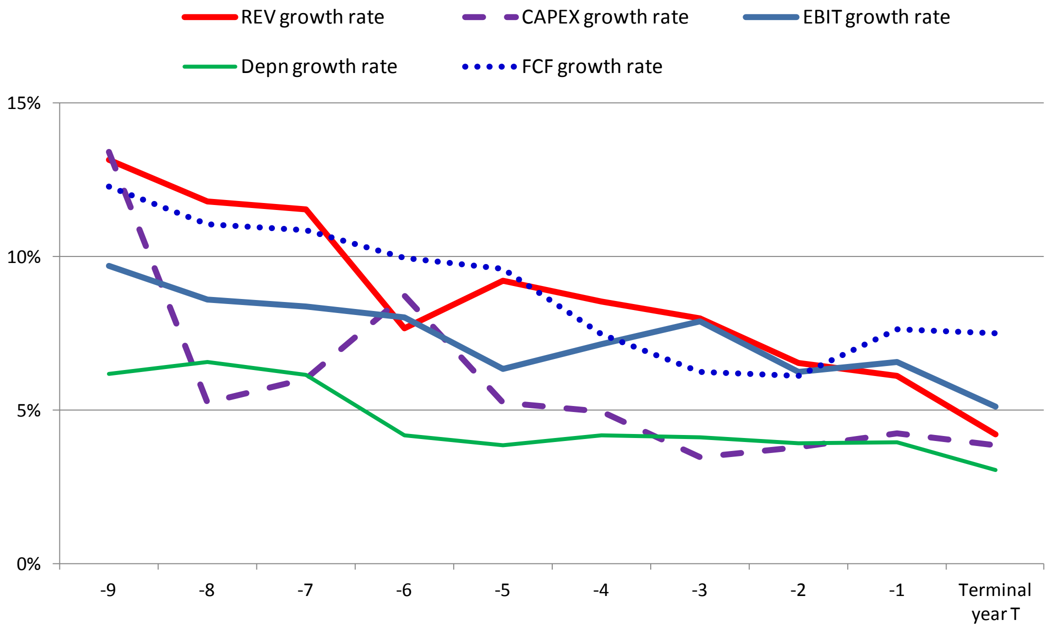
ii. The differences that we itemize between our stylized model and that of Lundholm and Sloan are as follows. We explicate the differences because if an analyst's DCF model does not conform to Lundholm and Sloan's assumed 100% correct model, but does conform to our reduced model, we do <u>not</u> grade the analyst as having made an error or dubious judgment.

- We do not include a line for the Change in Deferred Taxes after Taxes on EBIT. Some analysts address the deferred tax effect of the line Taxes on EBIT by forecasting Cash Taxes on EBIT instead of (book) Taxes on EBIT.
- We do not include lines for Non-Operating Income (Loss) or Extraordinary Items & Discontinued Operations after the Depreciation & Amortization add-back line after NOPAT.
- We do not include lines for Increase in Investments, Purchase of Intangibles, Increase in Other Assets, Increase in Other Liabilities, or Clean Surplus Plug after the CAPEX line.
- We do not include the cost of preferred stock or the cost of minority interest in calculating WACC.
- We do not mark the firm's financial assets and liabilities to their market values.
- We ignore company warrants, and ascribe no value to the conversion options embedded in convertible bonds.
- We address the contingent equity claim of employee stock options by (leniently) only grading the analyst as having made an error if the analyst arrives at their equity value per share by dividing their dollar equity value of the firm by outstanding common shares, and then only if the difference between basic and fully diluted common shares as of the most recent fiscal period prior to the report date exceeds 5% of common shares outstanding.
- We do not include information about year T+1 in Figure 2, even though a 100% correct DCF model should show year T+1 to prove out to the reader that steady state has been achieved (Levin and Olsson, 2000; Lundholm and Sloan, 2013). We do not grade analysts as having made an error if they do not show year T+1 data, although we do grade them with regard to the economic plausibility of the implied rates of growth in key financial statement variables and ratios in year T.

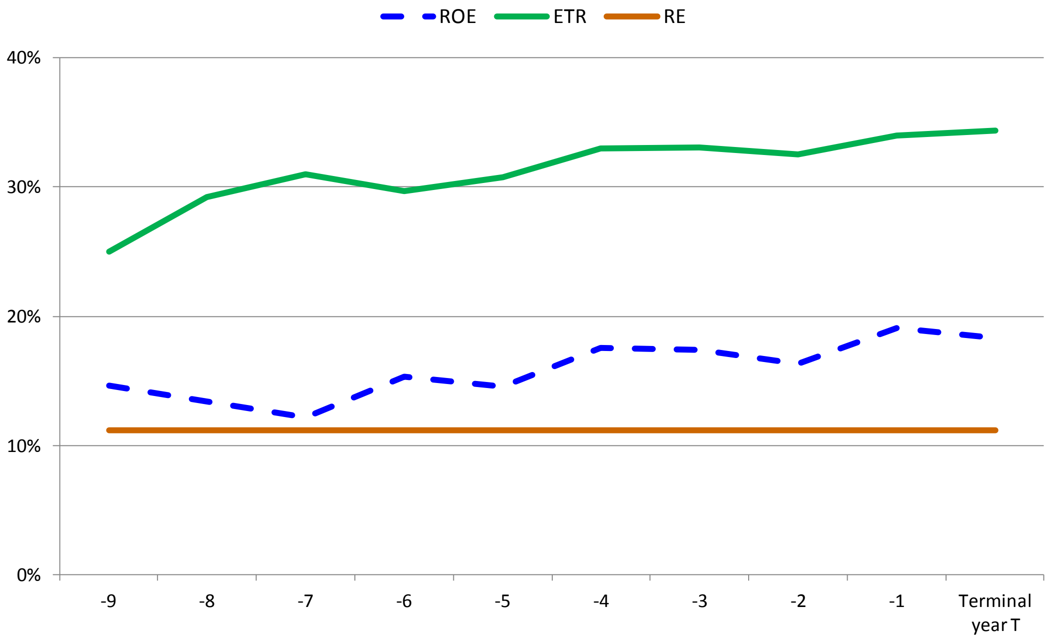
FIGURE 3

Trajectories of key financial statement ratios in event time relative to the DCF terminal year. Ratios are derived from the forecasted financial statements and/or DCF equity valuation models in 120 analyst reports sampled from Investext, Jan. 2012 – Dec. 2013.

Panel A Median rates of growth in financial statement variables



Panel B Median values of firms' ROE, effective tax rate ETR, and cost of equity capital RE



Note: The number of observations from which the median values plotted above are taken range between 12 and 108. The median number of observations in any given event year is 58.

The dual use of residual income and discounted cash flow valuation methods by U.S. sell-side equity analysts

John R. M. Hand*	Joshua Coyne	Jeremiah Green	X. Frank Zhang
UNC Chapel Hill	Univ. of Memphis	Penn State	Yale University
hand@unc.edu	jgcoyne@memphis.edu	jrg28@psu.edu	frank.zhang@yale.edu

Abstract

We explore the use of residual income (RI) valuation by U.S. sell-side equity analysts by comparing the characteristics and performance of RI valuations with those of discounted cash flow (DCF) when both methods are used by the same analysts for the same firm in the same report. We find that analysts are equally likely to adopt RI valuations built around forecasting net operating income (RNOA-RI) as around net income (ROE-RI). However, the economic properties of RNOA-RI and ROE-RI valuations are quite different. RNOA-RI valuations are optimistic relative to future prices and contain forecasted RNOAs that increase toward a terminal year median of 28%, whereas ROE-RI valuations are unbiased relative to future stock prices and contain ROEs that decline toward a terminal year median of 17%. Supporting our conclusion that ROE-RI valuations tend in practice to be superior to DCF and RNOA-RI valuations, we observe that analysts' ROE-RI valuations are stronger determinants of analysts' target prices than are their DCF or RNOA-RI counterparts.

This version: January 20, 2015

Keywords: Equity analysts; DCF; residual income; valuation; analyst sophistication

JEL codes: G12, G17, G32

* Corresponding author; tel. 919.962.3173.

We appreciate the helpful comments provided by Peter Joos, Trevor Harris, and workshop participants at UNC Chapel Hill. All errors are our own.

1. Introduction and overview

Beginning with the seminal papers of Ohlson (1995) and Feltham and Ohlson (1995), residual income (RI) valuation has gained prominence in academic accounting. Notable examples of its use include the value-relevance literature (Barth, Beaver and Landsman, 2001), identifying mispriced stocks (Lee, Myers and Swaminathan, 1999), estimating firms' costs of capital (Li and Mohanram, 2014), and understanding risk and growth (Penman 2011; Penman and Reggiani, 2013). RI is also widely taught alongside DCF methods in MBA valuation classes (Easton, McAnally, Sommers and Zhang, 2014; Lundholm and Sloan, 2013; Penman, 2012) and in the CFA curriculum (Pinto, Henry, Robinson and Stowe, 2010; CFA 2014 Level II Program curriculum).

In this study we contribute to the RI valuation literature by providing the first academic evidence on the use of RI in practice by sell-side equity analysts. Given the predominance of DCF in analysts' formal valuation modeling and the need to control for multiple determinants of DCF and RI valuations when undertaken by different analysts for different firms on different dates, we study analysts' RI methods using the subset of analyst reports issued by U.S. brokers that contain dual equity valuations—one from a DCF model and one from an RI model. We identify 422 such reports from Investext that span 103 firms over the period May 1998 - Oct. 2011.

Using this dataset, we conduct a series of empirical descriptions and tests. First, we observe that half of analysts' RI valuations are built around forecasting operating income and/or the return on net operating assets (the RNOA-RI method), and half are built on forecasting net income and/or the return on equity (the ROE-RI method). We then note that although in their DCF valuations analysts rarely report any measures of the economic rates of return implied by their forecasts of free cash flows, in their RNOA-RI (ROE-RI) valuations analysts almost always show such metrics in the form of RNOA and residual RNOA (ROE and residual ROE). The visibility of these long-term forecasted rates of return allows us to assess the sophistication of analysts' implementation of each RI valuation method since the effects of competition require that rational forecasts of long-term RNOA and ROE converge toward firms' weighted average and equity costs of capital, respectively.

Second, we find that analysts' DCF and ROE-RI valuations are often materially different from each other, while analysts' RNOA-RI valuations are very close to their DCF estimates. Specifically, we observe that ROE-RI valuations are lower than their DCF counterparts by an average of 5% and just 9% (44%) of ROE-RI valuations are within +/- 1% (5%) of DCF valuations. In contrast, RNOA-RI valuations are on average almost exactly equal to their DCF counterparts and 34% (93%) are within +/- 1% (5%) of DCF valuations. The magnitude of the difference in the differences between DCF vs. RNOA-RI and DCF vs. ROE-RI valuations lead us to hypothesize that analysts' ROE-RI valuations are created independently of their DCF valuations, whereas analysts' RNOA-RI valuations are purely a repackaging of their preexisting DCF data inputs and valuations.

