Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2017 Edition

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The equity risk premium is the price of risk in equity markets and is a key input in estimating costs of equity and capital in both corporate finance and valuation. Given its importance, it is surprising how haphazard the estimation of equity risk premiums remains in practice. We begin this paper by looking at the economic determinants of equity risk premiums, including investor risk aversion, information uncertainty and perceptions of macroeconomic risk. In the standard approach to estimating the equity risk premium, historical returns are used, with the difference in annual returns on stocks versus bonds, over a long period, comprising the expected risk premium. We note the limitations of this approach, even in markets like the United States, which have long periods of historical data available, and its complete failure in emerging markets, where the historical data tends to be limited and volatile. We look at two other approaches to estimating equity risk premiums – the survey approach, where investors and managers are asked to assess the risk premium and the implied approach, where a forward-looking estimate of the premium is estimated using either current equity prices or risk premiums in non-equity markets. In the next section, we look at the relationship between the equity risk premium and risk premiums in the bond market (default spreads) and in real estate (cap rates) and how that relationship can be mined to generated expected equity risk premiums. We close the paper by examining why different approaches yield different values for the equity risk premium, and how to choose the "right" number to use in analysis.

The notion that risk matters, and that riskier investments should have higher expected returns than safer investments, to be considered good investments, is intuitive and central to risk and return models in finance. Thus, the expected return on any investment can be written as the sum of the riskfree rate and a risk premium to compensate for the risk. The disagreement, in both theoretical and practical terms, remains on how to measure the risk in an investment, and how to convert the risk measure into an expected return that compensates for risk. A central number in this debate is the premium that investors demand for investing in the 'average risk' equity investment (or for investing in equities as a class), i.e., the equity risk premium.

In this paper, we begin by examining competing risk and return models in finance and the role played by equity risk premiums in each of them. We argue that equity risk premiums are central components in every one of these models and consider what the determinants of these premiums might be. We follow up by looking at three approaches for estimating the equity risk premium in practice. The first is to survey investors or managers with the intent of finding out what they require as a premium for investing in equity as a class, relative to the riskfree rate. The second is to look at the premiums earned historically by investing in stocks, as opposed to riskfree investments. The third is to back out an equity risk premium from market prices today. We consider the pluses and minuses of each approach and how to choose between the very different numbers that may emerge from these approaches.

Equity Risk Premiums: Importance and Determinants

Since the equity risk premium is a key component of every valuation, let's begin by looking at not only why it matters in the first place but also the factors that influence its level at any point in time and why that level changes over time. In this section, we look at the role played by equity risk premiums in corporate financial analysis, valuation and portfolio management, and then consider the determinants of equity risk premiums.

Why does the equity risk premium matter?

The equity risk premium reflects fundamental judgments we make about how much risk we see in an economy/market and what price we attach to that risk. In the process, it affects the expected return on every risky investment and the value that we estimate for that investment. Consequently, it makes a difference in both how we allocate wealth across different asset classes and which specific assets or securities we invest in within each asset class.

A Price for Risk

To illustrate why the equity risk premium is the price attached to risk, consider an alternate (though unrealistic) world where investors are risk neutral. In this world, the value of an asset would be the present value of expected cash flows, discounted back at a risk free rate. The expected cash flows would capture the cash flows under all possible scenarios (good and bad) and there would be no risk adjustment needed. In the real world, investors are risk averse and will pay a lower price for risky cash flows than for riskless cash flows, with the same expected value. How much lower? That is where equity risk premiums come into play. In effect, the equity risk premium is the premium that investors demand for the average risk investment, and by extension, the discount that they apply to expected cash flows with average risk. When equity risk premiums rise, investors are charging a higher price for risk and will therefore pay lower prices for the same set of risky expected cash flows.

Expected Returns and Discount Rates

Building on the theme that the equity risk premium is the price for taking risk, it is a key component into the expected return that we demand for a risky investment. This expected return, is a determinant of both the cost of equity and the cost of capital, essential inputs into corporate financial analysis and valuation.

While there are several competing risk and return models in finance, they all share some common assumptions about risk. First, they all define risk in terms of variance in actual returns around an expected return; thus, an investment is riskless when actual returns are always equal to the expected return. Second, they argue that risk has to be measured from the perspective of the marginal investor in an asset, and that this marginal investor is well diversified. Therefore, the argument goes, it is only the risk that an investment adds on to a diversified portfolio that should be measured and compensated. In fact, it is this view of risk that leads us to break the risk in any investment into two components. There is a firm-specific component that measures risk that relates only to that investment or to a few investments like it, and a market component that contains risk that affects a large subset or all investments. It is the latter risk that is not diversifiable and should be rewarded.

All risk and return models agree on this crucial distinction, but they part ways when it comes to how to measure this market risk. In the capital asset pricing model (CAPM), the market risk is measured with a beta, which when multiplied by the equity risk premium yields the total risk premium for a risky asset. In the competing models, such as the arbitrage pricing and multi-factor models, betas are estimated against individual market risk factors, and each factor has its own price (risk premium). Table 1 summarizes four models, and the role that equity risk premiums play in each one:

Table 1: Equity Risk Premiums in Risk and Return Models

	Model	*Equity Risk Premium*
	Expected Return = Riskfree Rate + $Beta_{Asset}$ (Equity Risk Premium)	Risk Premium for investing in the market portfolio, which includes all risky assets, relative to the riskless rate.
Arbitrage pricing model (APM)	$\text{Expected Return} = \text{Riskfree Rate} + \sum_{j=1}^{j=k} \beta_j (\text{Risk Premium}_j)$	Risk Premiums for individual (unspecified) market risk factors.
Multi-Factor Model	$\text{Expected Return} = \text{Riskfree Rate} + \sum_{j=1}^{j=k} \beta_j (\text{Risk Premium}_j)$	Risk Premiums for individual (specified) market risk factors
Proxy Models	Expected Return = a + b (Proxy 1) + c (Proxy 2) (where the proxies are firm characteristics such as market capitalization, price to book ratios or return momentum)	No explicit risk premium computation, but coefficients on proxies reflect risk preferences.

All of the models other than proxy models require three inputs. The first is the riskfree rate, simple to estimate in currencies where a default free entity exists, but more complicated in markets where there are no default free entities. The second is the beta (in the CAPM) or betas (in the APM or multi-factor models) of the investment being analyzed, and the third is the appropriate risk premium for the portfolio of all risky assets (in the CAPM) and the factor risk premiums for the market risk factors in the APM and multi-factor models. While I examine the issues of riskfree rate and beta estimation in companion pieces, I will concentrate on the measurement of the risk premium in this paper.

Note that the equity risk premium in all of these models is a market-wide number, in the sense that it is not company-specific or asset-specific but affects expected returns on all risky investments. Using a larger equity risk premium will increase the expected returns for all risky investments, and by extension, reduce their value. Consequently, the choice of an equity risk premium may have much larger consequences for value than firm-specific inputs such as cash flows, growth and even firm-specific risk measures (such as betas).

Investment and Policy Implications

It may be tempting for those not in the midst of valuation or corporate finance analysis to pay little heed to the debate about equity risk premium, but it would be a mistake to do so, since its effects are far reaching.

- The amounts set aside by both corporations and governments to meet future pension fund and health care obligations are determined by their expectations of returns from investing in equity markets, i.e., their views on the equity risk premium. Assuming that the equity risk premium is 6% will lead to far less being set aside each year to cover future obligations than assuming a premium of 4%. If the actual premium delivered by equity markets is only 2%, the fund's assets will be insufficient to meet its liabilities, leading to fund shortfalls which have to be met by raising taxes (for governments) or reducing profits (for corporations) In some cases, the pension benefits can be put at risk, if plan administrators use unrealistically high equity risk premiums, and set aside too little each year.
- Business investments in new assets and capacity is determined by whether the businesses think they can generate higher returns on those investments than the cost that they attach to the capital in that investment. If equity risk premiums increase, the cost of equity and capital will have to increase with them, leading to less overall investment in the economy and lower economic growth.
- Regulated monopolies, such as utility companies, are often restricted in terms of the prices that they charge for their products and services. The regulatory commissions that determine "reasonable" prices base them on the assumption that these companies have to earn a fair rate of return for their equity investors. To come up with this fair rate of

return, they need estimates of equity risk premiums; using higher equity risk premiums will translate into higher prices for the customers in these companies.[1]

- Judgments about how much you should save for your retirement or health care and where you should invest your savings are clearly affected by how much return you think you can make on your investments. Being over optimistic about equity risk premiums will lead you to save too little to meet future needs and to over investment in risky asset classes.

Thus, the debate about equity risk premiums has implications for almost every aspect of our lives.

Market Timing and Risk Premiums

Any one who invests has a view on equity risk premiums, though few investors are explicit about their views. In particular, if you believe that equity markets are efficient, you are arguing that the equity risk premiums built into market prices today are correct. If you believe that stock markets are over valued or in a bubble, you are asserting that the equity risk premiums built into prices today are too low, relative to what they should be (based on the risk in equities and investor risk aversion). Conversely, investors who believe that stocks are collectively underpriced or cheap are also making a case that the equity risk premium in the market today is much higher than what you should be making (again based on the risk in equities and investor risk aversion). Thus, every debate about the overall equity market can be translated into a debate about equity risk premiums.

Put differently, asset allocation decisions that investors make are explicitly or implicitly affected by investor views on risk premiums and how they vary across asset classes and geographically. Thus, if you believe that equity risk premiums are low, relative to the risk premiums in corporate bond markets (which take the form or default spreads on bonds), you will allocate more of your overall portfolio to bonds. Your allocation of equities across geographical markets are driven by your perceptions of equity risk premiums in those markets, with more of your portfolio going into markets where the

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[1] The Society of Utility and Regulatory Financial Analysts (SURFA) has annual meetings of analysts involved primarily in this debate. Not surprisingly, they spend a good chunk of their time discussing equity risk premiums, with analysts working for the utility firms arguing for higher equity risk premiums and analysts working for the state or regulatory authorities wanting to use lower risk premiums.

equity risk premium is higher than it should be (given the risk of those markets). Finally, if you determine that the risk premiums in financial assets (stocks and bonds) are too low, relative to what you can earn in real estate or other real assets, you will redirect more of your portfolio into the latter.

By making risk premiums the focus of asset allocation decisions, you give focus to those decisions. While it is very difficult to compare PE ratios for stocks to interest rates on bonds and housing price indicators, you can compare equity risk premiums to default spreads to real estate capitalization rates to make judgments about where you get the best trade off on risk and return. In fact, we will make these comparisons later in this paper.

What are the determinants of equity risk premiums?

Before we consider different approaches for estimating equity risk premiums, we should examine the factors that determine equity risk premiums. After all, equity risk premiums should reflect not only the risk that investors see in equity investments but also the price they attach to that risk.

Risk Aversion and Consumption Preferences

The first and most critical factor, obviously, is the risk aversion of investors in the markets. As investors become more risk averse, equity risk premiums will climb, and as risk aversion declines, equity risk premiums will fall. While risk aversion will vary across investors, it is the collective risk aversion of investors that determines equity risk premium, and changes in that collective risk aversion will manifest themselves as changes in the equity risk premium. While there are numerous variables that influence risk aversion, we will focus on the variables most likely to change over time.

a. Investor Age: There is substantial evidence that individuals become more risk averse as they get older. The logical follow up to this proposition is that markets with older investors, in the aggregate, should have higher risk premiums than markets with younger investors, for any given level of risk. Bakshi and Chen (1994), for instance, examined risk premiums in the United States and noted an increase in risk premiums as investors aged.[2] Liu and Spiegel computed the ratio of the middle-age cohort (40-49

[2] Bakshi, G. S., and Z. Chen, 1994, *Baby Boom, Population Aging, and Capital Markets*, The Journal of Business, LXVII, 165-202.

years) to the old-age cohort (60-69) and found that PE ratios are closely and positively related to the Middle-age/Old-age ratio for the US equity market from 1954 to 2010; since the equity risk premium is inversely related to the PE, this would suggest that investor age does play a role in determining equity risk premiums.[3]

b. Preference for current consumption: We would expect the equity risk premium to increase as investor preferences for current over future consumption increase. Put another way, equity risk premiums should be lower, other things remaining equal, in markets where individuals are net savers than in markets where individuals are net consumers. Consequently, equity risk premiums should increase as savings rates decrease in an economy. Rieger, Wang and Hens (2012) compare equity risk premiums and time discount factors across 27 countries and find that premiums are higher in countries where investors are more short term.[4]

Relating risk aversion to expected equity risk premiums is not straightforward. While the direction of the relationship is simple to establish – higher risk aversion should translate into higher equity risk premiums- getting beyond that requires us to be more precise in our judgments about investor utility functions, specifying how investor utility relates to wealth (and variance in that wealth). As we will see later in this paper, there has been a significant angst among financial economics that most conventional utility models do not do a good job of explaining observed equity risk premiums.

Economic Risk

The risk in equities as a class comes from more general concerns about the health and predictability of the overall economy. Put in more intuitive terms, the equity risk premium should be lower in an economy with predictable inflation, interest rates and economic growth than in one where these variables are volatile. Lettau, Ludwigson and Wachter (2008) link the changing equity risk premiums in the United States to shifting volatility in the real economy.[5] They attribute the lower equity risk premiums of the 1990s

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[3] Liu, Z. and M.M. Siegel, 2011, *Boomer Retirement: Headwinds for US Equity Markets?* FRBSF Economic Letters, v26.

[4] Rieger, M.O., M. Wang and T. Hens, 2012, International Evidence on the Equity Risk Premium Puzzle and Time Discounting, SSRN Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2120442

[5] Lettau, M., S.C. Ludvigson and J.A. Wachter, 2008. *The Declining Equity Risk Premium: What role does macroeconomic risk play?* Review of Financial Studies, v21, 1653-1687.

(and higher equity values) to reduced volatility in real economic variables including employment, consumption and GDP growth. One of the graphs that they use to illustrate the correlation looks at the relationship between the volatility in GDP growth and the dividend/ price ratio (which is the loose estimate that they use for equity risk premiums), and it is reproduced in figure 1.

Figure 1: Volatility in GDP growth and Equity Risk Premiums (US)

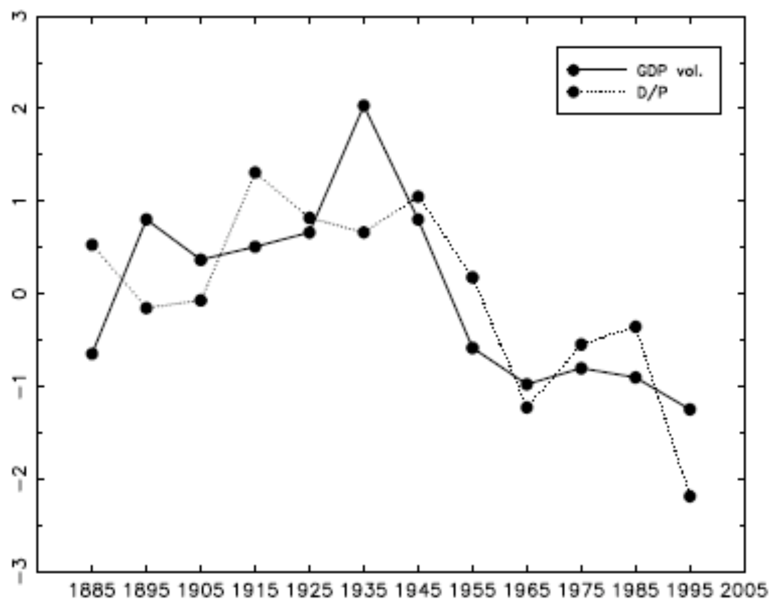

Figure 3
GDP volatility and the D/P ratio—Prewar evidence
This figure plots the standard deviations of GDP growth and the mean D/P ratio by decade starting in 1880 until 2000. Both series are demeaned and divided by their standard deviation. The GDP data are from Ray Fair's website (http://fairmodel.econ.yale.edu/RAYFAIR/PDF/2002DTBL.HTM) based on Balke and Gordon (1989). The dividend yield data is from Robert Shiller's website (http://aida.econ.yale.edu/~shiller/data/ie_data.htm).

Note how closely the dividend yield has tracked the volatility in the real economy over this very long period.

Gollier (2001) noted that the linear absolute risk tolerance often assumed in standard models breaks down when there is income inequality and the resulting concave absolute risk tolerance should lead to higher equity risk premiums.[6] Hatchondo (2008) attempted to quantify the impact on income inequality on equity risk premiums. In his model, which is narrowly structured, the equity risk premium is higher in an economy with

[6] Gollier, C., 2001. *Wealth Inequality and Asset Pricing*, Review of Economic Studies, v68, 181–203.

unequal income than in an egalitarian setting, but only by a modest amount (less than 0.50%).[7]

A related strand of research examines the relationship between equity risk premium and inflation, with mixed results. Studies that look at the relationship between the level of inflation and equity risk premiums find little or no correlation. In contrast, Brandt and Wang (2003) argue that news about inflation dominates news about real economic growth and consumption in determining risk aversion and risk premiums.[8] They present evidence that equity risk premiums tend to increase if inflation is higher than anticipated and decrease when it is lower than expected. Another strand of research on the Fisher equation, which decomposes the riskfree rate into expected inflation and a real interest rate, argues that when inflation is stochastic, there should be a third component in the risk free rate: an inflation risk premium, reflecting uncertainty about future inflation.[9] Reconciling the findings, it seems reasonable to conclude that it is not so much the level of inflation that determines equity risk premiums but uncertainty about that level, and that some of the inflation uncertainty premium may be captured in the risk free rate, rather than in the equity risk premiums.

Since the 2008 crisis, with its aftermath of low government bond rates and a simmering economic crisis, equity risk premiums in the United States have behaved differently than they have historically. Connolly and Dubofsky (2015) find that equity risk premiums have increased (decreased) as US treasury bond rates decrease (increase), and have moved inversely with inflation (with higher inflation leading to lower equity risk premiums), both behaviors at odds with the relationship in the pre-2008 period, suggesting a structural break in 2008.[10]

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[7] Hatchondo, J.C., 2008, *A Quantitative Study of the Role of Income Inequality on Asset Prices*, Economic Quarterly, v94, 73–96.

[8] Brandt, M.W. and K.Q. Wang. 2003. *Time-varying risk aversion and unexpected inflation*, Journal of Monetary Economics, v50, pp. 1457-1498.

[9] Benninga, S., and A. Protopapadakis, 1983, *Real and Nominal Interest Rates under Uncertainty: The Fisher Problem and the Term Structure*, Journal of Political Economy, vol. 91, pp. 856–67.

[10] Connolly, R. and D. Dubofsky, 2015, *Risk Perceptions, Inflation and Financial Asset Returns: A Tale of Two Connections*, Working Paper, SSRN #2527213.

Information

When you invest in equities, the risk in the underlying economy is manifested in volatility in the earnings and cash flows reported by individual firms in that economy. Information about these changes is transmitted to markets in multiple ways, and it is clear that there have been significant changes in both the quantity and quality of information available to investors over the last two decades. During the market boom in the late 1990s, there were some who argued that the lower equity risk premiums that we observed in that period were reflective of the fact that investors had access to more information about their investments, leading to higher confidence and lower risk premiums in 2000. After the accounting scandals that followed the market collapse, there were others who attributed the increase in the equity risk premium to deterioration in the quality of information as well as information overload. In effect, they were arguing that easy access to large amounts of information of varying reliability was making investors less certain about the future.

As these contrary arguments suggest, the relationship between information and equity risk premiums is complex. More precise information should lead to lower equity risk premiums, other things remaining equal. However, precision here has to be defined in terms of what the information tells us about future earnings and cash flows. Consequently, it is possible that providing more information about last period's earnings may create more uncertainty about future earnings, especially since investors often disagree about how best to interpret these numbers. Yee (2006) defines earnings quality in terms of volatility of future earnings and argues that equity risk premiums should increase (decrease) as earnings quality decreases (increases).[11]

Empirically, is there a relationship between earnings quality and observed equity risk premiums? The evidence is mostly anecdotal, but there are several studies that point to the deteriorating quality of earnings in the United States, with the blame distributed widely. First, the growth of technology and service firms has exposed inconsistencies in accounting definitions of earnings and capital expenditures – the treatment of R&D as an operating expense is a prime example. Second, audit firms have been accused of conflicts of interest leading to the abandonment of their oversight responsibility. Finally, the

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[11] Yee, K. K.,, 2006, *Earnings Quality and the Equity Risk Premium: A Benchmark Model*, Contemporary Accounting Research, 23: 833–877.

earnings game, where analysts forecast what firms will earn and firms then try to beat these forecasts has led to the stretching (and breaking) of accounting rules and standards. If earnings have become less informative in the aggregate, it stands to reason that equity investors will demand large equity risk premiums to compensate for the added uncertainty.

Information differences may be one reason why investors demand larger risk premiums in some emerging markets than in others. After all, markets vary widely in terms of transparency and information disclosure requirements. Markets like Russia, where firms provide little (and often flawed) information about operations and corporate governance, should have higher risk premiums than markets like India, where information on firms is not only more reliable but also much more easily accessible to investors. Lau, Ng and Zhang (2011) look at time series variation in risk premiums in 41 countries and conclude that countries with more information disclosure, measured using a variety of proxies, have less volatile risk premiums and that the importance of information is heightened during crises (illustrated using the 1997 Asian financial crisis and the 2008 Global banking crisis).[12]

Liquidity and Fund Flows

In addition to the risk from the underlying real economy and imprecise information from firms, equity investors also have to consider the additional risk created by illiquidity. If investors have to accept large discounts on estimated value or pay high transactions costs to liquidate equity positions, they will be pay less for equities today (and thus demand a large risk premium).

The notion that market for publicly traded stocks is wide and deep has led to the argument that the net effect of illiquidity on aggregate equity risk premiums should be small. However, there are two reasons to be skeptical about this argument. The first is that not all stocks are widely traded and illiquidity can vary widely across stocks; the cost of trading a widely held, large market cap stock is very small but the cost of trading an over-the-counter stock will be much higher. The second is that the cost of illiquidity in the aggregate can vary over time, and even small variations can have significant effects on

[12] Lau. S.T., L. Ng and B. Zhang, 2011, *Information Environment and Equity Risk Premium Volatility around the World*, Management Science, Forthcoming.

equity risk premiums. In particular, the cost of illiquidity seems to increase when economies slow down and during periods of crisis, thus exaggerating the effects of both phenomena on the equity risk premium.

While much of the empirical work on liquidity has been done on cross sectional variation across stocks (and the implications for expected returns), there have been attempts to extend the research to look at overall market risk premiums. Gibson and Mougeot (2004) look at U.S. stock returns from 1973 to 1997 and conclude that liquidity accounts for a significant component of the overall equity risk premium, and that its effect varies over time.[13] Baekart, Harvey and Lundblad (2006) present evidence that the differences in equity returns (and risk premiums) across emerging markets can be partially explained by differences in liquidity across the markets.[14]

Another way of framing the liquidity issue is in terms of funds flows, where the equity risk premium is determined by funds flows into and out of equities. Thus, if more funds are flowing into an equity market, either from other asset classes or other geographies, other things remaining equal, the equity risk premium should decrease, whereas funds flowing out of an equity market will lead to higher equity risk premiums.

Catastrophic Risk

When investing in equities, there is always the potential for catastrophic risk, i.e. events that occur infrequently but can cause dramatic drops in wealth. Examples in equity markets would include the great depression from 1929-30 in the United States and the collapse of Japanese equities in the last 1980s. In cases like these, many investors exposed to the market declines saw the values of their investments drop so much that it was unlikely that they would be made whole again in their lifetimes.[15] While the possibility of catastrophic events occurring may be low, they cannot be ruled out and the equity risk premium has to reflect that risk.

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[13] Gibson R., Mougeot N., 2004, *The Pricing of Systematic Liquidity Risk: Empirical Evidence from the US Stock Market*. Journal of Banking and Finance, v28: 157–78.

[14] Bekaert G., Harvey C. R., Lundblad C., 2006, *Liquidity and Expected Returns: Lessons from Emerging Markets*, The Review of Financial Studies.

[15] An investor in the US equity markets who invested just prior to the crash of 1929 would not have seen index levels return to pre-crash levels until the 1940s. An investor in the Nikkei in 1987, when the index was at 40000, would still be facing a deficit of 50% (even after counting dividends) in 2008,

Rietz (1988) uses the possibility of catastrophic events to justify higher equity risk premiums and Barro (2006) extends this argument. In the latter's paper, the catastrophic risk is modeled as both a drop in economic output (an economic depression) and partial default by the government on its borrowing.[16] Gabaix (2009) extends the Barro-Rietz model to allow for time varying losses in disasters.[17] Barro, Nakamura, Steinsson and Ursua (2009) use panel data on 24 countries over more than 100 years to examine the empirical effects of disasters.[18] They find that the average length of a disaster is six years and that half of the short run impact is reversed in the long term. Investigating the asset pricing implications, they conclude that the consequences for equity risk premiums will depend upon investor utility functions, with some utility functions (power utility, for instance) yielding low premiums and others generating much higher equity risk premiums. Barro and Ursua (2008) look back to 1870 and identify 87 crises through 2007, with an average impact on stock prices of about 22%, and estimate that investors would need to generate an equity risk premium of 7% to compensate for risk taken.[19] Wachter (2012) builds a consumption model, where consumption follows a normal distribution with low volatility most of the time, with a time-varying probability of disasters that explains high equity risk premiums.[20] Barro and Jin(2017) estimate a model with rare events and long run risks, using long term consumption data for 42 countries, and argue that much of the movement in equity risk premiums comes from shifts in the assessed likelihood of rare events.[21]

There have been attempts to measure the likelihood of catastrophic risk and incorporate them into models that predict equity risk premiums. In a series of papers with

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[16] Rietz, T. A., 1988, *The equity premium~: A solution*, Journal of Monetary Economics, v22, 117-131; Barro R J., 2006, *Rare Disasters and Asset Markets in the Twentieth Century*, Quarterly Journal of Economics, August, 823-866.

[17] Gabaix, Xavier, 2012, *Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro-Finance*, The Quarterly Journal of Economics, v127, 645-700.

[18] Barro, R.J. , E. Nakamura, J. Steinsson and J. Ursua, 2009, *Crises and Recoveries in an Empirical Model of Consumption Disasters*, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1594554.

[19] Barro, R.J. and J. Ursua, 2008, Macroeconomic Crises since 1870, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1124864.

[20] Wachter, J.A., 2013, *Can time-varying risk of rare disasters explain aggregate stock market volatility?* Journal of Finance, v68, 987-1035. See also Tsai, J. and J. Wachter, 2015, *Disaster Risk and its Implications for Asset Pricing*, Annual Review of Financial Economics, Vol. 7, pp. 219-252, 2015.

[21] Barro, R.J and T. Jin, 2017, *Rare Events and Long Term Risks*, Working Paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2933697

different co-authors, Bollerslev uses the variance risk premium, i.e., the difference between the implied variance in stock market options and realized variance, as a proxy for expectations of catastrophic risk, and documents a positive correlation with equity risk premiums.[22] Kelly (2012) looks at extreme stock market movements as a measure of expected future jump (catastrophic) risk and finds a positive link between jump risk and equity risk premiums.[23] Guo, Liu, Wang, Zhou and Zuo (2014) refine this analysis by decomposing jumps into bad (negative) and good (positive) ones and find that it is the risk of downside jumps that determines equity risk premiums..[24] Maheu, McCurdy and Zhao (2013) used a time-varying jump-arrival process and a two-component GARCH model on US stock market data from 1926 to 2011, and estimated that each additional jump per year increased the equity risk premium by 0.1062% and that there were, on average, 34 jumps a year, leading to a jump equity risk premium of 3.61%.[25]

The banking and financial crisis of 2008, where financial and real estate markets plunged in the last quarter of the year, has provided added ammunition to this school. As we will see later in the paper, risk premiums in all markets (equity, bond and real estate) climbed sharply during the weeks of the market crisis. In fact, the series of macro crises in the last four years that have affected markets all over the world has led some to hypothesize that the globalization may have increased the frequency and probability of disasters and by extension, equity risk premiums, in all markets.

Government Policy

The prevailing wisdom, at least until 2008, was that while government policy affected equity risk premiums in emerging markets, it was not a major factor in determining equity risk premiums in developed markets. The banking crisis of 2008 and the government responses to it have changed some minds, as both the US government and European

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[22] Bollerslev, T. M., T. H. Law, and G. Tauchen, 2008, *Risk, Jumps, and Diversification*, Journal of Econometrics, 144, 234-256; Bollerslev, T. M., G. Tauchen, and H. Zhou, 2009, *Expected Stock Returns and Variance Risk Premia*, Review of Financial Studies, 101-3, 552-573; Bollerselv, T.M., and V. Todorov, 2011, *Tails, Fears, and Risk Premia*, Journal of Finance, 66-6, 2165-2211.
[23] Kelly, B., 2012, *Tail Risk and Asset Prices*, Working Paper, University of Chicago.
[24] Guo, H., Z. Liu, K. Wang, H. Zhou and H. Zuo, 2014, *Good Jumps, Bad Jumps and Conditional Equity Risk Premium*, Working Paper, SSRN #2516074.
[25] Maheu, J.M., T.H. McCurdy and X. Wang, 2013, *Do Jumps Contribute to the Dynamics of the Equity Premium,* Journal of Financial Economics, v110, 457-477.

governments have made policy changes that at times have calmed markets and at other times roiled them, potentially affecting equity risk premiums.

Pastor and Veronesi (2012) argue that uncertainty about government policy can translate into higher equity risk premiums.[26] The model they develop has several testable implications. First, government policy changes will be more likely just after economic downturns, thus adding policy uncertainty to general economic uncertainty and pushing equity risk premiums upwards. Second, you should expect to see stock prices fall, on average, across all policy changes, with the magnitude of the negative returns increasing for policy changes create more uncertainty. Third, policy changes will increase stock market volatility and the correlation across stocks.

Lam and Zhang (2014) try to capture the potential policy shocks from either an unstable government (government stability) or an incompetent bureaucracy (bureaucracy quality) in 49 countries from 1995 to 2006, using two measures of policy uncertainty drawn from the international country risk guide (ICG). They do find that equity risk premiums are higher in countries with more policy risk from either factor, with more bureaucratic risk increasing the premium by approximately 8%.[27]

Monetary Policy

Do central banks affect equity risk premiums? While the conventional channel for the influence has always been through macro economic variables, i.e., the effects that monetary policy has on inflation and real growth, and through these variables, n equity risk premiums, increased activism on the part of central banks since the 2008 crisis has started on a debate on whether central banking policy can affect equity risk premiums. This has significant policy implications, since the notion that lower interest rates will give rise to higher prices for financial assets and more investment by businesses is built on the predication that equity risk premiums don't change when rates are lowered.

One argument for a feedback effect is that when central banks act aggressively to lower interest rates, using the mechanisms that they control, they send signals to investors

[26] Pástor, L. and P. Veronesi, 2012. *Uncertainty about Government policy and Stock Prices*. Journal of Finance 67: 1219-1264.
[27] Lam, S.S. and W. Zhang, 2014, *Does Policy Uncertainty matter for International Equity Markets?* Working Paper, SSRN #2297133.

and businesses about future growth and perhaps even about future risk in investing. In particular, as central bank move the rates they control to zero and below, markets may push up equity risk premiums and default spreads in bond markets, neutralizing or even countering whatever positive benefits might have been expected to flow from lower rates.

Peng and Zervou (2015) argue that monetary policy rules can have substantial effects on equity risk premiums and that an inflation-targeting policy will create more volatility in equity risk premiums and a higher equity risk premium than alternate rules that generate more stability.[28] The 2008 crisis and the low interest rates that followed in most of the developing markets has rekindled the debate about how much central banks can affect equity risk premiums with interest rate policy. As we will see later in this paper, there is evidence that equity risk premiums have risen since 2008 but much of that rise can be attributed to lower interest rates rather than higher required returns on stocks.

The behavioral/ irrational component

Investors do not always behave rationally, and there are some who argue that equity risk premiums are determined, at least partially, by quirks in human behavior. While there are several strands to this analysis, we will focus on three:

a. The Money Illusion: As equity prices declined significantly and inflation rates increased in the late 1970s, Modigliani and Cohn (1979) argued that low equity values of that period were the consequence of investors being inconsistent about their dealings with inflation. They argued that investors were guilty of using historical growth rates in earnings, which reflected past inflation, to forecast future earnings, but current interest rates, which reflected expectations of future inflation, to estimate discount rates.[29] When inflation increases, this will lead to a mismatch, with high discount rates and low cash flows resulting in asset valuations that are too low (and risk premiums that are too high). In the Modigliani-Cohn model, equity risk premiums will rise in periods when inflation is higher than expected and drop in periods when inflation in lower than expected. Campbell and Voulteenaho

[28] Peng, Y. and A. S. Zervou, 2015, Monetary Policy Rules and the Equity Risk Premium, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2498684.

[29] Modigliani, Franco and Cohn, Richard. 1979, *Inflation, Rational Valuation, and the Market*, Financial Analysts Journal, v37(3), pp. 24-44.

(2004) update the Modigliani-Cohn results by relating changes in the dividend to price ratio to changes in the inflation rate over time and find strong support for the hypothesis.[30]

b. Narrow Framing: In conventional portfolio theory, we assume that investors assess the risk of an investment in the context of the risk it adds to their overall portfolio, and demand a premium for this risk. Behavioral economists argue that investors offered new gambles often evaluate those gambles in isolation, separately from other risks that they face in their portfolio, leading them to over estimate the risk of the gamble. In the context of the equity risk premium, Benartzi and Thaler (1995) use this "narrow framing" argument to argue that investors over estimate the risk in equity, and Barberis, Huang and Santos (2001) build on this theme.[31]

The Equity Risk Premium Puzzle

While many researchers have focused on individual determinants of equity risk premiums, there is a related question that has drawn almost as much attention. Are the equity risk premiums that we have observed in practice compatible with the theory? Mehra and Prescott (1985) fired the opening shot in this debate by arguing that the observed historical risk premiums (which they estimated at about 6% at the time of their analysis) were too high, and that investors would need implausibly high risk-aversion coefficients to demand these premiums.[32] In the years since, there have been many attempts to provide explanations for this puzzle:

1. Statistical artifact: The historical risk premium obtained by looking at U.S. data is biased upwards because of a survivor bias (induced by picking one of the most successful equity markets of the twentieth century). The true premium, it is argued, is much lower. This view is backed up by a study of large equity markets over the twentieth century, which concluded that the historical risk premium is closer to 4%

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[30] Campbell, J.Y. and T. Vuolteenaho, 2004, *Inflation Illusion and Stock Prices,* American Economic Review, v94, 19-23.

[31] Benartzi, S. and R. Thaler, 1995, *Myopic Loss Aversion and the Equity Premium Puzzle*, Quarterly Journal of Economics; Barberis, N., M. Huang, and T. Santos, 2001, *Prospect Theory and Asset Prices*, Quarterly Journal of Economics, v 116(1), 1-53.

[32] Mehra, Rajnish, and Edward C.Prescott, 1985, *The Equity Premium: A Puzzle*, Journal of Monetary Economics, v15, 145–61. Using a constant relative risk aversion utility function and plausible risk aversion coefficients, they demonstrate the equity risk premiums should be much lower (less than 1%).

than the 6% cited by Mehra and Prescott.[33] However, even the lower risk premium would still be too high, if we assumed reasonable risk aversion coefficients.

2. Disaster Insurance: A variation on the statistical artifact theme, albeit with a theoretical twist, is that the observed volatility in an equity market does not fully capture the potential volatility, which could include rare but disastrous events that reduce consumption and wealth substantially. Reitz, referenced earlier, argues that investments that have dividends that are proportional to consumption (as stocks do) should earn much higher returns than riskless investments to compensate for the possibility of a disastrous drop in consumption. Prescott and Mehra (1988) counter than the required drops in consumption would have to be of such a large magnitude to explain observed premiums that this solution is not viable. [34] Berkman, Jacobsen and Lee (2011) use data from 447 international political crises between 1918 and 2006 to create a crisis index and note that increases in the index increase equity risk premiums, with disproportionately large impacts on the industries most exposed to the crisis.[35]
3. Taxes: One possible explanation for the high equity returns in the period after the Second World War is the declining marginal tax rate during that period. McGrattan and Prescott (2001), for instance, provide a hypothetical illustration where a drop in the tax rate on dividends from 50% to 0% over 40 years would cause equity prices to rise about 1.8% more than the growth rate in GDP; adding the dividend yield to this expected price appreciation generates returns similar to the observed equity risk premium.[36] In reality, though, the drop in marginal tax rates was much smaller and cannot explain the surge in equity risk premiums.
4. Alternative Preference Structures: There are some who argue that the equity risk premium puzzle stems from its dependence upon conventional expected utility theory to derive premiums. In particular, the constant relative risk aversion (CRRA)

[33] Dimson, E., P. March and M. Staunton, 2002, *Triumph of the Optimists*, Princeton University Press.
[34] Mehra, R. and E.C. Prescott, 1988, *The Equity Risk Premium: A Solution?* Journal of Monetary Economics, v22, 133-136.
[35] Berkman, H., B. Jacobsen and J. Lee, 2011, *Time-varying Disaster Risk and Stock Returns*, Journal of Financial Economics, v101, 313-332
[36] McGrattan, E.R., and E.C. Prescott. 2001, *Taxes, Regulations, and Asset Prices*, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=292522.

function used by Mehra and Prescott in their paper implies that if an investor is risk averse to variation in consumption across different states of nature at a point in time, he or she will also be equally risk averse to consumption variation across time. Epstein and Zin consider a class of utility functions that separate risk aversion (to consumption variation at a point in time) from risk aversion to consumption variation across time. They argue that individuals are much more risk averse when it comes to the latter and claim that this phenomenon explain the larger equity risk premiums.[37] Put in more intuitive terms, individuals will choose a lower and more stable level of wealth and consumption that they can sustain over the long term over a higher level of wealth and consumption that varies widely from period to period. Constantinides (1990) adds to this argument by noting that individuals become used to maintaining past consumption levels and that even small changes in consumption can cause big changes in marginal utility. The returns on stocks are correlated with consumption, decreasing in periods when people have fewer goods to consume (recessions, for instance); the additional risk explains the higher observed equity risk premiums.[38]

5. Myopic Loss Aversion: Myopic loss aversion refers to the finding in behavioral finance that the loss aversion already embedded in individuals becomes more pronounced as the frequency of their monitoring increases. Thus, investors who receive constant updates on equity values actually perceive more risk in equities, leading to higher risk premiums. The paper that we cited earlier by Benartzi and Thaler yields estimates of the risk premium very close to historical levels using a one-year time horizon for investors with plausible loss aversion characteristics (of about 2, which is backed up by the experimental research).