Third, we find that RNOA-RI valuations are optimistic relative to realized one-year-ahead prices by an average of 7% and contain forecasted RNOAs that increase toward a terminal year median of 28%. We argue that because a terminal year RNOA of 28% is economically implausible, and because analysts' DCF and RNOA-RI valuations are so similar to each other, analysts' RNOA-RI and DCF valuations reflect an equal lack of sophistication in economic forecasting. In contrast, analysts' ROE-RI valuations are more sophisticated in that they are unbiased relative to future prices and contain future ROEs that more sensibly decline over time toward a terminal year median of 17%.

Fourth, we propose that the divergent trajectories in analysts' forecasts of RNOA and ROE highlight a previously unrecognized practical advantage of using ROE-RI. This is that by focusing on the evolution of just ROE instead of the evolutions of both RNOA and financial leverage, ROE-RI reduces the risk that the user will make the economically unreasonable financial leverage assumption that management will allow future residual NOI to build up in the form of cash on the firm's balance sheet instead of being paid out to shareholders. We argue that the reason that analysts' forecasts of RNOA increase over time while their forecasts of ROE decrease is that in their RNOA-RI and DCF models analysts are making exactly this assumption, and to such a degree that its negative effect on ROE more than compensates for the positive impact of increasing RNOAs.

Lastly, we examine the role of different valuations in determining target prices by regressing analysts' target prices on analysts' DCF, RNOA-RI, and ROE-RI valuations. We find that between DCF and ROE-RI valuations, analysts' target prices are more determined by their ROE-RI valuations than their DCF counterparts. In contrast, between DCF and RNOA-RI valuations, only DCF matters in explaining analysts' target prices. The latter result supports our hypothesis that RNOA-RI valuations are mere derivatives of underlying DCF valuations, but that ROE-RI valuations are not.

Overall, we conclude from our data that ROE-RI valuation is in practice superior to DCF and RNOA-RI, and suggest that this makes its infrequent use by practitioners puzzling. We also conclude that while DCF has been criticized as promoting upwardly biased value estimates because it rarely reports the RNOAs that underlie projected free cash flows (Bernard, 1994), simply making the RNOAs visible as is the case in the RNOA-RI valuations we study does not necessarily yield more conservative valuations than DCF. We argue that the benefits of RI can only be obtained when practitioners explicitly allow their long-term forecasts to reflect the pervasive effects of competition, which in turn necessitates that analysts' forecasted RNOAs and ROEs fade toward the weighted average and equity costs of capital, respectively. We hope that our findings and perspectives will encourage both analyst and non-analyst practitioners to use ROE-RI valuation more frequently.

The remainder of our paper proceeds as follows. In section 2 we review the academic and practitioner literatures on DCF and RI valuation, and in section 3 motivate our interest in RI as undertaken by sell side equity analysts. In section 4 we present the criteria we use to arrive at a set of analyst reports that contain dual DCF and RI valuations. In section 5 we present our findings on the characteristics and performance of the DCF, RNOA-RI and ROE-RI valuations in our dataset. We conclude in section 6.

2. Prior academic and practitioner literature on DCF and RI valuation

2.1 DCF valuation

The literature on DCF is often seen as beginning with two important texts: Irving Fisher's *The Theory of Interest* (1930) and John Burr Williams' *The Theory of Investment Value* (1938). In the latter book—based on his Ph.D. thesis, the topic of which was suggested to him by Joseph Schumpeter—Williams argues that the value of an asset should be evaluated by "the rule of present worth." Applied to common stock, this meant that the intrinsic value of equity should rationally be viewed as the present value of expected future cash flows in the form of dividends and selling price.[1]

From this starting point, finance academics in the 1960s began to flesh out the dividend discount model (DDM), initially by focusing via the CAPM on the discount rate. As MBA programs that finance academics taught in grew in size and stature, they began to pay more attention to the practical limitations of the DDM due to its focusing on the distribution of cash to shareholders, the magnitude and timing of which Modigliani and Miller (1961) argue are irrelevant to shareholder value.[2] This concern led to the development of the current warhorse approach to valuation taken in the classroom, research and Wall Street, namely the "discounted cash flow" or DCF model. Isomorphic to the DDM, in the DCF model valuation centers on forecasting the cash flows generated by the firm's operating and investing activities, rather than the distribution of cash paid out via the firm's financing activities. The DCF model is typically implemented by predicting the expected future free cash flows to all investors, discounting them by the firm's weighted average cost of capital, and then subtracting the value of the firm's net financial liabilities to arrive at equity value.

Although the DCF method was well laid out and promoted by prominent academics and practitioners such as Copeland and Weston (1979), Brealey and Myers (1981, 1984), Rappaport (1986), and Copeland, Koller and Murrin (1990, 1995), until the late 1990s the main capital market users of DCF were investment banks in supplying fairness opinions to target shareholders in

[1] See Wikipedia's entries for John Burr Williams, and for Discounted Cash Flow.

[2] To quote Penman (2012, p.6), "A conundrum has to be resolved (in implementing the DDM): Value is based on expected dividends, but forecasting dividends is irrelevant to valuation."

corporate mergers and change of control transactions such as management buyouts (DeAngelo, 1990).[3] Even until the late 1990s sell-side equity analysts focused on multiples and tended to ignore DCF models (Arnold and Moizer 1984, Block 1999, Barker, 1999; Bradshaw, 2002; Demirako, Strong and Walker, 2004; Asquith, Mikhail and Au, 2005). However, starting in the early 2000s, analysts placed a greater emphasis on DCF models, a change that Imam, Barker and Clubb (2008) and Imam, Chan and Shah (2013) attribute to the lack of rational valuation methods used in the Internet bubble and associated criticisms of the research quality of investment analysts. The place of DCF as of today in the practitioner world is such that virtually every equity valuation model used by leading investment banks is based on DCF (Viebig, Poddig and Varmaz, 2008).[4]

Somewhat in contrast to this prevalence, however, relatively little in the way of finance research has centered on research questions that require or use explicitly derived DCF valuations. Kaplan and Ruback (1995) examine the DCF method in the context of highly leveraged transactions and find that that DCF valuation has approximately the same valuation accuracy as EV/EBITDA multiples. In the context of firms emerging from Ch. 11, Gilson, Hotchkiss and Ruback (2000) find that DCF valuations have a similar degree of accuracy as valuations that use comparable-firm multiples. More recently, motivated by studies that find that analysts use target prices to justify their recommendations (Bradshaw, 2002) and that analysts' target prices are useful to investors (Brav and Lehavy, 2003), a few papers have investigated the degree to which analysts' price targets are based on underlying DCF versus multiples-based valuations. Results suggest that while multiples-based valuation dominates DCF in importance when setting target prices (Imam, Barker and Clubb, 2008), DCF models are significantly more likely to be met at the end of a 12-month forecast horizon than are price-to-earnings models (Demirakos, Strong and Walker, 2010).

2.2 Residual income valuation

The academic literature on RI in part parallels that of DCF, but has some notable differences. The first parallel is that like DCF, the origins of RI date to the late 1930s when Preinrich (1938) derived from a 1925 paper by Hotelling an expression for 'capital value' that equated capital value to

---

[3] Per DeAngelo (1986, p.101), "Directors can be held liable for breach of fiduciary duty if they fail to consider explicit valuation evidence before acting on a bid. This standard of caser is usually satisfied by an investment banker's opinion that the offer is inadequate. Thus, managers who resist a hostile bid typically hire an investment bank to provide them a DCF-based opinion that the offer terms are inadequate. It should also be noted that DCF is only one of multiple valuation approaches that investment banks may provide their client in such situations, other examples being comparable firm valuations, comparable acquisition valuations, and asset-based valuations."

[4] Viebig, Poddig and Varmaz (2008, p.9) state that "The most sophisticated DCF models used by financial analysts today are, in our opinion, Credit Suisse's Cash Flow Return on Investment (CFROI) model, Morgan Stanley's ModelWare and UBS's Value Creation Analysis Model (VCAM). In Part VI [of our book] we discuss leveraged buyout (LBO) models used by Goldman Sachs, UBS and other leading investment banks."

book value plus discounted excess profits.[5] Despite subsequent work by Edwards and Bell (1961, Ch. 2, Appendix B), Peasnell (1982) and Brief and Lawson (1992), the use of RI in valuation was largely ignored until the 'rediscovering' attention paid to it in the seminal papers of Ohlson (1995) and Feltham and Ohlson (1995). The second parallel of RI with DCF is that RI is now widely taught in MBA programs alongside DCF (Lundholm and Sloan, 2006, 2007, 2013) as well as in the CFA curriculum (Pinto, Henry, Robinson and Stowe, 2010; CFA 2014 Level II Program curriculum).

However, the use of RI by academics and practitioners differs sharply from the use of DCF by academics and practitioners. Unlike DCF, since 1995 RI valuation has been fruitfully used in many areas of research, including the value-relevance literature (Barth, Beaver and Landsman, 2001), identifying mispriced stocks (Lee, 1999; Ali, Hwang and Trombley, 2003), estimating firms' costs of capital (Li and Mohanram, 2014), and understanding risk and growth (Penman 2011; Penman and Reggiani, 2013). Moreover, unlike DCF, informally derived evidence suggests that RI is only infrequently used by practitioners to value stocks.[6] For example, and as reflected in our analyst reports dataset containing dual DCF and RI valuations, of investment banks only Morgan Stanley has historically embraced RI (Harris, Estridge and Nissim, 2008).

The attraction of RI valuation to academics—especially accounting researchers—arises for both theoretical and empirical reasons. On the theory side, RI is algebraically isomorphic to DDM; it exhibits the Modigliani and Miller (1958, 1961) dividend displacement property; it focuses on the creation not distribution of value; by moving away from pure cash accounting it nests the DCF model within it as a special case; and it makes central to valuation the long-term expected return on net operating assets or equity. In terms of empirics, among other benefits RI has been seen as one way to legitimize the use of cross-sectional 'price levels' regressions. It also provides a compact way to embed analysts' near term earnings forecasts into models of intrinsic value, and provides a way for cost of capital estimates to be extracted from stock prices. At the same time, however, RI has generated its share of academic controversy, most notably with regard to how and why large-scale machine-driven implementations of DCF and RI valuations at times yield very different results, even

[5] Specifically, Preinrich (1938, p.240) states that "By means of elementary operations, the capital-value formula [equation] (43) can easily be converted into [equation] (57)" in which capital value equals book value plus discounted excess profits. Equation (43) comes from the capital value concept advanced in Hotelling (1925) that equates the capital value of a single machine to the discounted net rental of the machine plus the discounted scrap value of the machine. This said, however, Cwynar (2009) argues that Alfred Marshall's *Principles of Economics* (1890) and Robert Hamilton's *An Introduction to Merchandize* (1777) contain even earlier demonstrations of the concept of residual income.

[6] Residual income does form the basis of the approach taken by many practitioners to evaluate firm performance, the most noteworthy example of which is Stern Stewart & Co.'s economic value added or EVA metric.

though both approaches should yield the same output given the same inputs (Penman and Sougiannis, 1998; Francis, Olsson and Oswald, 2000; Lundholm and O'Keefe, 2001a, 2001b; Penman, 2001).

3. Research motivation and method

3.1 Research motivation

We seek to contribute to the literature on RI valuation by providing evidence on the use of RI by U.S. sell-side equity analysts. The chief motivation for our research is the argument that because sell-side equity analysts are economically important stock market participants, studying their use of RI valuation sheds light on the economic importance of RI methods. If RI valuation leads to more economically sensible analyst forecasts and yields less biased analyst valuations than other approaches such as DCF, then the view that the development of RI valuation methods has had practical value is supported. On the other hand, if analysts' RI valuations are more biased than their DCF valuations, then it may be that the teaching of RIV by academics to their MBA students who take jobs on Wall Street has been flawed, or for reasons that are not well understood RI valuation has attributes that diminish its practical usefulness which in turn warrants understanding by scholars.

3.2 Research method

Our research method is to directly analyze the subset of sell side equity analysts reports that contain dual equity valuations—one from a DCF model and (at least) one from an RI model.[7] As compared to collecting one set of analyst reports that only contain DCF valuations and a separate set that only contains RI valuations, the strength of our approach is that it controls for many of the potential determinants of variation in DCF and RI valuations that arise when such valuations are done by different analysts for different firms in different reports on different dates. These include the identities and experience of the issuing analysts, the date and macroeconomic timing of the report, the report's stock recommendation, the identify and history of the firm, the firm's industry, the equity and weighted average costs of capital used by the analysts, and the quantitative and qualitative components of the analysts' information set outside of the inputs used in the DCF and RI valuations.[8] In addition, because analysts can use either RNOA-RI or ROE-RI valuations (or both), our dual-valuation approach allows us to assess different roles that RNOA-RI and ROE-RI valuation methods

[7] Awe view understanding the reasons behind when and why analysts use multiple valuation methods in general (not limited to DCF and RI, but broadened to DCF, RI, sum of the parts, dividend discount, and multiples) as being a worthwhile topic for future research, but outside the defined scope of our paper.

[8] Work by Bonini, Zanetti, Bianchini and Salvi (2010), Bilinkski, Lyssimachou and Walker (2013) and Bradshaw, Huang and Tan (2014) indicates that the accuracy and optimism in analysts' target prices is a complex function of many economic determinants that vary across analysts, firms, time, institutional incentives and legal regimes.

play relative to DCF in analysts' reports. However, we recognize that the benefits we achieve in terms of high internal validity come with the counterweight that our findings may have a low degree of external validity because the choice of whether to use only DCF, only RI, or both DCF and RI may be systematically associated with the characteristics and performance of equity valuations produced by each method. To the extent that this is so, we expect that our results will not fully generalize back to the population of actual or potential users of DCF and RI valuation methods.

We adopt a hand-collection, textual content-based approach to investigating the role of RI valuation in analyst reports because we are unaware of any preexisting archival database that contains reliable information on the valuation methods used by, and modeling details associated with, analyst valuations.[9] Content-based analysis has gained greater academic acceptance in recent years due to the advantages it can offer with regard to addressing research questions that seek to look inside the 'black box' of analysts' the decision processes (Schipper, 1991; Bradshaw, 2011; Brown, call, Clement and Sharp, 2013; Green, Hand and Zhang, 2014; Markou and Taylor, 2014).

4. Sell-side equity analyst reports that contain both DCF and RI equity valuation models

4.1 Sample selection and examples of DCF and RI valuations

Table 1 presents the criteria we employ to identify sell-side equity analyst reports that contain both a DCF and a RI model, and their associated valuations. We searched Investext to identify analyst reports issued over the period 1/1/98 – 12/31/13 that contained the keywords "residual income" and either "DCF" or "discounted cash flow*" in their Table of Contents (panel A). We then retained only those reports that were for companies, for the U.S., and provided by brokers. This yielded an initial set of 478 reports. After inspecting each report, for reasons listed in panel B we excluded 56 reports as they lacked certain data items, such as no dollar per share figure provided for either the DCF or RI valuation. The final dataset of 422 reports covers 103 different firms.

We impose the restriction that the keywords be present in the Table of Contents, rather than the weaker requirement that the keywords be present only in the Text, in order to maximize the likelihood that the resulting reports will contain fully developed DCF and RI valuation models, rather than just single number or single sentence mentions of the keywords without supporting valuation structures. Although using the weaker requirements yielded 3,050 reports, untabulated analysis reveals that almost all of these reports (outside the initial set of 478 obtained under the Table of Contents restriction) do not contain full blown DCF and RI models.

[9] We therefore differ from the indirect type of approach taken by Gleason, Johnson and Li (2013) who infer the type of valuation model used by analysts in setting their price targets by comparing actual price targets with pseudo-price targets that the authors create using an ROE-based RI model and a PEG model.

We note that searching Investext for reports over the 1998-2013 period that contain only the keywords "residual income" and not also "DCF" or "discounted cash flow*" in the Table of Contents yielded 2,426 reports, while similarly searching for only the keywords "DCF" or "discounted cash flow*" but not also "residual income" resulted in 46,878 reports. The former figure suggests that residual income has been infrequently used by sell-side analysts working for U.S. brokers, both in an absolute sense (our data imply that one report containing an RI model was issued every two business days) and relative to DCF (present in about 10 reports per business day and thus 18 times more common than RI).

Panel C shows that all but five of the analyst reports were issued by a single broker, Morgan Stanley. The dominance of Morgan Stanley stems from the initiatives put into place by Professor Trevor Harris of Columbia University while he was an advisor to and employee at Morgan Stanley. This dominance likely reduces the generalizability of our results over and above the aspects of our quasi-experimental approach highlighted in section 3.2, but is an unavoidable feature of our design.[10]

Per panel D, each analyst report in our final dataset contains a DCF and an RI valuation. We note that of the 422 reports, 156 contain an RI model that centers on forecasting NOI and/or RNOA, 155 contain an RI model that centers on forecasting NI and/or ROE, and 111 contain both RNOA-based and ROE-based valuations. The RNOA-RI method parallels DCF by estimating the value of the entire firm, from which net financial liabilities are subtracted in order to arrive at the value of equity, while the ROE-RI method estimates the value of equity directly and is the approach most commonly (although not exclusively) taught in MBA classes and used in academic research.

In Figures 1 and 2 we supply illustrative examples of the dual valuations in our dataset. Figure 1 is taken from p.10 of Morgan Stanley's report on Nike issued on 12/12/02, and shows the DCF and RNOA-RI valuations exactly as disclosed. The DCF model is structured in a standard manner, both with regard to numerator components that culminate in forecasted free cash flows to all investors, and the components of the firm's weighted average cost of capital (WACC). The RNOA-RI model located immediately below the DCF model is also conventional in structure and detail, although in places it uses terminology different to that in most valuation texts.[11] Figure 2 comes from Morgan Stanley's report on Carnival Corp. issued on 1/29/04, and shows the DCF and ROE-RI valuations shown in that report on p.9 and p.10, respectively. Similar to Figure 1, the DCF model in panel A is structured in a standard and detailed manner, as is the ROE-RI model in panel B.

---

[10] We note that Joos and Piotrosk (2013) and Joos, Piotroski and Srinivasan (2014) also use data from a single broker (Morgan Stanley) to informative and interesting ends.

[11] For example, the model uses ROCE to denote return on capital employed rather than to denote return on common equity. In this report, capital (and 'invested capital') is net operating assets not assets or equity. The model also uses EVA to denote the dollar amount of abnormal net operating income.

4.2 Descriptive statistics on analysts, firms and forecasted financial statements in reports

In Table 2 we present descriptive statistics pertaining to the analysts and firms in our dataset of 422 equity analyst reports. Panel A shows that the reports are authored or coauthored by 86 different analysts, many of whom hold the CFA professional qualification but none of whom have a CPA, MD or PhD. The mean number of analysts authoring a report is 2.2 and the median number of pages in a report is 15. Of reports, 84% are updates/revisions rather than initiations, and of the stock recommendations given, 50% are overweight or outperform, 43% are neutral or equal-weight and 7% are reduce or underweight. Per panel C, firms are distributed across 26 of the 48 Fama and French (1997) defined industry classifications. Firms also vary widely in size, with market capitalizations as of the analysts' report date ranging between $224 million and $187 billion.

4.3 Descriptive statistics on key components of analysts' valuation models

In panel A of Table 3 we summarize what analysts report about the costs of capital they use across their DCF, RNOA-RI and ROE-RI valuation models. Outside of the maturity horizon for the risk free rate, analysts disclose the risk free rate, beta, equity market premium, cost of equity capital, and weighted average cost of capital almost 98% of the time. The median values of all items appear reasonable given the 1998-2011 window during which analysts wrote their reports.[12]

Panel B reports statistics on the distribution of the fraction of equity value made up by the present value of the post-terminal year free cash flows, residual net operating income and residual net income in analysts' valuation models. A common complaint leveled by practitioners against DCF is the typically very high fraction of equity value represented by the terminal value, since small changes in the firm's discount rate or assumed rate of growth in free cash flows in perpetuity beyond the terminal year can generate large changes in the firm's estimated equity value. Given the role of the book value of net operating assets or equity in RI models, we expect to observe that the fraction of equity value represented by the present value of post-terminal year residual net operating income or residual net income will be markedly lower than the fraction of equity value represented by the present value of post-terminal year free cash flows. We find that this is the case for ROE-RI where the median is 26% as compared to 65% for DCF valuation, but less so for RNOA-RI where the median is a much larger 53%.

[12] The 98% rate of disclosure for the components of firms' costs of capital is substantially higher than the median of 48% rate reported by Green, Hand and Zhang (2014) for a random sample of 120 analyst reports issued during 2012-13 that each contains a DCF valuation model. Since we focus on analyst reports that include both DCF and RI models, we posit that such analysts tend to be more sophisticated and thus disclose more information in their reports. In addition, our sample is dominated by Morgan Stanley, which has a higher reputation than most brokerage firms.

Lastly, panel C gives distributional statistics on the forecasted rates of growth in key components of analysts' DCF, RNOA-RI, and ROE-RI valuations in the terminal year T and in perpetuity beyond T. Where available, this data is taken from what analysts disclose in their models, examples of which are shown in Figures 1 and 2, or is reasonably inferable from their models.[13] From panel C we note that the median length of the explicit forecast horizon for ROE-RI valuations is 19 years, twice as long as the 10 years for DCF and RNOA-RI models. Also, the median rate of growth in post-terminal year residual income is 1.0%, somewhat lower than the 2.3% rate of growth in residual net operating income in RNOA-RI models and the 2.4% rate of growth in free cash flows in DCF models. All else held equal, this suggests that ROE-RI models may yield more conservative valuations than either RNOA-RI or DCF valuations.

5. Performance of DCF, RNOA-RI and ROE-RI valuation models

5.1 Comparison of DCF with RNOA-RI and ROE-RI valuations

In panel A of Table 4 we report statistics on the proximity of analysts' DCF valuations to the RNOA-RI and ROE-RI valuations they make for the same firm in the same report at the same point in time. Contrary to the theoretical prediction that DCF and RI should yield identical valuations, we document that analysts often produce different DCF and RI valuations. The visible nature of these differences—they are clearly visible in the layouts of analysts' valuations—suggests that not only are rounding errors and material differences in underlying assumptions exist across different valuation models, but that analysts are comfortable with presenting different valuations to their clients.