In conclusion, it is not quite clear what to make of the equity risk premium puzzle. It is true that historical risk premiums are higher than could be justified using conventional utility models for wealth. However, that may tell us more about the dangers of using historical data and the failures of classic utility models than they do about equity risk premiums. In

[37] Epstein, L.G., and S.E. Zin. 1991. *Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: An Empirical Analysis*, Journal of Political Economy, v99, 263–286.
[38] Constantinides, G.M. 1990. *Habit Formation: A Resolution of the Equity Premium Puzzle*, Journal of Political Economy, v98, no. 3 (June):519–543.

fact, the last decade of poor stock returns in the US and declining equity risk premiums may have made the equity risk premium puzzle less of a puzzle, since explaining a historical premium of 4% (the premium in 2011) is far easier than explaining a historical premium of 6% (the premium in 1999).

Estimation Approaches

There are three broad approaches used to estimate equity risk premiums. One is to survey subsets of investors and managers to get a sense of their expectations about equity returns in the future. The second is to assess the returns earned in the past on equities relative to riskless investments and use this historical premium as the expectation. The third is to attempt to estimate a forward-looking premium based on the market rates or prices on traded assets today; we will categorize these as implied premiums.

Survey Premiums

If the equity risk premium is what investors demand for investing in risky assets today, the most logical way to estimate it is to ask these investors what they require as expected returns. Since investors in equity markets number in the millions, the challenge is often finding a subset of investors that best reflects the aggregate market. In practice, se see surveys of investors, managers and even academics, with the intent of estimating an equity risk premium.

Investors

When surveying investors, we can take one of two tacks. The first is to focus on individual investors and get a sense of what they expect returns on equity markets to be in the future. The second is to direct the question of what equities will deliver as a premium at portfolio managers and investment professionals, with the rationale that their expectations should matter more in the aggregate, since they have the most money to invest.

a. Individual Investors: The oldest continuous index of investor sentiment about equities was developed by Robert Shiller in the aftermath of the crash of 1987 and has been updated since.[39] UBS/Gallup has also polled individual investors since 1996 about their

[39] The data is available at http://bit.ly/NcgTW7.

optimism about future stock prices and reported a measure of investor sentiment.[40] While neither survey provides a direct measure of the equity risk premium, they both yield broad measure of where investors expect stock prices to go in the near future. The Securities Industry Association (SIA) surveyed investors from 1999 to 2004 on the expected return on stocks and yields numbers that can be used to extract equity risk premiums. In the 2004 survey, for instance, they found that the median expected return across the 1500 U.S. investors they questioned was 12.8%, yielding a risk premium of roughly 8.3% over the treasury bond rate at that time.[41] While there are services that continue to survey individual investors, they seem to be designed more to capture shifts in sentiments rather than to estimate equity risk premiums.[42]

b. Institutional Investors/ Investment Professionals: Investors Intelligence, an investment service, tracks more than a hundred newsletters and categorizes them as bullish, bearish or neutral, resulting in a consolidated advisor sentiment index about the future direction of equities. Like the Shiller and UBS surveys, it is a directional survey that does not yield an equity risk premium. Merrill Lynch, in its monthly survey of institutional investors globally, explicitly poses the question about equity risk premiums to these investors. In its February 2007 report, for instance, Merrill reported an average equity risk premium of 3.5% from the survey, but that number jumped to 4.1% by March, after a market downturn.[43] As markets settled down in 2009, the survey premium has also settled back to 3.76% in January 2010. Through much of 2010, the survey premium stayed in a tight range (3.85% - 3.90%) but the premium climbed to 4.08% in the January 2012 update. In February 2014, the survey yielded a risk premium of 4.6%, though it may not be directly comparable to the earlier numbers because of changes in the survey.[44]

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[40] The data is available at http://www.ubs.com/us/en/wealth/misc/investor-watch.html

[41] See http://www.sifma.org/research/surveys.aspx. The 2004 survey seems to be the last survey done by SIA. The survey yielded expected stock returns of 10% in 2003, 13% in 2002, 19% in 2001, 33% in 2000 and 30% in 1999.

[42] The American Association of Individual Investors (AAII) surveys investors every week and reports sentiments shifts, http://www.aaii.com/files/surveys/sentiment.xls.

[43] See http://www.ml.com/index.asp?id=7695_8137_47928.

[44] Global Fund Manager Survey, Bank of America Merrill Lynch, February 2014. In more recent surveys, we were unable to find this premium.

While survey premiums have become more accessible, very few practitioners seem to be inclined to use the numbers from these surveys in computations and there are several reasons for this reluctance:

1. Survey risk premiums are responsive to recent stock prices movements, with survey numbers generally increasing after bullish periods and decreasing after market decline. Thus, the peaks in the SIA survey premium of individual investors occurred in the bull market of 1999, and the more moderate premiums of 2003 and 2004 occurred after the market collapse in 2000 and 2001.
2. Survey premiums are sensitive not only to whom the question is directed at but how the question is asked. For instance, individual investors seem to have higher (and more volatile) expected returns on equity than institutional investors and the survey numbers vary depending upon the framing of the question.[45]
3. In keeping with other surveys that show differences across sub-groups, the premium seems to vary depending on who gets surveyed. Kaustia, Lehtoranta and Puttonen (2011) surveyed 1,465 Finnish investment advisors and note that not only are male advisors more likely to provide an estimate but that their estimated premiums are roughly 2% lower than those obtained from female advisors, after controlling for experience, education and other factors.[46]
4. Studies that have looked at the efficacy of survey premiums indicate that if they have any predictive power, it is in the wrong direction. Fisher and Statman (2000) document the negative relationship between investor sentiment (individual and institutional) and stock returns.[47] In other words, investors becoming more optimistic (and demanding a larger premium) is more likely to be a precursor to poor (rather than good) market returns.

As technology aids the process, the number and sophistication of surveys of both individual and institutional investors will also increase. However, it is also likely that these survey premiums will be more reflections of the recent past rather than good forecasts of the future.

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[45] Asking the question "What do you think stocks will do next year?" generates different numbers than asking "What should the risk premium be for investing in stocks?"

[46] Kaustia, M., A. Lehtoranta and V. Puttonen, 2011, *Sophistication and Gender Effects in Financial Advisers Expectations*, Working Paper, Aalto University.

[47] Fisher, K.L., and M. Statman, 2000, *Investor Sentiment and Stock Returns*, Financial Analysts Journal, v56, 16-23.

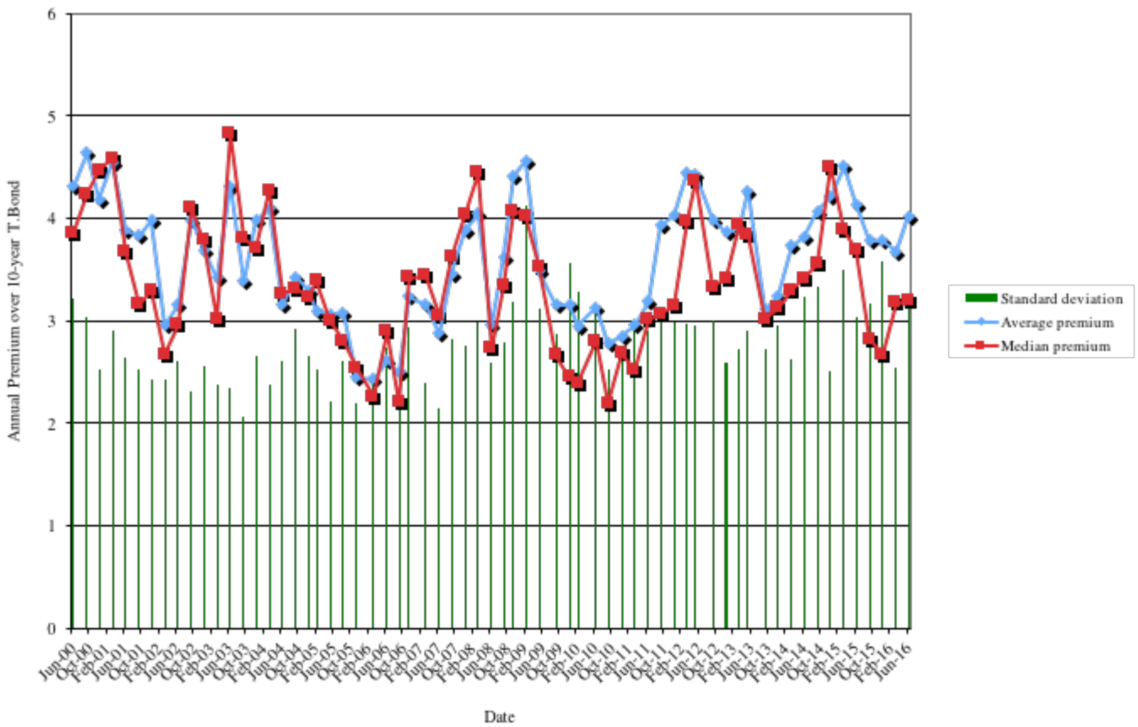
Managers

As noted in the first section, equity risk premiums are a key input not only in investing but also in corporate finance. The hurdle rates used by companies – costs of equity and capital – are affected by the equity risk premiums that they use and have significant consequences for investment, financing and dividend decisions. Graham and Harvey have been conducting annual surveys of Chief Financial Officers (CFOs) or companies for roughly the last decade with the intent of estimating what these CFOs think is a reasonable equity risk premium (for the next 10 years over the ten-year bond rate). In their March 2015 survey, they report an average equity risk premium of 4.51% across survey respondents, up from the average premium of 3.73% a year earlier. The median premium in the June 2016 survey was 3.19%, close to the prior year's value but lower than the numbers in earlier years.[48]

To get a sense of how these assessed equity risk premiums have behaved over time, we have graphed the average and median values of the premium and the cross sectional standard deviation in the estimates in each CFO survey, from 2001 to 2016, in Figure 2.

48 Graham, J.R. and C.R. Harvey, 2016, *The Equity Risk Premium in 2016*, Working paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2816603 . See also Graham, J.R. and C.R. Harvey, 2009, *The Equity Risk Premium amid a Global Financial Crisis*, Working paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1405459.

Figure 2: CFO Survey Premiums



Note the survey premium peak was 4.56% in February 2009, right after the crisis, and had its lowest recording (2.5%) in September 2006. The average across all 15 years of surveys (more than 10,000 responses) was 3.58%, but the standard deviation in the survey responses did increase after the 2008 crisis.

Academics

Most academics are neither big players in equity markets, nor do they make many major corporate finance decisions. Notwithstanding this lack of real world impact, what they think about equity risk premiums may matter for two reasons. The first is that many of the portfolio managers and CFOs that were surveyed in the last two sub-sections received their first exposure to the equity risk premium debate in the classroom and may have been influenced by what was presented as the right risk premium in that setting. The second is that practitioners often offer academic work (textbooks and papers) as backing for the numbers that they use.

Welch (2000) surveyed 226 financial economists on the magnitude of the equity risk premium and reported interesting results. On average, economists forecast an average annual risk premium (arithmetic) of about 7% for a ten-year time horizon and 6-7% for one to five-year time horizons. As with the other survey estimates, there is a wide range on the estimates, with the premiums ranging from 2% at the pessimistic end to 13% at the optimistic end. Interestingly, the survey also indicates that economists believe that their estimates are higher than the consensus belief and try to adjust the premiums down to reflect that view.[49]

Fernandez (2010) examined widely used textbooks in corporate finance and valuation and noted that equity risk premiums varied widely across the books and that the moving average premium has declined from 8.4% in 1990 to 5.7% in 2010.[50] In another survey, Fernandez, Aguirreamalloa and L. Corres (2011) compared both the level and standard deviation of equity risk premium estimates for analysts, companies and academics in the United States:[51]

Group	*Average Equity Risk Premium*	*Standard deviation in Equity Risk Premium estimates*
Academics	5.6%	1.6%
Analysts	5.0%	1.1%
Companies	5.5%	1.6%

The range on equity risk premiums in use is also substantial, with a low of 1.5% and a high of 15%, often citing the same sources. Fenandez, Pizarro and Acin also report survey responses from the same groups (academics, analysts and companies) in 71 countries in 2016` and note that those in emerging markets use higher risk premiums (not surprisingly) than those in developed markets.[52] In a 2015 survey, Fernandez, Ortiz and Acin report big differences in equity risk premiums across analysts within the same country; in the US, for

[49] Welch, I., 2000, *Views of Financial Economists on the Equity Premium and on Professional Controversies*, Journal of Business, v73, 501-537.
[50] Fernandez, P., 2010, *The Equity Premium in 150 Textbooks*, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1473225. He notes that the risk premium actually varies within the book in as many as a third of the textbooks surveyed.
[51] Fernandez, P., J. Aguirreamalloa and L. Corres, 2011, Equity Premium used in 2011 for the USA by Analysts, Companies and Professors: A Survey, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1805852&rec=1&srcabs=1822182.
[52] Fernandez, P., A.O. Pizarro and I.F. Acin, 2016, Market Risk Premium used in 71 countries in 2016, A Survey with 6932 Answers, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2776636

instance, they note that while the average ERP across analysts was 5.8%, the numbers used ranged from 3.2% to 10.5%.[53]

Historical Premiums

While our task is to estimate equity risk premiums in the future, much of the data we use to make these estimates is in the past. Most investors and managers, when asked to estimate risk premiums, look at historical data. In fact, the most widely used approach to estimating equity risk premiums is the historical premium approach, where the actual returns earned on stocks over a long period is estimated, and compared to the actual returns earned on a default-free (usually government security). The difference, on an annual basis, between the two returns is computed and represents the historical risk premium. In this section, we will take a closer look at the approach.

Estimation Questions and Consequences

While users of risk and return models may have developed a consensus that historical premium is, in fact, the best estimate of the risk premium looking forward, there are surprisingly large differences in the actual premiums we observe being used in practice, with the numbers ranging from 3% at the lower end to 12% at the upper end. Given that we are almost all looking at the same historical data, these differences may seem surprising. There are, however, three reasons for the divergence in risk premiums: different time periods for estimation, differences in riskfree rates and market indices and differences in the way in which returns are averaged over time.

1. Time Period

Even if we agree that historical risk premiums are the best estimates of future equity risk premiums, we can still disagree about how far back in time we should go to estimate this premium. For decades, Ibbotson Associates was the most widely used estimation service, reporting stock return data and risk free rates going back to 1926,[54] and Duff and

[53] Fernandez, P., A. Ortiz and I.F. Acin, 2015, Huge dispersion of the Risk-Free Rate and Market Risk Premium used by analysts in USA and Europe in 2015, SSRN Working Paper: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2684740.

[54] Ibbotson Stocks, Bonds, Bills and Inflation Yearbook (SBBI), 2011 Edition, Morningstar.

Phelps now provides the same service[55]. There are other less widely used databases that go further back in time to 1871 or even to 1792.[56]

While there are many analysts who use all the data going back to the inception date, there are almost as many analysts using data over shorter time periods, such as fifty, twenty or even ten years to come up with historical risk premiums. The rationale presented by those who use shorter periods is that the risk aversion of the average investor is likely to change over time, and that using a shorter and more recent time period provides a more updated estimate. This has to be offset against a cost associated with using shorter time periods, which is the greater noise in the risk premium estimate. In fact, given the annual standard deviation in stock returns[57] between 1928 and 2016 of 19.76% (approximated to 20%), the standard error associated with the risk premium estimate can be estimated in table 2 follows for different estimation periods:[58]

Table 2: Standard Errors in Historical Risk Premiums

Estimation Period	*Standard Error of Risk Premium Estimate*
5 years	$20\%/ \sqrt{5} = 8.94\%$
10 years	$20\%/ \sqrt{10} = 6.32\%$
25 years	$20\% / \sqrt{25} = 4.00\%$
50 years	$20\% / \sqrt{50} = 2.83\%$
80 years	$20\% / \sqrt{80} = 2.23\%$

Even using all of the data (about 88 years) yields a substantial standard error of 2.2%. Note that that the standard errors from ten-year and twenty-year estimates are likely to be almost as large or larger than the actual risk premium estimated. This cost of using shorter time

[55] Duff and Phelps, 2015 Valuation Handbook, Industry Cost of Capital.

[56] Siegel, in his book, Stocks for the Long Run, estimates the equity risk premium from 1802-1870 to be 2.2% and from 1871 to 1925 to be 2.9%. (Siegel, Jeremy J., Stocks for the Long Run, Second Edition, McGraw Hill, 1998). Goetzmann and Ibbotson estimate the premium from 1792 to 1925 to be 3.76% on an arithmetic average basis and 2.83% on a geometric average basis. Goetzmann. W.N. and R. G. Ibbotson, 2005, History and the Equity Risk Premium, Working Paper, Yale University. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=702341. You can get stock returns going back to 1871 on Professor Robert Shiller's web site.

[57] For the historical data on stock returns, bond returns and bill returns check under "updated data" in http://www.damodaran.com.

[58] The standard deviation in annual stock returns between 1928 and 2014 is 19.90%; the standard deviation in the risk premium (stock return – bond return) is a little higher at 21.59%. These estimates of the standard error are probably understated, because they are based upon the assumption that annual returns are uncorrelated over time. There is substantial empirical evidence that returns are correlated over time, which would make this standard error estimate much larger. The raw data on returns is provided in Appendix 1.

periods seems, in our view, to overwhelm any advantages associated with getting a more updated premium.

What are the costs of going back even further in time (to 1871 or before)? First, the data is much less reliable from earlier time periods, when trading was lighter and record keeping more haphazard. Second, and more important, the market itself has changed over time, resulting in risk premiums that may not be appropriate for today. The U.S. equity market in 1871 more closely resembled an emerging market, in terms of volatility and risk, than a mature market. Consequently, using the earlier data may yield premiums that have little relevance for today's markets.

There are two other solutions offered by some researchers. The first is to break the annual data down into shorter return intervals – quarters or even months – with the intent of increasing the data points over any given time period. While this will increase the sample size, the effect on the standard error will be minimal.[59] The second is to use the entire data but to give a higher weight to more recent data, thus getting more updated premiums while preserving the data. While this option seems attractive, weighting more recent data will increase the standard error of the estimate. After all, using only the last ten years of data is an extreme form of time weighting, with the data during that period being weighted at one and the data prior to the period being weighted at zero.

2. Riskfree Security and Market Index

The second estimation question we face relates to the riskfree rate. We can compare the expected return on stocks to either short-term government securities (treasury bills) or long term government securities (treasury bonds) and the risk premium for stocks can be estimated relative to either. Given that the yield curve in the United States has been upward sloping for most of the last eight decades, the risk premium is larger when estimated relative to short term government securities (such as treasury bills) than when estimated against treasury bonds.

Some practitioners and a surprising number of academics (and textbooks) use the treasury bill rate as the riskfree rate, with the alluring logic that there is no price risk in a

[59] If returns are uncorrelated over time, the variance in quarterly (monthly) risk premiums will be approximately one-quarter (one twelfth) the variance in annual risk premiums.

treasury bill, whereas the price of a treasury bond can be affected by changes in interest rates over time. That argument does make sense, but only if we are interested in a single period equity risk premium (say, for next year). If your time horizon is longer (say 5 or 10 years), it is the treasury bond that provides the more predictable returns.[60] Investing in a 6-month treasury bill may yield a guaranteed return for the next six months, but rolling over this investment for the next five years will create reinvestment risk. In contrast, investing in a ten-year treasury bond, or better still, a ten-year zero coupon bond will generate a guaranteed return for the next ten years.[61]

The riskfree rate chosen in computing the premium has to be consistent with the riskfree rate used to compute expected returns. Thus, if the treasury bill rate is used as the riskfree rate, the premium has to be the premium earned by stocks over that rate. If the treasury bond rate is used as the riskfree rate, the premium has to be estimated relative to that rate. For the most part, in corporate finance and valuation, the riskfree rate will be a long-term default-free (government) bond rate and not a short-term rate. Thus, the risk premium used should be the premium earned by stocks over treasury bonds.

The historical risk premium will also be affected by how stock returns are estimated. Using an index with a long history, such as the Dow 30, seems like an obvious solution, but returns on the Dow may not be a good reflection of overall returns on stocks. In theory, at least, we would like to use the broadest index of stocks to compute returns, with two caveats. The first is that the index has to be market-weighted, since the overall returns on equities will be tilted towards larger market cap stocks. The second is that the returns should be free of survivor bias; estimating returns only on stocks that have survived that last 80 years will yield returns that are too high. Stock returns should incorporate those equity investments from earlier years that did not make it through the estimation period, either because the companies in question went bankrupt or were acquired.

Finally, there is some debate about whether the equity risk premiums should be computed using nominal returns or real returns. While the choice clearly makes a

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60 For more on risk free rates, see Damodaran, A., 2008, *What is the riskfree rate?* Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1317436.

61 There is a third choice that is sometimes employed, where the short term government security (treasury bills) is used as the riskfree rate and a "term structure spread" is added to this to get a normalized long term rate.

difference, if we estimate the return on stocks or the government security return standing alone, it is less of an issue, when computing equity risk premiums, where we look at the difference between the two values. Put simply, subtracting out the inflation rate from both stock and bond returns each years should yield roughly the same premium as what you would have obtained with the nominal returns.

3. Averaging Approach

The final sticking point when it comes to estimating historical premiums relates to how the average returns on stocks, treasury bonds and bills are computed. The arithmetic average return measures the simple mean of the series of annual returns, whereas the geometric average looks at the compounded return[62]. Many estimation services and academics argue for the arithmetic average as the best estimate of the equity risk premium. In fact, if annual returns are uncorrelated over time, and our objective was to estimate the risk premium for the next year, the arithmetic average is the best and most unbiased estimate of the premium. There are, however, strong arguments that can be made for the use of geometric averages. First, empirical studies seem to indicate that returns on stocks are negatively correlated[63] over time. Consequently, the arithmetic average return is likely to over state the premium. Second, while asset pricing models may be single period models, the use of these models to get expected returns over long periods (such as five or ten years) suggests that the estimation period may be much longer than a year. In this context, the argument for geometric average premiums becomes stronger. Indro and Lee (1997) compare arithmetic and geometric premiums, find them both wanting, and argue for a weighted average, with the weight on the geometric premium increasing with the time horizon.[64]

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[62] The compounded return is computed by taking the value of the investment at the start of the period (Value_0) and the value at the end (Value_N), and then computing the following:

$$\text{Geometric Average} = \left(\frac{\text{Value}_N}{\text{Value}_0}\right)^{1/N} - 1$$

[63] In other words, good years are more likely to be followed by poor years, and vice versa. The evidence on negative serial correlation in stock returns over time is extensive, and can be found in Fama and French (1988). While they find that the one-year correlations are low, the five-year serial correlations are strongly negative for all size classes. Fama, E.F. and K.R. French, 1992, *The Cross-Section of Expected Returns*, Journal of Finance, Vol 47, 427-466.

[64] Indro, D.C. and W. Y. Lee, 1997, *Biases in Arithmetic and Geometric Averages as Estimates of Long-run Expected Returns and Risk Premium*, Financial Management, v26, 81-90.

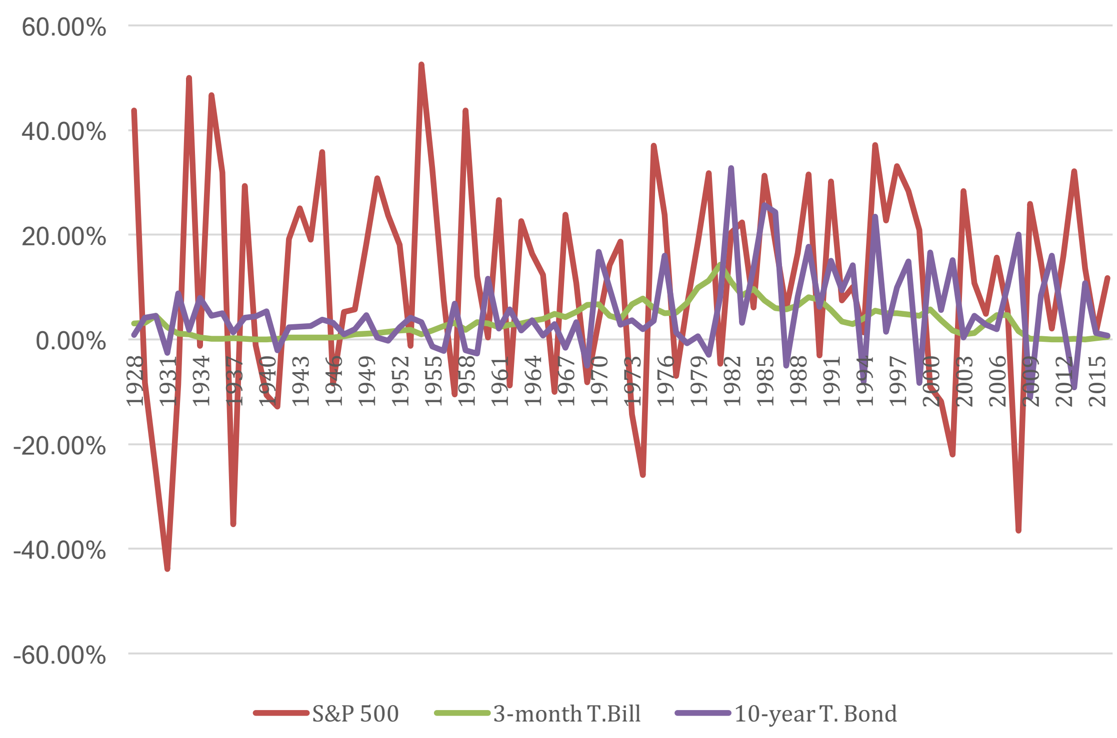
In closing, the averaging approach used clearly matters. Arithmetic averages will be yield higher risk premiums than geometric averages, but using these arithmetic average premiums to obtain discount rates, which are then compounded over time, seems internally inconsistent. In corporate finance and valuation, at least, the argument for using geometric average premiums as estimates is strong.

Estimates for the United States

The questions of how far back in time to go, what risk free rate to use and how to average returns (arithmetic or geometric) may seem trivial until you see the effect that the choices you make have on your equity risk premium. Rather than rely on the summary values that are provided by data services, we will use raw return data on stocks, treasury bills and treasury bonds from 1928 to 2016 to make this assessment.[65] In figure 3, we begin with a chart of the annual returns on stock, treasury bills and bonds for each year:

[65] The raw data for treasury rates is obtained from the Federal Reserve data archive (http://research.stlouisfed.org/fred2/) at the Fed site in St. Louis, with the 3-month treasury bill rate used for treasury bill returns and the 10-year treasury bond rate used to compute the returns on a constant maturity 10-year treasury bond. The stock returns represent the returns on the S&P 500. Appendix 1 provides the returns by year on stocks, bonds and bills, by year, from 1928 through the current year.

Figure 3: Annual Returns - US Stocks, T.Bonds & T.Bills



It is difficult to make much of this data other than to state the obvious, which is that stock returns are volatile, which is at the core of the demand for an equity risk premium in the first place. In table 3, we present summary statistics for stock, 3-month Treasury bill and ten-year Treasury bond returns from 1928 to 2016:

Table 3: Summary Statistics- U.S. Stocks, T. Bills and T. Bonds- 1928-2016

	Stocks	*T. Bills*	*T. Bonds*
Mean	11.42%	3.46%	5.18%
Standard Error	2.09%	0.32%	0.82%
Median	13.52%	3.08%	3.29%
Standard Deviation	19.70%	3.06%	7.76%
Kurtosis	3.01716	3.83519	4.482
Skewness	-0.39716	0.98532	0.9773
Minimum	-43.84%	0.03%	-11.12%
Maximum	52.56%	14.30%	32.81%
25th percentile	-1.19%	0.96%	0.92%

75th percentile	25.06%	5.13%	8.46%

While U.S. equities have delivered much higher returns than treasuries over this period, they have also been more volatile, as evidenced both by the higher standard deviation in returns and by the extremes in the distribution. Using this table, we can take a first shot at estimating a risk premium by taking the difference between the average returns on stocks and the average return on treasuries, yielding a risk premium of 7.96% for stocks over T.Bills (11.42% minus 3.46%) and 6.24% for stocks over T.Bonds (11.42% minus 5.18%). Note, though, that these represent arithmetic average, long-term premiums for stocks over treasuries.

How much will the premium change if we make different choices on historical time periods, riskfree rates and averaging approaches? To answer this question, we estimated the arithmetic and geometric risk premiums for stocks over both treasury bills and bonds over different time periods in table 4, with standard errors reported in brackets below the arithmetic averages:

Table 4: Historical Equity Risk Premiums (ERP) –Estimation Period, Riskfree Rate and Averaging Approach

	Arithmetic Average		*Geometric Average*	
	Stocks - Bills	*Stocks - Bonds*	*Stocks - Bills*	*Stocks - Bonds*
1928-2016	7.96%	6.24%	6.11%	4.62%
	(2.12%)	*(2.26%)*		
1967-2016	6.57%	4.37%	5.25%	3.42%
	(2.39%)	*(2.72%)*		
2007-2016	7.90%	3.62%	6.15%	2.30%
	(6.06%)	*(8.63%)*		

Note that even with only three slices of history considered, the premiums range from 2.30% to 7.96%, depending upon the choices made. If we take the earlier discussion about the "right choices" to heart, and use a long-term geometric average premium over the long-term rate as the risk premium to use in valuation and corporate finance, the equity risk premium that we would use would be 4.62%. The caveats that we would offer, though, are that this estimate comes with significant standard error and is reflective of time periods (such as 1920s and 1930s) when the U.S. equity market (and investors in it) had very different characteristics.

There have been attempts to extend the historical time period to include years prior to 1926, the start of the Ibbotson database. Goetzmann and Jorion (1999) estimate the returns on stocks and bonds between 1792 and 1925 and report an arithmetic average premium, for stocks over bonds, of 2.76% and a geometric average premium of 2.83%.[66] The caveats about data reliability and changing market characteristics that we raised in an earlier section apply to these estimates.

There is one more troublesome (or at least counter intuitive) characteristic of historical risk premiums. The geometric average equity risk premium through the end of 2007 was 4.79%, higher than the 3.88% estimated though the end of 2008; in fact, every single equity risk premium number in this table would have been much higher, if we had stopped with 2007 as the last year. Adding the data for 2008, an abysmal year for stocks and a good year for bonds, lowers the historical premium dramatically, even when computed using a long period of history. In effect, the historical risk premium approach would lead investors to conclude, after one of worst stock market crisis in several decades, that stocks were less risky than they were before the crisis and that investors should therefore demand lower premiums. In contrast, adding the data for 2009, a good year for stocks (+25.94%) and a bad year for bonds (-11.12%) would have increased the equity risk premium from 3.88% to 4.29%. As a general rule, historical risk premiums will tend to rise when markets are buoyant and investors are less risk averse and will fall as markets collapse and investor fears rise.

Pre-tax or Post-tax risk premium?

Is the equity risk premium that you extract from the historical data a pre-tax or a post-tax number? That is a question that seldom gets asked because most analysts who use this premium to come up with costs of equity and capital apply them on corporate valuations, where the cash flows are after corporate taxes. The answer is in the numbers. Since the returns are to equity investors and are based upon dividends and stock price

[66] Jorion, Philippe and William N. Goetzmann, 1999, *Global Stock Markets in the Twentieth Century*, Journal of Finance, 54(3), 953-980.

changes each year, they are returns after corporate taxes but before personal taxes to the investor.

There are cases, though, where it is inappropriate to use the equity risk premium in its unadjusted form to compute discount rates and here are two:

1. Cash flows after personal taxes: There are some cases where investors value companies after personal taxes, arguing that the cash flows that you should be looking at should be after the investor pays taxes on dividends and capital gains. If your cash flows are computed after personal taxes, you have to adjust your discount rate to also make it after personal taxes. To illustrate, consider the historical risk premium of 4.62% computed using historical data on stocks and treasury bonds between 1928 and 2016 and assume that you add this on to the treasury bond rate of 2.45% at the start of 2017 to arrive at a cost of equity of 7.07%. This is your required return as an equity investor, after corporate taxes and before personal taxes. Assume, for simplicity, that dividends and capital gains get taxed at 20%. The post-personal tax return will be lower:
   Post-personal tax cost of equity = 7.07% (1-.20) = 5.66%
   Note that if dividends and capital gains are taxed at different rates, the computation will become a little more complicated and require you to break down your expected return into dividend and price appreciation components. If, for instance, your tax rate on dividends is 40% and that on capital gains is 20%, and the expected dividend yield on stocks is 2%, your post-personal tax cost of equity is:
   Post-personal tax cost of equity = 2.00% (1-.4) + 5.07% (1-.20) = 5.26%
   It is this lower cost of equity that you should be using in discounting post-personal tax cash flows.
2. Cash flows before corporate taxes: There are other cases where investors choose to estimate cash flows before corporate taxes. If that is the case, you have to then adjust the expected returns to make them pre-corporate tax. Here again, the simplest version of this adjustment will use the average corporate tax rate to scale up the required return. Using the average effective tax rate of 25% that US companies paid in 2016, for instance, the pre-corporate tax cost of equity for an average risk US company would be higher than 7.07%:

   Pre-corporate tax cost of equity = 7.07%/ (1-.25) = 9.43%

   If you are discounting pre-corporate tax cash flows, you would use this higher discount rate.

3. Pass Through Entities: The messiest case is when you value entities which are pass-through entities, where the entity pays no tax but the income is taxed at the investor level. That is the case with master limited partnerships (MLPs) and real estate investment trusts (REITs). In these cases, the analyst has to decide whether he or she wants to discount the cash flows at the entity level, with no taxes, and use the pre-corporate tax discount rate (computed in the last section) or use the cash flows at the investor level, in which case the discount rate will need two adjustments, the first one to eliminate the corporate tax effect and the second one to incorporate the individual tax rate. The first adjustment will raise the discount rate and the second one will lower it and the net effect will depend upon the differential tax rate. Thus, for instance, if the individual tax rate is 40% and the corporate tax rate is 25%, the adjusted cost of equity will be as follows:

   Adjusted Cost of equity for post-personal tax cash flows on a pass-through entity

   $$= \frac{\text{Unadjusted Cost of equity } (1 - \text{Personal tax rate})}{(1 - \text{Corporate tax rate})} = \frac{7.07\% \ (1 - .25)}{(1 - .40)} = 5.67\%$$

Global Estimates

If it is difficult to estimate a reliable historical premium for the US market, it becomes doubly so, when looking at markets with short, volatile and transitional histories. This is clearly true for emerging markets, where equity markets have often been in existence for only short time periods (Eastern Europe, China) or have seen substantial changes over the last few years (Latin America, India). It also true for many West European equity markets. While the economies of Germany, Italy and France can be categorized as mature, their equity markets did not share the same characteristics until recently. They tended to be dominated by a few large companies, many businesses remained private, and trading was thin except on a few stocks.

Notwithstanding these issues, services have tried to estimate historical risk premiums for non-US markets with the data that they have available. To capture some of the danger in this practice, Table 5 summarizes historical arithmetic average equity risk premiums for major non-US markets below for 1976 to 2001, and reports the standard error in each estimate:[67]

Table 5: Risk Premiums for non-US Markets: 1976- 2001

Country	*Monthly average*	*Monthly Standard Deviation*	*Equity Risk Premium*	*Standard error*
Canada	0.14%	5.73%	1.69%	3.89%
France	0.40%	6.59%	4.91%	4.48%
Germany	0.28%	6.01%	3.41%	4.08%
Italy	0.32%	7.64%	3.91%	5.19%
Japan	0.32%	6.69%	3.91%	4.54%
UK	0.36%	5.78%	4.41%	3.93%
India	0.34%	8.11%	4.16%	5.51%
Korea	0.51%	11.24%	6.29%	7.64%
Chile	1.19%	10.23%	15.25%	6.95%
Mexico	0.99%	12.19%	12.55%	8.28%
Brazil	0.73%	15.73%	9.12%	10.69%

Before we attempt to come up with rationale for why the equity risk premiums vary across countries, it is worth noting the magnitude of the standard errors on the estimates, largely because the estimation period includes only 25 years. Based on these standard errors, we cannot even reject the hypothesis that the equity risk premium in each of these countries is zero, let alone attach a value to that premium.

If the standard errors on these estimates make them close to useless, consider how much more noise there is in estimates of historical risk premiums for some emerging market equity markets, which often have a reliable history of ten years or less, and very large standard deviations in annual stock returns. Historical risk premiums for emerging markets may provide for interesting anecdotes, but they clearly should not be used in risk and return models.

The survivor bias

Given how widely the historical risk premium approach is used, it is surprising that the flaws in the approach have not drawn more attention. Consider first the underlying assumption that investors' risk premiums have not changed over time and that the average

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[67] Salomons, R. and H. Grootveld, 2003, *The equity risk premium: Emerging vs Developed Markets,* Emerging Markets Review, v4, 121-144.

risk investment (in the market portfolio) has remained stable over the period examined. We would be hard pressed to find anyone who would be willing to sustain this argument with fervor. The obvious fix for this problem, which is to use a more recent time period, runs directly into a second problem, which is the large noise associated with historical risk premium estimates. While these standard errors may be tolerable for very long time periods, they clearly are unacceptably high when shorter periods are used.

Even if there is a sufficiently long time period of history available, and investors' risk aversion has not changed in a systematic way over that period, there is a final problem. Markets such as the United States, which have long periods of equity market history, represent "survivor markets". In other words, assume that one had invested in the largest equity markets in the world in 1926, of which the United States was one.[68] In the period extending from 1926 to 2000, investments in many of the other equity markets would have earned much smaller premiums than the US equity market, and some of them would have resulted in investors earning little or even negative returns over the period. Thus, the survivor bias will result in historical premiums that are larger than expected premiums for markets like the United States, even assuming that investors are rational and factor risk into prices.

How can we mitigate the survivor bias? One solution is to look at historical risk premiums across multiple equity markets across very long time periods. In the most comprehensive attempt of this analysis, Dimson, Marsh and Staunton (2002, 2008) estimated equity returns for 17 markets and obtained both local and a global equity risk premium.[69] In their most recent update in 2017, they provide the risk premiums from 1900 to 2016 for 21 markets, with standard errors on each estimate (reported in table 6):[70]

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[68] Jorion, Philippe and William N. Goetzmann, 1999, *Global Stock Markets in the Twentieth Century*, Journal of Finance, 54(3), 953-980. They looked at 39 different equity markets and concluded that the US was the best performing market from 1921 to the end of the century. They estimated a geometric average premium of 3.84% across all of the equity markets that they looked at, rather than just the US and estimated that the survivor bias added 1.5% to the US equity risk premium (with arithmetic averages) and 0.9% with geometric averages.

[69] Dimson, E., P Marsh and M Staunton, 2002, *Triumph of the Optimists: 101 Years of Global Investment Returns,* Princeton University Press, NJ; Dimson, E.,, P Marsh and M Staunton, 2008, The Worldwide Equity Risk Premium: a smaller puzzle, Chapter 11 in the Handbook of the Equity Risk Premium, edited by R. Mehra, Elsevier.

[70] *Credit Suisse Global Investment Returns Yearbook,* 2017, Credit Suisse/ London Business School. Summary data is accessible at the Credit Suisse website.

Table 6: Historical Risk Premiums across Equity Markets – 1900 – 2016 (in %)

	Stocks minus Short term Governments				*Stocks minus Long term Governments*			
Country	*Geometric Mean*	*Arithmetic Mean*	*Standard Error*	*Standard Deviation*	*Geometric Mean*	*Arithmetic Mean*	*Standard Error*	*Standard Deviation*
Australia	6.0%	7.4%	1.5%	16.4%	5.0%	6.6%	1.7%	18.1%
Austria	5.6%	10.4%	3.5%	37.1%	2.7%	21.4%	14.2%	152.2%
Belgium	3.0%	5.4%	2.2%	23.6%	2.2%	4.3%	1.9%	20.9%
Canada	4.2%	5.6%	1.6%	16.9%	3.4%	5.0%	1.7%	18.2%
Denmark	3.3%	5.2%	1.9%	20.6%	2.1%	3.7%	1.7%	18.0%
Finland	5.9%	9.4%	2.7%	29.6%	5.2%	8.7%	2.8%	29.9%
France	6.2%	8.7%	2.2%	24.0%	3.0%	5.3%	2.1%	22.6%
Germany	6.1%	9.9%	2.9%	31.2%	5.0%	8.4%	2.6%	28.3%
Ireland	3.6%	5.9%	2.0%	21.3%	2.7%	4.7%	1.8%	19.8%
Italy	5.7%	9.5%	2.9%	31.3%	3.1%	6.4%	2.7%	29.2%
Japan	6.2%	9.3%	2.6%	27.5%	5.1%	9.1%	3.0%	32.4%
Netherlands	4.5%	6.6%	2.1%	22.3%	3.2%	5.5%	2.0%	22.1%
New Zealand	4.4%	6.0%	1.7%	18.0%	4.0%	5.5%	1.6%	17.7%
Norway	3.2%	5.9%	2.4%	25.9%	2.4%	5.3%	2.5%	27.5%
Portugal	4.6%	9.2%	3.1%	33.6%	2.7%	7.5%	3.1%	33.0%
South Africa	6.2%	8.2%	2.0%	21.6%	5.3%	7.0%	1.8%	19.5%
Spain	3.3%	5.4%	2.0%	21.5%	1.7%	3.7%	1.9%	20.5%
Sweden	4.0%	6.0%	1.9%	20.3%	3.1%	5.3%	2.0%	21.3%
Switzerland	3.6%	5.3%	1.7%	18.6%	2.0%	3.5%	1.6%	17.4%
U.K.	4.4%	6.1%	1.8%	19.5%	3.6%	4.9%	1.6%	17.1%
U.S.	5.5%	7.4%	1.8%	19.6%	4.3%	6.4%	1.9%	20.8%
Europe	3.3%	5.1%	1.7%	19.1%	3.1%	4.4%	1.5%	16.0%
World-ex U.S.	3.5%	5.1%	1.7%	18.4%	2.8%	3.8%	1.3%	14.5%
World	4.2%	5.6%	1.6%	16.9%	3.2%	4.4%	1.4%	15.5%

Source: Credit Suisse Global Investment Returns Sourcebook, 2016

In making comparisons of the numbers in this table to prior years, note that this database was modified in two ways: the world estimates are now weighted by market capitalization and the issue of survivorship bias has been dealt with frontally by incorporating the return histories of three markets (Austria, China and Russia) where equity investors would have lost their entire investment some time during the last century. Note also that the risk premiums, averaged across the markets, are lower than risk premiums in the United States. For instance, the geometric average risk premium for stocks over long-term government bonds, across the non-US markets, is 2.8%, lower than the 4.3% for the US markets. The results are similar for the arithmetic average premium, with the average premium of 3.8% across non-US markets being lower than the 6.4% for the United States. In effect, the difference in returns captures the survivorship bias, implying that using historical risk premiums based only on US data will results in numbers that are too high for the future. Note that the "noise" problem persists, even with averaging across 21 markets and over 116 years. The standard error in the global equity risk premium estimate is 1.4%, suggesting that the range for the historical premium remains a large one.

Decomposing the historical equity risk premium

As the data to compute historical risk premiums has become richer, those who compute historical risk premiums have also become more creative, breaking down the historical risk premiums into its component parts, partly to understand the drivers of the premiums and partly to get better predictors for the future. Ibbotson and Chen (2013) started this process by breaking down the historical risk premium into four components:[71]

1. The income return is the return earned by stockholders from dividends and stock buybacks.
2. The second is the inflation rate during the estimation time period.
3. The third is the growth rate in real earnings (earnings cleansed of inflation) during the estimation period.
4. The change in PE ratio over the period, since an increase (decrease) in the PE ratio will raise (lower) the realized return on stocks during an estimation period.

Using the argument that the first three are sustainable and generated by "the productivity of corporations in the economy" and the fourth is not, they sum up the first three components to arrive at what they term a "supply-side" equity risk premium.

Following the same playbook, Dimson, Marsh and Staunton decompose the realized equity risk premium from 2000-2016 in each market into three components: the level of dividends, the growth in those dividends and the effects on stock price of a changing multiple for dividend (price to dividend ratio). For the United States, they

[71] Ibbotson, R. and P. Chen, 2003, *Long-Run Stock Returns: Participating in the Real Economy*, Financial Analysts Journal, pp.88-98.

attribute 1.68% of the overall premium of 5.52% (for stocks over treasury bills) to growth in real dividends and 0.44% to expansion in the price to dividend ratio. Of the global premium of 4.20%, 0.51% can be attributed to growth in dividends and 0.45% to increases in the price to dividend ratio.

While there is some value in breaking down a historical risk premium, notice that none of these decompositions remove the basic problems with historical risk premiums, which is that they are backward looking and noisy. Thus, a supply side premium has to come with all of the caveats that a conventional historical premium with the added noise created by the decomposition, i.e., in measuring inflation and real earnings.

Historical Premium Plus

If we accept the proposition that historical risk premiums are the best way to estimate future risk premiums and also come to terms with the statistical reality that we need long time periods of history to get reliable estimates, we are trapped when it comes to estimating risk premiums in most emerging markets, where historical data is either non-existent or unreliable. Furthermore, the equity risk premium that we estimate becomes the risk premium that we use for all stocks within a market, no matter what their differences are on market capitalization and growth potential; in effect, we assume that the betas we use will capture differences in risk across companies.

In this section, we consider one way out of this box, where we begin with the US historical risk premium (4.62%) or the global premium from the DMS data (3.20%) as the base premium for a mature equity market and then build additional premiums for riskier markets or classes of stock. For the first part of this section, we stay within the US equity market and consider the practice of adjusting risk premiums for company-specific characteristics, with market capitalization being the most common example. In the second part, we extend the analysis to look at emerging markets in Asia, Latin American and Eastern Europe, and take a look at the practice of estimating country risk premiums that augment the US equity risk premium. Since many of these markets have significant exposures to political and economic risk, we consider two fundamental questions in this section. The first relates to whether there should be an additional risk premium when valuing equities in these markets, because of the country risk. As we will see, the answer will depend upon whether we think country risk is diversifiable or non-diversifiable, view markets to be open or segmented and whether we believe in a one-factor or a multi-factor model. The second question relates to estimating equity risk premiums for emerging markets. Depending upon our answer to the first question, we will consider several solutions.

Small cap and other risk premiums

In computing an equity risk premium to apply to all investments in the capital asset pricing model, we are essentially assuming that betas carry the weight of measuring the risk in individual firms or assets, with riskier investments having higher betas than safer investments. Studies of the efficacy of the capital asset pricing model over the last three decades have cast some doubt on whether this is a reasonable assumption, finding that the model understates the expected returns of stocks with specific characteristics; small market cap companies and companies low price to book ratios, in particular, seem to earn much higher returns than predicted by the CAPM. It is to counter this finding that many practitioners add an additional premium to the required returns (and costs of equity) of smaller market cap companies.

The CAPM and Market Capitalization

In one of very first studies to highlight the failure of the traditional capital asset pricing model to explain returns at small market cap companies, Banz (1981) looked returns on stocks from 1936-1977 and concluded that investing in the smallest companies (the bottom 20% of NYSE firms in terms of capitalization) would have generated about 6% more, after adjusting for beta risk, than larger cap companies.[72] In the years since, there has been substantial research on both the origins and durability of the small cap premium, with mixed conclusions.

1. It exists globally, but it is more pronounced in developed markets: There is evidence of a small firm premium in markets outside the United States as well. Studies find small cap premiums of about 7% from 1955 to 1984 in the United

[72] Banz, R., 1981, *The Relationship between Return and Market Value of Common Stocks*, Journal of Financial Economics, v9.

Kingdom,[73] 8.8% in France and 3% in Germany,[74] and a premium of 5.1% for Japanese stocks between 1971 and 1988.[75] Dimson, March and Staunton (2017), in their updated assessment of equity risk premiums in global markets, also compute small cap premiums in 23 markets over long time periods (which range from 116 years for some markets to less for others). Of the 23 markets, small cap stocks have not outperformed the rest of the market in only Norway and the Netherlands; the small cap premium, over the long term, has been higher in developed markets than in emerging markets. On average, across the markets, they estimate the small cap premium to be 0.32% a month (or about 3.78% a year).

2. <u>There is a premium over a long history, but it is volatile</u>: While the small cap premium has been persistent in US equity markets, it has also been volatile, with large cap stocks outperforming small cap stocks for extended periods. In figure 4, we look at the difference in returns between small cap (defined as bottom 10% of firms in terms of market capitalization) and all US stocks between 1927 and 2016.[76]

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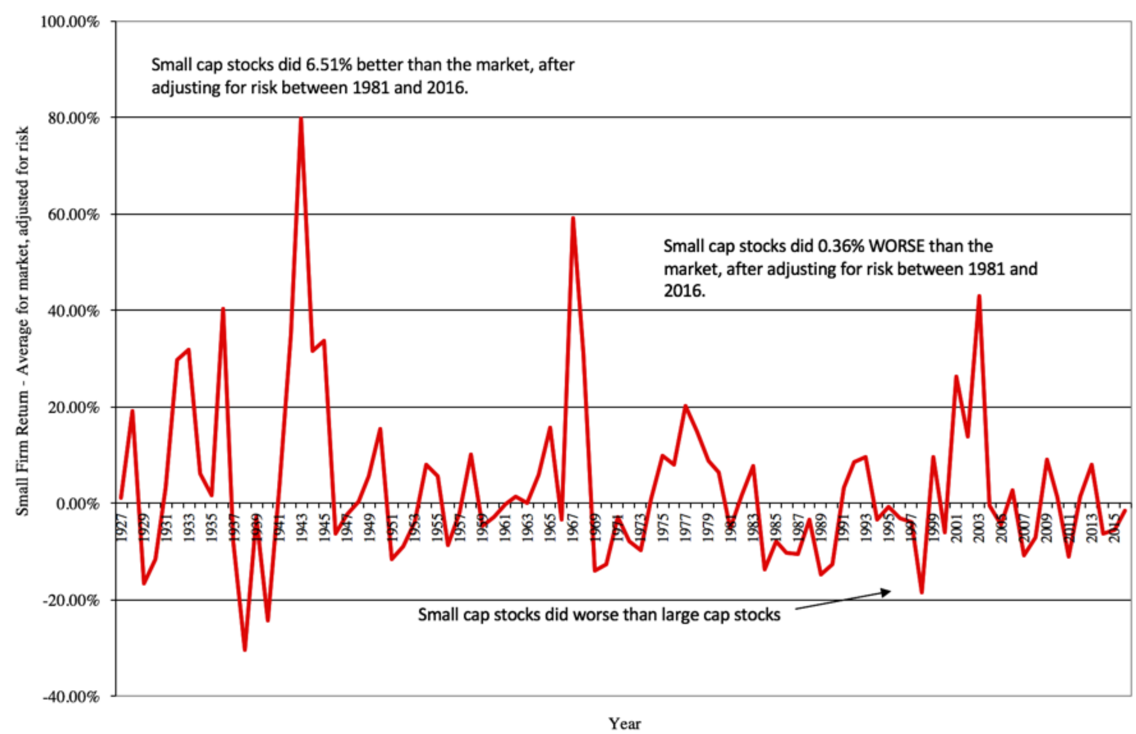
73 Dimson, E. and P.R. Marsh, 1986, *Event Studies and the Size Effect: The Case of UK Press Recommendations*, Journal of Financial Economics, v17, 113-142.

74 Bergstrom,G.L., R.D. Frashure and J.R. Chisholm, 1991, *The Gains from international small-company diversification* in Global Portfolios: Quantiative Strategies for Maximum Performance, Edited By R.Z. Aliber and B.R. Bruce, Business One Irwin, Homewood.

75 Chan, L.K., Y. Hamao, and J. Lakonishok, 1991, *Fundamentals and Stock Returns in Japan*, Journal of Finance. v46. 1739-1789.

76 The raw data for this table is obtained from Professor Ken French's website at Dartmouth. These premiums are based on value weighted portfolios. If equally weighted portfolios are used, the small cap premium is larger.

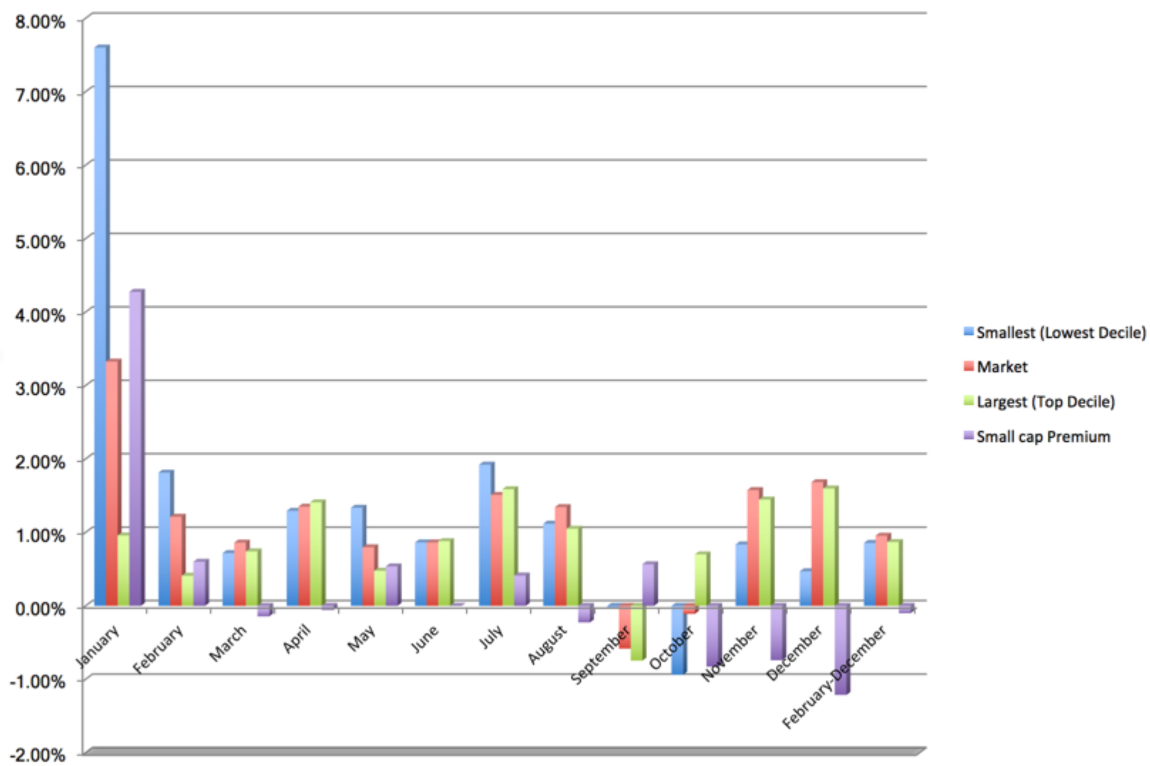
Figure 4: Small Firm Premium over time- 1927 -2016



The average premium for stocks in the smallest companies, in terms of market capitalization, between 1926 and 2016 was 3.76%, but the standard error in that estimate is 1.90%. However, the small cap premium from 1981 to 2016 is -0.36%, though it enjoyed a brief resurgence between 2001 and 2005.

3. <u>It is a January Premium</u>: Much of the premium is generated in one month of the year: January. As Figure 5 shows, eliminating that month from our calculations would essentially dissipate the entire small stock premium. That would suggest that size itself is not the source of risk, since small firms in January remain small firms in the rest of the year, but that the small firm premium, if it exists, comes from some other risk that is more pronounced or prevalent in January than in the rest of the year.

Figure 5: Small Cap Premium by Month of Year - 1926-2016



Source: Raw data from Ken French

Finally, a series of studies have argued that market capitalization, by itself, is not the reason for excess returns but that it is a proxy for other ignored risks such as illiquidity and poor information.

In summary, while the empirical evidence over a very long period supports the notion that small cap stocks have earned higher returns after adjusting for beta risk than large cap stocks, it is not as conclusive, nor as clean as it was initially thought to be. The argument that there is, in fact, no small cap premium and that we have observed over time is just an artifact of history should be given credence.

The Small Cap Premium

If we accept the notion that there is a small cap premium, there are two ways in which we can respond to the empirical evidence that small market cap stocks seem to earn higher returns than predicted by the traditional capital asset pricing model. One is to view this as a market inefficiency that can be exploited for profit: this, in effect, would require us to load up our portfolios with small market cap stocks that would then proceed to deliver higher than expected returns over long periods. The other is to take the excess returns as evidence that betas are inadequate measures of risk and view the additional returns are compensation for the missed risk. The fact that the small cap premium has endured for as long as it has suggests that the latter is the more reasonable path to take.

If CAPM betas understate the true risk of small cap stocks, what are the solutions? The first is to try and augment the model to reflect the missing risk, but this would require being explicit about this risk. For instance, there are models that include additional factors for illiquidity and imperfect information that claim to do better than the CAPM in predicting future returns. The second and simpler solution that is adopted by many practitioners is to add a premium to the expected return (from the CAPM) of small cap stocks. To arrive at this premium, analysts look at historical data on the returns on small cap stocks and the market, adjust for beta risk, and attribute the excess return to the small cap effect. As we noted earlier, using the data from 1926-2015, we would estimate a small cap premium of 3.82%.

Duff and Phelps present a richer set of estimates, where the premiums are computed for stocks in 25 different size classes (with size measured on eight different dimensions including market capitalization, book value and net income). Using the Fama/French data, we present excess returns for firms broken down by ten market value classes in Table 7, with the standard error for each estimate.

Table 7: Excess Returns by Market Value Class: US Stocks from 1927 – 2016

Excess Return = Return on Portfolio – Return on Market

Decile	*Average*	*Standard Error*	*Maximum*	*Minimum*
Smallest	3.76%	1.90%	79.77%	-30.42%
2	1.94%	1.30%	70.44%	-17.87%
3	1.28%	0.63%	25.00%	-16.83%
4	0.80%	0.55%	16.66%	-8.72%
5	0.07%	0.51%	8.98%	-15.99%
6	0.12%	0.49%	11.63%	-13.72%
7	-0.60%	0.55%	7.52%	-22.59%
8	-1.35%	0.77%	10.53%	-30.27%
9	-2.14%	1.03%	22.07%	-40.14%
Largest	-3.88%	1.54%	31.31%	-65.79%

Note that the market capitalization effect shows up at both extremes – the smallest firms earn higher returns than expected whereas the largest firms earn lower returns than expected. The small firm premium is statistically significant only for the lowest and three highest size deciles. In fact, it is the large cap discount that is more pronounced (mathematically and statistically) than the small cap premium.

Perils of the approach

While the small cap premium may seem like a reasonable way of dealing with the failure of the CAPM to capture the risk in smaller companies, there are significant costs to using the approach.

a. Standard Error on estimates: One of the dangers we noted with using historical risk premiums is the high standard error in our estimates. This danger is magnified when we look at sub-sets of stocks, based on market capitalization or any other characteristic, and extrapolate past returns. The standard errors on the small cap premiums that are estimated are likely to be significant, as is evidenced in table 7.
b. Small versus Large Cap: At least in its simplest form, the small cap premium adjustment requires us to divide companies into small market companies and the rest of the market, with stocks falling on one side of the line having much higher required returns (and costs of equity) than stocks falling on the other side.
c. Understanding Risk: Even in its more refined format, where the required returns are calibrated to market cap, using small cap premiums allows analysts to evade basic questions about what it is that makes smaller cap companies riskier, and whether these factors may vary across companies.
d. Small cap companies become large cap companies over time: When valuing companies, we attach high growth rates to revenues, earnings and value over time. Consequently, companies that are small market cap companies now grow to become large market cap companies over time. Consistency demands that we adjust the small cap premium as we go further into a forecast period.
e. Other risk premiums: Using a small cap premium opens the door to other premiums being used to augment expected returns. Thus, we could adjust expected returns upwards for stocks with price momentum and low price to book ratios, reflecting the excess returns that these characteristics seem to deliver, at least on paper. Doing

so will deliver values that are closer to market prices, across assets, but undercuts the rationale for intrinsic valuation, i.e., finding market mistakes.

There is another reason why we are wary about adjusting costs of equity for a small cap effect. If, as is the practice now, we add a small cap premium of between 4% to 5% to the cost of equity of small companies, without attributing this premium to any specific risk factor, we are exposed to the risk of double counting risk. For instance, assume that the small cap premium that we have observed over the last few decades is attributable to the lower liquidity (and higher transactions costs) of trading small cap stocks. Adding that premium on to the discount rate will reduce the estimated values of small cap and private businesses. If we attach an illiquidity discount to this value, we are double counting the effect of illiquidity.

The small cap premium is firmly entrenched in practice, with analysts generally adding on 3% to 5% to the conventional cost of equity for small companies, with the definition of small shifting from analyst to analyst. Even if you believe that small cap companies are more exposed to market risk than large cap ones, this is an extremely sloppy and lazy way of dealing with that risk, since risk ultimately has to come from something fundamental (and size is not a fundamental factor). Thus, if you believe that small cap stocks are more prone to failure or distress, it behooves you to measure that risk directly and incorporate it into the cost of equity. If it is illiquidity that is at the heart of the small cap premium, then you should be measuring liquidity risk and incorporating it into the cost of equity and you certainly should not be double counting the risk by first incorporating a small cap premium into the discount rate and then applying an illiquidity discount to value.

The question of whether there is a small cap premium ultimately is not a theoretical one but a practical one. While those who incorporate a small cap premium justify the practice with the historical data, we will present a more forward-looking approach, where we use market pricing of small capitalization stocks to see if the market builds in a small cap premium, later in this paper.

Country Risk Premiums

As both companies and investors get used to the reality of a global economy, they have also been forced to confront the consequences of globalization for equity risk premiums and hurdle rates. Should an investor putting his money in Indian stocks demand a higher risk premium for investing in equities that one investing in German stocks? Should a US consumer product company investing in Brazil demand the same hurdle rates for its Brazilian investments as it does for its US investments? In effect, should we demand one global equity risk premium that we use for investments all over the world or should we use higher equity risk premiums in some markets than in others?

The arguments for no country risk premium

Is there more risk in investing in a Malaysian or Brazilian stock than there is in investing in the United States? The answer, to most, seems to be obviously affirmative, with the solution being that we should use higher equity risk premiums when investing in riskier emerging markets. There are, however, three distinct and different arguments offered against this practice.

1. Country risk is diversifiable

In the risk and return models that have developed from conventional portfolio theory, and in particular, the capital asset pricing model, the only risk that is relevant for purposes of estimating a cost of equity is the market risk or risk that cannot be diversified away. The key question in relation to country risk then becomes whether the additional risk in an emerging market is diversifiable or non-diversifiable risk. If, in fact, the additional risk of investing in Malaysia or Brazil can be diversified away, then there should be no additional risk premium charged. If it cannot, then it makes sense to think about estimating a country risk premium.

But diversified away by whom? Equity in a publicly traded Brazilian, or Malaysian, firm can be held by hundreds or even thousands of investors, some of whom may hold only domestic stocks in their portfolio, whereas others may have more global exposure. For purposes of analyzing country risk, we look at the marginal investor – the investor most likely to be trading on the equity. If that marginal investor is globally diversified, there is at least the potential for global diversification. If the marginal investor does not have a global portfolio, the likelihood of diversifying away country risk declines substantially. Stulz (1999) made a similar point using different terminology.[77] He differentiated between

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[77] Stulz, R.M., *Globalization, Corporate finance, and the Cost of Capital,* Journal of Applied Corporate Finance, v12. 8-25.

segmented markets, where risk premiums can be different in each market, because investors cannot or will not invest outside their domestic markets, and open markets, where investors can invest across markets. In a segmented market, the marginal investor will be diversified only across investments in that market, whereas in an open market, the marginal investor has the opportunity (even if he or she does not take it) to invest across markets. It is unquestionable that investors today in most markets have more opportunities to diversify globally than they did three decades ago, with international mutual funds and exchange traded funds, and that many more of them take advantage of these opportunities. It is also true still that a significant home bias exists in most investors' portfolios, with most investors over investing in their home markets.

Even if the marginal investor is globally diversified, there is a second test that has to be met for country risk to be diversifiable. All or much of country risk should be country specific. In other words, there should be low correlation across markets. Only then will the risk be diversifiable in a globally diversified portfolio. If, on the other hand, the returns across countries have significant positive correlation, country risk has a market risk component, is not diversifiable and can command a premium. Whether returns across countries are positively correlated is an empirical question. Studies from the 1970s and 1980s suggested that the correlation was low, and this was an impetus for global diversification.[78] Partly because of the success of that sales pitch and partly because economies around the world have become increasingly intertwined over the last decade, more recent studies indicate that the correlation across markets has risen. The correlation across equity markets has been studied extensively over the last two decades and while there are differences, the overall conclusions are as follows:

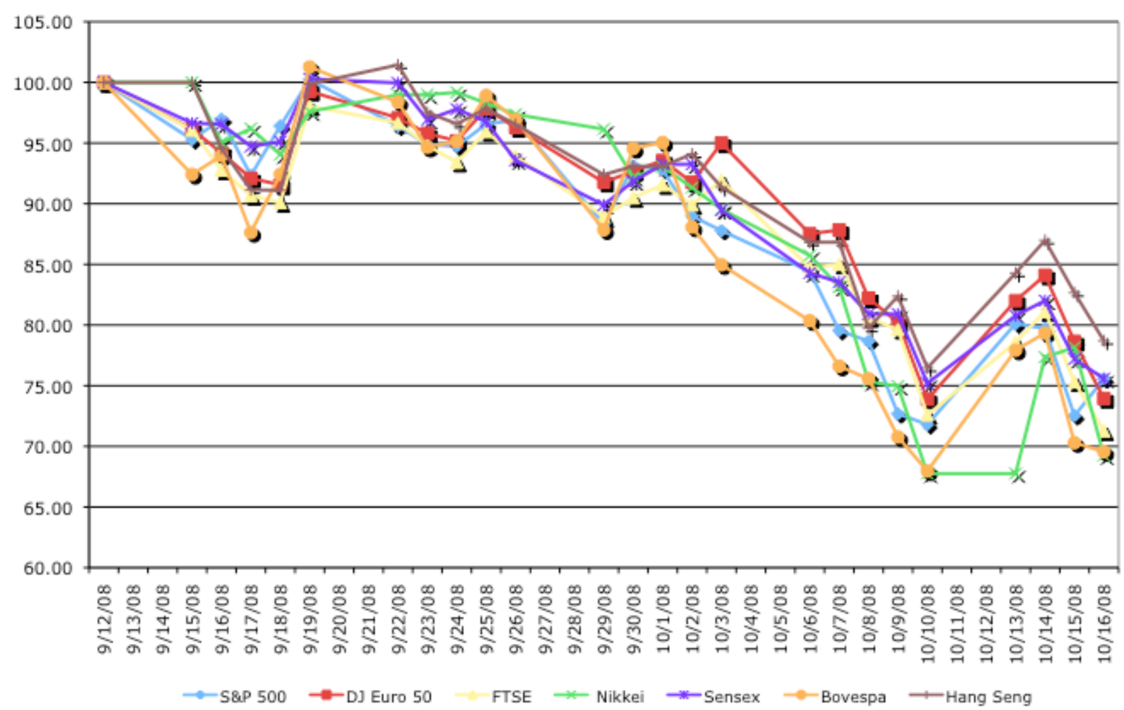
1. <u>The correlation across markets has increased over time</u>, as both investors and firms have globalized. Yang, Tapon and Sun (2006) report correlations across eight, mostly developed markets between 1988 and 2002 and note that the correlation in the 1998-2002 time period was higher than the correlation between 1988 and 1992 in every single market; to illustrate, the correlation between the Hong Kong and US markets increased from 0.48 to 0.65 and the correlation between the UK and the US markets

[78] Levy, H. and M. Sarnat, 1970, *International Diversification of Investment Portfolios*, American Economic Review 60(4), 668-75.

increased from 0.63 to 0.82.[79] In the global returns sourcebook, from Credit Suisse, referenced earlier for historical risk premiums for different markets, the authors estimate the correlation between developed and emerging markets between 1980 and 2013, and note that it has increased from 0.57 in 1980 to 0.88 in 2013.

2. The correlation across equity markets increases during periods of extreme stress or high volatility.[80] This is borne out by the speed with which troubles in one market, say Russia, can spread to a market with little or no obvious relationship to it, say Brazil. The contagion effect, where troubles in one market spread into others is one reason to be skeptical with arguments that companies that are in multiple emerging markets are protected because of their diversification benefits. In fact, the market crisis in the last quarter of 2008 illustrated how closely bound markets have become, as can be seen in figure 6:

Figure 6: The globalization of risk



[79] Yang, Li , Tapon, Francis and Sun, Yiguo, 2006, *International correlations across stock markets and industries: trends and patterns 1988-2002*, Applied Financial Economics, v16: 16, 1171-1183

[80] Ball, C. and W. Torous, 2000, *Stochastic correlation across international stock markets*, Journal of Empirical Finance. v7, 373-388.

Between September 12, 2008 and October 16, 2008, markets across the globe moved up and down together, with emerging markets showing slightly more volatility.

3. The downside correlation increases more than upside correlation: In a twist on the last point, Longin and Solnik (2001) report that it is not high volatility per se that increases correlation, but downside volatility. Put differently, the correlation between global equity markets is higher in bear markets than in bull markets.[81]
4. Globalization increases exposure to global political uncertainty, while reducing exposure to domestic political uncertainty: In the most direct test of whether we should be attaching different equity risk premiums to different countries due to systematic risk exposure, Brogaard, Dai, Ngo and Zhang (2014) looked at 36 countries from 1991-2010 and measured the exposure of companies in these countries to global political uncertainty and domestic political uncertainty.[82] They find that the costs of capital of companies in integrated markets are more highly influenced by global uncertainty (increasing as uncertainty increases) and those in segmented markets are more highly influenced by domestic uncertainty.[83]

2. A Global Capital Asset Pricing Model

The other argument against adjusting for country risk comes from theorists and practitioners who believe that the traditional capital asset pricing model can be adapted fairly easily to a global market. In their view, all assets, no matter where they are traded, should face the same global equity risk premium, with differences in risk captured by differences in betas. In effect, they are arguing that if Malaysian stocks are riskier than US stocks, they should have higher betas and expected returns.

While the argument is reasonable, it flounders in practice, partly because betas do not seem capable of carry the weight of measuring country risk.

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[81] Longin, F. and B. Solnik, 2001, *Extreme Correlation of International Equity Markets*, Journal of Finance, v56 , pg 649-675.

[82] Brogaard, J., L. Dai, P.T.H. Ngo, B. Zhuang, 2014, *The World Price of Political Uncertainty*, SSRN #2488820.

[83] The implied costs of capital for companies in the 36 countries were computed and related to global political uncertainty, measured using the US economic policy uncertainty index, and to domestic political uncertainty, measured using domestic national elections.

1. If betas are estimated against local indices, as is usually the case, the average beta within each market (Brazil, Malaysia, US or Germany) has to be one. Thus, it would be mathematically impossible for betas to capture country risk.
2. If betas are estimated against a global equity index, such as the Morgan Stanley Capital Index (MSCI), there is a possibility that betas could capture country risk but there is little evidence that they do in practice. Since the global equity indices are market weighted, it is the companies that are in developed markets that have higher betas, whereas the companies in small, very risky emerging markets report low betas. Table 8 reports the average beta estimated for the ten largest market cap companies in Brazil, India, the United States and Japan against the MSCI.[84]

Table 8: Betas against MSCI – Large Market Cap Companies

Country	*Average Beta (against local index)*	*Average Beta (against MSCI Global)*
India	0.97	0.83
Brazil	0.98	0.81
United States	0.96	1.05
Japan	0.94	1.03

The emerging market companies consistently have lower betas, when estimated against global equity indices, than developed market companies. Using these betas with a global equity risk premium will lead to lower costs of equity for emerging market companies than developed market companies. While there are creative fixes that practitioners have used to get around this problem, they seem to be based on little more than the desire to end up with higher expected returns for emerging market companies.[85]

3. *Country risk is better reflected in the cash flows*

The essence of this argument is that country risk and its consequences are better reflected in the cash flows than in the discount rate. Proponents of this point of view argue

[84] The betas were estimated using two years of weekly returns from January 2006 to December 2007 against the most widely used local index (Sensex in India, Bovespa in Brazil, S&P 500 in the US and the Nikkei in Japan) and the MSCI Global Equity Index.

[85] There are some practitioners who multiply the local market betas for individual companies by a beta for that market against the US. Thus, if the beta for an Indian chemical company is 0.9 and the beta for the Indian market against the US is 1.5, the global beta for the Indian company will be 1.35 (0.9*1.5). The beta for the Indian market is obtained by regressing returns, in US dollars, for the Indian market against returns on a US index (say, the S&P 500).

that bringing in the likelihood of negative events (political chaos, nationalization and economic meltdowns) into the expected cash flows effectively risk adjusts the cashflows, thus eliminating the need for adjusting the discount rate.

This argument is alluring but it is wrong. The expected cash flows, computed by taking into account the possibility of poor outcomes, is not risk adjusted. In fact, this is exactly how we should be calculating expected cash flows in any discounted cash flow analysis. Risk adjustment requires us to adjust the expected cash flow further for its risk, i.e. compute certainty equivalent cash flows in capital budgeting terms. To illustrate why, consider a simple example where a company is considering making the same type of investment in two countries. For simplicity, let us assume that the investment is expected to deliver $ 90, with certainty, in country 1 (a mature market); it is expected to generate $ 100 with 90% probability in country 2 (an emerging market) but there is a 10% chance that disaster will strike (and the cash flow will be $0). The expected cash flow is $90 on both investments, but only a risk neutral investor would be indifferent between the two. A risk averse investor would prefer the investment in the mature market over the emerging market investment, and would demand a premium for investing in the emerging market.

In effect, a full risk adjustment to the cash flows will require us to go through the same process that we have to use to adjust discount rates for risk. We will have to estimate a country risk premium, and use that risk premium to compute certainty equivalent cash flows.[86]

The arguments for a country risk premium

There are elements in each of the arguments in the previous section that are persuasive but none of them is persuasive enough.

- Investors have become more globally diversified over the last three decades and portions of country risk can therefore be diversified away in their portfolios. However, the significant home bias that remains in investor portfolios exposes investors disproportionately to home country risk, and the increase in correlation

[86] In the simple example above, this is how it would work. Assume that we compute a country risk premium of 3% for the emerging market to reflect the risk of disaster. The certainty equivalent cash flow on the investment in that country would be $90/1.03 = $87.38.

across markets has made a portion of country risk into non-diversifiable or market risk.

- As stocks are traded in multiple markets and in many currencies, it is becoming more feasible to estimate meaningful global betas, but it also is still true that these betas cannot carry the burden of capturing country risk in addition to all other macro risk exposures.
- Finally, there are certain types of country risk that are better embedded in the cash flows than in the risk premium or discount rates. In particular, risks that are discrete and isolated to individual countries should be incorporated into probabilities and expected cash flows; good examples would be risks associated with nationalization or related to acts of God (hurricanes, earthquakes etc.).

After you have diversified away the portion of country risk that you can, estimated a meaningful global beta and incorporated discrete risks into the expected cash flows, you will still be faced with residual country risk that has only one place to go: the equity risk premium.

There is evidence to support the proposition that you should incorporate additional country risk into equity risk premium estimates in riskier markets:

1. <u>Historical equity risk premiums:</u> Donadelli and Prosperi (2011) look at historical risk premiums in 32 different countries (13 developed and 19 emerging markets) and conclude that emerging market companies had both higher average returns and more volatility in these returns between 1988 and 2010 (see table 9).

Table 9: Historical Equity Risk Premiums (Monthly) by Region

Region	*Monthly ERP*	*Standard deviation*
Developed Markets	0.62%	4.91%
Asia	0.97%	7.56%
Latin America	2.07%	8.18%
Eastern Europe	2.40%	15.66%
Africa	1.41%	6.03%

While we remain cautious about using historical risk premiums over short time periods (and 22 years is short in terms of stock market history), the evidence is consistent with the argument that country risk should be incorporated into a larger equity risk premium.[87]

2. Survey premiums: Earlier in the paper, we referenced a paper by Fernandez et al (2014) that surveyed academics, analysts and companies in 88 countries on equity risk premiums. The reported average premiums vary widely across markets and are higher for riskier emerging markets, as can be seen in table 10.

Table 10: Survey Estimates of Equity Risk Premium: By Region

Region	*Number of countries*	*Average*	*Median*
Africa	4	10.28%	9.75%
Developed Markets	21	5.47%	5.28%
Eastern Europe	11	8.32%	8.03%
Emerging Asia	12	7.93%	7.44%
EU Troubled	4	8.95%	9.13%
Latin America	12	9.50%	9.74%
Middle East	7	7.03%	7.03%
Grand Total	**71**	**7.63%**	**7.46%**

Again, while this does not conclusively prove that country risk commands a premium, it does indicate that those who do valuations in emerging market countries seem to act like it does. Ultimately, the question of whether country risk matters and should affect the equity risk premium is an empirical one, not a theoretical one, and for the moment, at least, the evidence seems to suggest that you should incorporate country risk into your discount rates. This could change as we continue to move towards a global economy, with globally diversified investors and a global equity market, but we are not there yet.

Estimating a Country Risk Premium

If country risk is not diversifiable, either because the marginal investor is not globally diversified or because the risk is correlated across markets, we are then left with the task of measuring country risk and considering the consequences for equity risk premiums. In this section, we will consider three approaches that can be used to estimate country risk premiums, all of which build off the historical risk premiums estimated in the

[87] Donadelli, M. and L. Prosperi, 2011, *The Equity Risk Premium: Empirical Evidence from Emerging Markets*, Working Paper, http://ssrn.com/abstract=1893378.

last section. To approach this estimation question, let us start with the basic proposition that the risk premium in any equity market can be written as:

Equity Risk Premium = Base Premium for Mature Equity Market + Country Risk Premium

The country premium could reflect the extra risk in a specific market. This boils down our estimation to estimating two numbers – an equity risk premium for a mature equity market and the additional risk premium, if any, for country risk. To estimate a mature market equity risk premium, we can look at one of two numbers. The first is the historical risk premium that we estimated for the United States, which yielded 4.62% as the geometric average premium for stocks over treasury bonds from 1928 to 2016. If we do this, we are arguing that the US equity market is a mature market, and that there is sufficient historical data in the United States to make a reasonable estimate of the risk premium. The other is the average historical risk premium across global equity markets, approximately 3.2%, that was estimated by Dimson et al (see earlier reference), as a counter to the survivor bias that they saw in using the US risk premium. Consistency would then require us to use this as the equity risk premium, in every other equity market that we deem mature; the equity risk premium in January 2017 would be 4.62% in Germany and Norway, for instance. For markets that are not mature, however, we need to measure country risk and convert the measure into a country risk premium, which will augment the mature market premium.