In panel A, we note that of the RNOA-RI and ROE-RI methods, ROE-RI is the approach that most often produces value estimates that markedly differ from analysts' DCF valuations, with just 9% (44%) of ROE-RI valuations being within 1% (5%) of the accompanying DCF figure. This contrasts with RNOA-RI valuations where a much larger 34% (93%) of valuations are within 1% (5%) of the DCF figure. The magnitude of the difference in the differences between DCF vs. RNOA-RI and DCF vs. ROE-RI valuations, combined with the strong similarities in forecast horizon and the positioning of RNOA-RI directly underneath (rather than above) the DCF valuation lead us to hypothesize that analysts' RNOA-RI valuations are merely a repackaging of preexisting DCF data inputs and valuations, while analysts' ROE-RI valuations are created more independently of their DCF valuations.

---

[13] For example, given the present value of terminal value of free cash flows PV_TV, free cash flows FCF_T in period T, and weighted average cost of capital WACC, we take the rate of growth in post-terminal year free cash flows g to be that which equates PV_TV with $FCF\_T*(1+g)/[(WACC-g)*(1+WACC)^T]$.

5.2 *Target prices and expected returns*

For the subset of reports where there is an analyst price target, panel B of Table 4 describes the distribution of stock prices per CRSP as of one trading day prior to the analyst report date, the target prices stated in the report, and the expected annualized returns implied by the target prices.[14] We define realized annual returns on a without-dividend basis, and unexpected returns as realized less expected.[15] Panel B allows us to calibrate our dataset of analyst reports against others in the literature, given that the pervasive finding in prior research is that target prices are on average highly optimistic, both in the U.S. and around the world. For example, Bradshaw, Brown and Huang (2013) and Bradshaw, Huang and Tan (2014) find that analysts' 12-month ahead target prices are upward biased by an average of 15% for U.S. firms and 18% for non-U.S. firms, respectively.

Panel B reveals that the mean (median) expected return implicit in analysts' target prices in our dataset is 14% (16%), with 91% of individual expected returns being positive. We find that the mean unexpected target price return in our dataset is insignificantly different from zero (-2%, t-statistic = -0.8) although the median unexpected return is a reliably negative -5% (Binomial z-statistic = -3.2). We interpret these results as indicating that there is less optimism displayed in the target prices issued by the analysts in our study than in other studies. To the extent that optimism in target prices reflects less than fully rational information processing, the relative paucity of optimism in the target prices in our dataset suggests that the analysts we study may be more sophisticated than the typical analyst, consistent with their using RI-based valuation methods, or that using both DCF and RI valuation methods leads to less optimistic target prices in general.

5.3 *Expected, realized and unexpected returns in DCF, RNOA-RI and ROE-RI valuations*

We evaluate the return performance of analysts' DCF and RI valuations by measuring the expected, realized and unexpected 12-month signed returns associated with them. This is possible because the valuations provided by analysts in their reports are either directly stated by analysts to be 12-month ahead forecasts, or can be projected to be because of their tight proximity in magnitude to analysts price targets which almost always have a 12-month forecast horizon.

Since there are an average of 4.1 reports per firm in our dataset (viz., 422 reports covering 103 firms), there is material overlap within and across firms in the 12-month windows over which we measure expected, realized and unexpected returns. We seek to mitigate the effects of the resulting lack of independence across observations by aggregating returns by firm and across time. For each

[14] Virtually all target prices are associated with a 12-month forecast horizon.

[15] We define realized returns as not including any dividends paid between the analyst report date and the target price date because analysts' target prices typically are defined as the stock price that will be in place on the target date.

firm and for each valuation method, we sort individual returns by report date from earliest to latest. Then beginning with the earliest return, we average into one firm-valuation-method observation all subsequent returns for that same firm and same valuation method for which the report date is within 12 months of the earliest return. We then repeat the process using the first report issued after the last report that is part of the just-defined 12 month window. In terms of aggregated returns, this process yields 136, 70 and 93 triplets of expected, realized and unexpected returns associated with DCF-based, RNOA-based and ROE-RI valuations, respectively.

In panel C we report statistics pertaining to these aggregated returns. Since our experimental approach is to directly compare and contrast DCF and RI valuations on a within-firm and within-report basis, we use only those 70 (93) of the 136 DCF returns that match to the 70 RNOA-based (93 ROE-based) RI returns. Based on these returns, we highlight the following results in panel C.

First, per the uppermost part of panel C, in terms of accuracy the mean unexpected return associated with both DCF and RNOA-RI valuations is -7% (t-statistic = -1.7) while the median unexpected returns are each -8% (binomial z-statistics = -2.4 and -2.6 versus a null of 50%). We interpret this as indicating that DCF and RNOA-RI valuations are optimistic when they are provided in the same report. Virtually the same value estimates from DCF and RNOA-RI valuations suggest that RNOA-RI is not independent from DCF, confirming our more anecdotal observation that analysts typically derive their operating income or ROA forecasts from the cash flow spreadsheet. Second, the mean unexpected return associated with ROE-RI valuations is 5% (t-statistic = 1.3), and the median expected return is 2% (t-statistic = 0.7). This suggests that ROE-RI valuations are unbiased predictors of 12-month ahead stock prices. Third, when directly evaluated against each other, ROE-RI valuations are more conservative than DCF valuations, since the mean difference in expected returns is 5% (t-statistic = 3.4) and the median difference is 2% (t-statistic = 2.0).

Finally, we examine the subsample of analyst reports that contain all three of DCF and RNOA-RI, and ROE-RI valuations. Panel D of Table 4 shows that DCF and RNOA-RI valuations produce virtually the same value estimates, confirming the finding in Panel C. Although ROE-RI valuations are less optimistic than their DCF counterparts, the differences are not statistically significant due to our small sample size of 28 observations. The finding of less optimistic ROE-RI valuations in this subsample, similar to what observed in Panel C, helps rule out the self-selection concern that analysts who construct ROE-RI models are sophisticated and that such sophistication manifests itself in both their ROE-RI and DCF valuations. Our results indicate that ROE-RI valuations provide relatively independent information to DCF whereas RNOA-RI valuations are a manifestation of DCF. Analyst reports with ROE-RI valuations tend to be less optimistic, possibly because their more independent estimates from ROE-RI help analysts to adjust their DCF estimates.

5.4 Long-run forecasted RNOAs and ROEs in analysts' dual DCF and RI valuations

Since RI methods are typically promoted as making long-term forecasted RNOAs or ROEs the central features of valuation, in Figure 3 we display the median annual RNOAs and ROEs forecasted by analysts in our dataset, together with the median weighted average and equity costs of capital that analysts employ. Panel A is shown in event time starting with the first forecasted year beyond the most recent year of realized data available to the analyst, while panel B is in event time relative to the terminal year of the valuation, denoted "0". Panel C limits the view taken in panel B to only the reports in which analysts provide all three valuations—DCF, RNOA-RI and ROE-RI.

From Figure 3 it is clear that median forecasted RNOAs in analysts' RNOA-RI valuations increase both as the forecast horizon increases per se (panel A) and as the forecast horizon approaches the terminal year (panels B and C). For example, per panel B median RNOAs rise from 19% one year out from the report to 28% in the terminal year at which point they are 20 percentage points larger than analysts' median WACCs of 8%. Since panel C of Table 4 reported that RNOA-RI valuations are very close in size to their DCF counterparts, the median RNOAs shown in Figure 3 must also be the median RNOAs embedded in, but not visibly presented on the face of analysts' DCF valuations. In contrast, Figure 3 makes plain that median forecasted ROEs taken from the ROEs that are visibly presented in analysts' ROE-RI valuation models decrease as the forecast horizon increases. Median ROEs fall from 21% one year out beyond the report date to 17% in the terminal year at which point they are 8 percentage points larger than analysts' median REs of 9%.

The striking results reported in Figure 3 lead us to argue that DCF and RNOA-RI valuations reflect a lack of sophistication in long-term economic forecasting that is not shared by analysts ROE-RI valuations. We arrive at this conclusion because the effects of competition require that rational forecasts of long-term RNOA and ROE converge toward firms' weighted average and equity costs of capital, respectively, yet of the long-horizon paths in RNOA and ROE shown in Figure 3, only that of ROE declines toward its cost of capital benchmark. Not only does the increasing path of RNOAs not make economic sense, but all else held equal it predicts that RNOA-RI valuations will be optimistic per se, and more optimistic than ROE-RI valuations. The evidence on unexpected returns in panel C of Table 4 supports these predictions—RNOA-RI valuations are optimistic relative to realized one-year-ahead prices by an average of 7%, while ROE-RI valuations are unbiased.

We draw one additional conclusion from the divergent trajectories of RNOA and ROE in Figure 3 when combined with the relatively similar RNOA-RI and ROE-RI valuations in Table 4. This is that ROE-RI has a previously unrecognized practical advantage over DCF and RNOA-RI stemming from the fact that ROE combines a firm's operating profitability with its financing stance.

Since ROE = RNOA + [FLEV x SPREAD], where FLEV = net financial liabilities divided by common equity and SPREAD = net financial expense divided by net financial liabilities, by focusing on the evolution of just ROE rather than the evolutions of both RNOA and financial leverage, ROE-RI reduces the risk that a practitioner will make the economically implausible financial leverage assumption that management will allow future residual NOI to build up in the form of cash on the firm's balance sheet instead of being paid out to shareholders. We argue that the reason that analysts' forecasts of RNOA increase over time in Figure 3 while their forecasts of ROE decrease is that in their RNOA-RI and DCF models analysts are making the assumption that management will allow future residual NOI to build up in the form of cash on the firm's balance sheet instead of being paid out to shareholder, and to such a degree that its negative effect on ROE more than compensates for the positive impact of increasing RNOAs. Equivalently, we conjecture that for either unconscious behavioral or consciously strategic reasons, analysts who use DCF or RNOA-RI optimistically project increasing RNOAs and then allow FLEV x SPREAD to turn highly negative in order for their resulting valuations to not be wildly in excess of current prices. We therefore posit that a practical advantage of ROE-RI over DCF and RNOA-RI is that it prevents analysts from visibly presenting two mostly offsetting errors (an ever increasing RNOA and an ever more negative FLEV x SPREAD) to their clients.

5.5 The role of different valuation models in determining analysts' target prices

The last aspect of analysts' dual DCF and RI valuations that we study is to explore the role of different valuation models in determining analysts' target prices. We do so by regressing analysts' target prices on their DCF, RNOA-RI, and ROE-RI valuations. If RNOA-RI is just a manifestation of DCF, we expect the coefficient on DCF valuation to be close to one and the coefficient on RNOA-RI valuation to be close to zero. If ROE-RI plays a more significant role in determining target prices than DCF does, we expect the coefficient on ROE-RI valuation to be higher than that on DCF valuation. Finally, if analysts use multiple valuation methods because they believe that averaging different valuations from different methods yields less noisy and more accurate results, then their target prices will reflect the influence of multiple methods, and we will observe significant regression coefficient estimates on more than one type of valuation.