Measuring Country Risk

There are at least three measures of country risk that we can use. The first is the sovereign rating attached to a country by ratings agencies. The second is to subscribe to services that come up with broader measures of country risk that explicitly factor in the economic, political and legal risks in individual countries. The third is go with a market-based measure such as the volatility in the country's currency or markets.

I. Sovereign Ratings

One of the simplest and most accessible measures of country risk is the rating assigned to a country's debt by a ratings agency (S&P, Moody's and Fitch, among others, all provide country ratings). These ratings measure default risk (rather than equity risk) but they are affected by many of the factors that drive equity risk – the stability of a country's currency, its budget and trade balances and political uncertainty, among other variables[88].

To get a measure of country ratings, consider six countries – Germany, Brazil, China, India, Russia and Greece. In January 2017, the Moody's ratings for the countries are summarized in table 11:

Table 11: Sovereign Ratings in January 2017 – Moody's

Country	*Foreign Currency Rating*	*Local Currency Rating*
Brazil	Ba2	Ba2
China	Aa3	Aa3
Germany	Aaa	Aaa
Greece	Caa3	Caa3
India	Baa3	Baa3
Russia	Ba1	Ba1

What do these ratings tell us? First, the local currency and foreign currency ratings are identical for all of the countries on the list. There are a few countries (not on this list) where the two ratings diverge, and when they do, the local currency ratings tend to be higher (or at worst equal to) the foreign currency ratings for most countries, because a country should be in a better position to pay off debt in the local currency than in a foreign currency. Second, at least based on Moody's assessments at the start of 2017, Germany is the safest company in this group, followed by China, India, Russia, Brazil and Greece, in that order. Third, ratings do change over time. In fact, Brazil's rating moved from B1 in 2001 to Baa2 in 2015, reflecting both strong economic growth and a more robust political system, but it dropped back to Ba2 at the start of 2017, in the midst of political and economic problems. Appendix 2 contains the current ratings – local currency and foreign currency – for the countries that are tracked by Moody's in January 2017.[89]

While ratings provide a convenient measure of country risk, there are costs associated with using them as the only measure. First, ratings agencies often lag markets when it comes to responding to changes in the underlying default risk. The ratings for

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[88] The process by which country ratings are obtained in explained on the S&P web site at http://www.ratings.standardpoor.com/criteria/index.htm.

[89] In a disquieting reaction to the turmoil of the market crisis in the last quarter of 2008, Moody's promoted the notion that Aaa countries were not all created equal and slotted these countries into three groups – resistant Aaa (the stongest), resilient Aaa (weaker but will probably survive intact) and vulnerable Aaa (likely to face additional default risk.

India, according to Moody's, were unchanged from 2004 to 2007, though the Indian economy grew at double-digit rates over that period. Similarly, Greece's ratings did not plummet until the middle of 2011, though their financial problems were visible well before that time. Second, the ratings agency focus on default risk may obscure other risks that could still affect equity markets. For instance, rising commodity (and especially oil) prices pushed up the ratings for commodity supplying countries (like Russia), even though there was little improvement in the rest of the economy. In the same vein, you could argue that the risk in many oil-rich Middle Eastern countries will not be captured in the default risk measure. Finally, not all countries have ratings; much of sub-Saharan Africa, for instance, is unrated as are a host of markets on the front lines of warfare or tumult.

II. Country Risk Scores

Rather than focus on just default risk, as rating agencies do, some services have developed numerical country risk scores that take a more comprehensive view of risk. These risk scores are often estimated from the bottom-up by looking at economic fundamentals in each country. This, of course, requires significantly more information and, as a consequence, most of these scores are available only to commercial subscribers.

The Political Risk Services (PRS) group, for instance, considers political, financial and economic risk indicators to come up with a composite measure of risk (ICRG) for each country that ranks from 0 to 100, with 0 being highest risk and 100 being the lowest risk.[90] Appendix 3 lists countries with their composite country risk measures from the PRS Group in January 2017.[91] Harvey (2005) examined the efficacy of these scores and found that they were correlated with costs of capital, but only for emerging market companies.

The Economist, the business newsmagazine, also operates a country risk assessment unit that measures risk from 0 to 100, with 0 being the least risk and 100 being

[90] The PRS group considers three types of risk – political risk, which accounts for 50% of the index, financial risk, which accounts for 25%, and economic risk, which accounts for the balance. While this table is dated, updated numbers are available for a hefty price. We have used the latest information in the public domain. Some university libraries have access to the updated data. While we have not updated the numbers, out of concerns about publishing proprietary data, you can get the latest PRS numbers by paying $99 on their website (http://www.prsgroup.com).

[91] Harvey, C.R., *Country Risk Components, the Cost of Capital, and Returns in Emerging Markets*, Working paper, Duke University. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=620710.

the most risk. In September 2008, Table 12 the following countries were ranked as least and most risky by their measure:

Table 12: Country Risk Scores – The Economist

Economist.com rankings

Country risk

Selected countries and territories, September 2008 (except where noted)

Least risky

Rank		Score*
1	Switzerland †	12
2	Finland **	14
	Norway **	14
	Sweden ††	14
5	Canada **	17
	Denmark †	17
	Netherlands §	17
8	Germany ††	18
9	Austria **	19
	France ††	19
11	Belgium ††	20
12	Singapore	21
13	Japan **	23
14	Ireland #	24
	Britain	24
	United States †	24

Most risky

Rank		Score
120	Zimbabwe	86
119	Iraq	80
118	Sudan	76
117	Myanmar	75
116	Nicaragua	69
115	Jamaica	68
114	Kenya	66
113	Cuba	64
112	Cambodia	62
111	Côte d'Ivoire	61
	Ecuador	61
	Pakistan	61
	Venezuela	61
	Vietnam	61
106	Syria	60

*Out of 100, with higher numbers indicating more risk. Scores are based on indicators from three categories: currency risk, sovereign debt risk and banking risk.

† May 2008; ** July 2008; †† June 2008; § August 2008; # February 2008

In fact, comparing the PRS and Economist measures of country risk provides some insight into the problems with using their risk measures. The first is that the measures may be internally consistent but are not easily comparable across different services. The Economist, for instance, assigns its lowest scores to the safest countries whereas PRS assigns the highest scores to these countries. The second is that, by their very nature, significant components of these measures have to be black boxes to prevent others from replicating them at no cost. Third, the measures are not linear and the services do not claim that they are; a country with a risk score of 60 in the Economist measure is not twice as risky as a country with a risk score of 30.

III. Market-based Measures

To those analysts who feel that ratings agencies are either slow to respond to changes in country risk or take too narrow a view of risk, there is always the alternative of using market based measures.

- Bond default spread: We can compute a default spread for a country if it has bonds that are denominated in currencies such as the US dollar, Euro or Yen, where there is a riskfree rate to compare it to. In January 2017, for instance, a 10-year US dollar denominated bond issued by the Brazilian government had a yield to maturity of 6.09%, giving it a default spread of 3.64% over the 10-year US treasury bond rate (2.45%), as of the same time.
- Credit Default Swap Spreads: In the last few years, credit default swaps (CDS) markets have developed, allowing us to obtain updated market measures of default risk in different entities. In particular, there are CDS spreads for countries (governments) that yield measures of default risk that are more updated and precise, at least in some cases, than bond default spreads.[92] Table 13 summarizes the CDS spreads for all countries where a CDS spread was available, in January 2017:

Table 13: Credit Default Swap Spreads (in basis points)– January 2017

Country	CDS Spread	Country	CDS Spread	Country	CDS Spread
Abu Dhabi	0.97%	Hungary	1.67%	Peru	1.73%
Argentina	5.14%	Iceland	1.10%	Philippines	1.61%
Australia	0.49%	India	1.76%	Poland	1.17%
Austria	0.52%	Indonesia	2.25%	Portugal	3.42%
Bahrain	3.17%	Ireland	1.02%	Qatar	1.17%
Belgium	0.60%	Israel	1.12%	Romania	1.51%
Brazil	3.59%	Italy	2.22%	Russia	2.46%
Bulgaria	1.87%	Japan	0.62%	Saudi Arabia	1.45%
Chile	1.29%	Kazakhstan	2.13%	Slovakia	0.85%
China	1.65%	Korea	0.67%	Slovenia	1.52%
Colombia	2.42%	Latvia	1.02%	South Africa	2.87%
Costa Rica	3.40%	Lebanon	5.57%	Spain	1.25%
Croatia	2.60%	Lithuania	0.94%	Sweden	0.40%
Cyprus	2.67%	Malaysia	1.94%	Switzerland	0.50%

[92] The spreads are usually stated in US dollar or Euro terms.

Czech Republic	0.74%	Mexico	2.20%	Thailand	1.28%
Denmark	0.41%	Morocco	2.11%	Tunisia	5.00%
Egypt	4.76%	Netherlands	0.51%	Turkey	3.44%
Estonia	0.81%	New Zealand	0.50%	Ukraine	7.64%
Finland	0.45%	Nigeria	5.76%	United Kingdom	0.61%
France	0.70%	Norway	0.34%	United States	0.38%
Germany	0.44%	Pakistan	4.18%	Venezuela	30.82%
Hong Kong	0.58%	Panama	1.94%	Vietnam	2.61%

Source: Bloomberg; Spreads are for 10-year US $ CDS.

In January 2017, for instance, the CDS market yielded a spread of 3.59% for the Brazilian Government, slightly lower than the 3.64% that we obtained from the 10-year dollar denominated Brazilian bond. However, the CDS market does have some counterparty risk exposure and there is no country with a zero CDS spread, indicating either that there is no entity with default risk or that the CDS spread is not a pure default spread. To counter that problem, we netted the US CDS spread of 0.38% from each country's CDS to get a modified measure of country default risk.[93] Using this approach for Brazil, for instance, yields a netted CDS spread of 3.21% (3.59% minus 0.38%) for the country.

- Market volatility: In portfolio theory, the standard deviation in returns is generally used as the proxy for risk. Extending that measure to emerging markets, there are some analysts who argue that the best measure of country risk is the volatility in local stock prices. Stock prices in emerging markets will be more volatile that stock prices in developed markets, and the volatility measure should be a good indicator of country risk. While the argument makes intuitive sense, the practical problem with using market volatility as a measure of risk is that it is as much a function of the underlying risk as it is a function of liquidity. Markets that are risky and illiquid often have low volatility, since you need trading to move stock prices. Consequently, using volatility measures

[93] If we assume that there is default risk in the US, we would subtract the default spread associated with this risk from the 0.67% first, before netting the value against other CDS spreads. Thus, if the default spread for the US is 0.15%, we would subtract out only 0.52% (0.67% - 0.15%) from each country's CDS spread to get to a corrected default spread for that country.

will understate the risk of emerging markets that are illiquid and overstate the risk of liquid markets.

Market-based numbers have the benefit of constant updating and reflect the points of view of investors at any point in time. However, they also are also afflicted with all of the problems that people associate with markets – volatility, mood shifts and at times, irrationality. They tend to move far more than the other two measures – sovereign ratings and country risk scores – sometimes for good reasons and sometimes for no reason at all.

Estimating Country Risk Premium (for Equities)

How do we link a country risk measure to a country risk premium? In this section, we will look at three approaches. The first uses default spreads, based upon country bonds or ratings, whereas the latter two use equity market volatility as an input in estimating country risk premiums.

1. Default Spreads

The simplest and most widely used proxy for the country risk premium is the default spread that investors charge for buying bonds issued by the country. This default spread can be estimated in one of three ways.

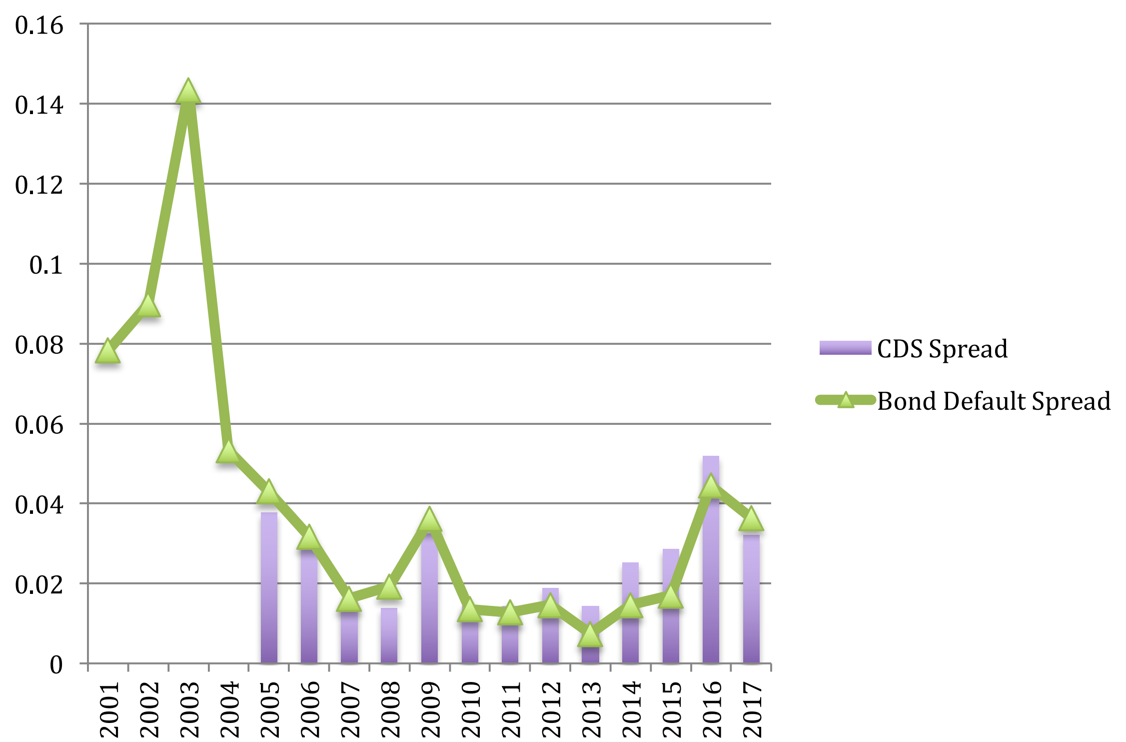
a. <u>Current Default Spread on Sovereign Bond or CDS market</u>: As we noted in the last section, the default spread comes from either looking at the yields on bonds issued by the country in a currency where there is a default free bond yield to which it can be compared or spreads in the CDS market.[94] With the 10-year US dollar denominated Brazilian bond that we cited as an example in the last section, the default spread would have amounted to 3.64% in January 2017: the difference between the interest rate on the Brazilian bond and a treasury bond of the same maturity. The netted CDS market spread on the same day for the default spread was 3.21%. Bekaert, Harvey, Lundblad and Siegel (2014) break down the sovereign bond default spread into four components, including global economic conditions, country-specific economic factors, sovereign bond liquidity and policial risk,

[94] You cannot compare interest rates across bonds in different currencies. The interest rate on a peso bond cannot be compared to the interest rate on a dollar denominated bond.

and find that it is the political risk component that best explain money flows into and out of the country equity markets.[95]

<u>b. Average (Normalized) spread on bond</u>: While we can make the argument that the default spread in the dollar denominated is a reasonable measure of the default risk in Brazil, it is also a volatile measure. In figure 7, we have graphed the yields on the dollar denominated ten-year Brazilian Bond and the U.S. ten-year treasury bond and highlighted the default spread (as the difference between the two yields) from January 2000 to January 2017. In the same figure, we also show the 10-year CDS spreads and those spreads have not only changed over time, but they move with bond default spreads.[96]

Figure 7: Brazil - Bond Default Spread vs Sovereign CDS



Note that the bond default spread widened dramatically during 2002, mostly as a result of uncertainty in neighboring Argentina and concerns about the Brazilian presidential

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[95] Bekaert, G., C.R. Harvey, C.T. Lundblad and S. Siegel, 2014, *Political Risk Spreads*, Journal of International Business Studies, v45, 471-493.

[96] Data for the sovereign CDS market is available only from the last part of 2004.

elections in that year.[97] After those elections, the spreads decreased just as quickly and continued on a downward trend through the middle of last year. Between 2004 and 2013, they stabilized, with a downward trend; they spiked during the market crisis in the last quarter of 2008 but then settled back into pre-crisis levels. From 2014 through 2016, the spreads widened in both markets as the country has been hit with a series of political and corporate scandals before declining again in 2017. Given this volatility, there are some who make the arguments we should consider the average spread over a period of time rather than the default spread at the moment. If we accept this argument, the normalized default spread, using the average spreads over the last 5 years of data would be 2.40% (bond default spread) or 3.05% (CDS spread). Using this approach makes sense only if the economic fundamentals of the country have not changed significantly (for the better or worse) during the period but will yield misleading values, if there have been structural shifts in the economy. In 2008, for instance, it would have made sense to use averages over time for a country like Nigeria, where oil price movements created volatility in spreads over time, but not for countries like China and India, which saw their economies expand and mature dramatically over the period or Venezuela, where government capriciousness made operating private businesses a hazardous activity (with a concurrent tripling in default spreads). In fact, the last year has seen a spike in the Brazilian default spread, partly the result of another election and partly because of worries about political corruption and worse in large Brazilian companies.

<u>c. Imputed or Synthetic Spread</u>: The two approaches outlined above for estimating the default spread can be used only if the country being analyzed has bonds denominated in US dollars, Euros or another currency that has a default free rate that is easily accessible. Most emerging market countries, though, do not have government bonds denominated in another currency and some do not have a sovereign rating. For the first group (that have sovereign rating but no foreign currency government bonds), there are two solutions. If we assume that countries with the similar default risk should have the same sovereign rating, we can use the typical default spread for other countries that have the same rating as the

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[97] The polls throughout 2002 suggested that Lula Da Silva who was perceived by the market to be a leftist would beat the establishment candidate. Concerns about how he would govern roiled markets and any poll that showed him gaining would be followed by an increase in the default spread.

country we are analyzing and dollar denominated or Euro denominated bonds outstanding. Thus, Bulgaria, with a Baa2 rating, would be assigned the same default spread as Colombia, which also had a Baa2 rating in January 2017. For the second group, we are on even more tenuous grounds. Assuming that there is a country risk score from the Economist or PRS for the country, we could look for other countries that are rated and have similar scores and assign the default spreads that these countries face. For instance, we could assume that Brazil and Burkina Faso, which fall within the same score grouping from PRS, have similar country risk; this would lead us to attach Brazil's rating of Ba2 to Burkina Faso (which is not rated) and to use the same default spread (based on this rating) for both countries.

In table 14, we have estimated the typical default spreads for bonds in different sovereign ratings classes in January 2017. One problem that we had in obtaining the numbers for this table is that relatively few emerging markets have dollar or Euro denominated bonds outstanding. Consequently, there were some ratings classes where there was only one country with data and several ratings classes where there were none. To mitigate this problem, we used spreads from the CDS market, referenced in the earlier section. We were able to get default spreads for 65 countries, categorized by rating class, and we averaged the spreads across multiple countries in the same ratings class.[98] An alternative approach to estimating default spread is to assume that sovereign ratings are comparable to corporate ratings, i.e., a Ba1 rated country bond and a Ba1 rated corporate bond have equal default risk. In this case, we can use the default spreads on corporate bonds for different ratings classes. Table 14 summarizes the typical default spreads by sovereign rating class in January 2017, and compares it to the default spreads for similar corporate ratings.

Table 14: Default Spreads by Ratings Class – Sovereign vs. Corporate in January 2017

S&P Rating	Moody's Rating	Sovereign Default Spread	Corporate Default Spread
AAA	Aaa	0.00%	0.60%
AA+	Aa1	0.46%	0.70%
AA	Aa2	0.57%	0.80%
AA-	Aa3	0.70%	0.90%

[98] There were thirteen Baa2 rated countries, with ten-year CDS spreads, in January 2016. The average spread a these countries is 2.11%.

A+	A1	0.81%	1.00%
A	A2	0.98%	1.10%
A-	A3	1.39%	1.25%
BBB+	Baa1	1.84%	1.40%
BBB	Baa2	2.20%	1.60%
BBB-	Baa3	2.54%	2.00%
BB+	Ba1	2.89%	2.50%
BB	Ba2	3.47%	3.00%
BB	Ba3	4.16%	3.25%
B+	B1	5.20%	3.75%
B	B2	6.36%	4.50%
B-	B3	7.51%	5.50%
CCC+	Caa1	8.66%	6.00%
CCC	Caa2	10.40%	6.50%
CCC-	Caa3	11.55%	7.00%
CC+	Ca1	13.86%	7.50%
CC	Ca2	15.25%	8.00%
CC-	Ca3	16.50%	8.75%
C+	C1	18.00%	9.50%
C	C2	20.00%	10.50%
C-	C3	25.00%	12.00%

Source: FRED (Federal Reserve, St. Louis) and Bloomberg

Note that the corporate bond spreads, at least in January 2017, were slightly larger than the sovereign spreads for the higher ratings classes and were lower at the lowest ratings. Using this approach to estimate default spreads for Brazil, with its rating of Ba2 would result in a spread of 3.47% (3.00%), if we use sovereign spreads (corporate spreads). These spreads are roughly equal to the market-based spreads that we estimated for Brazil in the prior approaches, reflecting that ratings agencies have finally caught up with the markets in assessing default risk in Brazil.

Figure 8 depicts the alternative approaches to estimating default spreads for four countries, Brazil, China, India and Poland, in early 2017:

Figure 8: Approaches for estimating Sovereign Default Spreads

Estimating a default spread for a country or sovereign entity

Market Based estimates

Sovereign Bond spread
1. Find a bond issued by the country, denominated in US$ or Euros.
2. Compute the default spread by comparing to US treasury bond (if US $) or German Euro bond (if Euros).

CDS Market
1. Find a 10-year CDS for the country (if one exists)
2. Net out US CDS
2. This is your default spread.

	Sovereign Bond Yield	Currency	Risk free rate	Default Spread	CDS Spread
Brazil	6.09%	US $	2.45%	3.64%	3.21%
China	NA	NA	NA	NA	1.27%
Russia	4.40%	US $	2.45%	1.95%	2.08%
India	NA	NA	NA	NA	1.38%

Rating/Risk score based estimates
Step 1: Find a sovereign rating (local currency) for the country (on Moody's or S&P)
Step 2: Look up the default spread for that rating in the lookup table below:

Moody's	Sovereign Default Spread
Aaa/AAA	0.00%
Aa1/AA+	0.46%
Aa2/AA	0.57%
Aa3/AA-	0.70%
A1/A+	0.81%
A2/A	0.98%
A3/A-	1.39%
Baa1/BBB+	1.84%
Baa2/BBB	2.20%
Baa3/BBB-	2.54%
Ba1/BB+	2.89%
Ba2/BB	3.47%
Ba3/BB-	4.16%
B1/B+	5.20%
B2/B	6.36%
B3/B-	7.51%
Caa1/CCC+	8.66%
Caa2/CCC	10.40%
Caa3/CCC-	11.55%
Ca1/CC+	13.86%
Ca2/CC	15.25%
Ca3/CC-	16.50%
C1/C+	18.00%
C2/C	20.00%
C3/C-	25.00%

	Rating	Spread
Brazil	Ba2	3.47%
China	Aa3	0.70%
Russia	Ba1	2.89%
India	Baa3	2.54%

With some countries, without US-dollar (or Euro) denominated sovereign bonds or CDS spreads, you don't have a choice since the only estimate of the default spread comes from the sovereign rating. With some countries, such as Brazil, you have multiple estimates of the default spreads: 3.64% from the dollar denominated bond, 3.59% from the CDS spread, 3.21% from the netted CDS spread and 3.47% from the sovereign rating look up table (table 14). When the numbers they yield for Brazil are similar, we get a default spread of 2.89% from the rating-based spread) and much smaller using the market-based approaches. When this occurs, you have to choose between the "updated but noisy" market numbers and the "stable but stagnant" rating-based spread.

Analysts who use default spreads as measures of country risk typically add them on to both the cost of equity and debt of every company traded in that country. Thus, the cost of equity for an Indian company, estimated in U.S. dollars, will be 2.54% higher than the cost of equity of an otherwise similar U.S. company, using the January 2017 measure of the default spread, based upon the rating. In some cases, analysts add the default spread to the U.S. risk premium and multiply it by the beta. This increases the cost of equity for high beta companies and lowers them for low beta firms.[99]

While many analysts use default spreads as proxies for country risk, the evidence for its use is still thin. Abuaf (2011) examines ADRs from ten emerging markets and relates the returns on these ADRs to returns on the S&P 500 (which yields a conventional beta) and to the CDS spreads for the countries of incorporation. He finds that ADR returns as well as multiples (such as PE ratios) are correlated with movement in the CDS spreads over time and argues for the addition of the CDS spread (or some multiple of it) to the costs of equity and capital to incorporate country risk.[100]

2. Relative Equity Market Standard Deviations

There are some analysts who believe that the equity risk premiums of markets should reflect the differences in equity risk, as measured by the volatilities of these markets. A conventional measure of equity risk is the standard deviation in stock prices; higher standard deviations are generally associated with more risk. If you scale the standard deviation of one market against another, you obtain a measure of relative risk. For instance, the relative standard deviation for country X (against the US) would be computed as follows:

$$\text{Relative Standard Deviation}_{\text{Country X}} = \frac{\text{Standard Deviation}_{\text{Country X}}}{\text{Standard Deviation}_{\text{US}}}$$

If we assume a linear relationship between equity risk premiums and equity market standard deviations, and we assume that the risk premium for the US can be computed (using historical data, for instance) the equity risk premium for country X follows:

$$\text{Equity risk premium}_{\text{Country X}} = \text{Risk Premum}_{\text{US}} * \text{Relative Standard Deviation}_{\text{Country X}}$$

Assume, for the moment, that you are using an equity risk premium for the United States of 5.69%. The annualized standard deviation in the S&P 500 in the 260 trading days leading

[99] In a companion paper, I argue for a separate measure of company exposure to country risk called lambda that is scaled around one (just like beta) that is multiplied by the country risk premium to estimate the cost of equity. See Damodaran, A., 2007, Measuring Company Risk Exposure to Country Risk, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=889388.

[100] Abuaf, N., 2011, *Valuing Emerging Market Equities – The Empirical Evidence*, Journal of Applied Finance, v21, 123-138.

into March 2017, using weekly returns, was 10.12%, whereas the standard deviation in the Bovespa (the Brazilian equity index) over the same period was 21.22%.[101] Using these values, the estimate of a total risk premium for Brazil would be as follows.

$$\text{Equity Risk Premium}_{Brazil} = 5.69\% * \frac{21.22\%}{10.12\%} = 11.93\%$$

The country risk premium for Brazil can be isolated as follows:

$$\text{Country Risk Premium}_{Brazil} = 11.93\% - 5.69\% = 6.24\%$$

Table 15 lists country volatility numbers for some of the Latin American markets and the resulting total and country risk premiums for these markets, based on the assumption that the equity risk premium for the United States is 5.69%. Appendix 4 contains a more complete list of emerging markets, with equity risk premiums and country risk premiums estimated for each.

Table 15: Equity Market Volatilities and Risk Premiums (Weekly returns: Jan 1, 2014-Jan 1, 2017): Latin American Countries, relative to US

Country	*Annualized Stock Market Volatility*	*Relative Volatility (to US)*	*Total Equity Risk Premium*	*Country risk premium*
Argentina	26.67%	2.64	15.00%	9.31%
Brazil	21.22%	2.10	11.93%	6.24%
Chile	11.08%	1.09	6.23%	0.54%
Colombia	11.62%	1.15	6.53%	0.84%
Costa Rica	7.28%	0.72	4.09%	-1.60%
Mexico	13.54%	1.34	7.61%	1.92%
Panama	5.03%	0.50	2.83%	-2.86%
Peru	16.54%	1.63	9.30%	3.61%
US	10.12%	1.00	**5.69%**	**0.00%**
Venezuela	43.37%	4.29	24.38%	18.69%

While this approach has intuitive appeal, there are problems with using standard deviations computed in markets with widely different market structures and liquidity. Since equity market volatility is affected by liquidity, with more liquid markets often showing higher volatility, this approach will understate premiums for illiquid markets and overstate the

[101] If the dependence on historical volatility is troubling, the options market can be used to get implied volatilities for both the US market (14.16%) and for the Bovespa (24.03%).

premiums for liquid markets. For instance, the standard deviations for Panama and Costa Rica are lower than the standard deviation in the S&P 500, leading to equity risk premiums for those countries that are lower than the US. The second problem is related to currencies since the standard deviations are usually measured in local currency terms; the standard deviation in the U.S. market is a dollar standard deviation, whereas the standard deviation in the Brazilian market is based on nominal Brazilian Real returns. This is a relatively simple problem to fix, though, since the standard deviations can be measured in the same currency – you could estimate the standard deviation in dollar returns for the Brazilian market.

3. Default Spreads + Relative Standard Deviations

In the first approach to computing equity risk premiums, we assumed that the default spreads (actual or implied) for the country were good measures of the additional risk we face when investing in equity in that country. In the second approach, we argued that the information in equity market volatility can be used to compute the country risk premium. In the third approach, we will meld the first two, and try to use the information in both the country default spread and the equity market volatility.

The country default spreads provide an important first step in measuring country equity risk, but still only measure the premium for default risk. Intuitively, we would expect the country equity risk premium to be larger than the country default risk spread. To address the issue of how much higher, we look at the volatility of the equity market in a country relative to the volatility of the bond market used to estimate the spread. This yields the following estimate for the country equity risk premium.

$$\text{Country Risk Premium=Country Default Spread*}\left(\frac{\sigma_{\text{Equity}}}{\sigma_{\text{Country Bond}}}\right)$$

To illustrate, consider again the case of Brazil. As noted earlier, the default spread for Brazil in January 2017, based upon its sovereign rating, was 3.47%. We computed annualized standard deviations, using two years of weekly returns, in both the equity market and the government bond, in January 2016. The annualized standard deviation in the Brazilian dollar denominated ten-year bond was 10.01%, well below the standard deviation in the Brazilian equity index of 21.22%. The resulting country equity risk premium for Brazil is as follows:

$$\text{Brazil Country Risk Premium} = 3.47\% * \frac{21.22\%}{10.01\%} = 7.35\%$$

Unlike the equity standard deviation approach, this premium is in addition to a mature market equity risk premium. Thus, assuming a 5.69% mature market premium, we would compute a total equity risk premium for Brazil of 13.04%:

Brazil's Total Equity Risk Premium = 5.69% + 7.35% = 13.04%

Note that this country risk premium will increase if the country rating drops or if the relative volatility of the equity market increases.

Why should equity risk premiums have any relationship to country bond spreads? A simple explanation is that an investor who can make 3.47% risk premium on a dollar-denominated Brazilian government bond would not settle for an additional risk premium of 3.47% (in dollar terms) on Brazilian equity. Playing devil's advocate, however, a critic could argue that the interest rate on a country bond, from which default spreads are extracted, is not really an expected return since it is based upon the promised cash flows (coupon and principal) on the bond rather than the expected cash flows. In fact, if we wanted to estimate a risk premium for bonds, we would need to estimate the expected return based upon expected cash flows, allowing for the default risk. This would result in a lower default spread and equity risk premium. Both this approach and the last one use the standard deviation in equity of a market to make a judgment about country risk premium, but they measure it relative to different bases. This approach uses the country bond as a base, whereas the previous one uses the standard deviation in the U.S. market. This approach assumes that investors are more likely to choose between Brazilian bonds and Brazilian equity, whereas the previous approach assumes that the choice is across equity markets.

There are three potential measurement problems with using this approach. The first is that the relative standard deviation of equity is a volatile number, both across countries and across time. The second is that computing the relative volatility requires us to estimate volatility in the government bond, which, in turn, presupposes that long-term government bonds not only exist but are also traded.[102] The third is that even if an emerging market

[102] One indication that the government bond is not heavily traded is an abnormally low standard deviation on the bond yield.

meet the conditions of having a government bond that is traded, the trading is often so light that the standard deviation is too low (and the relative volatility value is too high). To illustrate the volatility in this number, note the range of values in the estimates of relative volatility at the start of 2017:

Table 16: Relative Equity Market Volatility – Government Bonds and CDS

	$\sigma_{Equity} / \sigma_{Bond}$	$\sigma_{Equity} / \sigma_{CDS}$
Number of countries with data	40	46
Average	2.05	1.02
Median	2.09	0.72
Maximum	3.70	4.69
Minimum	0.33	0.06

Note that there were only 40 markets where volatility estimates on government bonds were available, and even in those markets, the relative volatility measure ranged from a high of 3.70 to a low of 0.33. In many the markets where volatility measures are available, the government bond is so thinly traded to make it an unreliable value. There is some promise in the sovereign CDS market, both because you have more countries where you have traded CDS, but also because it is a more volatile market. In fact, the relative volatility measure there has a median value less than one, but the range in relative equity volatility values is even higher.

The problems associated with computing country-specific government bond or sovereign CDS volatility are increasingly overwhelming its intuitive appeal and it is worth looking at two alternatives.[103] One is to revert back to the first approach of using the default spreads as country risk premiums. The other is to compare the standard deviation of an emerging market equity index and that of an emerging market government bond index and to use this use this ratio as the scaling variable for all emerging market default spreads. While there will be some loss of information at the country level, the use of indices should allow for aggregation across multiple countries and perhaps give a more reliable and stable measure of relative risk in equity markets. To this end, we computed the standard deviations in the S&P BMI Emerging Market Index (for equity) and the Bank of America

103 Thanks are due to the Value Analysis team at Temasek, whose detailed and focused work on the imprecision of government bond volatility finally led to this break.

Merrill Lynch Emerging Market Public Sector Bond Index (for sovereign debt) as of January 1, 2017, and computed a relative equity market volatility of 1.23:

$$\text{Relative Equity Volatility}_{EM} = \frac{\textit{Standard Deviation of S\&P BMI Emerging Markets}}{\textit{Standard Deviation of BAML Emerging Market Public Bonds}}$$

$$= 14.12\%/\ 11.48\% = 1.23$$

Applying this multiple to each country's default spread, you can estimate a country risk premium for that country, which when added on to the base premium for a mature market should yield an equity risk premium for that country. In fact, with this multiple applied to Brazil's default spread of 3.47% in January 2017, you would have obtained a country risk premium of 4.27% for Brazil and a total equity risk premium of 9.96% (using 5.69% as the estimate for a mature market premium).

Country Risk Premium for Brazil = 3.47% *1.23 = 4.27%

Equity Risk Premium for Brazil = 5.69% + 4.27% = 9.96%

Choosing between the approaches

It is ironic that as investors and companies go global, our approaches for dealing with country risk remain unpolished. Each of the approaches described in this section come with perils and can yield very different values. Table 17 summarizes the estimates of country risk and total equity risk premiums, using the three approaches, with sub-variants, for Brazil in January 2017:

Table 17: Country and Total Equity Risk Premium: Brazil in January 2017

Approach	*ERP*	*CRP*
Rating-based Default Spread	9.16%	3.47%
$-Bond based Default Spread	9.33%	3.64%
CDS-based Default Spread	8.90%	3.21%
Relative Equity Market Volatility	11.93%	6.24%
Default Spread, scaled for equity risk with Brazil Govt Bond	13.04%	7.35%
Default Spread, scaled for equity risk with EM multiple	9.96%	4.27%

The default-spread based approaches yield similar equity risk premiums, but the approaches that scale standard deviations (to either equity or the government bond) yield much higher values. With all the approaches, just as companies mature and become less risky over time, countries can mature and become less risky as well and it is reasonable to assume that country risk premiums decrease over time, especially for risky and rapidly evolving markets. One way to adjust country risk premiums over time is to begin with the premium that emerges from the melded approach and to adjust this premium down towards either the country bond default spread or even a regional average. Thus, the equity risk premium will converge to the country bond default spread as we look at longer term expected returns. As an illustration, the country risk premium for Brazil would be 4.27% for the next year but decline over time to 3.47% (country default spread) or perhaps even lower, depending upon your assessment of how Brazil's economy will evolve over time.

Implied Equity Premiums

The problem with any historical premium approach, even with substantial modifications, is that it is backward looking. Given that our objective is to estimate an updated, forward-looking premium, it seems foolhardy to put your faith in mean reversion and past data. In this section, we will consider three approaches for estimating equity risk premiums that are more forward looking.

1. DCF Model Based Premiums

When investors price assets, they are implicitly telling you what they require as an expected return on that asset. Thus, if an asset has expected cash flows of $15 a year in perpetuity, and an investor pays $75 for that asset, he is announcing to the world that his required rate of return on that asset is 20% (15/75). In this section, we expand on this intuition and argue that the current market prices for equity, in conjunction with expected cash flows, should yield an estimate on the equity risk premium.

A Stable Growth DDM Premium

It is easiest to illustrated implied equity premiums with a dividend discount model (DDM). In the DDM, the value of equity is the present value of expected dividends from the investment. In the special case where dividends are assumed to grow at a constant rate forever, we get the classic stable growth (Gordon) model:

$$\text{Value of equity} = \frac{\text{Expected Dividends Next Period}}{(\text{Required Return on Equity - Expected Growth Rate})}$$

This is essentially the present value of dividends growing at a constant rate. Three of the four inputs in this model can be obtained or estimated - the current level of the market (value), the expected dividends next period and the expected growth rate in earnings and dividends in the long term. The only "unknown" is then the required return on equity; when we solve for it, we get an implied expected return on stocks. Subtracting out the riskfree rate will yield an implied equity risk premium.

To illustrate, assume that the current level of the S&P 500 Index is 900, the expected dividend yield on the index is 2% and the expected growth rate in earnings and dividends in the long term is 7%. Solving for the required return on equity yields the following:

$$900 = (.02*900) /(r - .07)$$

Solving for r,

$$r = (18+63)/900 = 9\%$$

If the current riskfree rate is 6%, this will yield a premium of 3%.

In fact, if we accept the stable growth dividend discount model as the base model for valuing equities and assume that the expected growth rate in dividends should equate to the riskfree rate in the long term, the dividend yield on equities becomes a measure of the equity risk premium:

$$\text{Value of equity} = \frac{\text{Expected Dividends Next Period}}{(\text{Required Return on Equity - Expected Growth Rate})}$$

Dividends/ Value of Equity = Required Return on Equity – Expected Growth rate

Dividend Yield = Required Return on Equity – Riskfree rate

= Equity Risk Premium

Rozeff (1984) made this argument[104] and empirical support has been claimed for dividend yields as predictors of future returns in many studies since.[105] Note that this simple equation will break down if (a) companies do not pay out what they can afford to in dividends, i.e., they hold back cash or (b) if earnings are expected to grow at extraordinary rates for the short term.

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[104] Rozeff, M. S. 1984. *Dividend yields are equity risk premiums*, Journal of Portfolio Management, v11, 68-75.

[105] Fama, E. F., and K. R. French. 1988. *Dividend yields and expected stock returns*. Journal of Financial Economics, v22, 3-25.

There is another variant of this model that can be used, where we focus on earnings instead of dividends. To make this transition, though, we have to state the expected growth rate as a function of the payout ratio and return on equity (ROE) :[106]

Growth rate = (1 – Dividends/ Earnings) (Return on equity)

= (1 – Payout ratio) (ROE)

Substituting back into the stable growth model,

$$\text{Value of equity} = \frac{\text{Expected Earnings Next Period (Payout ratio)}}{\text{(Required Return on Equity - (1-Payout ratio) (ROE))}}$$

If we assume that the return on equity (ROE) is equal to the required return on equity (cost of equity), i.e., that the firm does not earn excess returns, this equation simplifies as follows:

$$\text{Value of equity} = \frac{\text{Expected Earnings Next Period}}{\text{Required Return on Equity}}$$

In this case, the required return on equity can be written as:

$$\text{Required return on equity} = \frac{\text{Expected Earnings Next Period}}{\text{Value of Equity}}$$

In effect, the inverse of the PE ratio (also referenced as the earnings yield) becomes the required return on equity, <u>if firms are in stable growth and earning no excess returns</u>. Subtracting out the riskfree rate should yield an implied premium:

Implied premium (EP approach) = Earnings Yield on index – Riskfree rate

In January 2015, the first of these approaches would have delivered a very low equity risk premium for the US market.

Dividend Yield = 1.87%

The second approach of netting the earnings yield against the risk free rate would have generated a more plausible number[107]:

Earnings Yield = 5.57%:

Implied premium = Earnings yield – 10-year US Treasury Bond rate

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106 This equation for sustainable growth is discussed more fully in Damodaran, A., 2002, Investment Valuation, John Wiley and Sons.

107 The earnings yield in January 2015 is estimated by dividing the aggregated earnings for the index by the index level.

= 5.57% - 2.17% = 3.40%

Both approaches, though, draw on the dividend discount model and make strong assumptions about firms being in stable growth and/or long-term excess returns.

A Generalized Model: Implied Equity Risk Premium

To expand the model to fit more general specifications, we would make the following changes: Instead of looking at the actual dividends paid as the only cash flow to equity, we would consider potential dividends instead of actual dividends. In my earlier work (2002, 2006), the free cash flow to equity (FCFE), i.e, the cash flow left over after taxes, reinvestment needs and debt repayments, was offered as a measure of potential dividends.[108] Over the last decade, for instance, firms have paid out only about half their FCFE as dividends. If this poses too much of an estimation challenge, there is a simpler alternative. Firms that hold back cash build up large cash balances that they use over time to fund stock buybacks. Adding stock buybacks to aggregate dividends paid should give us a better measure of total cash flows to equity. The model can also be expanded to allow for a high growth phase, where earnings and dividends can grow at rates that are very different (usually higher, but not always) than stable growth values. With these changes, the value of equity can be written as follows:

$$\text{Value of Equity} = \sum_{t=1}^{t=N} \frac{E(FCFE_t)}{(1+k_e)^t} + \frac{E(FCFE_{N+1})}{(k_e - g_N)\,(1+k_e)^N}$$

In this equation, there are N years of high growth, $E(FCFE_t)$ is the expected free cash flow to equity (potential dividend) in year t, k_e is the rate of return expected by equity investors and g_N is the stable growth rate (after year N). We can solve for the rate of return equity investors need, given the expected potential dividends and prices today. Subtracting out the riskfree rate should generate a more realistic equity risk premium.

In a variant of this approach, the implied equity risk premium can be computed from excess return or residual earnings models. In these models, the value of equity today

108 Damodaran, A., 2002, *Investment Valuation*, John Wiley and Sons; Damodaran, A., 2006, *Damodaran on Valuation*, John Wiley and Sons.

can be written as the sum of capital invested in assets in place and the present value of future excess returns:[109]

$$\text{Value of Equity} = \text{Book Equity today} + \sum_{t=1}^{t=\infty} \frac{\text{Net Income}_t - k_e(\text{Book Equity}_{t-1})}{(1+k_e)^t}$$

If we can make estimates of the book equity and net income in future periods, we can then solve for the cost of equity and use that number to back into an implied equity risk premium. Claus and Thomas (2001) use this approach, in conjunction with analyst forecasts of earnings growth, to estimate implied equity risk premiums of about 3% for the market in 2000.[110] Easton (2007) provides a summary of possible limitations of models that attempt to extract costs of equity from accounting data including the unreliability of book value numbers and the use of optimistic estimates of growth from analysts.[111]

Implied Equity Risk Premium: S&P 500

Given its long history and wide following, the S&P 500 is a logical index to use to try out the implied equity risk premium measure. In this section, we will begin by estimating implied equity risk premiums at the start of the years 2008 to 2016, and follow up by looking at the volatility in that estimate over time.

Implied Equity Risk Premiums: Annual Estimates from 2008 to 2016

On December 31, 2007, the S&P 500 Index closed at 1468.36, and the dividend yield on the index was roughly 1.89%. In addition, the consensus estimate of growth in earnings for companies in the index was approximately 5% for the next 5 years.[112] Since this is not a growth rate that can be sustained forever, we employ a two-stage valuation model, where we allow growth to continue at 5% for 5 years, and then lower the growth

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[109] For more on excess return models, see Damodaran, A, 2006, *Valuation Approaches and Metrics: A Survey of the Theory and Evidence,* Working Paper, www.damodaran.com.

[110] 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(5), 1629–1666.

[111] Easton, P., 2007, *Estimating the cost of equity using market prices and accounting data*, Foundations and Trends in Accounting, v2, 241-364.

[112] We used the average of the analyst estimates for individual firms (bottom-up). Alternatively, we could have used the top-down estimate for the S&P 500 earnings.

rate to 4.02% (the riskfree rate) after that.[113] Table 18 summarizes the expected dividends for the next 5 years of high growth, and for the first year of stable growth thereafter:

Table 18: Estimated Dividends on the S&P 500 Index – January 1, 2008

Year	*Dividends on Index*
1	29.12
2	30.57
3	32.10
4	33.71
5	35.39
6	36.81

[a]Dividends in the first year = 1.89% of 1468.36 (1.05)

If we assume that these are reasonable estimates of the expected dividends and that the index is correctly priced, the value can be written as follows:

$$1468.36 = \frac{29.12}{(1+r)} + \frac{30.57}{(1+r)^2} + \frac{32.10}{(1+r)^3} + \frac{33.71}{(1+r)^4} + \frac{35.39}{(1+r)^5} + \frac{36.81}{(r-.0402)(1+r)^5}$$

Note that the last term in the equation is the terminal value of the index, based upon the stable growth rate of 4.02%, discounted back to the present. Solving for required return in this equation yields us a value of 6.04%. Subtracting out the ten-year treasury bond rate (the riskfree rate) yields an implied equity premium of 2.02%.

The focus on dividends may be understating the premium, since the companies in the index have bought back substantial amounts of their own stock over the last few years. In 2007, for instance, firms collectively returned more than twice as much in the form of buybacks than they paid out in dividends. Since buybacks are volatile over time, and 2007 may represent a high-water mark for the phenomenon, we recomputed the expected cash flows, in table 19, for the next 6 years using the average total yield (dividends + buybacks) of 4.11%, instead of the actual dividends, and the growth rates estimated earlier (5% for the next 5 years, 4.02% thereafter):

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[113] The treasury bond rate is the sum of expected inflation and the expected real rate. If we assume that real growth is equal to the real interest rate, the long term stable growth rate should be equal to the treasury bond rate.

Table 19: Cashflows on S&P 500 Index

Year	*Dividends+ Buybacks on Index*
1	63.37
2	66.54
3	69.86
4	73.36
5	77.02

Using these cash flows to compute the expected return on stocks, we derive the following:

$$1468.36 = \frac{63.37}{(1+r)} + \frac{66.54}{(1+r)^2} + \frac{69.86}{(1+r)^3} + \frac{73.36}{(1+r)^4} + \frac{77.02}{(1+r)^5} + \frac{77.02(1.0402)}{(r-.0402)(1+r)^5}$$

Solving for the required return and the implied premium with the higher cash flows:

Required Return on Equity = 8.39%

Implied Equity Risk Premium = Required Return on Equity - Riskfree Rate

= 8.48% - 4.02% = 4.46%

This value (4.46%) would have been our estimate of the equity risk premium on January 1, 2008.

During 2008, the S&P 500 lost just over a third of its value and ended the year at 903.25 and the treasury bond rate plummeted to close at 2.21% on December 31, 2008. Firms also pulled back on stock buybacks and financial service firms in particular cut dividends during the year. The inputs to the equity risk premium computation reflect these changes:

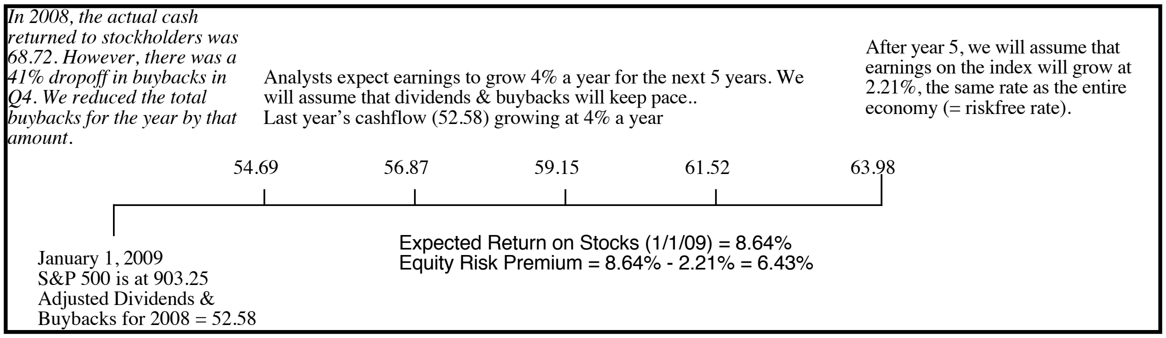
Level of the index = 903.25 (Down from 1468.36)

Treasury bond rate = 2.21% (Down from 4.02%)

Updated dividends and buybacks on the index = 52.58 (Down about 15%)

Expected growth rate = 4% for next 5 years (analyst estimates) and 2.21% thereafter (set equal to riskfree rate).

The computation is summarized below:



The resulting equation is below:

$$903.25 = \frac{54.69}{(1+r)} + \frac{56.87}{(1+r)^2} + \frac{59.15}{(1+r)^3} + \frac{61.52}{(1+r)^4} + \frac{63.98}{(1+r)^5} + \frac{63.98(1.0221)}{(r-.0221)(1+r)^5}$$

Solving for the required return and the implied premium with the higher cash flows:

Required Return on Equity = 8.64%

Implied Equity Risk Premium = Required Return on Equity - Riskfree Rate

= 8.64% - 2.21% = 6.43%

The implied premium rose more than 2%, from 4.37% to 6.43%, over the course of the year, indicating that investors perceived more risk in equities at the end of the year, than they did at the start and were demanding a higher premium to compensate.

By January 2010, the fears of a banking crisis had subsided and the S&P 500 had recovered to 1115.10. However, a combination of dividend cuts and a decline in stock buybacks had combined to put the cash flows on the index down to 40.38 in 2009. That was partially offset by increasing optimism about an economic recovery and expected earnings growth for the next 5 years had bounced back to 7.2%.[114] The resulting equity risk premium is 4.36%:

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[114] The expected earnings growth for just 2010 was 21%, primarily driven by earnings bouncing back to pre-crisis levels, followed by a more normal 4% earnings growth in the following years. The compounded average growth rate is $((1.21)\ (1.04)^4)^{1/5}$-1= .072 or 7.2%.

In 2009, the actual cash returned to stockholders was 40.38. That was down about 40% from 2008 levels.

Analysts expect earnings to grow 21% in 2010, resulting in a compounded annual growth rate of 7.2% over the next 5 years. We will assume that dividends & buybacks will keep pace.

After year 5, we will assume that earnings on the index will grow at 3.84%, the same rate as the entire economy (= riskfree rate).

43.29 46.40 49.74 53.32 57.16

January 1, 2010
S&P 500 is at 1115.10
Adjusted Dividends & Buybacks for 2009 = 40.38

$$1115.10 = \frac{43.29}{(1+r)} + \frac{46.40}{(1+r)^2} + \frac{49.74}{(1+r)^3} + \frac{53.32}{(1+r)^4} + \frac{57.16}{(1+r)^5} + \frac{57.16(1.0384)}{(r-.0384)(1+r)^5}$$

Expected Return on Stocks (1/1/10) = 8.20%
T.Bond rate on 1/1/10 = 3.84 %
Equity Risk Premium = 8.20% - 3.84% = 4.36%

In effect, equity risk premiums have reverted back to what they were before the 2008 crisis.

Updating the numbers to January 2011, the S&P 500 had climbed to 1257.64, but cash flows on the index, in the form of dividends and buybacks, made an even more impressive comeback, increasing to 53.96 from the depressed 2009 levels. The implied equity risk premium computation is summarized below:

In 2010, the actual cash returned to stockholders was 53.96. That was up about 30% from 2009 levels.

Analysts expect earnings to grow 13% in 2011, 8% in 2012, 6% in 2013 and 4% therafter, resulting in a compounded annual growth rate of 6.95% over the next 5 years. We will assume that dividends & buybacks will tgrow 6.95% a year for the next 5 years.

After year 5, we will assume that earnings on the index will grow at 3.29%, the same rate as the entire economy (= riskfree rate).

57.72 61.73 66.02 70.60 75.51

January 1, 2011
S&P 500 is at 1257.64
Adjusted Dividends & Buybacks for 2010 = 53.96

$$1257.64 = \frac{57.72}{(1+r)} + \frac{61.73}{(1+r)^2} + \frac{66.02}{(1+r)^3} + \frac{70.60}{(1+r)^4} + \frac{75.51}{(1+r)^5} + \frac{75.51(1.0329)}{(r-.0329)(1+r)^5}$$

Expected Return on Stocks (1/1/11) = 8.49%
T.Bond rate on 1/1/11 = 3.29%
Equity Risk Premium = 8.03% - 3.29% = 5.20%

Data Sources:
Dividends and Buybacks last year: S&P
Expected growth rate: News stories, Yahoo! Finance, Zacks

The implied equity risk premium climbed to 5.20%, with the higher cash flows more than offsetting the rise in equity prices.

The S&P 500 ended 2011 at 1257.60, almost unchanged from the level at the start of the year. The other inputs into the implied equity risk premium equation changed significantly over the year:

a. The ten-year treasury bond rate dropped during the course of the year from 3.29% to 1.87%, as the European debt crisis caused a "flight to safety". The US did lose its AAA rating with Standard and Poor's during the course of the year, but we will continue to assume that the T.Bond rate is risk free.
b. Companies that had cut back dividends and scaled back stock buybacks in 2009, after the crisis, and only tentatively returned to the fray in 2010, returned to buying

back stocks at almost pre-crisis levels. The total dividends and buybacks for the trailing 12 months leading into January 2012 climbed to 72.23, a significant increase over the previous year.[115]

c. Analysts continued to be optimistic about earnings growth, in the face of signs of a pickup in the US economy, forecasting growth rate of 9.6% for 2012 (year 1), 11.9% in 2013, 8.2% in 2014, 4% in 2015 and 2.5% in 2016, leading to a compounded annual growth rate of 7.18% a year.

Incorporating these inputs into the implied equity risk premium computation, we get an expected return on stocks of 9.29% and an implied equity risk premium of 7.32%:

In the trailing 12 months, the cash returned to stockholders was 72.23.

Analysts expect earnings to grow 9.6% in 2012, 11.9% in 2013, 8.2% in 2014, 4.5% in 2015 and 2% therafter, resulting in a compounded annual growth rate of 7.18% over the next 5 years. We will assume that dividends & buybacks will grow 7.18% a year for the next 5 years.

After year 5, we will assume that earnings on the index will grow at 1.87%, the same rate as the entire economy (= riskfree rate).

77.41 | 82.97 | 88.93 | 95.31 | 102.16

January 1, 2012
S&P 500 is at 1257.60
Dividends & Buybacks for 2011 = 72.23

$$1257.60 = \frac{77.41}{(1+r)} + \frac{82.97}{(1+r)^2} + \frac{88.93}{(1+r)^3} + \frac{95.31}{(1+r)^4} + \frac{102.16}{(1+r)^5} + \frac{102.16(1.0187)}{(r-.0187)(1+r)^5}$$

Expected Return on Stocks (1/1/12) = 9.19%
T.Bond rate on 1/1/12 = 1.87%
Equity Risk Premium = 7.91% - 1.87% = 7.32%

Data Sources:
Dividends and Buybacks last year: S&P
Expected growth rate: News stories, Yahoo! Finance, Bloomberg

Since the index level did not change over the course of the year, the jump in the equity risk premium from 5.20% on January 1, 2011 to 7.32% on January 1, 2012, was precipitated by two factors. The first was the drop in the ten-year treasury bond rate to a historic low of 1.87% and the second was the surge in the cash returned to stockholders, primarily in buybacks. With the experiences of the last decade fresh in our minds, we considered the possibility that the cash returned during the trailing 12 months may reflect cash that had built up during the prior two years, when firms were in their defensive posture. If that were the case, it is likely that buybacks will decline to a more normalized value in future years. To estimate this value, we looked at the total cash yield on the S&P 500 from 2002 to 2011 and computed an average value of 4.69% over the decade in table 20.

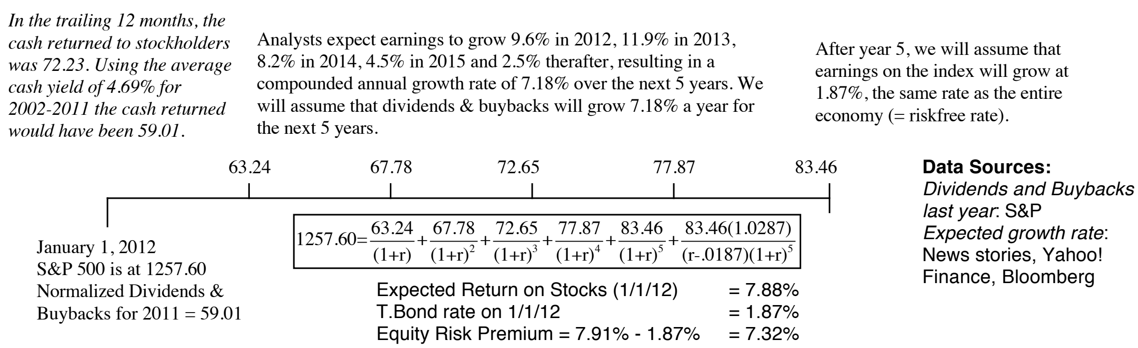
Table 20: Dividends and Buybacks on S&P 500 Index: 2002-2011

Year	Dividend Yield	Buybacks/Index	Yield

[115] These represented dividends and stock buybacks from October 1, 2010 to September 30, 2011, based upon the update from S&P on December 22, 2011. The data for the last quarter is not made available until late March of the following year.

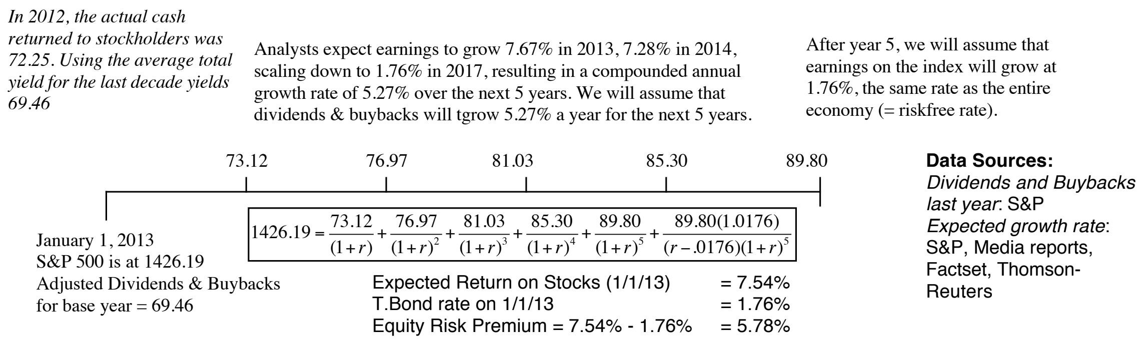
2002	1.81%	1.58%	3.39%
2003	1.61%	1.23%	2.84%
2004	1.57%	1.78%	3.35%
2005	1.79%	3.11%	4.90%
2006	1.77%	3.39%	5.16%
2007	1.92%	4.58%	6.49%
2008	3.15%	4.33%	7.47%
2009	1.97%	1.39%	3.36%
2010	1.80%	2.61%	4.42%
2011	2.00%	3.53%	5.54%
Average: Last 10 years =			4.69%

Assuming that the cash returned would revert to this yield provides us with a lower estimate of the cash flow (4.69% of 1257.60= 59.01) and an equity risk premium of 6.01%:



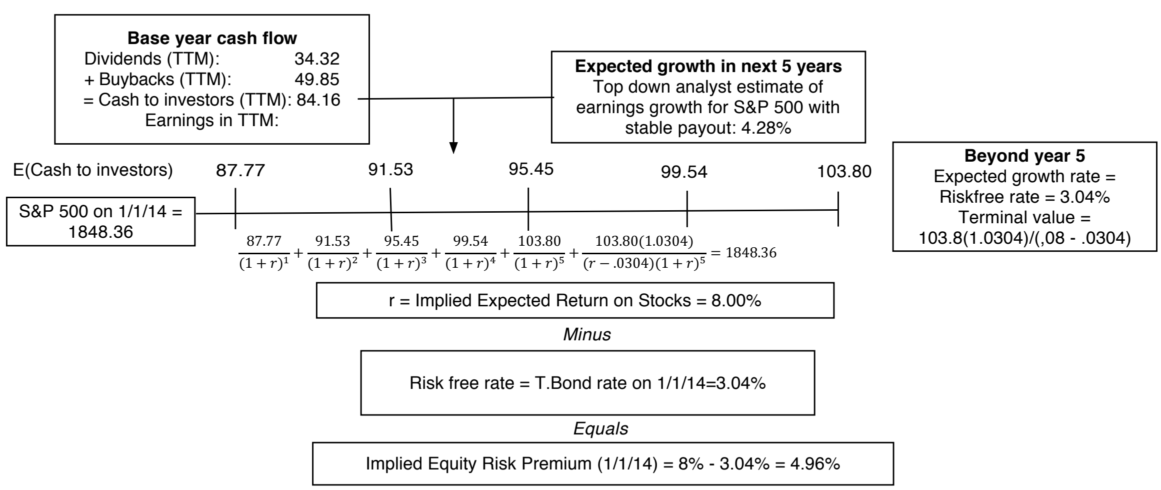
So, did the equity risk premium for the S&P 500 jump from 5.20% to 7.32%, as suggested by the raw cash yield, or from 5.20% to 6.01%, based upon the normalized yield? We would be more inclined to go with the latter, especially since the index remained unchanged over the year. Note, though, that if the cash returned by firms does not drop back in the next few quarters, we will revisit the assumption of normalization and the resulting lower equity risk premium.

By January 1, 2013, the S&P 500 climbed to 1426.19 and the treasury bond rate had dropped to 1.76%. The dividends and buybacks were almost identical to the prior year and the smoothed out cash returned (using the average yield over the prior 10 years) climbed to 69.46. Incorporating the lower growth expectations leading into 2013, the implied equity risk premium dropped to 5.78% on January 1, 2013:

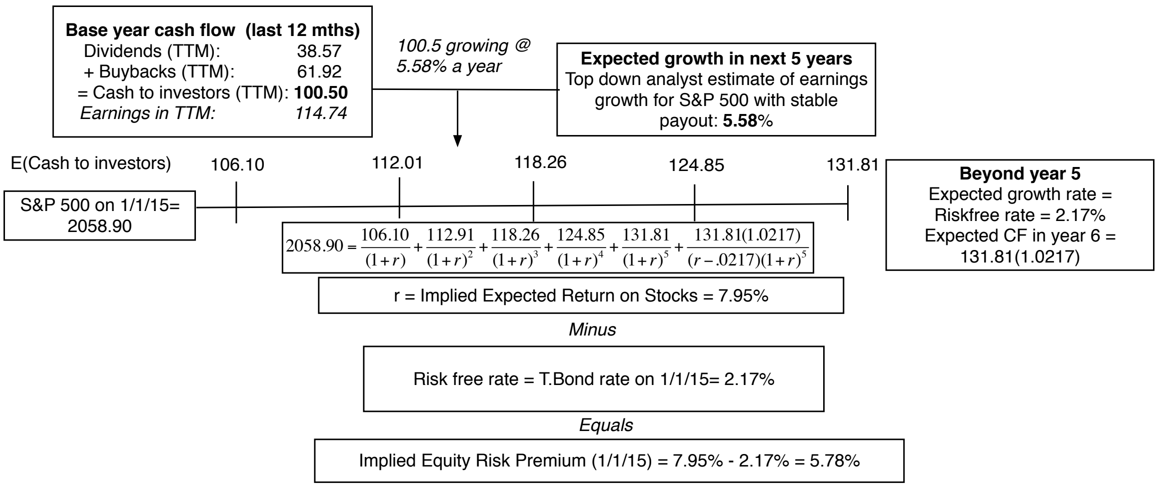


Note that the chasm between the trailing 12-month cash flow premium and the smoother cash yield premium that had opened up at the start of 2012 had narrowed. The trailing 12-month cash flow premium was 6%, just 0.22% higher than the 5.78% premium obtained with the smoothed out cash flow.

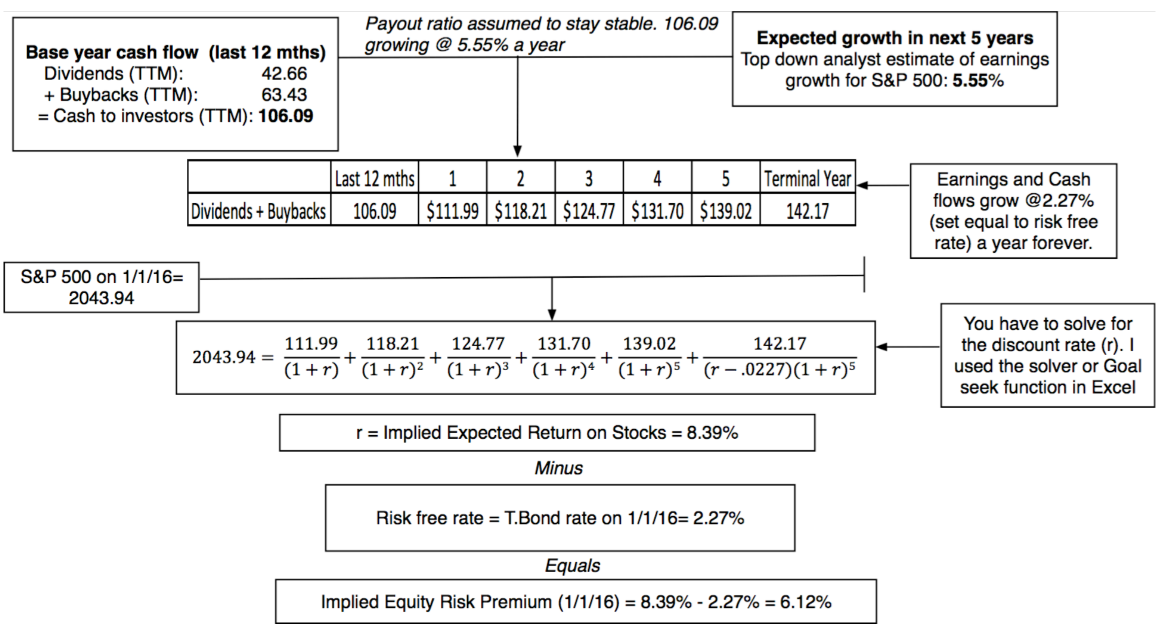
After a good year for stocks, the S&P 500 was at 1848.36 on January 1, 2014, up 29.6% over the prior year, and cash flows also jumped to 84.16 over the trailing 12 months (ending September 30, 2013), up 16.48% over the prior year. Incorporating an increase in the US ten-year treasury bond rate to 3.04%, the implied equity risk premium at the start of 2014 was 4.96%.



During 2014, stocks continued to rise, albeit at a less frenetic pace, and the US ten-year treasury bond rate dropped back again to 2.17%. Since buybacks and dividends grew at higher rate than prices, the net effect was an increase in the implied equity risk premium to 5.78% at the start of 2015:



At the start of 2016, we updated the implied equity risk premium after a year in which stocks were flat and the treasury bond rate moved up slightly to 2.27%. The resulting implied premium was 6.12%:



One troubling aspect of cash flows in the twelve months leading into January 1, 2016, was that the companies in the S&P 500 collectively returned 106.09 in cash flows, 101.54% of earnings during the period and inconsistent with the assumption that earnings would continue to grow over time. To correct for this, I recomputed the equity risk premium with the assumption that the cash payout would decrease over time to a sustainable level and came up with an equity risk premium of 5.16%.

Base Year Earnings = 104.48
Base Year ROE = 14.18%

104.48 growing @ 5.55% a year

Expected growth in next 5 years
Top down analyst estimate of earnings growth for S&P 500: **5.55%**

Base year cash flow (last 12 mths)
Dividends (TTM): 42.66
+ Buybacks (TTM): 63.43
= Cash to investors (TTM): **106.09**
Payout Ratio = **101.54%**

Payout Ratio adjusts in linear steps to sustainable payout

Payout Ratio in stable growth
Growth rate = 2.27% a year forever
ROE = 14.18%
Sustainable Payout = 1 - .0227/.1418 = **83.99%**

	Last 12 months	1	2	3	4	5	*Terminal Year*
Earnings	104.48	110.29	116.41	122.88	129.70	136.91	140.01
Payout Ratio	101.54%	98.03%	94.52%	91.01%	87.50%	83.99%	83.99%
Cash Paid out	106.09	$ 108.12	$ 110.03	$ 111.83	$ 113.49	$ 114.99	117.60

Earnings and Cash flows grow @2.27% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/16= 2043.94

$$2043.94 = \frac{108.12}{(1+r)} + \frac{110.03}{(1+r)^2} + \frac{111.83}{(1+r)^3} + \frac{113.49}{(1+r)^4} + \frac{114.99}{(1+r)^5} + \frac{117.60}{(r-.0227)(1+r)^5}$$

r = Implied Expected Return on Stocks = 7.43%

Minus

Risk free rate = T.Bond rate on 1/1/16= 2.27%

Equals

Implied Equity Risk Premium (1/1/16) = 7.43% - 2.27% = 5.16%

This recomputed premium, though, cannot be compared easily with my estimates of the risk premiums with earlier years (since I did not use the same payout adjustment assumption in earlier years) but it does indicate the reasons why there can be differences in estimated implied premiums across investors.

After stocks posted a strong year in 2016, we re-estimated the equity risk premium at the start of 2017 at 5.69%:

Base year cash flow (last 12 mths)
Dividends (TTM): 45.39
+ Buybacks (TTM): 62.38
= Cash to investors (TTM): **108.67**

Expected cashflow growth in next 5 years
Top down analyst estimate of earnings growth for S&P 500: **5.54**%

Payout Ratio in stable growth
Growth rate = 2.45% a year forever

	Last 12 months	1	2	3	4	5	Terminal Year
Expected Dividends + Buybacks =	$108.67	$114.69	$121.04	$127.75	$134.82	$142.28	$145.77

Earnings and Cash flows grow @2.45% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/17= 2238.83

$$2238.83 = \frac{114.69}{(1+r)} + \frac{121.04}{(1+r)^2} + \frac{127.75}{(1+r)^3} + \frac{134.82}{(1+r)^4} + \frac{142.28}{(1+r)^5} + \frac{145.77}{(r-.0245)(1+r)^5}$$

r = Implied Expected Return on Stocks = 8.14%

Minus

Risk free rate = T.Bond rate on 1/1/17= 2.45%

Equals

Implied Equity Risk Premium (1/1/17) = 8.14% - 2.45% = 5.69%

Since the cash flows in 2016 were higher than the earnings, just as in 2015, we followed the 2016 rulebook and computed the equity risk premium, allowing for dividend payout to adjust to sustainable levels by the end of the fifth year:

Base Year Earnings = 102.00
Base Year ROE = 13.84%

102.00 growing @ 5.54% a year

Expected growth in next 5 years
Top down analyst estimate of earnings growth for S&P 500: **5.54**%

Base year cash flow (last 12 mths)
Dividends (TTM): 45.39
+ Buybacks (TTM): 62.38
= Cash to investors (TTM): **108.67**
Payout Ratio = **106.54%**

Payout Ratio adjusts in linear steps to sustainable payout

Payout Ratio in stable growth
Growth rate = 2.45% a year forever
ROE = 13.84%
Sustainable Payout = 1 - .0245/.1384 = **82.30%**

	Last 12 months	1	2	3	4	5	Terminal Year
Expected Earnings	$ 102.00	$ 107.65	$ 113.61	$ 119.90	$ 126.54	$ 133.55	$ 136.82
Expected cash payout %	106.54%	101.69%	96.85%	92.00%	87.15%	82.30%	82.30%
Expected Dividends + Buybacks	$ 108.67	$ 109.47	$ 110.03	$ 110.31	$ 110.28	$ 109.92	$ 112.61

Earnings and Cash flows grow @2.45% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/17= 2238.83

$$2238.83 = \frac{109.47}{(1+r)} + \frac{110.03}{(1+r)^2} + \frac{110.31}{(1+r)^3} + \frac{110.28}{(1+r)^4} + \frac{109.92}{(1+r)^5} + \frac{112.61}{(r-.0245)(1+r)^5}$$

r = Implied Expected Return on Stocks = 6.95%

Minus

Risk free rate = T.Bond rate on 1/1/17= 2.45%

Equals

Implied Equity Risk Premium (1/1/17) = 6.95% - 2.45% = 4.50%

The adjusted premium is 4.50%, reflecting the expectation of lower cash flows in the future.

A Term Structure for Equity Risk Premiums

When we estimate an implied equity risk premium, from the current level of the index and expected future cash flows, we are estimating a compounded average equity risk premium over the long term. Thus, the 5.78% estimate of the equity risk premium at the start of 2015 is the geometric average of the annualized equity risk premiums in future years and is analogous to the yield to maturity on a long term bond.

But is it possible that equity risk premiums have a term structure, just as interest rates do? Absolutely. In a creative attempt to measure the slope of the term structure of equity risk premiums, Binsberger, Brandt and Koijen (2012) use dividend strips, i.e., short term assets that pay dividends for finite time periods (and have no face value), to extract equity risk premiums for the short term as opposed to the long term. Using dividend strips on the S&P 500 to extract expected returns from 1996 to 2009, they find that equity risk premiums are higher for shorter term claims than for longer term claims, by approximately 2.75%.[116] Their findings are contested by Boguth, Carlson, Fisher and Simutin (2011), who note that small market pricing frictions are amplified when valuing synthetic dividend strips and that using more robust return measures results in no significant differences between short term and longer term equity risk premiums.[117] Schulz (2015) argues that the finding of a term structure in equity risk premiums may arise from a failure to consider differential tax treatment of dividends, as opposed to capital gains, and that incorporating those tax differences flattens out the equity risk premium term structure.[118]

While this debate will undoubtedly continue, the relevance to valuation and corporate finance practice is questionable. Even if you could compute period-specific equity risk premiums, the effect on value of using these premiums (instead of the compounded average premium) would be small in most valuations. To illustrate, your valuation of an asset, using an equity risk premium of 7% for the first 3 years and 5.5%

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[116] Binsbergen, J. H. van, Michael W. Brandt, and Ralph S. J. Koijen, 2012, *On the timing and pricing of dividends*, American Economic Review, v102, 1596-1618.

[117] Boguth, O., M. Carlson, A. Fisher and M. Simutin, 2011, *Dividend Strips and the Term Structure of Equity Risk Premia: A Case Study of Limits to Arbitrage*, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1931105. In a response, Binsbergen, Brandt and Koijen argue that their results hold even if traded dividend strips (rather than synthetic strips) are used.

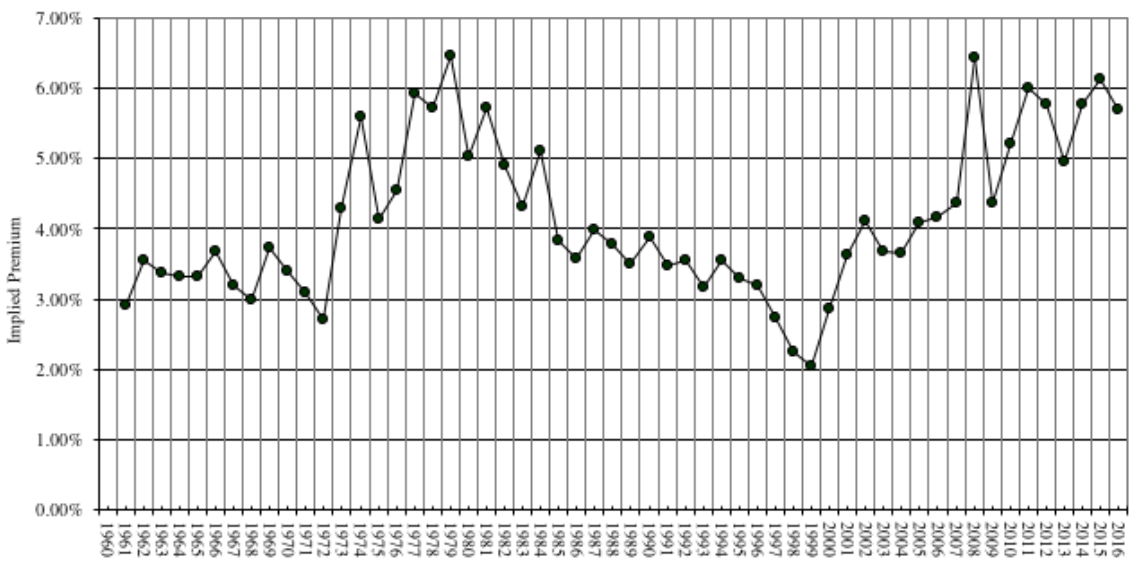
[118] Schulz, F., 2015, On the Timing and Pricing of Dividends, SSRN Working paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2705909

thereafter[119], at the start of 2015, would be very similar to the value you would have obtained using 5.78% as your equity risk premium for all time periods. The only scenario where using year-specific premiums would make a material difference would be in the valuation of an asset or investment with primarily short-term cash flows, where using a higher short term premium will yield a lower (and perhaps more realistic) value for the asset.