Table 5 reports the regression results. In model 1, analysts' price targets—where provided, which is less in 100% of reports—are projected onto analysts' DCF and RNOA-RI valuations. The results clearly show that DCF valuations are tightly associated with target prices (t-statistics on estimated coefficients relative to nulls of zero and one are 5.5 and -0.5, respectively, with an adjusted R^2 = 96%), while RNOA-RI valuations are incrementally irrelevant (t-statistic = -0.4). This result also confirm the idea that analysts' RNOA-RI valuations are entirely derived from, and are not in any economically meaningful sense independent of, analysts' DCF valuations.

In contrast, in model 2 where analysts' price targets are projected onto DCF and ROE-RI valuations, both independent variables exhibit reliably non-zero coefficient estimates. Moreover, in a manner opposite to that of model 1, in model 2 ROE-RI valuations and not DCF valuations are the primary determinant of analysts' price targets: the estimated coefficient on the RNOE-based RI valuation is 1.10 (t-statistic = 14.6) while the estimated coefficient on the DCF valuation is -0.18 (t-statistic = -2.4). This suggests analysts' ROE-RI valuations are materially independent of analysts' DCF valuations, consistent with analysts' using the two types of valuation methods because each method has a degree of non-overlapping practical benefit to it. In analyst reports with both DCF and ROE-based methods, ROE-RI valuations are the main driver of target prices.

In model 3 we restrict the data sets used in models 1 and 2 to the subset of observations where both RNOA-RI and ROE-RI valuations accompany analysts' DCF valuations, and then simultaneously project all three valuations onto target prices. The resulting parameter estimates and their associated t-statistics indicate that in this situation all three valuations are important, although the very high correlation between DCF and RNOA-RI valuations is the likely cause for the large and similarly sized but oppositely signed coefficient estimates on DCF and RNOA-RI. Consistent with this, in model 4 we keep the dataset used in model 3 but include DCF and ROE-RI valuations, and exclude RNOA-RI valuations, the results parallel those of model 2 in that we observe that both DCF and ROE-RI valuations drive analysts' target prices: the estimated coefficient on the RNOE-based RI valuation is 0.71 (t-statistic = 5.4) while the estimated coefficient on the DCF valuation is 0.26 (t-statistic = 2.0).[16]

Overall, the results in Table 5 indicate that in analyst reports with both DCF and RNOA-RI, RNOA-RI valuations are not independent of DCF since target prices are solely driven by DCF valuations. However, in analyst reports with both DCF and ROE-RI, analysts largely rely on ROE-RI in setting their target prices. Analysts' preference for ROE-RI over DCF or RNOA-RI valuations is sensible given that ROE-RI valuations are empirically unbiased while DCF and RNOA-RI valuations are not. We also note that the finding that ROE-RI and not DCF valuations largely determine target prices helps alleviate the concern that our study suffers from the selection bias that those analysts who choose to use ROE-RI are of higher ability than those who use DCF. This is because if ROE-RI does not play an active role, we should not expect ROE-RI valuations to load more significantly than DCF valuations in determining target prices, but they do.

[16] We note that the estimated coefficients on DCF valuations in models 2 and 4 have the opposite sign. We are not able to offer a satisfactory explanation for why this is the case.

6. Conclusions

In this study, we contribute to the residual income valuation literature by providing the first academic evidence on the use of RI in practice by sell-side equity analysts. We do so by comparing the hand-collected characteristics and performance of RI valuations with those of DCF when both methods are used by the same analysts for the same firm in the same report.

We find that analysts are equally likely to adopt RI valuations built around forecasting net operating income as around net income. However, we observe that the economic properties of RNOA-RI and ROE-RI are quite different along several dimensions. First, contrary to the theoretical equivalence of DCF and RI, analysts' DCF and ROE-RI valuations are often materially different from each other, while their RNOA-RI and DCF valuations are very close to each other. Second, we conclude that the reason that analysts' RNOA-RI and DCF valuations are so similar is that analysts' RNOA-RI valuations are simply a repackaging of their DCF data inputs and valuations. Not only do analysts visually place their DCF valuations before and above their RNOA-RI valuations and use the same forecast horizon for each, but between DCF and RNOA-RI valuations, only DCF matters in explaining analysts' target prices. In contrast, between DCF and ROE-RI valuations, analysts' target prices are more determined by their ROE-RI valuations than their DCF counterparts.

Third, we document that analysts' RNOA-RI valuations are optimistic relative to future prices and contain forecasted returns on net operating assets that increase toward a terminal year median of 28%, whereas ROE-based RI valuations contain returns on equity that are unbiased relatively to future stock prices and decline toward a terminal year median of just 17%. As such, we conclude that analysts' RNOA-RI and DCF valuations reflect a lack of sophistication in economic forecasting that is not found in their ROE-RI valuations because their RNOA forecasts fail to reflect the effects of competition require that rational forecasts of long-term RNOA should converge toward firms' weighted average costs of capital.

Lastly, by focusing on the evolution of just ROE instead of the evolutions of both RNOA and financial leverage, we argue that ROE-RI reduces the risk that the user will make the economically unreasonable financial leverage assumption that management will allow future residual NOI to build up in the form of cash on the firm's balance sheet instead of being paid out to shareholders. We conjecture that for either unconscious behavioral or consciously strategic reasons, analysts who use DCF or RNOA-RI optimistically project increasing RNOAs and then allow FLEV x SPREAD to turn highly negative in order for their resulting valuations to not be wildly in excess of current prices.

Overall, our results corroborate early evidence in the valuation literature that DCF results in overly optimistic valuations. While DCF has been criticized as promoting upwardly biased value estimates because it rarely highlights the RNOAs that underlie projected free cash flows (Bernard, 1994), our results indicate that simply making the RNOAs visible as is the case in the RNOA-RI valuations we study does not necessarily yield more conservative valuations than DCF. With their attention on DCF and with RNOA-RI being only repackaging of DCF, analysts appear to ignore the economically implausible and persistently increasing RNOAs that are implicitly detailed in the presentation of their RNOA-RI valuations. In contrast, our dataset demonstrate the superiority of ROE-RI valuations when used by equity analysts. Analysts' ROE-RI valuations generate economically sensible ROE forecasts, drive their target prices, and are unbiased relative to future stock prices. All told, we propose that ROE-RI models deserve more attention from practitioners, and express the hope that our findings will encourage analyst and non-analyst practitioners to use ROE-RI valuation more frequently.

REFERENCES

Ali, A., Hwang, L-S., and M.A. Twombley. 2003. Residual-income-based valuation predicts future stock returns: Evidence on mispricing vs. risk explanations. *The Accounting Review* 78(2), 377-396.

Arnold, J., and P. Moizer. 1984. A survey of the methods used by UK investment analysts to appraise investments in ordinary shares. *Accounting and Business Research* Summer: 195-207.

Asquith, P., Mikhail, M. and A. Au. 2005. Information content of equity analyst reports. *Journal of Financial Economics* 38, 17-39.

Barker, R. 1999. Survey and market-based evidence of industry-dependence in analyst' preferences between the dividend yield and price-earnings ratio valuation models. *Journal of Business Finance & Accounting* 26(3/4): 393-418.

Barth, M.E., Beaver, W.H., and W.R. Landsman. 2001. The relevance of the value relevance literature for financial accounting standard setting: Another view. *Journal of Accounting & Economics* 31: 77-104.

Bernard, V.L. 1994. Accounting-based valuation methods, determinants of market-to-book ratios, and implications for financial statements analysis. Unpublished manuscript, University of Michigan.

Bilinski, P., Lyssimachou, D., and M. Walker. 2013. Target price accuracy: International evidence. *The Accounting Review* 88(3), 825-851.

Block, S.B. 1999. A study of financial analysts: Practice and theory. *Financial Analysts Journal* 55(4), 86-95.

Bonini, S., Zanetti, L., Bianchini, R., and A. Salvi. 2010. Target price accuracy in equity research. *Journal of Business Finance & Accounting* 37(9-10), 1177-1217.

Bradshaw, M.T. 2002. The use of target prices to justify sell-side analysts' stock recommendations. *Accounting Horizons* 16(1), 27-41.

Bradshaw, M.T. 2011. Analysts' forecasts: What do we know after decades of work? Working paper, Boston College.

Bradshaw, M.T., Brown, L.D., and K. Huang. 2013. Do sell-side analysts exhibit differential target price forecasting ability? *Review of Accounting Studies* 18: 930-955.

Bradshaw, M.T., Huang, K. and H. Tan. 2014. Analyst target price optimism around the world. Working paper, Boston College.

Brav, A. and R. Lehavy. 2003. An empirical analysis of analysts' target prices: Short-term informativeness and long-term dynamics. *Journal of Finance* 58(5): 1933-1967.

Brealey, R.A., and S.C. Myers. 1981, 1984. *Principles of corporate finance*. 1st and 2nd editions. McGraw-Hill.

Brief, R.P., and R.A. Lawson. 1992. The role of the accounting rate of return in financial statement analysis. *The Accounting Review* 67(2): 411-426.

Brown, L.D. 1993. Earnings forecasting research: Its implications for capital markets research. *International Journal of Forecasting* 9(3), 295-320.

Brown, L.D., Call, A.C., Clement, M.B., and N.Y. Sharp. 2013. Inside the "black box" of sell-side financial analysts. Working paper, UT Austin.

Copeland, T.E., and J.F. Weston. 1979. *Financial theory and corporate policy*. 1st edition, Reading, MA, Addition-Wesley.

Copeland, T.E., Koller, T. and J. Murrin. 1990, 1995. *Valuation: Measuring and managing the value of companies*. 1st and 2nd editions, New York, John Wiley & Sons, Inc.

Courteau, L., Kao, J.L., and G.D. Richardson. 2001. Equity valuation employing the ideal versus ad hoc terminal value expressions. *Contemporary Accounting Research* 18(4), 625-661.

Cwynar, A. 2009. Residual income: The essence, history and premises of utilization. *Journal of Information, Control and Management Systems* 9(2): 95-108.

DeAngelo, L. 1990. Equity valuation and corporate control. *The Accounting Review* 65(1), 93-112.

Demirakos, E.G., Strong, N.C., and M. Walker. 2004. What valuation models do analysts use? *Accounting Horizons* 18(4), 221-240.

Demirakos, E.G., Strong, N.C., and M. Walker. 2010. Does valuation model choice affect target price accuracy? *European Accounting Review* 19(1): 35-72.

Easton, P.D., McAnally, M.L., Sommers, G.A., and X.-J. Zhang. 2014. *Financial Statement Analysis & Valuation*. 4th edition. Cambridge Business Publishers.

Edwards, E., and P. Bell. 1961. *The theory and measurement of business income.* Berkeley, University of California Press.

Fama, E.F., and K.R. French. 1997. Industry costs of equity. *Journal of Financial Economics* 43, 153-193.

Feltham, G.A., and J.A. Ohlson. 1995. Valuation and clean surplus accounting for operating and financial activities. *Contemporary Accounting Research* 11, 689-732.

Fisher, I. 1930. *The theory of interest.* 1st edition, New York: The Macmillan Co.