Time Series Behavior for S&P 500 Implied Premium

As the inputs to the implied equity risk premium, it is quite clear that the value for the premium will change not just from day to day but from one minute to the next. In particular, movements in the index will affect the equity risk premium, with higher (lower) index values, other things remaining equal, translating into lower (higher) implied equity risk premiums. In Figure 9, we chart the implied premiums in the S&P 500 from 1960 to 2016 (year ends):

Figure 9: Implied Premium for US Equity Market: 1960-2016



In terms of mechanics, we used potential dividends (including buybacks) as cash flows, and a two-stage discounted cash flow model; the estimates for each year are in appendix 6.[120] Looking at these numbers, we would draw the following conclusions:

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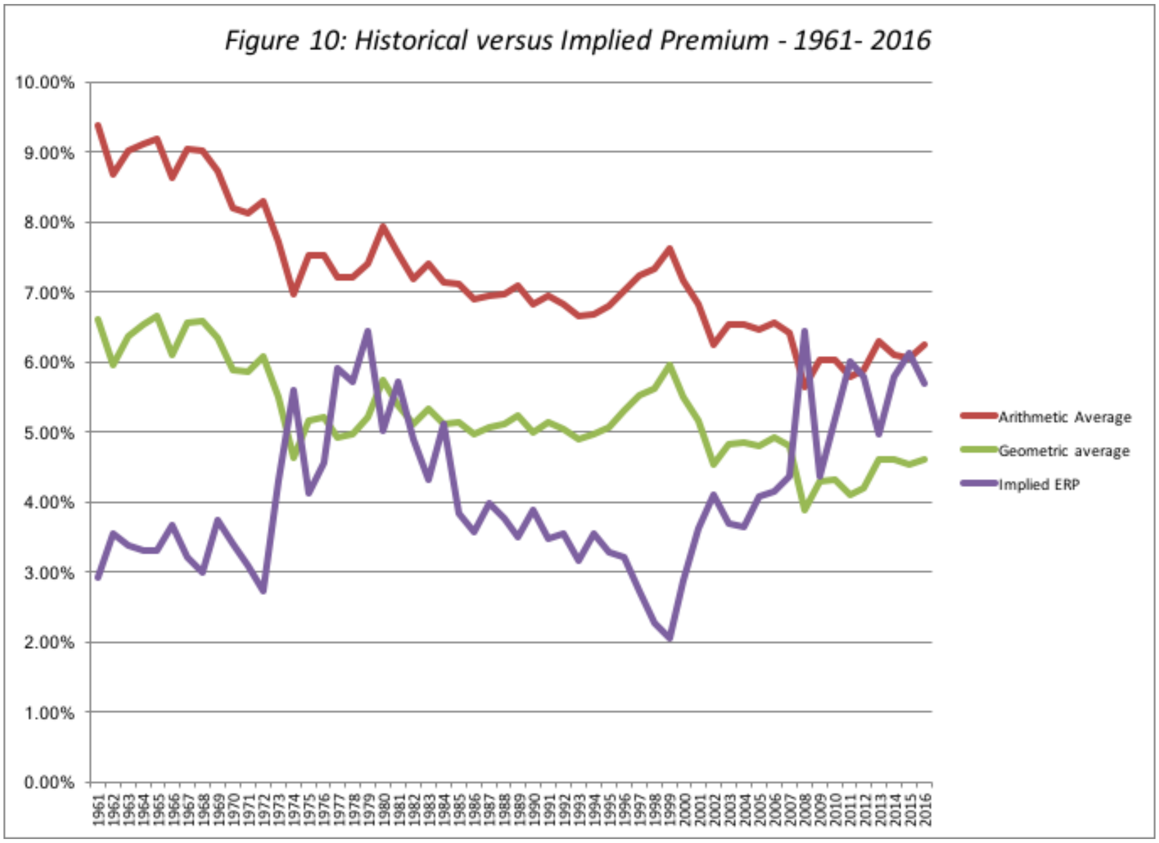
119 The compounded average premium over time, using a 7% equity risk premium for the first 3 years and 5.88% thereafter, is roughly 6.01%.

120 We used analyst estimates of growth in earnings for the 5-year growth rate after 1980. Between 1960 and 1980, we used the historical growth rate (from the previous 5 years) as the projected growth, since analyst

- The implied equity premium has deviated from the historical premium for the US equity market for most of the last few decades. To provide a contrast, we compare the implied equity risk premiums each year to the historical risk premiums for stocks over treasury bonds, using both geometric and arithmetic averages, each year from 1961 to 2015 in figure 10:



The arithmetic average premium, which is used by many practitioners, has been significantly higher than the implied premium over almost the entire fifty-year period (with 2009 and 2011 being the only exceptions). The geometric premium does provide a more interesting mix of results, with implied premiums exceeding historical premiums in the mid-1970s and again since 2008.

- The implied equity premium did increase during the seventies, as inflation increased. This does have implications for risk premium estimation. Instead of assuming that the risk premium is a constant, and unaffected by the level of inflation and interest rates,

estimates were difficult to obtain. Prior to the late 1980s, the dividends and potential dividends were very similar, because stock buybacks were uncommon. In the last 20 years, the numbers have diverged.

which is what we do with historical risk premiums, would it be more realistic to increase the risk premium if expected inflation and interest rates go up? We will come back and address this question in the next section.

- While historical risk premiums have generally drifted down for the last few decades, there is a strong tendency towards mean reversion in implied equity premiums. Thus, the premium, which peaked at 6.5% in 1978, moved down towards the average in the 1980s. By the same token, the premium of 2% that we observed at the end of the dot-com boom in the 1990s quickly reverted back to the average, during the market correction from 2000-2003.[121] Given this tendency, it is possible that we can end up with a far better estimate of the implied equity premium by looking at not just the current premium, but also at historical trend lines. We can use the average implied equity premium over a longer period, say ten to fifteen years. Note that we do not need as many years of data to make this estimate as we do with historical premiums, because the standard errors tend to be smaller.

Finally, the crisis of 2008 was unprecedented in terms of its impact on equity risk premiums. Implied equity risk premiums rose more during 2008 than in any one of the prior 50 years, with much of the change happening in a fifteen-week time period towards the end of the year. While much of that increase dissipated in 2009, as equity risk premiums returned to pre-crisis levels, equity risk premiums have remained more volatile since 2008. In the next section, we will take a closer look at the 2008 crisis.

Implied Equity Risk Premiums during a Market Crisis and Beyond

When we use historical risk premiums, we are, in effect, assuming that equity risk premiums do not change much over short periods and revert back over time to historical averages. This assumption was viewed as reasonable for mature equity markets like the United States, but was put under a severe test during the market crisis that unfolded with the fall of Lehman Brothers on September 15, and the subsequent collapse of equity markets, first in the US, and then globally.

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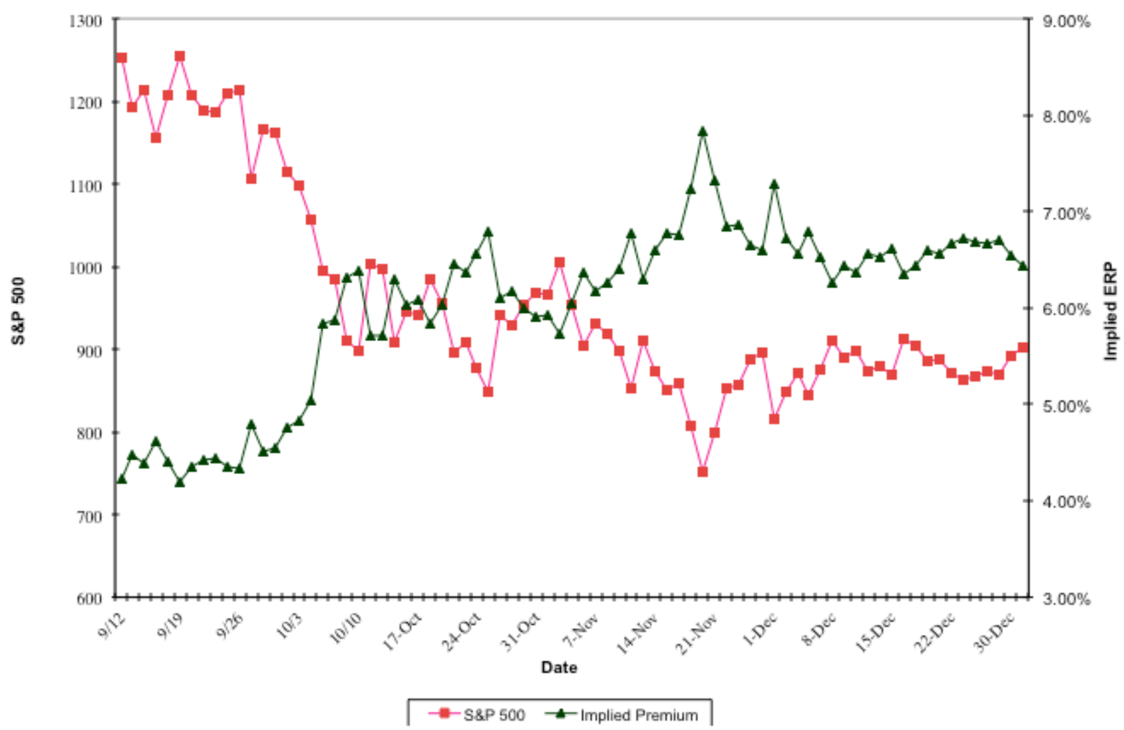
[121] Arnott, Robert D., and Ronald Ryan, 2001, *The Death of the Risk Premium: Consequences of the 1990s*, Journal of Portfolio Management, v27, 61-74. They make the same point about reduction in implied equity risk premiums that we do. According to their calculations, though, the implied equity risk premium in the late 1990s was negative.

Since implied equity risk premiums reflect the current level of the index, the 75 trading days between September 15, 2008, and December 31, 2008, offer us an unprecedented opportunity to observe how much the price charged for risk can change over short periods. In figure 11, we depict the S&P 500 on one axis and the implied equity risk premium on the other. To estimate the latter, we used the level of the index and the treasury bond rate at the end of each day and used the total dollar dividends and buybacks over the trailing 12 months to compute the cash flows for the most recent year.[122] We also updated the expected growth in earnings for the next 5 years, but that number changed only slowly over the period. For example, the total dollar dividends and buybacks on the index for the trailing 12 months of 52.58 resulted in a dividend yield of 4.20% on September 12 (when the index closed at 1252) but jumped to 4.97% on October 6, when the index closed at 1057.[123]

Figure 11: Implied Equity Risk Premium - 9/12- 12/31/08



[122] This number, unlike the index and treasury bond rate, is not updated on a daily basis. We did try to modify the number as companies in the index announced dividend suspensions or buyback modifications.

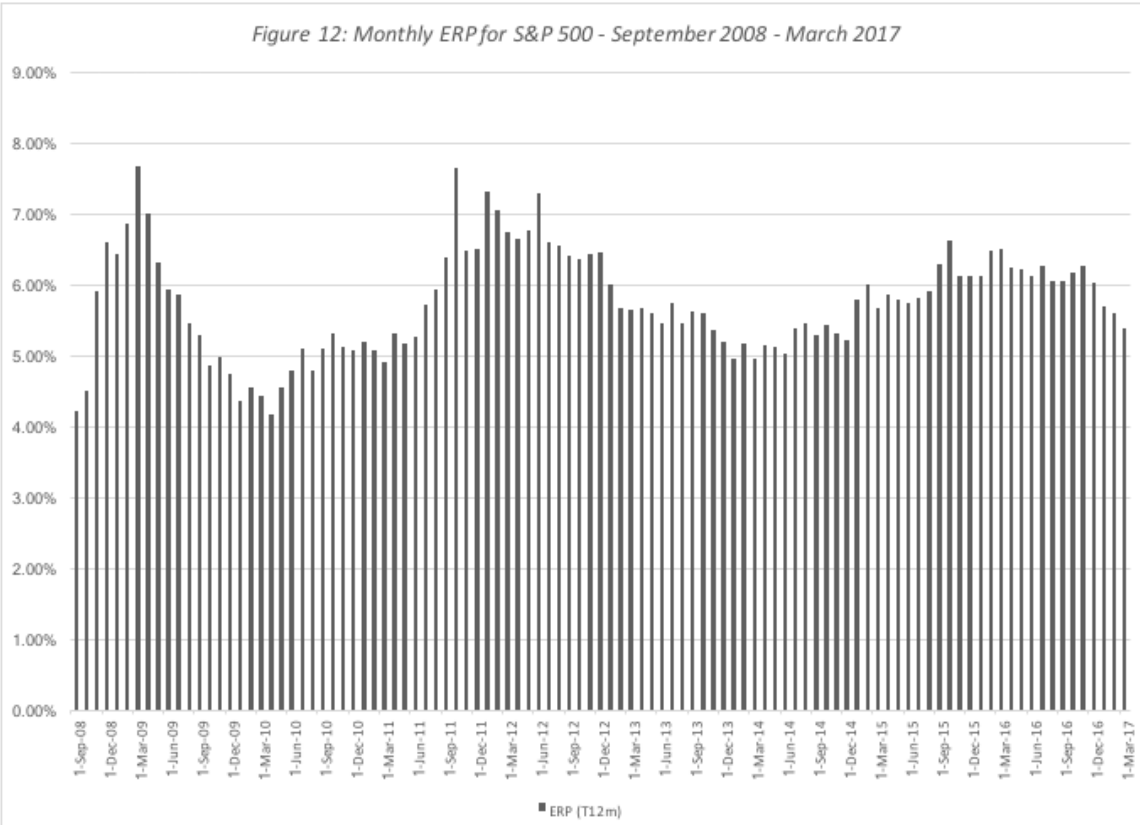
[123] It is possible, and maybe even likely, that the banking crisis and resulting economic slowdown was leading some companies to reassess policies on buybacks. Alcoa, for instance, announced that it was terminating stock buybacks. However, other companies stepped up buybacks in response to lower stock prices. If the total cash return was dropping, as the market was, the implied equity risk premiums should be lower than the numbers that we have computed.

In a period of a month, the implied equity risk premium rose from 4.20% on September 12 to 6.39% at the close of trading of October 10 as the S&P moved from 1250 down to 903. Even more disconcertingly, there were wide swings in the equity risk premium within a day; in the last trading hour just on October 10, the implied equity risk premium ranged from a high of 6.6% to a low of 6.1%. Over the rest of the year, the equity risk premium gyrated, hitting a high of 8% in late November, before settling into the year-end level of 6.43%.

The volatility captured in figure 12 was not restricted to just the US equity markets. Global equity markets gyrated with and sometimes more than the US, default spreads widened considerably in corporate bond markets, commercial paper and LIBOR rates soared while the 3-month treasury bill rate dropped close to zero and the implied volatility in option markets rose to levels never seen before. Gold surged but other commodities, such as oil and grains, dropped. Not only did we discover how intertwined equity markets are around the globe but also how markets for all risky assets are tied together. We will explicitly consider these linkages as we go through the rest of the paper.

There are two ways in which we can view this volatility. One the one side, proponents of using historical averages (either of actual or implied premiums) will use the day-to-day volatility in market risk premiums to argue for the stability of historical averages. They are implicitly assuming that when the crisis passes, markets will return to the status quo. On the other hand, there will be many who point to the unprecedented jump in implied premiums over a few weeks and note the danger of sticking with a “fixed” premium. They will argue that there are sometimes structural shifts in markets, i.e. big events that change market risk premiums for long periods, and that we should be therefore be modifying the risk premiums that we use in valuation as the market changes around us. In January 2009, in the context of equity risk premiums, the first group would have argued we should ignore history (both in terms of historical returns and implied equity risk premiums) and move to equity risk premiums of 6%+ for mature markets (and higher for emerging markets whereas the second would have made a case for sticking with a historical average, which would have been much lower than 6.43%.

The months since the crisis ended in 2008 have seen ups and downs in the implied premium, with clear evidence that the volatility in the equity risk premium has increased over the last few years. In figure 12, we report on the monthly equity risk premiums for the S&P 500 from January 2009 through March 2017:



Note that the equity risk premium dropped from its post-crisis highs in 2010 but climbed back in 2011 to 6% or higher, and has been volatile since.

On a personal note, I believe that the very act of valuing companies requires taking a stand on the appropriate equity risk premium to use. For many years prior to September 2008, I used 4% as my mature market equity risk premium when valuing companies, and assumed that mean reversion to this number (the average implied premium over time) would occur quickly and deviations from the number would be small. Though mean reversion is a powerful force, I think that the banking and financial crisis of 2008 has created a new reality, i.e., that equity risk premiums can change quickly and by large amounts even in mature equity markets. Consequently, I have forsaken my practice of staying with a fixed equity risk premium for mature markets, and I now vary it year-to-year, and even on an intra-year basis, if conditions warrant. After the crisis, in the first half of 2009, I used equity risk premiums of 6% for mature markets in my valuations. As risk premiums came down in 2009, I moved back to using a 4.5% equity risk premium for mature markets in 2010. With the increase in implied premiums at the start of 2011, my valuations for the year were based upon an equity risk premium of 5% for mature markets and I increased that number to 6% for 2012. In 2016, I used an equity risk premium of 6.12%, reflecting the implied premium at the start of the year but adjusted the premium on a monthly basis, as investors navigated Brexit and the US presidential election. At the start of 2017, I was using 5.69% as my base premium for a mature market. While some may view this shifting equity risk premium as a sign of weakness, I would frame it differently. When valuing individual companies, I want my valuations to reflect my assessments of the company and not my assessments of the overall equity market. Using equity risk premiums that are very different from the implied premium will introduce a market view into individual company valuations.

Determinants of Implied Premiums

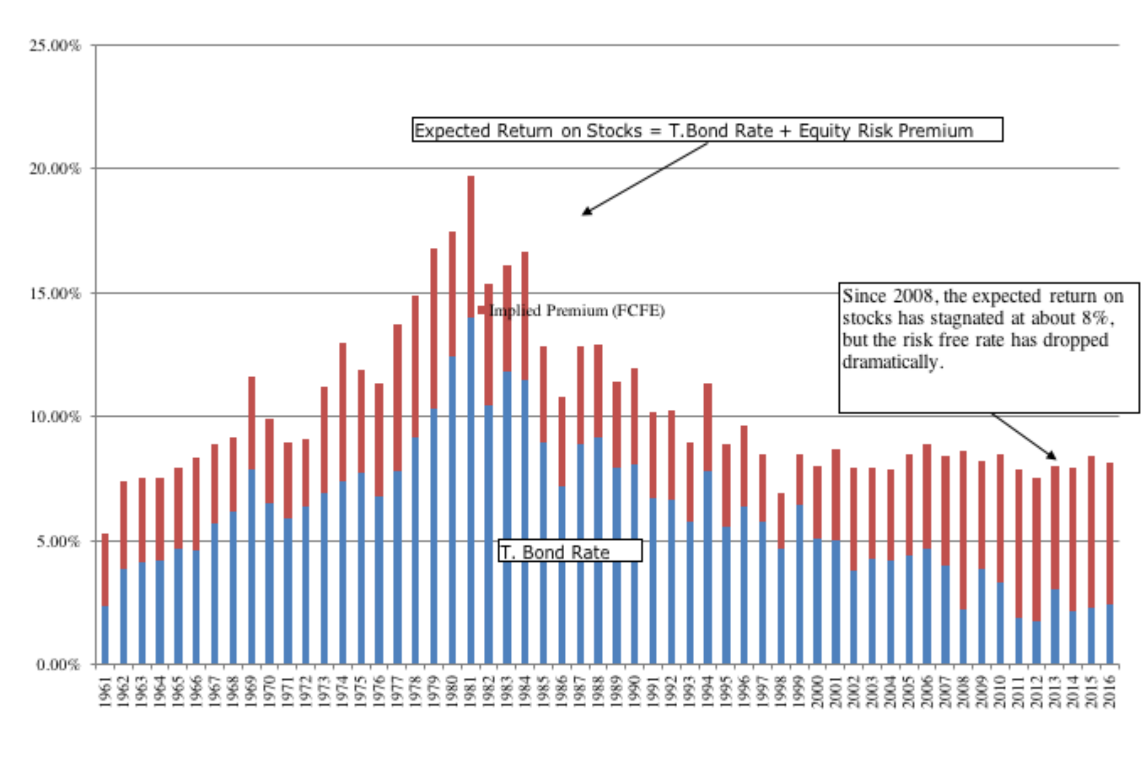
One of the advantages of estimating implied equity risk premiums, by period, is that we can track year to year changes in that number and relate those changes to shifts in interest rates, the macro environment or even to company characteristics. By doing so, not only can we get a better understanding of what causes equity risk premiums to change over time, but we are also able to come up with better estimates of future premiums.

Implied ERP and Interest rates

In much of valuation and corporate finance practice, we assume that the equity risk premium that we compute and use is unrelated to the level of interest rates. In particular, the use of historical risk premiums, where the premium is based upon an average premium earned over shifting risk free rates, implicitly assumes that the level of the premium is unchanged as the risk free rate changes. Thus, we use the same equity risk premium of 4.62% (the historical average for 1928-2016) on a risk free rate of 2.45% in 2016, as we would have, if the risk free rate had been 10%.

But is this a reasonable assumption? How much of the variation in the premium over time can be explained by changes in interest rates? Put differently, do equity risk premiums increase as the risk free rate increases or are they unaffected? To answer this question, we looked at the relationship between the implied equity risk premium and the treasury bond rate (risk free rate). As can be seen in figure 13, the implied equity risk premiums were highest in the 1970s, when interest rates and inflation were also high. However, there is contradictory evidence between 2008 and 2016, when high equity risk premiums accompanied low risk free rates.

Figure 13: Implied ERP and Risk free Rates



To examine the relationship between equity risk premiums and risk free rates, we ran a regression of the implied equity risk premium against both the level of long-term rates (the treasury bond rate) and the slope of the yield curve (captured as the difference between the 10-year treasury bond rate and the 3-month T.Bill rate), with the t statistics reported in brackets below each coefficient:

$$\text{Implied ERP} = \underset{(9.12)}{3.87\%} + \underset{(0.43)}{0.0236}\,(\text{T.Bond Rate}) + \underset{(0.75)}{0.0957}\,(\text{T.Bond} - \text{T.Bill}) \quad R^2 = 1.24\%$$

Looking across the time period (1961-2016), neither the level of rates nor the slope of the yield curve seem to have much impact on the implied equity risk premium in that year. Though the coefficients are positive, suggesting that implied risk premiums tend to be higher when the T.Bond rate is higher and the yield curve is upward sloping, the t statistics are not significant. This regression does not provide support for the view that equity risk premiums should not be constant but should be linked to the level of interest rates. In earlier versions of the paper, this regression has yielded a mildly positive relationship between the implied ERP and the T.Bond rate, but the combination of low rates and high equity risk premiums since 2008 seems to have eliminated even that mild connection between the two.

The rising equity risk premiums, in conjunction with low risk free rates, can be viewed paradoxically as both an indicator of how much and how little power central banks have over asset pricing. To the extent that the lower US treasury bond rate is the result of the Fed's quantitative easing policies since the 2008 crisis, they underscore the effect that central banks can have on equity risk premiums. At the same time, the stickiness of the overall expected return on stocks, which has not gone down with the risk free rate, is a testimonial that central banking policy is not pushing up the prices of financial assets. To the extent that this failure to move expected returns is also happening in real businesses, in the form of sticky hurdle rates for investments, the Fed's hope of increasing real investment at businesses with lower interest rates is not coming to fruition.

Implied ERP and Macroeconomic variables

While we considered the interaction between equity risk premiums and interest rates in the last section, the analysis can be expanded to include other macroeconomic variables including economic growth, inflation rates and exchange rates. Doing so may give us a way of estimating an "intrinsic' equity risk premium, based upon macro economic variables, that is less susceptible to market moods and perceptions.

To explore the relationship, we estimated the correlation, between the implied equity risk premiums that we estimated for the S&P 500 and three macroeconomic variables – real GDP growth for the US, inflation rates (CPI) and exchange rates (trade weighted dollar), using data from 1973 to 2016, in table 21 (t statistics in brackets):

Table 21: Correlation Matrix: ERP and Macroeconomic variables: 1973-2016

	ERP	Real GDP	CPI	Weighted Dollar
ERP	1.0000			
Real GDP	-0.3612	1.0000		
	-2.4801			

CPI	0.3115	-0.1290	1.0000	
	2.0988	-0.8327		
Weighted Dollar	-0.1926	-0.0355	-0.0847	1.0000
	-1.2566	-0.2277	-0.5445	

** Statistically significant

The implied equity risk premium is negatively correlated with GDP growth, increasing as GDP growth increases and is positively correlated with both inflation and the weighted dollar, with a stronger dollar going with higher implied equity risk premiums.[124]

Following up on this analysis, we regressed equity risk premiums against the inflation rate, the weighted dollar and GDP growth, using data from 1974 to 2015:

ERP = 0.04571 - 0.17782 * Real GDP + 0.09373 * CPI - 0.0376 * Weighted Dollar R^2= 23.50%

(12.73) (2.37) (1.78) (1.31)

Based on this regression, every 1% increase in the inflation rate increases the equity risk premium by approximately 0.10%, whereas every 1% increase in the growth rate in real GDP decreases the implied equity risk premium by 0.18%.

From a risk perspective, it is not the level of GDP growth that matters, but uncertainty about that level; you can have low and stable economic growth and high and unstable economic growth. Since 2008, the economies of both developed and emerging markets have become more unstable over time and upended long held beliefs about developed economies. It will be interesting to see if equity risk premiums become more sensitive to real economic growth in this environment.

Implied ERP, Earnings Yields and Dividend Yields

Earlier in the paper, we noted that the dividend yield and the earnings yield (net of the riskfree rate) can be used as proxies for the equity risk premium, if we make assumptions about future growth (stable growth, with the dividend yield) or expected excess returns (zero, with the earnings yield). In figure 14, we compare the implied equity risk premiums that we computed to the earnings and dividend yields for the S&P 500 from 1961 to 2016:

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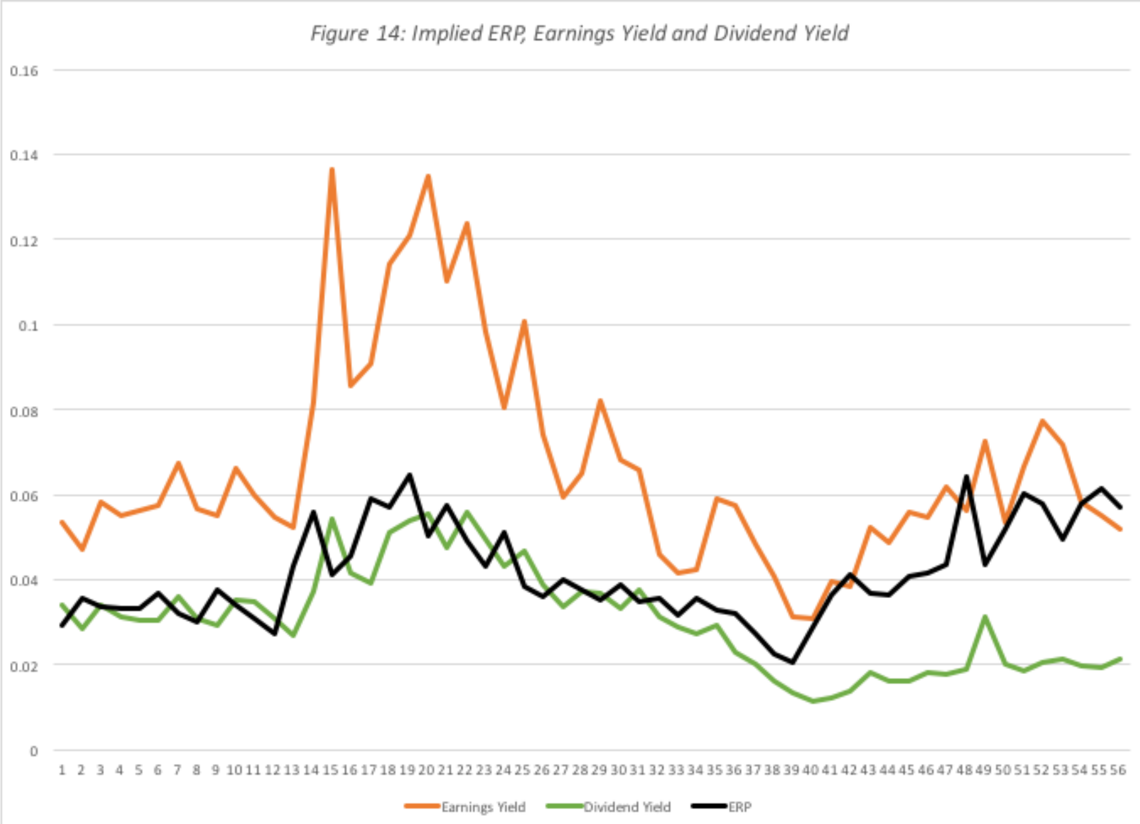
[124] The correlation was also computed for lagged and leading versions of these variables, with little material change to the relationship.



Note that the dividend yield is a very close proxy for the implied equity risk premium until the late 1980s, when the two measures decoupled, a phenomenon that is best explained by the rise of stock buybacks as an alternative way of returning cash to stockholders.

The earnings yield, with the risk free rate netted out, has generally not been a good proxy for the implied equity risk premium and would have yielded negative values for the equity risk premium (since you have to subtract out the risk free rate from it) through much of the 1990s. However, it does move with the implied equity risk premium. The difference between the earnings to price measure and the implied ERP can be attributed to a combination of higher earnings growth and excess returns that investors expect companies to deliver in the future. Analysts and academic researchers who use the earnings to price ratio as a proxy for forward-looking costs of equity may therefore end up with significant measurement error in their analyses.

Implied ERP and Technical Indicators

Earlier in the paper, we noted that any market timing forecast can be recast as a view on the future direction of the equity risk premium. Thus, a view that the market is under (over) priced and likely to go higher (lower is consistent with a belief that equity risk premiums will decline (increase) in the future. Many market timers do rely on technical indicators, such as moving averages and momentum measures, to make their judgment about market direction. To evaluate whether these approaches have a basis, you would need to look at how these measures are correlated with changes in equity risk premiums.

In a test of the efficacy of technical indicators, Neely, Rapach, Tu and Zhou (2011) compare the predictive power of macroeconomic/fundamental indications (including the interest rate, inflation, GDP growth and earnings/dividend yield numbers) with those of technical indicators (moving average, momentum and trading volume) and conclude that the latter better explain movements in stock returns.[125] They conclude that a composite prediction, that incorporates both macroeconomic and technical indicators, is superior to using just one set or the other of these variables. Note, however, that their study focused primarily on the predictability of stock returns over the next year and not on longer term equity risk premiums.

Extensions of Implied Equity Risk Premium

The process of backing out risk premiums from current prices and expected cash flows is a flexible one. It can be expanded into emerging markets to provide estimates of risk premiums that can replace the country risk premiums we developed in the last section. Within an equity market, it can be used to compute implied equity risk premiums for individual sectors or even classes of companies.

Other Equity Markets

The advantage of the implied premium approach is that it is market-driven and current, and does not require any historical data. Thus, it can be used to estimate implied equity premiums in any market, no matter how short its history, It is, however, bounded by whether the model used for the valuation is the right one and the availability and reliability of the inputs to that model. Earlier in this paper, we estimated country risk premiums for Brazil, using default spreads and equity market volatile. To provide a contrast, we estimated the implied equity risk premium for the Brazilian equity market in September 2009, from the following inputs.

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[125] Neely, C.J., D.E. Rapach, J. Tu and G. Zhou, 2011, *Forecasting the Equity Risk Premium: The Role of Technical Indicators*, Working Paper, http://ssrn.com/abstract=1787554.

- The index (Bovespa) was trading at 61,172 on September 30, 2009, and the dividend yield on the index over the previous 12 months was approximately 2.2%. While stock buybacks represented negligible cash flows, we did compute the FCFE for companies in the index, and the aggregate FCFE yield across the companies was 4.95%.
- Earnings in companies in the index are expected to grow 6% (in US dollar terms) over the next 5 years, and 3.45% (set equal to the treasury bond rate) thereafter.
- The riskfree rate is the US 10-year treasury bond rate of 3.45%.

The time line of cash flows is shown below:

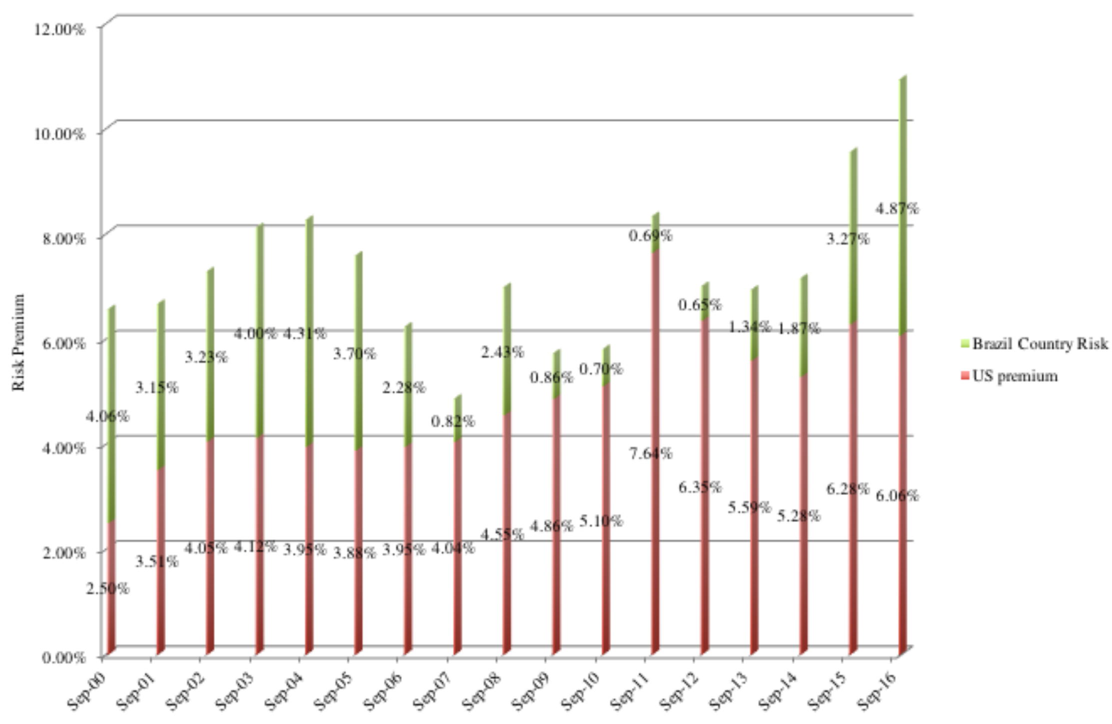
$$61,272 = \frac{3210}{(1+r)} + \frac{3,402}{(1+r)^2} + \frac{3,606}{(1+r)^3} + \frac{3,821}{(1+r)^4} + \frac{4,052}{(1+r)^5} + \frac{4,052(1.0345)}{(r-.0345)(1+r)^5}$$

These inputs yield a required return on equity of 9.17%, which when compared to the treasury bond rate of 3.45% on that day results in an implied equity premium of 5.72%. For simplicity, we have used nominal dollar expected growth rates[126] and treasury bond rates, but this analysis could have been done entirely in the local currency.

One of the advantages of using implied equity risk premiums is that that they are more sensitive to changing market conditions. The implied equity risk premium for Brazil in September 2007, when the Bovespa was trading at 73512, was 4.63%, lower than the premium in September 2009, which in turn was much lower than the premium prevailing in September 2015. In figure 15, we trace the changes in the implied equity risk premium in Brazil from September 2000 to September 2017 and compare them to the implied premium in US equities:

[126] The input that is most difficult to estimate for emerging markets is a long-term expected growth rate. For Brazilian stocks, I used the average consensus estimate of growth in earnings for the largest Brazilian companies which have ADRs listed on them. This estimate may be biased, as a consequence.

Figure 15: Implied Equity Risk Premium - Brazil



Implied equity risk premiums in Brazil declined steadily from 2003 to 2007, with the September 2007 numbers representing a historic low. They surged in September 2008, as the crisis unfolded, fell back in 2009 and 2010 but increased again in 2011. In fact, the Brazil portion of the implied equity risk premium fell to its lowest level in ten years in September 2010, a phenomenon that remained largely unchanged in 2011 and 2012. Political turmoil and corruptions scandals have combined to push the premium back up again in the last few years.

Computing and comparing implied equity risk premiums across multiple equity markets allows us to pinpoint markets that stand out, either as over priced (because their implied premiums are too low, relative to other markets) or under priced (because their premiums at too high, relative to other markets). In September 2007, for instance, the implied equity risk premiums in India and China were roughly equal to or even lower than the implied premium for the United States, computed at the same time. Even an optimist on future growth these countries would be hard pressed to argue that equity markets in these markets and the United States were of equivalent risk, which would lead us to conclude that these stocks were overvalued relative to US companies.

One final note is worth making. Over the last decade, the implied equity risk premiums in the largest emerging markets – India, China and Brazil- have all declined substantially, relative to developed markets. In table 22, we summarize implied equity risk premiums for developed and emerging markets from 2001 and 2016, making simplistic assumptions about growth and stable growth valuation models:[127]

Table 22: Developed versus Emerging Market Equity Risk Premiums

Start of year	PBV Developed	PBV Emerging	ROE Developed	ROE Emerging	US T.Bond rate	Growth Rate Developed	Growth Rate Emerging	Cost of Equity (Developed)	Cost of Equity (Emerging)	Differential ERP
2004	2.00	1.19	10.81%	11.65%	4.25%	3.75%	5.25%	7.28%	10.63%	3.35%
2005	2.09	1.27	11.12%	11.93%	4.22%	3.72%	5.22%	7.26%	10.50%	3.24%
2006	2.03	1.44	11.32%	12.18%	4.39%	3.89%	5.39%	7.55%	10.11%	2.56%
2007	1.67	1.67	10.87%	12.88%	4.70%	4.20%	5.70%	8.19%	10.00%	1.81%
2008	0.87	0.83	9.42%	11.12%	4.02%	3.52%	5.02%	10.30%	12.37%	2.07%
2009	1.20	1.34	8.48%	11.02%	2.21%	1.71%	3.21%	7.35%	9.04%	1.69%
2010	1.39	1.43	9.14%	11.22%	3.84%	3.34%	4.84%	7.51%	9.30%	1.79%
2011	1.12	1.08	9.21%	10.04%	3.29%	2.79%	4.29%	8.52%	9.61%	1.09%
2012	1.17	1.18	9.10%	9.33%	1.88%	1.38%	2.88%	7.98%	8.35%	0.37%
2013	1.56	1.63	8.67%	10.48%	1.76%	1.26%	2.76%	6.02%	7.50%	1.48%
2014	1.95	1.50	9.27%	9.64%	3.04%	2.54%	4.04%	6.00%	7.77%	1.77%
2015	1.88	1.56	9.69%	9.75%	2.17%	1.67%	3.17%	5.94%	7.39%	1.45%
2016	1.89	1.59	9.24%	10.16%	2.27%	1.77%	3.27%	5.72%	7.60%	1.88%

The trend line from 2004 to 2012 is clear as the equity risk premiums, notwithstanding a minor widening in 2008, have converged in developed and emerging markets, suggesting that globalization has put "emerging market risk" into developed markets, while creating "developed markets stability factors" (more predictable government policies, stronger legal and corporate governance systems, lower inflation and stronger currencies) in emerging markets. In the last four years, we did see a correction in emerging markets that pushed the premium back up, albeit to a level that was still lower than it was prior to 2010.