Francis, J., Olsson, P., and D.R. Oswald. 2000. Comparing the accuracy and explainability of dividend, free cash flow, and abnormal earnings equity value estimates. *Journal of Accounting Research* 38(1), 45-70.

Gilson, S.C., Hotchkiss, E.S., and R.S. Ruback. 2000. Valuation of bankrupt firms. *Review of Financial Studies* 13(1): 43-74.

Gleason, C.A., Johnson, W.B., and H. Li. 2013. Valuation model use and the price target performance of sell-side analysts. *Contemporary Accounting Research* 30(1), 80-115.

Green, J.G., Hand, J.R.M., and F. Zhang. 2014. Errors and questionable judgments in analysts' DCF valuation models. Working paper, UNC Chapel Hill.

Harris, T.S., Estridge, J., and D. Nissim. 2008. Morgan Stanley ModelWare's approach to intrinsic value: Focusing on risk-reward trade-offs. In Equity valuation: Models from leading investment banks. Eds. Viebig, J., T. Poddig, and A. Varmaz. John Wiley & Sons, Ltd.

Hotelling, H. 1925. A general mathematical theory of depreciation. *Journal of the American Statistical Association*, 20, 340-353.

Imam, S., Barker, R., and C. Clubb. 2008. The use of valuation models by UK investment analysts. *European Accounting Review* 17(3): 503-535.

Iman, S., Chan, J., and S.Z.A. Shah. 2013. Equity valuation models and target price accuracy in Europe: Evidence from equity reports. *International Review of Financial Analysis* 28: 9-19.

Joos, P.R., and J.D. Piotroski. 2013. The best of all possible worlds: Analyst ex ante valuation forecast optimism and the distribution of scenario-based valuations. Working paper, Stanford University.

Joos, P.R., Piotroski, J.D., and S. Srinivasan. 2014. Can analysts assess fundamental risk and valuation uncertainty? An empirical analysis of scenario-based value estimates. Working paper, Stanford University.

Kaplan, S.N., and R.S. Ruback. The valuation of cash flow forecasts: An empirical analysis. *Journal of Finance* 50(4), 1059-1093.

Lee, C.M.C., Myers, J., and B. Swaminathan. 1999. What is the intrinsic value of the Dow? *Journal of Finance* 54(5), 1693-1741.

Li, K. and P. Mohanram. 2014. Evaluating cross-sectional forecasting models for implied cost of capital. *Review of Accounting Studies*, forthcoming.

Lundholm, R., and T. O'Keefe. 2001a. Reconciling value estimates from the discounted cash flow model and the residual income model. *Contemporary Accounting Research* 18(2), 311-335.

Lundholm, R., and T. O'Keefe. 2001b. On comparing residual income and discounted cash flow models of equity valuation: A response to Penman 2001. *Contemporary Accounting Research* 18(4), 693-696.

Lundholm, R. and R. Sloan. 2013. *Equity valuation and analysis with eVal*. 3rd edition. McGraw-Hill, New York.

Markou, A., and S. Taylor. 2014. Peering inside the analyst 'Black Box': How do equity analysts model companies? Working paper, Cambridge University.

Marshall, A. 1890. *Principles of economics*. London, Macmillan.

Modigliani, F., and M. Miller. 1961. Dividend policy, growth and the valuation of shares. *Journal of Business* 23 (October), 411-433.

Ohlson, J.A. 1995. Earnings, book values, and dividends in equity valuation. *Contemporary Accounting Research* 11(2), 661-687.

Peasnell, K.V. 1982. Some formal connections between economic values and yields and accounting numbers. *Journal of Business Finance & Accounting* 9(3): 361-381.

Penman, S.H. 2001. On comparing residual income and discounted cash flow models of equity valuation: A response to Lundholm and O'Keefe. *Contemporary Accounting Research* 18(4), 681-692.

Penman, S.H. 2011. Accounting for risk and return in equity valuation. *Journal of Applied Corporate Finance* 23(2), 50-58.

Penman, S.H. 2012. Paths to valuation, asset pricing, and practical investing: Can accounting and finance approaches be reconciled? In *Bridging the GAAP: Recent Advances in Finance and Accounting*, 3-20. Eds. I. Venezia and Z. Wiener, World Scientific Publishing.

Penman, S.H. 2012. *Financial Statement Analysis and Security Valuation*. 5th edition. McGraw-Hill/Irwin.

Penman, S.H., and F. Reggiani. 2013. Returns to buying earnings and book value: Accounting for growth and risk. *Review of Accounting Studies* 18(4), 1021-1049.

Penman, S.H., and T. Sougiannis. 1998. A comparison of dividend, cash flow, and earnings approaches to equity valuation. *Contemporary Accounting Research* 15(3), 343-383.

Pinto, J.E., Henry, E., Robinson, T.R., and J.D. Stowe. 2010. *Equity asset valuation.* 2nd edition, CFA Institute.

Preinrich, G.A.D. 1938. *Annual survey of economic theory: The theory of depreciation*. Econometrica 6(3), 219-241.

Rappaport, A. 1986. *Creating shareholder value*. Free Press.

Schipper, K. 1991. Analysts' forecasts. *Accounting Horizons* 5(4), 105-121.

Viebig, J., T. Poddig, and A. Varmaz. 2008. Equity valuation: Models from leading investment banks. John Wiley & Sons, Ltd.

William, J.B. 1938. *The theory of investment value*. Harvard University Press.

TABLE 1

Criteria applied in arriving at 422 sell-side equity analyst reports in Investext issued by U.S. brokers that contain both DCF and RI equity valuations (May 1998 – Nov. 2011), and descriptive statistics on authoring brokers, report dates, and types of analysts' RI models.

Panel A: Investext search criteria

Asset class:	**All**
Dates:	**Custom,** 01/01/98 **to** 12/31/13
Keyword(s):	DCF or ("discounted cash flow*") in **Table of Contents** and "residual income" in **Table of Contents**
Report type:	**Company**
Geography:	**United States**
Contributor:	**Non-broker research excluded**

Panel B: Sample refinement criteria

Base sample:	478 analyst reports	
Excluded:	No $/share DCF valuation provided	26
	No $/share RI valuation provided	19
	Firm is a non-U.S. company	5
	No determinable valuation date	3
	No target price provided	2
	Insufficient stock price/return data	1
Final sample:	422 analyst reports covering 103 different firms	

Panel C: Number of sampled analyst reports by authoring broker, and distribution of report dates

Broker	# reports in sample
Morgan Stanley	417
Cowen & Company	4
HSBC Global Research	1

Date of report	
Min.	19980513
25th pctile	20011105
Median	20021163
75th pctile	20041019
Max.	20111003

Panel D: Frequency of DCF and RI valuation models used by analysts in sample reports

Type of equity valuation model contained in analysts' report		
DCF to all investors	422	
Residual income (RI), of which:	422	
1. To all investors, forecasting NOI and RNOA		168
2. To equity investors, forecasting NI and ROE		152
3. Both types of RI valuation models		102

TABLE 2

Descriptive statistics on the analysts and firms in the 422 analyst reports in Investext issued by U.S. brokers that contain both DCF and RI equity valuations (May 1998 – Nov. 2011).

Panel A: Number of reports authored by analysts, analysts' professional qualifications, and number of analysts on the analyst team

# reports analyst is on	
Min.	1
Median	2
Mean	10.9
Max.	142

# analysts on team	
Min.	1
Mean	2.2
Max.	5
# unique analysts	86

# pages in report	
Min.	6
Median	15
Mean	20
Max.	110

Type of report	#
Initiation	67
Update/revision	355

Stock recommendation	#
Reduce or underweight	26
Neutral or equal-weight	184
Overweight or outperform	212

% of reports with one or more CFAs on analyst team	28%

Panel B: Industry and market cap of covered firms

Industry	#
Business services	89
Consumer goods	77
Apparel	55
Recreational products	30
Construction materials	26
Chemicals	24
Retail	24
Transportation	16
Computers	14
Business supplies	11
Restaurants, hotel, motel	11
Construction	9
Electronic equipment	8

Industry (continued)	#
Telecommunications	6
Personal services	4
Rubber & plastic products	3
Aircraft	2
Automobiles & trucks	2
Shipping containers	2
Trading	2
Wholesale	2
Agriculture	1
Coal	1
Food products	1
Insurance	1
Machinery	1

Market cap ($ mil.)		
Min.	$	224
Median	$	7,529
Mean	$	16,825
Max.	$	187,763

TABLE 3

Statistics on the components of costs of capital, and the terminal and post-terminal rates of growth in key components of the DCF, RNOA-based RI and ROE-based RI valuations, that are forecasted by analysts in the 422 analyst reports in Investext issued by U.S. brokers that contain both DCF and RI equity valuations (May 1998 – Nov. 2011).

Panel A: Components of analysts' cost of capital estimates

Components of costs of capital	# obs	Min.	Median	Mean	Max.
RF horizon (yrs)	295	10	30	21	30
RF	412	3.0%	5.0%	4.9%	6.5%
BETA	412	0.68	1.00	1.14	2.55
MKTPREM	412	2.5%	4.0%	4.0%	8.0%
RE	417	6.7%	9.0%	9.3%	14%
WACC	418	5.8%	8.8%	8.9%	13%

Panel B: Fraction of total equity value represented by the present value of post-terminal year free cash flows (DCF model), residual net operating income (RNOA-RI model), and residual income (ROE-RI model)

pv(TV)/Eq_value	# obs	Min.	Median	Mean	Max.
DCF	409	17%	65%	64%	289%
RNOA	266	10%	53%	50%	280%
ROE	243	-0.5%	26%	32%	75%

Panel C: Forecasted rates of growth in key components of DCF valuations and RNOA-based and ROE-RI valuations in terminal year T (denoted by the prefix "g_"), and in perpetuity beyond T (denoted by "g_perp > T")

	Terminal value-related item	# obs	Min.	Median	Mean	Max.
DCF	# years ahead is T	416	5	10	11	40
	g_perp > T	402	-8.0%	2.4%	2.6%	7.6%
	g_REV_T	386	-15%	4.2%	4.6%	15%
	g_CAPEX_T	403	-65%	2.4%	2.4%	40%
	g_FCF_T	403	-20%	5.2%	6.2%	79%
RNOA	# years ahead is T	267	5	10	10	24
	g_perp > T	265	-5.9%	2.1%	2.1%	6.3%
	g_RNOI_T	264	-58%	5.2%	5.2%	28%
ROE	# years ahead is T	253	5	19	17	40
	g_perp > T	235	-32%	1.0%	2.1%	11%
	g_RI_T	232	-80%	4.1%	3.2%	30%

TABLE 4

Statistics on the valuations, target prices and returns associated with the DCF, RNOA-based RI and ROE-RI valuations in the 422 analyst reports in Investext issued by U.S. brokers that contain both DCF and RI equity valuations (May 1998 – Nov. 2011).