[127] We start with the US treasury bond rate as the proxy for global nominal growth (in US dollar terms), and assume that the expected growth rate in developed markets is 0.5% lower than that number and the expected growth rate in emerging markets is 1% higher than that number. The equation used to compute the ERP is a simplistic one, based on the assumptions that the countries are in stable growth and that the return on equity in each country is a predictor of future return on equity:
PBV = (ROE – g)/ (Cost of equity –g)
Cost of equity = (ROE –g + PBV(g))/ PBV

Sector premiums

Using current prices and expected future cash flows to back out implied risk premiums is not restricted to market indices. We can employ the approach to estimate the implied equity risk premium for a specific sector at a point in time. In September 2008, for instance, there was a widely held perception that investors were attaching much higher equity risk premiums to commercial bank stocks, in the aftermath of the failures of Fannie Mae, Freddie Mac, Bear Stearns and Lehman. To test this proposition, we took a look at the S&P Commercial Bank index, which was trading at 318.26 on September 12, 2008, with an expected dividend yield of 5.83% for the next 12 months. Assuming that these dividends will grow at 4% a year for the next 5 years and 3.60% (the treasury bond rate) thereafter, well below the nominal growth rate in the overall economy, we arrived at the following equation:

$$318.26 = \frac{19.30}{(1+r)} + \frac{20.07}{(1+r)^2} + \frac{20.87}{(1+r)^3} + \frac{21.71}{(1+r)^4} + \frac{22.57}{(1+r)^5} + \frac{22.57(1.036)}{(r-.036)(1+r)^5}$$

Solving for the expected return yields a value of 9.74%, which when netted out against the riskfree rate at the time (3.60%) yields an implied premium for the sector:

Implied ERP for Banking in September 2008 = 9.74% - 3.60% = 6.14%

How would we use this number? One approach would be to compare it to the average implied premium in this sector over time, with the underlying assumption that the value will revert back to the historical average for the sector. The implied equity risk premium for commercial banking stocks was close to 4% between 2005 and 2007, which would lead to the conclusion that banking stocks were undervalued in September 2008. The other is to assume that the implied equity premium for a sector is reflective of perceptions of future risk in that sector; in September 2008, there can be no denying that financial service companies faced unique risks and the market was reflecting these risks in prices. As a postscript, the implied equity risk premium for financial service firms was 5.80% in January 2012, just below the market-implied premium at the time (6.01%), suggesting that some of the post-crisis fear about banking stocks had receded.

A note of caution has to be added to about sector-implied premiums. Since these risk premiums consolidate both sector risk and market risk, it would be inappropriate to multiply these premiums by conventional betas, which are measures of sector risk. Thus, multiplying the implied equity risk premium for the technology sector (which will yield a high value) by a market beta for a technology company (which will also be high for the same reason) will result in double counting risk.[128]

Firm Characteristics

Earlier in this paper, we talked about the small firm premium and how it has been estimated using historical data, resulting in backward looking estimates with substantial standard error. We could use implied premiums to arrive at more forward looking estimates, using the following steps:

Step 1: Compute the implied equity risk premium for the overall market, using a broad index such as the S&P 500. Earlier in this paper, we estimated this, as of January 2017, to be 5.69%, using the cash returned last year as a base, and 4.50%, adjusting the cashflows for lower payout in the future.

Step 2: Compute the implied equity risk premium for an index containing primarily or only small cap firms, such as the S&P 600 Small Cap Index. On January 1, 2017, the index was trading at 837.96, with aggregated dividends and buybacks amounting to 2.93% of the index in the trailing 12 months, and an expected growth rate in earnings of 10.28% for the next 5 years. Allowing for an increase in cash payout, as the growth rate decreases over time, yields the following equation:

$$837.96 = \frac{29.25}{(1+r)} + \frac{34.62}{(1+r)^2} + \frac{40.77}{(1+r)^3} + \frac{47.83}{(1+r)^4} + \frac{55.91}{(1+r)^5} + \frac{55.91\,(1.0245)}{(r-.0245)(1+r)^5}$$

Solving for the expected return, we get:

Expected return on small cap stocks = 8.17%

Implied equity risk premium for small cap stocks = 8.17% -2.45% = 5.72%

Step 3: The forward-looking estimate of the small cap premium should be the difference between the implied premium for small cap stocks (in step 2) and the implied premium for the market (in step 1). Since we did use the adjusted buyback for small cap stocks, we will compare the small cap premium to the 4.50% that we estimated for the S&P 500 using the same approach.

Small cap premium = 5.72% - 4.50% = 1.22%

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[128] You could estimate betas for technology companies against a technology index (rather than the market index) and use these betas with the implied equity risk premium for technology companies.

With the numbers in January 2017, small caps are priced to generate an expected return that is 1.22% higher than the rest of the market, a shift from the close-to-zero premiums that we estimated in 2015 and 2016. Does that mean that the small cap premium is back? Perhaps or perhaps not. In fact, we would argue that the only way to answer that question is to update these equity risk premiums for the S&P 500 and S&P 600 each year and to compute the premium for that year.

This approach to estimating premiums can be extended to other variables. For instance, one of the issues that has challenged analysts in valuation is how to incorporate the illiquidity of an asset into its estimated value. While the conventional approach is to attach an illiquidity discount, an alternative is to adjust the discount rate upwards for illiquid assets. If we compute the implied equity risk premiums for stocks categorized by illiquidity, we may be able to come up with an appropriate adjustment. For instance, you could estimate the implied equity risk premium for the stocks that rank in the lowest decile in terms of illiquidity, defined as turnover ratio.[129] Comparing this value to the implied premium for the S&P 500 of 5.78% should yield an implied illiquidity risk premium. Adding this premium to the cost of equity for relatively illiquid investments will then discount the value of these investments for illiquidity.

2. Default Spread Based Equity Risk Premiums

While we think of corporate bonds, stocks and real estate as different asset classes, it can be argued that they are all risky assets and that they should therefore be priced consistently. Put another way, there should be a relationship across the risk premiums in these asset classes that reflect their fundamental risk differences. In the corporate bond market, the default spread, i.e, the spread between the interest rate on corporate bonds and the treasury bond rate, is used as the risk premium. In the equity market, as we have seen through this paper, historical and implied equity premiums have tussled for supremacy as the measure of the equity risk premium. In the real estate market, no mention is made of an explicit risk premium, but real estate valuations draw heavily on the "capitalization rate", which is the discount rate applied to a real estate property's earnings to arrive at an

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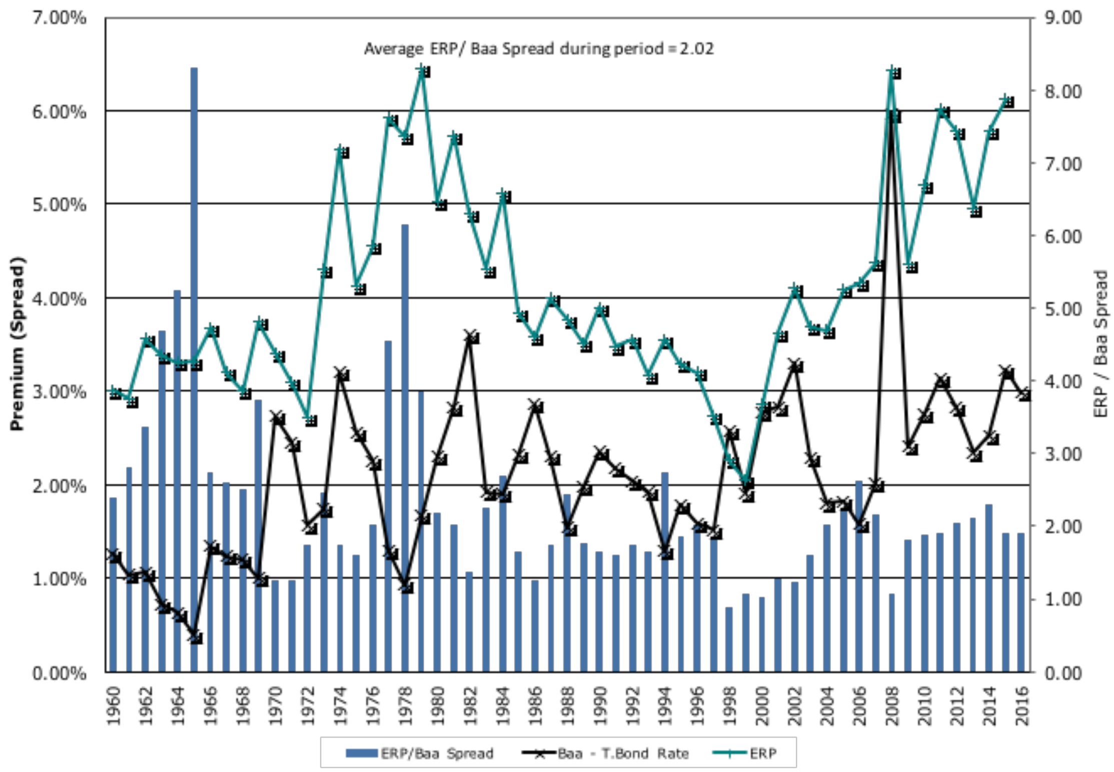
[129] The turnover ratio is obtained by dividing $ trading volume in a stock by its market capitalization at that time.

estimate of value. The use of higher (lower) capitalization rates is the equivalent of demanding a higher (lower) risk premium.

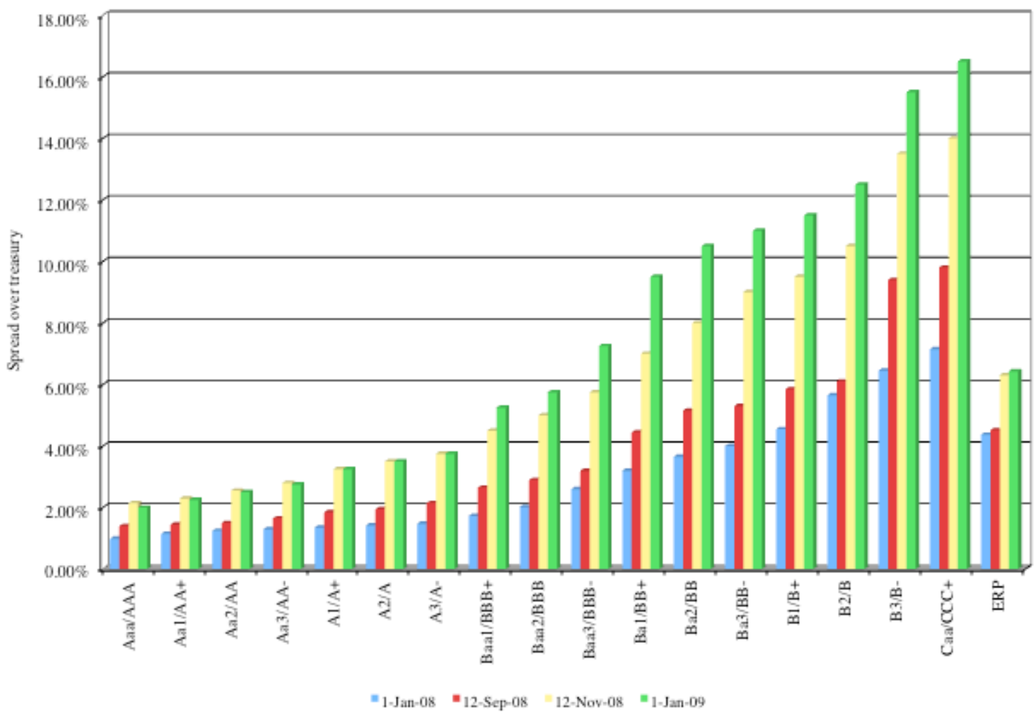
Of these three premiums, the default spread is the less complex and the most widely accessible data item. If equity risk premiums could be stated in terms of the default spread on corporate bonds, the estimation of equity risk premiums would become immeasurably simpler. For instance, assume that the default spread on Baa rated corporate bonds, relative to the ten-year treasury bond, is 2.2% and that equity risk premiums are routinely twice as high as Baa bonds, the equity risk premium would be 4.4%. Is such a rule of thumb even feasible? To answer this question, we looked at implied equity risk premiums and Baa-rated corporate bond default spreads from 1960 to 2016 in Figure 16.

Figure 16: Equity Risk Premiums and Bond Default Spreads



Note that both default spreads and equity risk premiums jumped in 2008, with the former increasing more on a proportionate basis. The ratio of 1.08 (ERP/ Baa Default Spread) at the end of 2008 was close to the lowest value in the entire series, suggesting that either equity risk premiums were too low or default spreads were too high. At the end of 2016, both the equity risk premium and the default spread increased, and the ratio moved back to 1.91, a little lower than the median value of 2.02 for the entire time period. The connection between equity risk premiums and default spreads was most obvious during 2008, where changes in one often were accompanied by changes in the other. Figure 17 graphs out changes in default spreads and ERP over the tumultuous year:

Figure 17: Default Spreads on Ratings Classes



How could we use the historical relationship between equity risk premiums and default spreads to estimate a forward-looking equity risk premium? On January 1, 2017, the default spread on a Baa rated bond was about 3.00%. Applying the median ratio of 2.02, estimated from 1960-2016 numbers, to the Baa default spread of 3.00% results in the following estimate of the ERP:

Default Spread on Baa bonds (over treasury) on 1/1/2017 = 3.00%

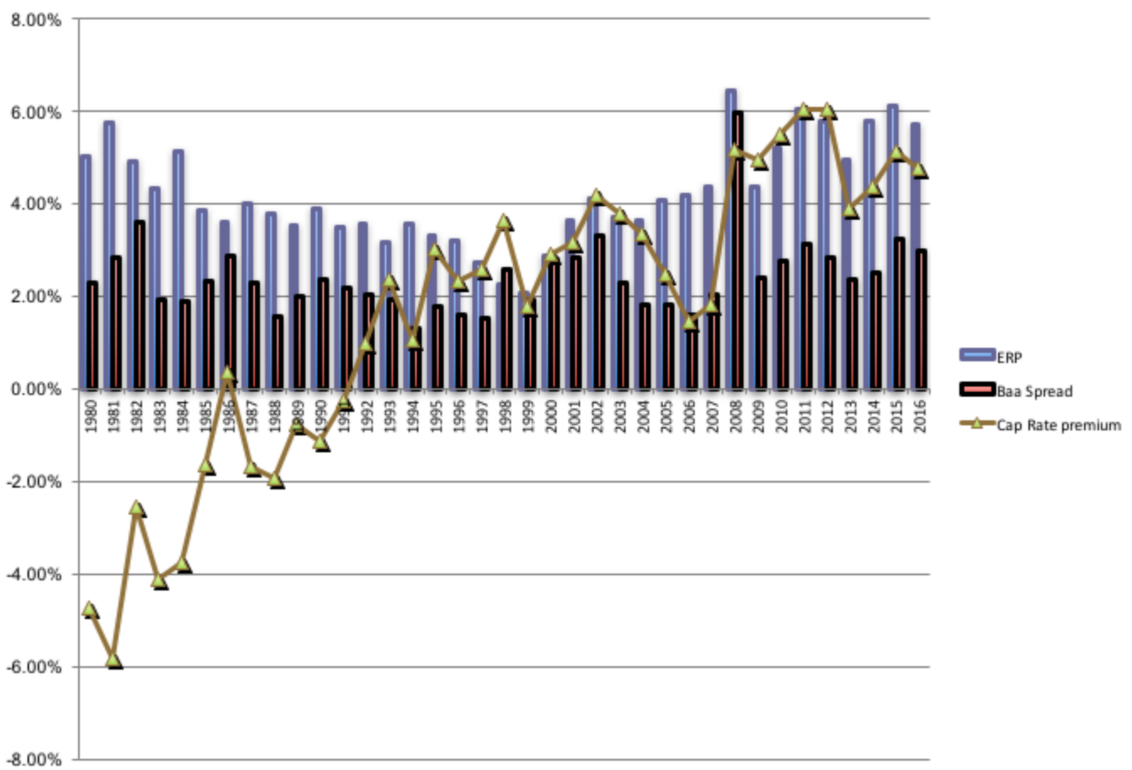
Imputed Equity Risk Premium = Default Spread * Median ratio or ERP/Spread

= 3.00%* 2.02 = 6.04%

This is higher than the implied equity risk premium of 5.69% that we computed in January 2017. Note that there is significant variation in the ratio (of ERP to default spreads) over time, with the ratio dropping below one at the peak of the dot.com boom (when equity risk premiums dropped to 2%) and rising to as high as 2.63 at the end of 2006; the standard error in the estimate is 0.20. Whenever the ratio has deviated significantly from the average, though, there is reversion back to that median over time.

The capitalization rate in real estate, as noted earlier, is widely used metric in the valuation of real estate properties. For instance, a capitalization rate of 8%, in conjunction with an office building that generates income of $ 10 million, would result in a property value of $ 125 million ($10/.08). The difference between the capitalization ratio and the treasury bond rate can be considered a real estate market risk premium, In Figure 18, we used the capitalization rate in real estate ventures and compared the risk premiums imputed for real estate with both bond default spreads and implied equity risk premiums between 1980 and 2016.

Figure 18: Equity Risk Premiums, Cap Rates and Bond Spreads



The story in this graph is the convergence of the real estate and financial asset risk premiums. In the early 1980s, the real estate market seems to be operating in a different risk/return universe than financial assets, with the cap rates being less than the treasury bond rate. For instance, the cap rate in 1980 was 8.1%, well below the treasury bond rate of 12.8%, resulting in a negative risk premium for real estate. The risk premiums across the three markets - real estate, equity and bonds - started moving closer to each other in the late 1980s and the trend accelerated in the 1990s. We would attribute at least some of this increased co-movement to the securitization of real estate in this period. In 2008, the three markets moved almost in lock step, as risk premiums in the markets rose and prices fell. The housing bubble of 2004-2008 is manifested in the drop in the real estate equity risk premium during those years, bottoming out at less than 2% at the 2006. The correction in housing prices since has pushed the premium back up. Both equity and bond premiums adjusted quickly to pre-crisis levels in 2009 and 2010, and real estate premiums followed, albeit at a slower pace. Between 2013 and 2016, the risk premiums in the three markets have moved in tandem, all rising over the period.

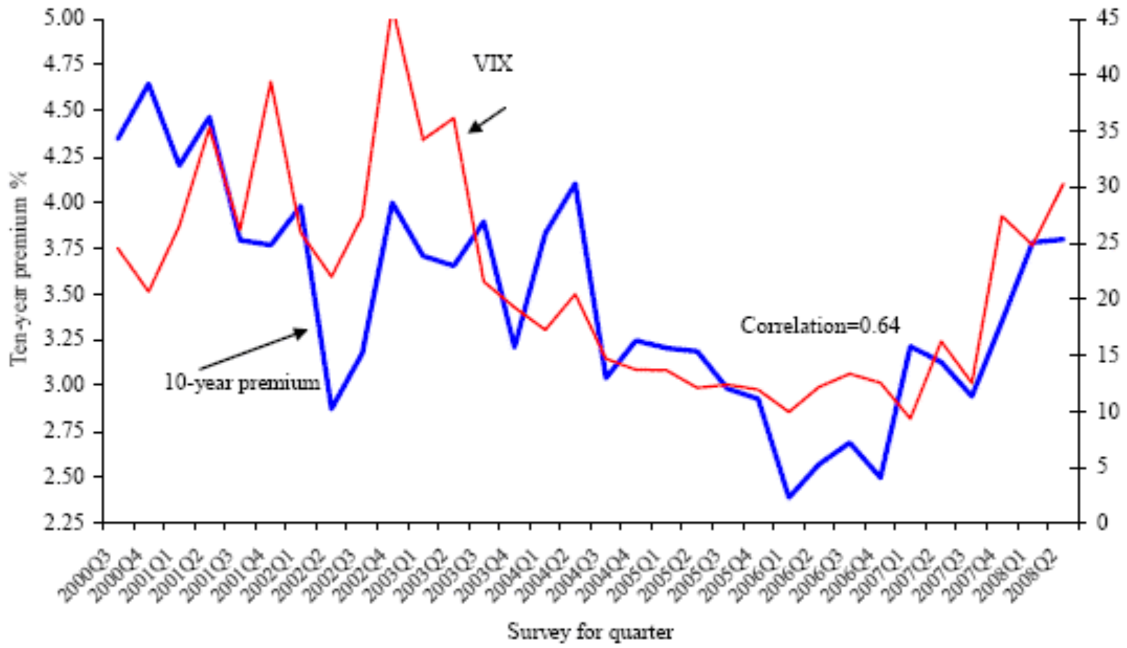
While the noise in the ratios (of ERP to default spreads and cap rates) is too high for us to develop a reliable rule of thumb, there is enough of a relationship here that we would suggest using this approach as a secondary one to test to see whether the equity risk premiums that we are using in practice make sense, given how risky assets are being priced in other markets. Thus, using an equity risk premium of 2%, when the Baa default spread is approximately at the same level strikes us as imprudent, given history. For macro strategists, there is a more activist way of using these premiums. When risk premiums in markets diverge, there is information in the relative pricing. Thus, the drop in equity risk premiums in the late 1990s, as default spreads stayed stable, would have signaled that the equity markets were overvalued (relative to bonds), just as the drop in default spreads between 2004 and 2007, while equity risk premiums were stagnant, would have suggested the opposite.

3. Option Pricing Model based Equity Risk Premium

There is one final approach to estimating equity risk premiums that draws on information in the option market. Option prices can be used to back out implied volatility in the equity market. To the extent that the equity risk premium is our way of pricing in the risk of future stock price volatility, there should be a relationship between the two.

The simplest measure of volatility from the options market is the volatility index (VIX), which is a measure of 30—day volatility constructed using the implied volatilities in traded S&P 500 index options. The CFO survey premium from Graham and Harvey that we referenced earlier in the paper found a high degree of correlation between the premiums demanded by CFOs and the VIX value (see figure 19 below):

Figure 19: Volatility Index (VIX) and Survey Risk Premiums



Santa-Clara and Yan (2006) use options on the S&P 500 to estimate the ex-ante risk assessed by investors from 1996 and 2002 and back out an implied equity risk premium on that basis.[130] To estimate the ex-ante risk, they allow for both continuous and discontinuous (or jump) risk in stocks, and use the option prices to estimate the probabilities of both types of risk. They then assume that investors share a specific utility function (power utility) and back out a risk premium that would compensate for this risk. Based on their estimates, investors should have demanded an equity risk premium of 11.8% for their perceived risk and that the perceived risk was about 70% higher than the realized risk over this period. Ross (2015) uses the implied volatilities in calls and puts on the S&P 500 to extract not only equity risk premiums but to also estimate the probabilities of catastrophic events embedded in stock prices.[131]

The link between equity market volatility and the equity risk premium also became clearer during the market meltdown in the last quarter of 2008. Earlier in the paper, we noted the dramatic shifts in the equity risk premiums, especially in the last year, as the financial crisis has unfolded. In Figure 20, we look at the implied equity risk premium

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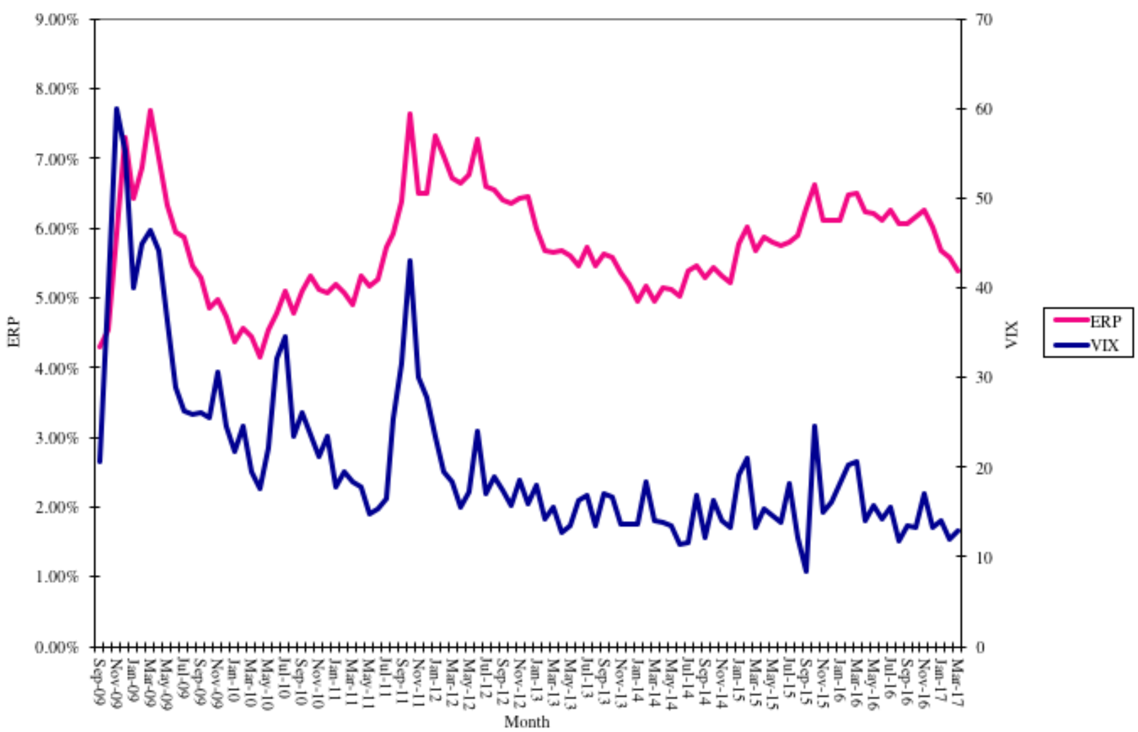
[130] Santa-Clara, P. and S. Yan, 2006, *Crashes, Volatility, and the Equity Premium: Lessons from S&P 500 Options*, Review of Economics and Statistics, v92, pg 435-451.
[131] Ross, S.M., 2015, *The Recovery Theorem*, Journal of Finance, v 70, 615-648.

each month from September 2008 to March 2017 and the volatility index (VIX) for the S&P 500:

Figure 20: ERP versus VIX



Note that the surge in equity risk premiums between September 2008 and December 2008 coincided with a jump in the volatility index and that both numbers have declined in the years since the crisis. The drop in the VIX between September 2011 and March 2012 was not accompanied by a decrease in the implied equity risk premium, but equity risk premiums drifted down in the year after. While the VIX stayed low for much of 2014, equity risk premiums climbed through the course of the year. In the last few months of 2015, the VIX spiked again on global market crises and the equity risk premium also went up. Both numbers were relatively stable in 2016.

In a paper referenced earlier, Bollerslev, Tauchen and Zhou (2009) take a different tack and argue that it is not the implied volatility per se, but the variance risk, i.e., the difference between the implied variance (in option prices) and the actual variance, that drives expected equity returns.[132] Thus, if the realized variance in a period is far higher

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[132] Bollerslev, T. G. Tauchen and H. Zhou, 2009, *Expected Stock Returns and Variance Risk Premia*, Review of Financial Studies, v22, 4463-4492.

(lower) than the implied variance, you should expect to see higher (lower) equity risk premiums demanded for subsequent periods. While they find evidence to back this proposition, they also note the relationship is strongest for short term returns (next quarter) and are weaker for longer-term returns. Bekaert and Hoerova (2013) decomposed the squared VIX into two components, a conditional variance of the stock market and an equity variance premium, and conclude that while the latter is a significant predictor of stock returns but the former is not.[133]

Choosing an Equity Risk Premium

We have looked at three different approaches to estimating risk premiums, the survey approach, where the answer seems to depend on who you ask and what you ask them, the historical premium approach, with wildly different results depending on how you slice and dice historical data and the implied premium approach, where the final number is a function of the model you use and the assumptions you make about the future. Ultimately, though, we have to choose a number to use in analysis and that number has consequences. In this section, we consider why the approaches give you different numbers and a pathway to use to devise which number is best for you.

Why do the approaches yield different values?

The different ways of estimating equity risk premium provide cover for analysts by providing justification for almost any number they choose to use in practice. No matter what the premium used by an analyst, whether it be 3% or 12%, there is back-up evidence offered that the premium is appropriate. While this may suffice as a legal defense, it does not pass muster on common sense grounds since not all risk premiums are equally justifiable. To provide a measure of how the numbers vary, the values that we have attached to the US equity risk premium, using different approaches, in January 2013 are summarized in table 23.

Table 23: Equity Risk Premium (ERP) for the United States – January 2013

Approach Used	*ERP*	*Additional information*

[133] Bekaert, G. and M. Hoerova, 2013, *The VIX, Variance Premium and Stock Market Volatility*, SSRN Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2342200.

Survey: CFOs	4.51%	Campbell and Harvey survey of CFOs (2015); Average estimate. Median was 3.19%.
Survey: Global Fund Managers	4.60%	Merrill Lynch (January 2014) survey of global managers
Historical - US	4.62%	Geometric average - Stocks over T.Bonds: 1928-2016
Historical – Multiple Equity Markets	3.20%	Average premium across 20 markets from 1900-2016: Dimson, Marsh and Staunton (2017)
Current Implied premium	5.69%	From S&P 500 – January 1, 2017
Average Implied premium	4.14%	Average of implied equity risk premium: 1960-2016
Default spread based premium	6.02%	Baa Default Spread * Median value of (ERP/ Default Spread)

The equity risk premiums, using the different approaches, yield a range, with the lowest value being 3.20% and the highest being 6.02%. Note that the range would have been larger if we used other measures of historical risk premiums: different time periods, arithmetic instead of geometric averages.

There are several reasons why the approaches yield different answers much of time and why they converge sometimes.

1. When stock prices enter an extended phase of upward (downward) movement, the historical risk premium will climb (drop) to reflect past returns. Implied premiums will tend to move in the opposite direction, since higher (lower) stock prices generally translate into lower (higher) premiums. In 1999, for instance, after the technology induced stock price boom of the 1990s, the implied premium was 2% but the historical risk premium was almost 6%.
2. Survey premiums reflect historical data more than expectations. When stocks are going up, investors tend to become more optimistic about future returns and survey

premiums reflect this optimism. In fact, the evidence that human beings overweight recent history (when making judgments) and overreact to information can lead to survey premiums overshooting historical premiums in both good and bad times. In good times, survey premiums are even higher than historical premiums, which, in turn, are higher than implied premiums; in bad times, the reverse occurs.

3. When the fundamentals of a market change, either because the economy becomes more volatile or investors get more risk averse, historical risk premiums will not change but implied premiums will. Shocks to the market are likely to cause the two numbers to deviate. After the terrorist attack on the World Trade Center in September 2001, for instance, implied equity risk premiums jumped almost 0.50% but historical premiums were unchanged (at least until the next update).

In summary, we should not be surprised to see large differences in equity risk premiums as we move from one approach to another, and even within an approach, as we change estimation parameters.

Which approach is the "best" approach?

If the approaches yield different numbers for the equity risk premium, and we have to choose one of these numbers, how do we decide which one is the "best" estimate? The answer to this question will depend upon several factors:

a. Predictive Power: In corporate finance and valuation, what we ultimately care about is the equity risk premium for the future. Consequently, the approach that has the best predictive power, i.e. yields forecasts of the risk premium that are closer to realized premiums, should be given more weight. So, which of the approaches does best on this count?

Campbell and Shiller (1988) suggested that the dividend yield, a simplistic measure of the implied equity risk premium, had significant predictive power for future returns.[134] However, Goyal and Welch (2007) examined many of the measures suggested as predictors of the equity risk premium in the literature, including the dividend yield and the earnings to price ratio, and find them all wanting.[135] Using data

[134] Campbell, J. Y. and R. J. Shiller. 1988, *The Dividend-Price Ratio And Expectations Of Future Dividends And Discount Factors*, Review of Financial Studies, v1(3), 195-228.
[135] Goyal, A. and I. Welch, 2007, *A Comprehensive Look at the Empirical Performance of Equity Premium Prediction,* Review of Financial Studies, v21, 1455-1508.

from 1926 to 2005, they conclude that while the measures do reasonably well in sample, they perform poorly out of sample, suggesting that the relationships in the literature are either spurious or unstable. Campbell and Thompson (2008) disagree, noting that putting simple restrictions on the predictive regressions improve out of sample performance for many predictive variables.[136]

To answer this question, we looked at the implied equity risk premiums from 1960 to 2016 and considered four predictors of this premium – the historical risk premium through the end of the prior year, the implied equity risk premium at the end of the prior year, the average implied equity risk premium over the previous five years and the premium implied by the Baa default spread. Since the survey data does not go back very far, we could not test the efficacy of the survey premium. Our results are summarized in table 24:

Table 24: Predictive Power of different estimates- 1960 - 2015

Predictor	*Correlation with implied premium next year*	*Correlation with actual return- next 5 years*	*Correlation with actual return – next 10 years*[137]
Current implied premium	0.761	0.478	0.537
Average implied premium: Last 5 years	0.716	0.544	0.745
Historical Premium	-0.490	-0.448	-0.456
Default Spread based premium	0.045	0.236	0.231

Over this period, the implied equity risk premium at the end of the prior period was the best predictor of the implied equity risk premium in the next period, whereas historical

[136] Campbell, J.Y., and S.B. Thompson, 2008, *Predictive Excess Stock Returns Out of Sample: Can Anything Beat the Historical Average?* Review of Financial Studies, v21, 150-9-1531.

[137] I computed the compounded average return on stocks in the following five (ten) years and netted out the compounded return earned on T.Bonds over the following five (ten) years. This was a switch from the simple arithmetic average of returns over the next 10 years that I was using until last year's survey.

risk premiums did worst. If we extend our analysis to make forecasts of the actual return premium earned by stocks over bonds for the next five or ten years, the average implied equity risk premium over the last five years yields the best forecast for the future, though default spread based premiums improve as predictors. Historical risk premiums perform even worse as forecasts of actual risk premiums over the next 5 or 10 years. If predictive power were the only test, historical premiums clearly fail the test.

b. Beliefs about markets: Implicit in the use of each approach are assumptions about market efficiency or lack thereof. If you believe that markets are efficient in the aggregate, or at least that you cannot forecast the direction of overall market movements, the current implied equity premium is the most logical choice, since it is estimated from the current level of the index. If you believe that markets, in the aggregate, can be significantly overvalued or undervalued, the historical risk premium or the average implied equity risk premium over long periods becomes a better choice. If you have absolutely no faith in markets, survey premiums will be the choice.
c. Purpose of the analysis: Notwithstanding your beliefs about market efficiency, the task for which you are using equity risk premiums may determine the right risk premium to use. In acquisition valuations and equity research, for instance, you are asked to assess the value of an individual company and not take a view on the level of the overall market. This will require you to use the current implied equity risk premium, since using any other number will bring your market views into the valuation. To see why, assume that the current implied premium is 4% and you decide to use a historical premium of 6% in your company valuation. Odds are that you will find the company to be over valued, but a big reason for your conclusion is that you started off with the assumption that the market itself is over valued by about 25-30%.[138] To make yourself market neutral, you will have to stick with the current implied premium. In corporate finance, where the equity risk premium is used to come up with a cost of capital, which in turn determines the long-term investments of the company, it may be more prudent to build in a long-term average (historical or implied) premium.

[138] If the current implied premium is 4%, using a 6% premium on the market will reduce the value of the index by about 25-30%.

In conclusion, there is no one approach to estimating equity risk premiums that will work for all analyses. If predictive power is critical or if market neutrality is a pre-requisite, the current implied equity risk premium is the best choice. For those more skeptical about markets, the choices are broader, with the average implied equity risk premium over a long time period having the strongest predictive power. Historical risk premiums are very poor predictors of both short-term movements in implied premiums or long-term returns on stocks.

As a final note, there are papers that report consensus premiums, often estimated by averaging across approaches. I remain skeptical about these estimates, since the approaches vary not only in terms of accuracy and predictive power but also in their philosophy. Averaging a historical risk premium with an implied premium may give an analyst a false sense of security but it really makes no sense since they represent different views of the world and push in different directions.

Five myths about equity risk premiums

There are widely held misconceptions about equity risk premiums that we would like to dispel in this section.

1. Estimation services "know" the risk premium: When Ibbotson and Sinquefield put together the first database of historical returns on stocks, bonds and bills in the 1970s, the data that they used was unique and not easily replicable, even for professional money managers. The niche they created, based on proprietary data, has led some to believe that Ibbotson Associates, and data services like them, have the capacity to read the historical data better than the rest of us, and therefore come up with better estimates. Now that the access to data has been democratized, and we face a much more even playing field, there is no reason to believe that any service has an advantage over any other, when it comes to historical premiums. Analysts should no longer be allowed to hide behind the defense that the equity risk premiums they use come from a reputable service and are thus beyond questioning.
2. There is no right risk premium: The flip side of the "services know it best" argument is that the data is so noisy that no one knows what the right risk premium is, and that any risk premium within a wide range is therefore defensible. As we have noted in this paper, it is indeed possible to arrive at outlandishly high or low premiums, but only if

you use estimation approaches that do not hold up to scrutiny. The arithmetic average premium from 2006 to 2015 for stocks over treasury bonds is an equity risk premium estimate, but it is not a good one.

3. The equity risk premium does not change much over time: Equity risk premiums reflect both economic fundamentals and investor risk aversion and they do change over time, sometimes over very short intervals, as evidenced by what happened in the last quarter of 2008. Shocks to the system – a collapse of a large company or sovereign entity or a terrorist attack – can cause premiums to shoot up overnight. A failure to recognize this reality will lead to analyses that lag reality.
4. Using the same premium is more important than using the right premium: Within many investment banks, corporations and consulting firms, the view seems to be that getting all analysts to use the same number as the risk premium is more important than testing to see whether that number makes sense. Thus, if all equity research analysts use 5% as the equity risk premium, the argument is that they are all being consistent. There are two problems with this argument. The first is that using a premium that is too high or low will lead to systematic errors in valuation. For instance, using a 5% risk premium across the board, when the implied premium is 4%, will lead you to find that most stocks are overvalued. . The second is that the impact of using too high a premium can vary across stocks, with growth stocks being affected more negatively than mature companies. A portfolio manager who followed the recommendations of these analysts would then be over invested in mature companies and under invested in growth companies.
5. If you adjust the cash flows for risk, there is no need for a risk premium: While statement is technically correct, adjusting cash flows for risk has to go beyond reflecting the likelihood of negative scenarios in the expected cash flow. The risk adjustment to expected cash flows to make them certainty equivalent cash flows requires us to answer exactly the same questions that we deal with when adjusting discount rates for risk.

Summary

The risk premium is a fundamental and critical component in portfolio management, corporate finance and valuation. Given its importance, it is surprising that more attention has not been paid in practical terms to estimation issues. In this paper, we began by looking at the determinants of equity risk premiums including macro economic volatility, investor risk aversion and behavioral components. We then looked at the three basic approaches used to estimate equity risk premiums – the survey approach, where investors or managers are asked to provide estimates of the equity risk premium for the future, the historical return approach, where the premium is based upon how well equities have done in the past and the implied approach, where we use future cash flows or observed bond default spreads to estimate the current equity risk premium.