Panel A: Proximity of analysts' DCF valuations to their RNOA-RI and ROE-RI valuations of the same firm in the same report

		Difference in analysts' valuations			
Valuation comparison	# obs	Exactly the same	Within 1%	Within 2%	Within 5%
DCF vs. RNOA	267	6%	34%	59%	93%
DCF vs. ROE	254	2%	9%	21%	44%

Panel B: Analysts' target prices and the annualized expected, realized and unexpected stock returns associated with them (only for subset where there is a target price provided by analysts)

	# obs	Min.	Median	Mean	Max.	t-stat.	% > 0	Binomial z-stat.
Current stock price	285	$ 6.60	$ 31.55	$ 35.94	$ 246.10			
Target stock price	285	$ 9.00	$ 35.00	$ 42.28	$ 320.00			
Expected return in target	285	-27%	16%	14%	53%	21.5	91%	-13.9
Realized return	285	-68%	8%	13%	134%	6.9	62%	4.0
Unexpected target return	283	-69%	-5%	-2%	121%	-0.8	41%	-3.2

Note: Target price horizon is almost always 12 months beyond report date.

Panel C: Comparisons of the expected, realized and unexpected returns in analysts' valuations, where observations are aggregated by firm and across time, by 12-month windows

Unexpected return = realized - expected (on an aggregated basis)	# obs	Min.	Median	Mean	Max.	t-stat.	% > 0	Binomial z-stat.
DCF when there is an RNOA valuation	70	-110%	-8%	-7%	86%	-1.7	36%	-2.4
RNOA valuation	70	-110%	-8%	-7%	83%	-1.7	34%	-2.6
DCF when there is an ROE valuation	93	-88%	0%	0%	116%	0.0	52%	0.3
ROE valuation	93	-85%	2%	5%	118%	1.3	54%	0.7

Expected return (on an aggregated basis)	# obs	Min.	Median	Mean	Max.	t-stat.	% > 0	Binomial z-stat.
DCF when there is an RNOA valuation	70	-23%	15%	15%	69%	6.3	77%	4.5
RNOA valuation	70	-20%	13%	15%	60%	6.5	76%	4.3
DCF - RNOA	70	-8%	-1%	0%	14%	0.4	39%	-1.9
DCF when there is an ROE valuation	93	-23%	19%	19%	96%	7.7	77%	5.3
ROE valuation	93	-35%	15%	13%	65%	6.2	74%	4.7
DCF - ROE	93	-29%	2%	5%	53%	3.4	60%	2.0

Realized return (on an aggregated basis)	# obs	Min.	Median	Mean	Max.	t-stat.	% > 0	Binomial z-stat.
RNOA valuation	70	-67%	7%	8%	106%	2.2	64%	2.4
ROE valuation	93	-68%	16%	19%	107%	5.5	76%	5.1

TABLE 4 (continued)

Panel D: Comparisons of the unexpected returns in analysts' valuations, where observations are restricted to analyst reports that contain all three of a DCF, RNOA-RI and ROE-RI valuations. Valuations are aggregated by firm and across time, by 12-month windows.

Unexpected return when all 3 present	# obs	Min.	Median	Mean	Max.	t-stat.	% > 0	Binomial z-stat.
DCF	28	-71%	8%	9%	86%	1.3	61%	-1.1
RNOA	28	-68%	6%	8%	83%	1.3	61%	-1.1
ROE	28	-72%	0%	6%	79%	1.0	50%	0.0
DCF - ROE	28	-15%	3%	2%	14%	2.2	61%	-1.1

Notes:

Since there are an average of 4.1 reports per firm in our dataset (422 reports covering 103 different firms), there is overlap within and across firms in the 12-month windows over which we measure expected, realized and unexpected returns. In panel C we seek to minimize the impacts of this lack of independence by aggregating returns by firm and across time. For each firm and for each valuation method, we sort individual returns by report date from earliest to latest. We start with the earliest return, and average together into one firm-valuation-method observation all subsequent returns for that same firm and same valuation method for which the report date was within 12 months of the earliest return. We then repeat the process using the first report issued after the last report that is part of the just-defined 12 month window. In terms of aggregated returns, this process yields 136, 70 and 93 triplets of expected, realized and unexpected returns associated with DCF-based, RNOA-based and ROE-RI valuations, respectively.

TABLE 5

OLS regressions of analyts' target prices on analysts' DCF valuations, RNOA-based RI valuations, and ROE-based RI valuations. Sample is the subset of the 422 analyst reports in Investext issued by U.S. brokers that contain both DCF and RI equity valuations (May 1998 – Nov. 2011), and for which there is an analyst target price. t-statistics relative to a null parameter value of zero are in parentheses.

Independent variables:	Pred. sign on coef.	Model 1	Model 2	Model 3	Model 4
Intercept		$5.28	$3.16	$1.52	$1.77
		(8.5)	(5.8)	(3.2)	(3.4)
DCF valuation	+	0.92	-0.18	-2.32	0.26
		(5.5)	(-2.4)	(-3.6)	(2.0)
RNOA-based valuation	+	-0.06		2.80	
		(-0.4)		(4.1)	
ROE-based valuation	+		1.10	0.49	0.71
			(14.6)	(3.7)	(5.4)
Adj. R-squared		96%	98%	99%	99%
# obs.		183	183	84	84

FIGURE 1

Example of an analyst report in which both DCF and RNOA-based RI valuations are presented, and on one single page as shown below. Firm is Nike Inc. (12/12/02, Morgan Stanley, p.10).

Exhibit 12

Nike Discounted Cash Flow Model

Discounted Cash Flow Analysis	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Operating Revenue	9,893	10,457	10,978	11,567	12,163	12,816	13,504	14,228	14,992	15,796
Revenue Growth		5.7%	5.0%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%
EBITDA	1,344	1,481	1,611	1,785	1,964	2,069	2,180	2,297	2,420	2,550
EBITDA Margin	13.6%	14.2%	14.7%	15.4%	16.1%	16.1%	16.1%	16.1%	16.1%	16.1%
- Depreciation	(224)	(234)	(246)	(259)	(272)	(273)	(294)	(314)	(335)	(356)
- Amort. of Non-Deduct. Goodwill	(53)	(55)	(51)	(47)	(44)	(44)	(44)	(44)	(44)	(44)
EBIT	1,068	1,192	1,315	1,478	1,648	1,752	1,842	1,939	2,041	2,150
- Imputed Taxes on EBIT	(392)	(436)	(478)	(534)	(592)	(628)	(660)	(694)	(730)	(768)
EBIAT	676	756	837	944	1,056	1,123	1,182	1,245	1,312	1,382
+ Depreciation & Amortization	277	289	297	306	316	317	338	358	379	400
- Capital Expenditures	(303)	(225)	(225)	(264)	(279)	(393)	(414)	(436)	(459)	(484)
- + Change in WC and Other Assets	97	(63)	6	2	13	0	0	0	0	0
Net Investment in Capital	71	0	78	44	50	(76)	(76)	(78)	(80)	(84)
Free Cash Flow to Debt & Equity	746	756	915	989	1,105	1,048	1,106	1,167	1,231	1,298
FCF growth rate		1.4%	20.9%	8.1%	11.8%	-5.2%	5.6%	5.5%	5.5%	5.5%
Discount Factor		0.919	0.845	0.777	0.714	0.656	0.603	0.554	0.510	0.468
PV of Free Cash Flow to Debt & Equity		$ 695	$ 773	$ 768	$ 789	$ 688	$ 667	$ 647	$ 627	$ 608
Sum PV of Free Cash Flow		$ 15,769								
+ MV of Equity Investments		$ -								
+ MV of Non-Operating Assets		$ -								
+ Other		$ -								
= Enterprise Value		$ 15,769								
- MV of Net Debt		$ (529)								
- Capitalized Off Balance Sheet Leases		$ -								
- Pension & Other Non-Funded Liability		$ -								
- MV of Non-Convert. Preferred Stock		$ -								
- PV of Minority Interest		$ -								
- MV of Options Outstanding		$ -								
Equity Value		**$ 15,239**								
Shares Outstanding (mil)		272.2								
Equity Value/Share		**$ 55.99**								
Long-Term Sustainable Growth Rate	5.0%									

Weighted Average Cost of Debt & Equity Capital (WACC)	
Shares Outstanding (mm)	272.2
Price Per Share	$ 39.83
Market Value of Equity (MVE)	$ 10,842
Levered Beta for This Company	0.88
30 Year Risk Free Rate	5.5%
Equity Risk Premium	4.0%
Cost of Equity:	**9.0%**
Market Value of Total Interest Bearing Debt (MVD)	$ 529
Marginal Cost of Long-Term Debt	7.0%
Marginal Tax Rate	35.0%
After-Tax Cost of Debt:	4.6%
MVE/(MVD+MVE)	95.3%
MVD/(MVD+MVE)	4.7%
Weighted Average Cost of Capital	**8.79%**

Return on Capital Employed	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Beginning Capital		$ 4,202	$ 4,201	$ 4,124	$ 4,079	$ 4,029	$ 4,105	$ 4,181	$ 4,259	$ 4,340
Revenues / Beg. Capital		2.49	2.61	2.81	2.98	3.18	3.29	3.40	3.52	3.64
Capital Growth Rate		NA	0.0%	-1.9%	-1.1%	-1.2%	1.9%	1.9%	1.9%	1.9%
EBIAT		$ 756	$ 837	$ 944	$ 1,056	$ 1,123	$ 1,182	$ 1,245	$ 1,312	$ 1,382
Adjusted Return on Capital Employed (ROCE)		18.0%	19.9%	22.9%	25.9%	27.9%	28.8%	29.8%	30.8%	31.8%
WACC Based on Beta		8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%
ROCE - WACC		9.2%	11.1%	14.1%	17.1%	19.1%	20.0%	21.0%	22.0%	23.1%
EVA		$ 386	$ 467	$ 582	$ 697	$ 769	$ 821	$ 877	$ 937	$ 1,001
Discount Factor		0.919	0.845	0.777	0.714	0.656	0.603	0.554	0.510	0.468
PV EVA		$ 355	$ 395	$ 452	$ 498	$ 505	$ 495	$ 486	$ 477	$ 469
Sum PV EVA		$ 11,413	72% is value from growth + understated book value							
+ Invested Capital at Mid Year		$ 4,383	28% is value from existing book value							
+ MV of Equity Investments		$ -	0% is value from investments							
+ MV of Non-Operating Assets		$ -	0% is value from non-op. assets							
+ Other		$ -	0% is value from other							
Enterprise value		**$ 15,796**	100%							
- MV of Net Debt		$ (529)								
- Capitalized Off Balance Sheet Leases		$ -								
- Pension & Other Non-Funded Liability		$ -								
- MV of Non Convert. Preferred Stock		$ -								
- MV of Minority Interest		$ -								
- MV of Options Outstanding		$ -								
Equity value		**$ 15,266**								
Shares Outstanding (mil)		272.2								
Equity Value/Share		**$ 56.08**								

Total Capital Provided	1Q02
ST Debt	$ 223
- Cash & Securities	$ (430)
+ LT Debt	$ 736
+ Capitalized Leases Net of Depreciation	$ -
+ Pension & Other Non-Funded Liability	$ -
+ Deferred Tax Liability	$ -
+ Minority Interest	$ -
+ Preferred Stock	$ -
+ Equity	$ 3,673
=Total Capital Provided	**$ 4,202**

Source: Morgan Stanley research

FIGURE 2

Example of an analyst report in which both DCF and ROE-based RI valuations are presented, using two pages as shown below. Firm is Carnival Corp & Plc (1/29/04, Morgan Stanley, pp. 9-10).

Panel A: The DCF model, disclosed on p.9 of the report

Exhibit 15

Carnival Discounted Cash Flow Analysis

US$mn	**2004e**	**2005e**	**2006e**	**2007e**	**2008e**	**2009e**	**2010e…**
Operating Revenue	9,526	10,608	11,337	12,065	12,802	13,543	14,328
Revenue Growth (%)		*11.4*	*6.9*	*6.4*	*6.1*	*5.8*	*5.8*
EBITDA	**2,907**	**3,416**	**3,762**	**4,071**	**4,368**	**4,649**	**4,946**
EBITDA Growth (%)	*30.5*	*32.2*	*33.2*	*33.7*	*34.1*	*34.3*	*34.5*
- Depreciation	(811)	(925)	(989)	(1,011)	(1,034)	(1,060)	(1,087)
EBIT	2,096	2,491	2,773	3,060	3,334	3,589	3,859
- Imputed Taxes on EBIT	(63)	(75)	(83)	(92)	(100)	(108)	(116)
EBIAT	2,033	2,416	2,690	2,968	3,234	3,482	3,743
+ Depreciation & Amortisation	811	925	989	1,011	1,034	1,060	1,087
- Capital Expenditures	(3,380)	(1,480)	(1,480)	(1,537)	(1,606)	(1,677)	(1,752)
- + Change in WC and Other Assets	208	141	232	260	282	168	182
Net Investment in Capital	(2,361)	(414)	(258)	(266)	(289)	(450)	(483)
Free Cash Flow to Debt & Equity	**(328)**	**2,002**	**2,431**	**2,702**	**2,945**	**3,032**	**3,260**
FCF Growth Rate (%)	*nm*	*nm*	*21.4*	*11.1*	*9.0*	*3.0*	*7.5*
Discount Factor	1.000	0.924	0.853	0.788	0.728	0.672	0.621
PV of Free Cash Flow to Debt & Equity	(328)	1,849	2,074	2,129	2,143	2,038	2,023
Sum PV of Free Cash Flow	9,905						
Terminal value (US$)	37,947						
Enterprise Value	**47,852**						
- MV of Net Debt (Ex Convertible)	(6,241)						
Equity Value	**41,610**						
Shares Outstanding (mn)	818.0						
Equity Value/Share (US$)	**50.9**						
Long-Term Sustainable Growth Rate	**2.5**						
Weighted Average Cost of Debt & Equity (WACC)							
Shares Outstanding (F/D, mm)	818.0						
Price Per Share	42.00						
Market Value of Equity (MVE)	34,356						
Levered Beta for This Company	1.00						
Risk Free Rate (%)	5.0						
Equity Risk Premium (%)	4.0						
Cost of Equity: (%)	**9.00**						
Market Value of Total Interest Bearing Debt (MVD)	6,241						
Marginal Cost of Long-Term Debt (%)	4.4						
Marginal Tax Rate (%)	3.0						
After-Tax Cost of Debt: (%)	**4.3**						
MVE/(MVD+MVE) (%)	84.6						
MVD/(MVD+MVE) (%)	15.4						
Weighted Average Cost of Capital (%)	**8.3**						

Source: Morgan Stanley Research estimates

FIGURE 2 (continued)

Panel B: The ROE-RI model, disclosed on p.10 of the report

Exhibit 16

Carnival Residual Income Model

Inputs - Single Period Decay Model:		Outputs	US$	Other Statistical Output	(%)		(%)
Number of Shares Outstanding (mn)	818	Current Share Price (Local Currency)	42.0	5 Year Net Income CAGR	14.7	Year 1 ROE	15.3
Required Rate of Return (%)	9.00	RI Value Per Share (With Perpetuity)	48.1	10 Year Net Income CAGR	12.0	Year 5 ROE	18.0
2014… decay of ROE (%)	(2.0)	Value of Perpetuity	13.1	15 Year Net Income CAGR	10.6	Year 10 ROE	15.5
		RI Value Per Share (Without Perpetuity)	35.0	20 Year Net Income CAGR	9.9	Year 15 ROE	14.0
						Year 20 ROE	12.6

US$ million	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Net Income	1,760	2,124	2,512	2,880	3,208	3,488	3,795	4,119	4,461	4,820	5,452	5,909	6,393	6,903	7,441	8,005	8,597	9,217	9,864	10,539
Growth (%)		*20.7*	*18.3*	*14.6*	*11.4*	*8.8*	*8.8*	*8.5*	*8.3*	*8.0*	*13.1*	*8.4*	*8.2*	*8.0*	*7.8*	*7.6*	*7.4*	*7.2*	*7.0*	*6.8*
Dividends paid	409	491	589	677	779	896	1,030	1,185	1,362	1,567										
Total Return of Capital	**409**	**491**	**589**	**677**	**779**	**896**	**1,030**	**1,185**	**1,362**	**1,567**	**1,635**	**1,773**	**1,918**	**2,071**	**2,232**	**2,402**	**2,579**	**2,765**	**2,959**	**3,162**
Total Payout Ratio (%)	23.2	23.1	23.4	23.5	24.3	25.7	27.1	28.8	30.5	32.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Sharehldrs' Equity ex g/w	11,514	13,147	14,780	16,703	18,906	21,334	23,927	26,692	29,627	32,726	35,979	39,795	43,932	48,407	53,239	58,447	64,051	70,069	76,520	83,425
ROE (%)	15.3	17.2	18.0	18.3	18.0	17.3	16.8	16.3	15.8	15.5	15.2	14.8	14.6	14.3	14.0	13.7	13.4	13.2	12.9	12.6
Residual Income	**724**	**941**	**1,182**	**1,376**	**1,506**	**1,568**	**1,642**	**1,717**	**1,795**	**1,875**	**2,213**	**2,328**	**2,439**	**2,547**	**2,649**	**2,745**	**2,832**	**2,911**	**2,977**	**3,031**
PV of Residual Income	**724**	**863**	**995**	**1,063**	**1,067**	**1,019**	**979**	**939**	**901**	**863**	**935**	**902**	**867**	**831**	**793**	**754**	**713**	**673**	**631**	**589**

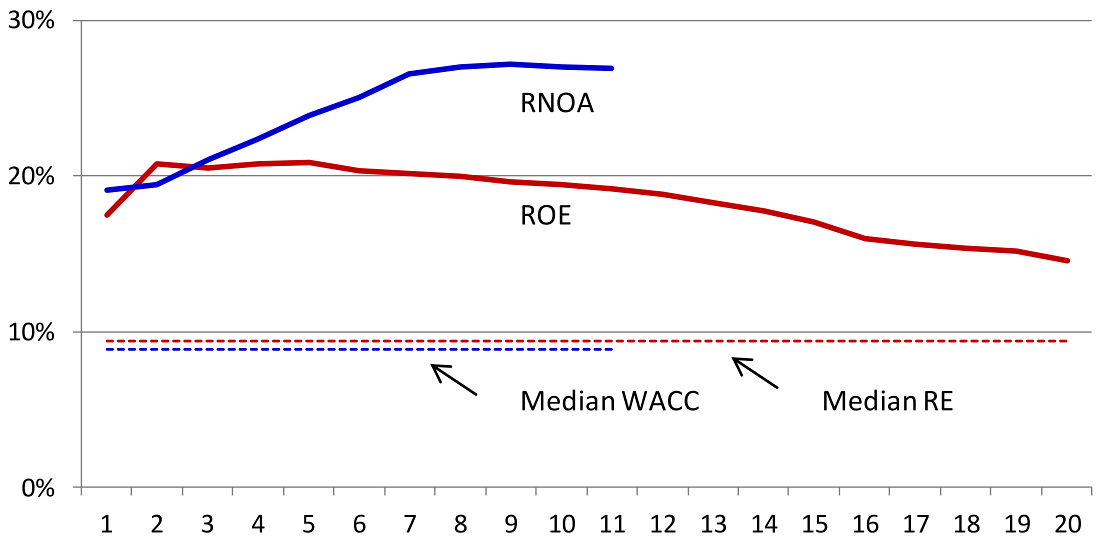
Value Per Share Breakdown		(%)
Shareholder's Equity	14.1	29
Analyst's Forecast	11.5	24
Extended Forecast	9.4	20
Terminal Value	13.1	27
Total Value	**48.1**	**100**

Source: Morgan Stanley Research estimates

FIGURE 3

Median annual RNOAs and ROEs forecasted by analysts in the 422 analyst reports in Investext issued by U.S. brokers that contain both DCF and RI equity valuations. Panel A is in event time starting with the first year explicitly forecasted by analysts. Panel B is in event time relative to year 0, defined as the terminal year of the analyst's valuation model.

Panel A: Median future annual RNOAs and ROEs forecasted by analysts



Panel B: Median annual RNOAs and ROEs forecasted by analysts up to the terminal year 0

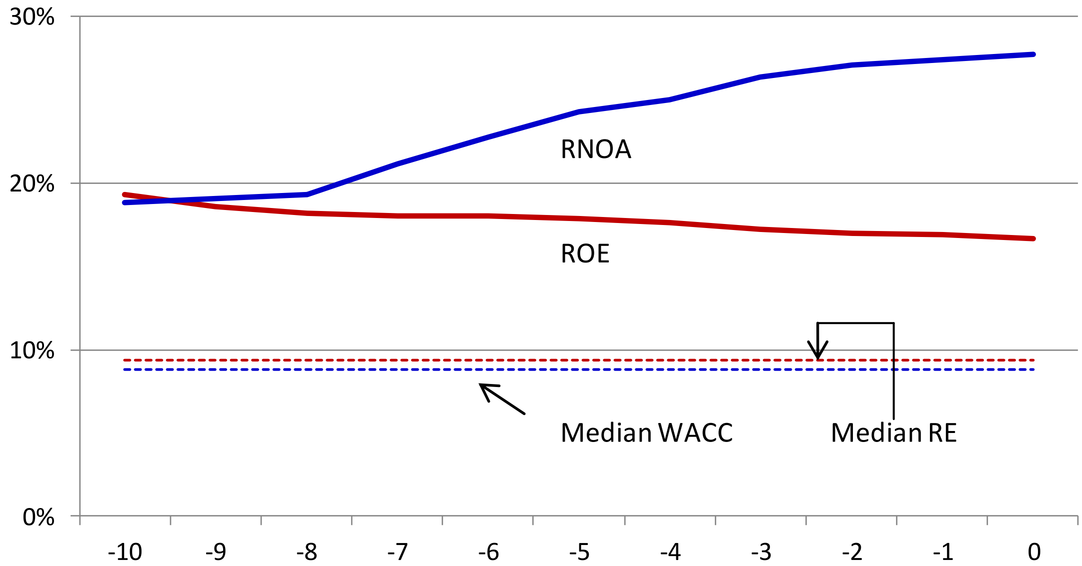


FIGURE 3 (continued)

Panel C: Median annual RNOAs and ROEs forecasted by analysts up to the terminal year 0 for the subsample of analyst reports with all three of DCF, RNOA-RI, and ROE-RI valuations.