The premiums that we estimate can vary widely across approaches, and we considered two questions towards the end of the paper. The first is why the numbers vary across approaches and the second is how to choose the "right" number to use in analysis. For the latter question, we argued that the choice of a premium will depend upon the forecast period, whether your believe markets are efficient and whether you are required to be market neutral in your analysis.

Appendix 1: Historical Returns on Stocks, Bonds and Bills – United States

The historical returns on stocks include dividends each year and the historical returns on T.Bonds are computed for a constant-maturity 10-year treasury bond and include both price change and coupon each year.

Year	*S&P 500*	*3-month T.Bill*	*10-year T. Bond*	*Stocks - Bills*	*Stocks - Bonds*	*Arithmetic Average: Stocks minus T.Bonds*	*Geometric Average: Stocks minus T. Bonds*
1928	43.81%	3.08%	0.84%	40.73%	42.98%	42.98%	42.98%
1929	-8.30%	3.16%	4.20%	-11.46%	-12.50%	15.24%	12.33%
1930	-25.12%	4.55%	4.54%	-29.67%	-29.66%	0.27%	-3.60%
1931	-43.84%	2.31%	-2.56%	-46.15%	-41.28%	-10.12%	-15.42%
1932	-8.64%	1.07%	8.79%	-9.71%	-17.43%	-11.58%	-15.81%
1933	49.98%	0.96%	1.86%	49.02%	48.13%	-1.63%	-7.36%
1934	-1.19%	0.32%	7.96%	-1.51%	-9.15%	-2.70%	-7.61%
1935	46.74%	0.18%	4.47%	46.57%	42.27%	2.92%	-2.49%
1936	31.94%	0.17%	5.02%	31.77%	26.93%	5.59%	0.40%
1937	-35.34%	0.30%	1.38%	-35.64%	-36.72%	1.36%	-4.22%
1938	29.28%	0.08%	4.21%	29.21%	25.07%	3.51%	-1.87%
1939	-1.10%	0.04%	4.41%	-1.14%	-5.51%	2.76%	-2.17%
1940	-10.67%	0.03%	5.40%	-10.70%	-16.08%	1.31%	-3.30%
1941	-12.77%	0.08%	-2.02%	-12.85%	-10.75%	0.45%	-3.88%
1942	19.17%	0.34%	2.29%	18.84%	16.88%	1.54%	-2.61%
1943	25.06%	0.38%	2.49%	24.68%	22.57%	2.86%	-1.18%
1944	19.03%	0.38%	2.58%	18.65%	16.45%	3.66%	-0.21%
1945	35.82%	0.38%	3.80%	35.44%	32.02%	5.23%	1.35%
1946	-8.43%	0.38%	3.13%	-8.81%	-11.56%	4.35%	0.63%
1947	5.20%	0.57%	0.92%	4.63%	4.28%	4.35%	0.81%
1948	5.70%	1.02%	1.95%	4.68%	3.75%	4.32%	0.95%
1949	18.30%	1.10%	4.66%	17.20%	13.64%	4.74%	1.49%
1950	30.81%	1.17%	0.43%	29.63%	30.38%	5.86%	2.63%
1951	23.68%	1.48%	-0.30%	22.20%	23.97%	6.61%	3.46%
1952	18.15%	1.67%	2.27%	16.48%	15.88%	6.98%	3.94%
1953	-1.21%	1.89%	4.14%	-3.10%	-5.35%	6.51%	3.57%
1954	52.56%	0.96%	3.29%	51.60%	49.27%	8.09%	4.98%
1955	32.60%	1.66%	-1.34%	30.94%	33.93%	9.01%	5.93%
1956	7.44%	2.56%	-2.26%	4.88%	9.70%	9.04%	6.07%
1957	-10.46%	3.23%	6.80%	-13.69%	-17.25%	8.16%	5.23%
1958	43.72%	1.78%	-2.10%	41.94%	45.82%	9.38%	6.39%

1959	12.06%	3.26%	-2.65%	8.80%	14.70%	9.54%	6.66%
1960	0.34%	3.05%	11.64%	-2.71%	-11.30%	8.91%	6.11%
1961	26.64%	2.27%	2.06%	24.37%	24.58%	9.37%	6.62%
1962	-8.81%	2.78%	5.69%	-11.59%	-14.51%	8.69%	5.97%
1963	22.61%	3.11%	1.68%	19.50%	20.93%	9.03%	6.36%
1964	16.42%	3.51%	3.73%	12.91%	12.69%	9.13%	6.53%
1965	12.40%	3.90%	0.72%	8.50%	11.68%	9.20%	6.66%
1966	-9.97%	4.84%	2.91%	-14.81%	-12.88%	8.63%	6.11%
1967	23.80%	4.33%	-1.58%	19.47%	25.38%	9.05%	6.57%
1968	10.81%	5.26%	3.27%	5.55%	7.54%	9.01%	6.60%
1969	-8.24%	6.56%	-5.01%	-14.80%	-3.23%	8.72%	6.33%
1970	3.56%	6.69%	16.75%	-3.12%	-13.19%	8.21%	5.90%
1971	14.22%	4.54%	9.79%	9.68%	4.43%	8.12%	5.87%
1972	18.76%	3.95%	2.82%	14.80%	15.94%	8.30%	6.08%
1973	-14.31%	6.73%	3.66%	-21.03%	-17.97%	7.73%	5.50%
1974	-25.90%	7.78%	1.99%	-33.68%	-27.89%	6.97%	4.64%
1975	37.00%	5.99%	3.61%	31.01%	33.39%	7.52%	5.17%
1976	23.83%	4.97%	15.98%	18.86%	7.85%	7.53%	5.22%
1977	-6.98%	5.13%	1.29%	-12.11%	-8.27%	7.21%	4.93%
1978	6.51%	6.93%	-0.78%	-0.42%	7.29%	7.21%	4.97%
1979	18.52%	9.94%	0.67%	8.58%	17.85%	7.42%	5.21%
1980	31.74%	11.22%	-2.99%	20.52%	34.72%	7.93%	5.73%
1981	-4.70%	14.30%	8.20%	-19.00%	-12.90%	7.55%	5.37%
1982	20.42%	11.01%	32.81%	9.41%	-12.40%	7.18%	5.10%
1983	22.34%	8.45%	3.20%	13.89%	19.14%	7.40%	5.34%
1984	6.15%	9.61%	13.73%	-3.47%	-7.59%	7.13%	5.12%
1985	31.24%	7.49%	25.71%	23.75%	5.52%	7.11%	5.13%
1986	18.49%	6.04%	24.28%	12.46%	-5.79%	6.89%	4.97%
1987	5.81%	5.72%	-4.96%	0.09%	10.77%	6.95%	5.07%
1988	16.54%	6.45%	8.22%	10.09%	8.31%	6.98%	5.12%
1989	31.48%	8.11%	17.69%	23.37%	13.78%	7.08%	5.24%
1990	-3.06%	7.55%	6.24%	-10.61%	-9.30%	6.82%	5.00%
1991	30.23%	5.61%	15.00%	24.62%	15.23%	6.96%	5.14%
1992	7.49%	3.41%	9.36%	4.09%	-1.87%	6.82%	5.03%
1993	9.97%	2.98%	14.21%	6.98%	-4.24%	6.65%	4.90%
1994	1.33%	3.99%	-8.04%	-2.66%	9.36%	6.69%	4.97%
1995	37.20%	5.52%	23.48%	31.68%	13.71%	6.80%	5.08%
1996	22.68%	5.02%	1.43%	17.66%	21.25%	7.01%	5.30%
1997	33.10%	5.05%	9.94%	28.05%	23.16%	7.24%	5.53%

1998	28.34%	4.73%	14.92%	23.61%	13.42%	7.32%	5.63%
1999	20.89%	4.51%	-8.25%	16.38%	29.14%	7.63%	5.96%
2000	-9.03%	5.76%	16.66%	-14.79%	-25.69%	7.17%	5.51%
2001	-11.85%	3.67%	5.57%	-15.52%	-17.42%	6.84%	5.17%
2002	-21.97%	1.66%	15.12%	-23.62%	-37.08%	6.25%	4.53%
2003	28.36%	1.03%	0.38%	27.33%	27.98%	6.54%	4.82%
2004	10.74%	1.23%	4.49%	9.52%	6.25%	6.53%	4.84%
2005	4.83%	3.01%	2.87%	1.82%	1.97%	6.48%	4.80%
2006	15.61%	4.68%	1.96%	10.94%	13.65%	6.57%	4.91%
2007	5.48%	4.64%	10.21%	0.84%	-4.73%	6.43%	4.79%
2008	-36.55%	1.59%	20.10%	-38.14%	-56.65%	5.65%	3.88%
2009	25.94%	0.14%	-11.12%	25.80%	37.05%	6.03%	4.29%
2010	14.82%	0.13%	8.46%	14.69%	6.36%	6.03%	4.31%
2011	2.10%	0.03%	16.04%	2.07%	-13.94%	5.80%	4.10%
2012	15.89%	0.05%	2.97%	15.84%	12.92%	5.88%	4.20%
2013	32.15%	0.07%	-9.10%	32.08%	41.25%	6.29%	4.62%
2014	13.52%	0.05%	10.75%	13.47%	2.78%	6.25%	4.60%
2015	1.36%	0.21%	1.28%	1.15%	0.08%	6.18%	4.54%
2016	11.74%	0.51%	0.69%	11.23%	11.05%	6.24%	4.62%

Appendix 2: Sovereign Ratings by Country- January 2016

These are Moody's sovereign ratings for both foreign currency (FC) and local currency (LC) borrowings, by country.

Country	FC	LC	Country	FC	LC
Abu Dhabi	Aa2	Aa2	Czech Republic	A1	A1
Albania	B1	B1	Democratic Republic of the Congo	B3	B3
Andorra	NA	NA	Denmark	Aaa	Aaa
Angola	B1	B1	Dominican Republic	B1	B1
Argentina	B3	B3	Ecuador	B3	B3
Armenia	B1	B1	Egypt	B3	B3
Australia	Aaa	Aaa	El Salvador	B3	B3
Austria	Aa1	Aa1	Estonia	A1	A1
Azerbaijan	Ba1	Ba1	Ethiopia	B1	B1
Bahamas	Baa3	Baa3	Fiji	B1	B1
Bahrain	Ba2	Ba2	Finland	Aa1	Aa1
Bangladesh	Ba3	Ba3	France	Aa2	Aa2
Barbados	Caa1	Caa1	Gabon	B1	B1
Belarus	Caa1	Caa1	Georgia	Ba3	Ba3
Belgium	Aa3	Aa3	Germany	Aaa	Aaa
Belize	Caa2	Caa2	Ghana	B3	B3
Bermuda	A2	A2	Greece	Caa3	Caa3
Bolivia	Ba3	Ba3	Guatemala	Ba1	Ba1
Bosnia and Herzegovina	B3	B3	Guernsey (Channel Islands)	NA	NA
Botswana	A2	A2	Honduras	B2	B2
Brazil	Ba2	Ba2	Hong Kong	Aa1	Aa1
Bulgaria	Baa2	Baa2	Hungary	Baa3	Baa3
Cambodia	B2	B2	Iceland	A3	A3
Cameroon	B2	B2	India	Baa3	Baa3
Canada	Aaa	Aaa	Indonesia	Baa3	Baa3
Cayman Islands	Aa3	Aa3	Ireland	A3	A3
Chile	Aa3	Aa3	Isle of Man	Aa1	Aa1
China	Aa3	Aa3	Israel	A1	A1
Colombia	Baa2	Baa2	Italy	Baa2	Baa2
Costa Rica	Ba1	Ba1	Jamaica	B3	B3
Cote d'Ivoire	Ba3	Ba3	Japan	A1	A1
Croatia	Ba2	Ba2	Jersey (Channel Islands)	NA	NA
Cuba	Caa2	Caa2	Jordan	B1	B1
Cyprus	B1	B1	Kazakhstan	Baa3	Baa3

Country	FC	LC	Country	FC	LC
Kenya	B1	B1	Qatar	Aa2	Aa2
Korea	Aa2	Aa2	Republic of the Congo	B3	B3
Kuwait	Aa2	Aa2	Romania	Baa3	Baa3
Kyrgyzstan	B2	B2	Russia	Ba1	Ba1
Latvia	A3	A3	Rwanda	B2	B2
Lebanon	B2	B2	Saudi Arabia	A1	A1
Liechtenstein			Senegal	B1	B1
Lithuania	A3	A3	Serbia	B1	B1
Luxembourg	Aaa	Aaa	Sharjah	A3	A3
Macao	Aa3	Aa3	Singapore	Aaa	Aaa
Malaysia	A3	A3	Sint. Maarten	Baa2	Baa2
Malta	A3	A3	Slovakia	A2	A2
Mauritius	Baa1	Baa1	Slovenia	Baa3	Baa3
Mexico	A3	A3	South Africa	Baa2	Baa2
Moldova	B3	B3	Spain	Baa2	Baa2
Mongolia	Caa1	Caa1	Sri Lanka	B1	B1
Montenegro	B1	B1	St. Vincent & the Grenadines	B3	B3
Morocco	Ba1	Ba1	Suriname	B1	B1
Mozambique	Caa3	Caa3	Sweden	Aaa	Aaa
Namibia	Baa3	Baa3	Switzerland	Aaa	Aaa
Netherlands	Aaa	Aaa	Taiwan	Aa3	Aa3
New Zealand	Aaa	Aaa	Thailand	Baa1	Baa1
Nicaragua	B2	B2	Trinidad and Tobago	Baa3	Baa3
Nigeria	B1	B1	Tunisia	Ba3	Ba3
Norway	Aaa	Aaa	Turkey	Ba1	Ba1
Oman	Baa1	Baa1	Uganda	B2	B2
Pakistan	B3	B3	Ukraine	Caa3	Caa3
Panama	Baa2	Baa2	United Arab Emirates	Aa2	Aa2
Papua New Guinea	B2	B2	United Kingdom	Aa1	Aa1
Paraguay	Ba1	Ba1	United States	Aaa	Aaa
Peru	A3	A3	Uruguay	Baa2	Baa2
Philippines	Baa2	Baa2	Venezuela	Caa3	Caa3
Poland	A2	A2	Vietnam	B1	B1
Portugal	Ba1	Ba1	Zambia	B3	B3

Appendix 3: Country Risk Scores from the PRS Group – January 2017

Political Risk Services (PRS) is a risk estimation service that estimates country risk on multiple dimensions. The risk scores reported in this table are composite risk scores for each country, with lower numbers indicating higher risk.

Country	***PRS Score***	***Country***	***PRS Score***
Albania	69.3	Egypt	53.8
Algeria	61.3	El Salvador	67.0
Angola	57.3	Estonia	74.0
Argentina	64.3	Ethiopia	58.3
Armenia	62.5	Finland	82.0
Australia	78.3	France	72.3
Austria	79.8	Gabon	63.0
Azerbaijan	58.8	Gambia	60.5
Bahamas	76.0	Georgia	0.0
Bahrain	65.8	Germany	85.0
Bangladesh	66.5	Ghana	65.0
Belarus	62.5	Greece	66.5
Belgium	76.5	Guatemala	69.5
Bolivia	67.3	Guinea	55.0
Botswana	77.8	Guinea-Bissau	65.0
Brazil	64.5	Guyana	68.8
Brunei	73.5	Haiti	59.3
Bulgaria	74.0	Honduras	66.8
Burkina Faso	64.0	Hong Kong	80.8
Cameroon	63.5	Hungary	76.3
Canada	82.8	Iceland	80.3
Chile	74.8	India	72.0
China	71.5	Indonesia	67.5
Colombia	67.0	Iran	73.0
Congo (Democratic Republic of)	53.5	Iraq	56.3
Congo (Republic of)	61.3	Ireland	82.3
Costa Rica	75.3	Israel	78.0
Côte d'Ivoire	63.8	Italy	74.5
Croatia	71.3	Jamaica	72.3
Cuba	68.3	Japan	82.5
Cyprus	74.0	Jordan	63.8
Czech Republic	80.3	Kazakhstan	65.3
Denmark	81.0	Kenya	63.5
Dominican Republic	74.3	Korea	81.3
Ecuador	60.5	Korea, D.P.R.	56.0

Country	*PRS Score*	*Country*	*PRS Score*
Kuwait	72.8	Romania	72.0
Latvia	73.8	Russia	66.3
Lebanon	61.0	Saudi Arabia	69.3
Liberia	52.8	Senegal	62.8
Libya	48.3	Serbia	67.0
Lithuania	74.0	Sierra Leone	58.8
Luxembourg	87.0	Singapore	85.5
Madagascar	64.8	Slovakia	75.0
Malawi	58.3	Slovenia	73.8
Malaysia	74.5	Somalia	41.8
Mali	63.3	South Africa	66.0
Malta	80.0	Spain	74.8
Mexico	67.0	Sri Lanka	64.5
Moldova	60.8	Sudan	47.8
Mongolia	67.5	Suriname	55.0
Morocco	69.8	Sweden	85.8
Mozambique	50.0	Switzerland	88.5
Myanmar	62.8	Syria	44.8
Namibia	70.8	Taiwan	83.3
Netherlands	82.8	Tanzania	64.3
New Zealand	82.8	Thailand	70.0
Nicaragua	64.5	Togo	60.8
Niger	56.5	Trinidad and Tobago	68.0
Nigeria	54.0	Tunisia	65.0
Norway	88.0	Turkey	62.0
Oman	68.8	Uganda	60.3
Pakistan	62.8	Ukraine	61.5
Panama	74.3	United Arab Emirates	77.8
Papua New Guinea	64.5	United Kingdom	78.0
Paraguay	69.3	United States of America	79.0
Peru	72.0	Uruguay	70.8
Philippines	74.3	Venezuela	41.0
Poland	77.8	Vietnam	70.8
Portugal	77.3	Yemen, Republic	51.3
Qatar	78.3	Zambia	65.8
		Zimbabwe	55.8

Appendix 4: Equity Market volatility, relative to S&P 500: Total Equity Risk Premiums and Country Risk Premiums (Weekly returns from 1/14 – 1/16)

The standard deviation in stocks is computed using the primary index for each country, using two years of weekly returns.

Country	*Annualized Stock Market Volatility*	*Relative Volatility (to US)*	*Total Equity Risk Premium*	*Country risk premium*
Argentina	26.67%	2.64	15.00%	9.31%
Bahrain	7.95%	0.79	4.47%	-1.22%
Bangladesh	8.84%	0.87	4.97%	-0.72%
Bosnia	13.67%	1.35	7.69%	2.00%
Botswana	3.48%	0.34	1.96%	-3.73%
Brazil	21.22%	2.10	11.93%	6.24%
Bulgaria	11.82%	1.17	6.65%	0.96%
Chile	11.08%	1.09	6.23%	0.54%
China	14.34%	1.42	8.06%	2.37%
Colombia	11.62%	1.15	6.53%	0.84%
Costa Rica	7.28%	0.72	4.09%	-1.60%
Croatia	10.41%	1.03	5.85%	0.16%
Cyprus	12.39%	1.22	6.97%	1.28%
Czech Republic	13.89%	1.37	7.81%	2.12%
Egypt	22.75%	2.25	12.79%	7.10%
Estonia	7.75%	0.77	4.36%	-1.33%
Ghana	9.20%	0.91	5.17%	-0.52%
Greece	26.83%	2.65	15.09%	9.40%
Hungary	15.54%	1.54	8.74%	3.05%
Iceland	14.87%	1.47	8.36%	2.67%
India	12.66%	1.25	7.12%	1.43%
Indonesia	12.56%	1.24	7.06%	1.37%
Ireland	20.13%	1.99	11.32%	5.63%
Israel	12.17%	1.20	6.84%	1.15%
Italy	24.15%	2.39	13.58%	7.89%
Jamaica	13.58%	1.34	7.64%	1.95%
Jordan	5.35%	0.53	3.01%	-2.68%
Kazakhastan	14.69%	1.45	8.26%	2.57%
Kenya	11.10%	1.10	6.24%	0.55%
Korea	10.71%	1.06	6.02%	0.33%
Kuwait	9.15%	0.90	5.14%	-0.55%

Laos	25.63%	2.53	14.41%	8.72%
Latvia	13.91%	1.37	7.82%	2.13%
Lebanon	7.29%	0.72	4.10%	-1.59%
Lithuania	6.89%	0.68	3.87%	-1.82%
Macedonia	8.93%	0.88	5.02%	-0.67%
Malaysia	7.36%	0.73	4.14%	-1.55%
Malta	6.19%	0.61	3.48%	-2.21%
Mauritius	4.50%	0.44	2.53%	-3.16%
Mexico	13.54%	1.34	7.61%	1.92%
Mongolia	16.06%	1.59	9.03%	3.34%
Montenegro	15.55%	1.54	8.74%	3.05%
Morocco	11.76%	1.16	6.61%	0.92%
Namibia	22.47%	2.22	12.63%	6.94%
Nigeria	15.03%	1.49	8.45%	2.76%
Oman	7.20%	0.71	4.05%	-1.64%
Pakistan	11.02%	1.09	6.20%	0.51%
Palestine	6.63%	0.66	3.73%	-1.96%
Panama	5.03%	0.50	2.83%	-2.86%
Peru	16.54%	1.63	9.30%	3.61%
Philippines	16.22%	1.60	9.12%	3.43%
Poland	14.80%	1.46	8.32%	2.63%
Portugal	15.56%	1.54	8.75%	3.06%
Qatar	13.27%	1.31	7.46%	1.77%
Romania	10.72%	1.06	6.03%	0.34%
Russia	13.93%	1.38	7.83%	2.14%
Saudi Arabia	16.63%	1.64	9.35%	3.66%
Serbia	9.62%	0.95	5.41%	-0.28%
Singapore	11.16%	1.10	6.27%	0.58%
Slovakia	16.03%	1.58	9.01%	3.32%
Slovenia	10.33%	1.02	5.81%	0.12%
South Africa	15.82%	1.56	8.89%	3.20%
Spain	22.21%	2.19	12.49%	6.80%
Sri Lanka	6.97%	0.69	3.92%	-1.77%
Taiwan	11.88%	1.17	6.68%	0.99%
Tanzania	29.35%	2.90	16.50%	10.81%
Thailand	12.67%	1.25	7.12%	1.43%
Tunisia	5.18%	0.51	2.91%	-2.78%
Turkey	20.45%	2.02	11.50%	5.81%
UAE	14.72%	1.45	8.28%	2.59%

Ukraine	24.62%	2.43	13.84%	8.15%
US	10.12%	1.00	**5.69%**	**0.00%**
Venezuela	43.37%	4.29	24.38%	18.69%
Vietnam	12.16%	1.20	6.84%	1.15%

Appendix 5: Equity Market Volatility versus Bond Market/CDS volatility- January 2017

Standard deviation in equity index (σ_{Equity}) and government bond price (σ_{Bond}) was computed, using the last 260 trading days, where available. To compute the σ_{CDS}, we first computed the standard deviation of the CDS in basis points over the the last 260 trading days and then divided by the level of the CDS to get a coefficient of variation.

Country	*Std deviation in Equities (weekly)*	s_{Bond}	s_{Equity}/s_{Bond}	*s (CDS)*	*CDS*	*CVCDS*	s_{Equity}/s_{CDS}
Argentina	26.67%	10.63%	2.51	0.31%	4.67%	6.64%	4.02
Bahrain	7.95%	NA	NA	0.40%	2.60%	15.38%	0.52
Bangladesh	8.84%	NA	NA	NA	NA	NA	NA
Bosnia	13.67%	NA	NA	NA	NA	NA	NA
Botswana	3.48%	NA	NA	NA	NA	NA	NA
Brazil	21.22%	10.01%	2.12	0.30%	3.15%	9.52%	2.23
Bulgaria	11.82%	8.74%	1.35	0.30%	1.57%	19.11%	0.62
Chile	11.08%	4.01%	2.76	0.43%	1.22%	35.25%	0.31
China	14.34%	NA	NA	0.28%	1.30%	21.54%	0.67
Colombia	11.62%	6.37%	1.82	0.29%	2.31%	12.55%	0.93
Costa Rica	7.28%	3.21%	2.27	0.28%	2.73%	10.26%	0.71
Croatia	10.41%	5.86%	1.78	0.31%	2.48%	12.50%	0.83
Cyprus	12.39%	6.97%	1.78	0.42%	2.43%	17.28%	0.72
Czech Republic	13.89%	4.93%	2.82	0.37%	0.65%	56.92%	0.24
Egypt	22.75%	NA	NA	0.37%	3.83%	9.66%	2.35
Estonia	7.75%	NA	NA	0.24%	0.77%	31.17%	0.25
Ghana	9.20%	NA	NA	NA	NA	NA	NA
Greece	26.83%	45.54%	0.59	1.39%	7.48%	18.58%	1.44
Hungary	15.54%	7.18%	2.16	0.26%	1.64%	15.85%	0.98
Iceland	14.87%	4.02%	3.70	0.20%	1.10%	18.18%	0.82
India	12.66%	6.38%	1.98	0.30%	1.51%	19.87%	0.64
Indonesia	12.56%	8.87%	1.42	0.32%	1.97%	16.24%	0.77
Ireland	20.13%	6.02%	3.34	0.25%	0.92%	27.17%	0.74
Israel	12.17%	4.32%	2.82	0.38%	1.07%	35.51%	0.34
Italy	24.15%	7.66%	3.15	0.37%	2.56%	14.45%	1.67
Jamaica	13.58%	NA	NA	NA	NA	NA	NA
Jordan	5.35%	NA	NA	NA	NA	NA	NA
Kazakhastan	14.69%	NA	NA	0.32%	2.13%	15.02%	0.98
Kenya	11.10%	NA	NA	NA	NA	NA	NA
Korea	10.71%	4.49%	2.39	0.39%	0.72%	54.17%	0.20
Kuwait	9.15%	NA	NA	0.11%	0.63%	17.46%	0.52

Laos	25.63%	NA	NA	NA	NA	NA	NA
Latvia	13.91%	8.58%	1.62	0.34%	1.00%	34.00%	0.41
Lebanon	7.29%	3.15%	2.31	0.35%	4.60%	7.61%	0.96
Lithuania	6.89%	NA	NA	0.31%	0.97%	31.96%	0.22
Macedonia	8.93%	NA	NA	NA	NA	NA	NA
Malaysia	7.36%	5.78%	1.27	0.33%	1.58%	20.89%	0.35
Malta	6.19%	NA	NA	NA	NA	NA	NA
Mauritius	4.50%	NA	NA	NA	NA	NA	NA
Mexico	13.54%	7.81%	1.73	0.34%	2.03%	16.75%	0.81
Mongolia	16.06%	NA	NA	NA	NA	NA	NA
Montenegro	15.55%	NA	NA	NA	NA	NA	NA
Morocco	11.76%	NA	NA	0.30%	1.67%	17.96%	0.65
Namibia	22.47%	NA	NA	NA	NA	NA	NA
Nigeria	15.03%	NA	NA	0.57%	4.14%	13.77%	1.09
Oman	7.20%	NA	NA	NA	NA	NA	NA
Pakistan	11.02%	9.52%	1.16	0.19%	3.97%	4.79%	2.30
Palestine	6.63%	NA	NA	NA	NA	NA	NA
Panama	5.03%	NA	NA	0.37%	1.89%	19.58%	0.26
Peru	16.54%	12.00%	1.38	0.39%	1.75%	22.29%	0.74
Philippines	16.22%	7.09%	2.29	0.31%	1.33%	23.31%	0.70
Poland	14.80%	7.16%	2.07	0.27%	1.13%	23.89%	0.62
Portugal	15.56%	7.23%	2.15	0.30%	3.25%	9.23%	1.69
Qatar	13.27%	NA	NA	0.33%	1.06%	31.13%	0.43
Romania	10.72%	6.45%	1.66	0.29%	1.43%	20.28%	0.53
Russia	13.93%	5.69%	2.45	0.37%	2.65%	13.96%	1.00
Saudi Arabia	16.63%	17.55%	0.95	0.33%	1.50%	22.00%	0.76
Serbia	9.62%	NA	NA	NA	NA	NA	NA
Singapore	11.16%	NA	NA	NA	NA	NA	NA
Slovakia	16.03%	6.54%	2.45	0.21%	0.84%	25.00%	0.64
Slovenia	10.33%	5.23%	1.98	0.33%	1.33%	24.81%	0.42
South Africa	15.82%	14.74%	1.07	0.34%	2.98%	11.41%	1.39
Spain	22.21%	6.87%	3.23	0.39%	1.25%	31.20%	0.71
Sri Lanka	6.97%	NA	NA	NA	NA	NA	NA
Taiwan	11.88%	35.48%	0.33	NA	NA	NA	NA
Tanzania	29.35%	15.55%	1.89	NA	NA	NA	NA
Thailand	12.67%	5.49%	2.31	0.34%	0.98%	34.69%	0.37
Tunisia	5.18%	NA	NA	0.11%	4.52%	2.43%	2.13
Turkey	20.45%	7.21%	2.84	0.33%	3.22%	10.25%	2.00
UAE	14.72%	NA	NA	0.37%	0.80%	46.25%	0.32

Ukraine	24.62%	9.98%	2.47	0.37%	7.05%	5.25%	4.69
US	10.12%	NA	NA	0.62%	0.37%	167.57%	0.06
Venezuela	43.37%	26.65%	1.63	3.73%	28.19%	13.23%	3.28
Vietnam	12.16%	NA	NA	0.27%	2.34%	11.54%	1.05

Average			2.05				1.02
Median			2.09				0.72

Appendix 6: Year-end Implied Equity Risk Premiums: 1961-2015

These estimates of equity risk premium for the S&P 500 are forward looking and are computed based on the index level at the end of each year and the expected cash flows on the index for the future. The cash flows are computed as dividends plus stock buybacks in each year.

Year	*S&P 500*	*Earnings*[a]	*Dividends*[a]	*T.Bond Rate*	*Estimated Growth*	*Implied Premium*
1961	71.55	3.37	2.04	2.35%	2.41%	2.92%
1962	63.1	3.67	2.15	3.85%	4.05%	3.56%
1963	75.02	4.13	2.35	4.14%	4.96%	3.38%
1964	84.75	4.76	2.58	4.21%	5.13%	3.31%
1965	92.43	5.30	2.83	4.65%	5.46%	3.32%
1966	80.33	5.41	2.88	4.64%	4.19%	3.68%
1967	96.47	5.46	2.98	5.70%	5.25%	3.20%
1968	103.86	5.72	3.04	6.16%	5.32%	3.00%
1969	92.06	6.10	3.24	7.88%	7.55%	3.74%
1970	92.15	5.51	3.19	6.50%	4.78%	3.41%
1971	102.09	5.57	3.16	5.89%	4.57%	3.09%
1972	118.05	6.17	3.19	6.41%	5.21%	2.72%
1973	97.55	7.96	3.61	6.90%	8.30%	4.30%
1974	68.56	9.35	3.72	7.40%	6.42%	5.59%
1975	90.19	7.71	3.73	7.76%	5.99%	4.13%
1976	107.46	9.75	4.22	6.81%	8.19%	4.55%
1977	95.1	10.87	4.86	7.78%	9.52%	5.92%
1978	96.11	11.64	5.18	9.15%	8.48%	5.72%
1979	107.94	14.55	5.97	10.33%	11.70%	6.45%
1980	135.76	14.99	6.44	12.43%	11.01%	5.03%
1981	122.55	15.18	6.83	13.98%	11.42%	5.73%
1982	140.64	13.82	6.93	10.47%	7.96%	4.90%
1983	164.93	13.29	7.12	11.80%	9.09%	4.31%
1984	167.24	16.84	7.83	11.51%	11.02%	5.11%
1985	211.28	15.68	8.20	8.99%	6.75%	3.84%
1986	242.17	14.43	8.19	7.22%	6.96%	3.58%
1987	247.08	16.04	9.17	8.86%	8.58%	3.99%
1988	277.72	24.12	10.22	9.14%	7.67%	3.77%
1989	353.4	24.32	11.73	7.93%	7.46%	3.51%
1990	330.22	22.65	12.35	8.07%	7.19%	3.89%
1991	417.09	19.30	12.97	6.70%	7.81%	3.48%
1992	435.71	20.87	12.64	6.68%	9.83%	3.55%
1993	466.45	26.90	12.69	5.79%	8.00%	3.17%
1994	459.27	31.75	13.36	7.82%	7.17%	3.55%

1995	615.93	37.70	14.17	5.57%	6.50%	3.29%
1996	740.74	40.63	14.89	6.41%	7.92%	3.20%
1997	970.43	44.09	15.52	5.74%	8.00%	2.73%
1998	1229.23	44.27	16.20	4.65%	7.20%	2.26%
1999	1469.25	51.68	16.71	6.44%	12.50%	2.05%
2000	1320.28	56.13	16.27	5.11%	12.00%	2.87%
2001	1148.09	38.85	15.74	5.05%	10.30%	3.62%
2002	879.82	46.04	16.08	3.81%	8.00%	4.10%
2003	1111.91	54.69	17.88	4.25%	11.00%	3.69%
2004	1211.92	67.68	19.407	4.22%	8.50%	3.65%
2005	1248.29	76.45	22.38	4.39%	8.00%	4.08%
2006	1418.3	87.72	25.05	4.70%	12.50%	4.16%
2007	1468.36	82.54	27.73	4.02%	5.00%	4.37%
2008	903.25	65.39	28.05	2.21%	4.00%	6.43%
2009	1115.10	59.65	22.31	3.84%	7.20%	4.36%
2010	1257.64	83.66	23.12	3.29%	6.95%	5.20%
2011	1257.60	97.05	26.02	1.87%	7.18%	6.01%
2012	1426.19	102.47	30.44	1.76%	5.27%	5.78%
2013	1848.36	107.45	36.28	3.04%	4.28%	4.96%
2014	2058.90	114.74	38.57	2.17%	5.58%	5.78%
2015	2043.90	106.32	43.16	2.27%	5.51%	6.12%
2016	2238.83	108.86	45.03	2.45%	5.54%	5.69%

[a] The earnings and dividend numbers for the S&P 500 represent the estimates that would have been available at the start of each of the years and thus may not match up to the actual numbers for the year. For instance, in January 2011, the estimated earnings for the S&P 500 index included actual earnings for three quarters of 2011 and the estimated earnings for the last quarter of 2011. The actual earnings for the last quarter would not have been available until March of 2011.

Title: Equity Risk Premium: Expectations Great and Small

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Equity Risk Premium: Expectations Great and Small

What I actually think is that our prey, called the equity risk premium, is extremely elusive.

Stephen A. Ross 2001

Abstract:
The Equity Risk Premium (ERP) is an essential building block of the market value of risk. In theory, the collective action of all investors results in an equilibrium expectation for the return on the market portfolio excess of the risk-free return, the equity risk premium. The ability of the valuation actuary to choose a sensible value for the ERP, whether as a required input to CAPM valuation, or any of its descendants, is as important as choosing risk-free rates and risk relatives (betas) to the ERP for the asset at hand. The historical realized ERP for the stock market appears to be at odds with pricing theory parameters for risk aversion. Since 1985, there has been a constant stream of research, each of which reviews theories of estimating market returns, examines historical data periods, or both. Those ERP value estimates vary widely from about minus one percent to about nine percent, based on a geometric or arithmetic averaging, short or long horizons, short or long-run expectations, unconditional or conditional distributions, domestic or international data, data periods, and real or nominal returns. This paper will examine the principal strains of the recent research on the ERP and catalogue the empirical values of the ERP implied by that research. In addition, the paper will supply several time series analyses of the standard Ibbotson Associates 1926-2002 ERP data using short Treasuries for the risk-free rate. Recommendations for ERP values to use in common actuarial valuation problems will be offered.

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Keywords: Equity Risk Premium, Risk Premium Puzzle, Market Return Models, CAPM, Dividend Growth Models, Actuarial Valuations.

Introduction

The Equity Risk Premium (ERP) is an essential building block of the market value of risk. In theory, the collective action of all investors results in an equilibrium expectation for the return on the market portfolio excess of the risk-free return, the equity risk premium. The ability of the valuation actuary to choose a sensible value for the ERP, whether as a required input to CAPM valuation, or any of its descendants[1], is as important as choosing risk-free rates and risk relatives (betas) to the ERP for the asset at hand. Risky discount rates, asset allocation models, and project costs of capital are common actuarial uses of ERP as a benchmark rate.

The equity risk premium should be of particular interest to actuaries. For pensions and annuities backed by bonds and stocks, the actuary needs to have an understanding of the ERP and its variability compared to fixed horizon bonds. Variable products, including Guaranteed Minimum Death Benefits, require accurate projections of returns to ensure adequate future assets. With the latest research producing a relatively low equity risk premium, the rationale for including equities in insurers' asset holdings is being tested. In describing individual investment account guarantees, LaChance and Mitchell (2003) point out an underlying assumption of pension asset investing that, based only on the historical record, future equity returns will continue to outperform bonds; they clarify that those higher expected equity returns come with the additional higher risk of equity returns. Ralfe et al. (2003) support the risky equity view and discuss their pension experience with an all bond portfolio. Recent projections in some literature of a zero or negative equity risk premium challenge the assumptions underlying these views. By reviewing some of the most recent and relevant work on the issue of the equity risk premium, actuaries will have a better understanding of how these values were estimated, critical assumptions that allowed for such a low EPR, and the time period for the projection. Actuaries can then make informed decisions for expected investment results going forward.[2]

In 1985, Mehra and Prescott published their work on the so-called Equity Risk Premium Puzzle: The fact that the historical realized ERP for the stock market 1889-1978 appeared to be at odds with and, relative to Treasury bills, far in excess of asset pricing theory values based on investors with reasonable risk aversion parameters. Since then, there has been a constant stream of research, each of which reviews theories of estimating market returns, examines historical data periods, or both.[3] Those ERP value estimates vary <u>widely</u> from about minus one percent to about nine percent, based on geometric or arithmetic averaging, short or long horizons, short or long-run means, unconditional or conditional expectations, using domestic or international data, differing data periods, and real or nominal returns. Brealey and Myers, in the sixth edition of their standard corporate finance textbook, believe a range of 6% to 8.5% for the US ERP is reasonable for practical project valuation. Is that a fair estimate?

[1] The multifactor arbitrage pricing theory (APT) of Ross (1976), the three-factor model of Fama and French (1992) and the recent Mamaysky (2002) five-factor model for stocks and bonds are all examples of enhanced CAPM models.
[2] See Appendix D
[3] For example, see Cochrane (1997), Cornell (1999), or Leibowitz (2001).

Current research on the equity risk premium is plentiful (Leibowitz, 2001). This paper covers a selection of mainstream articles and books that describe different approaches to estimating the ex ante equity risk premium. We select examples of the research that cover the most important approaches to the ERP. We begin by describing the methodology of using historical returns to predict future estimates. We identify the many varieties of ERPs in order to alert the reader to the fact that numerical estimates of the ERP that appear different may instead be about the same under a common definition. We examine the well-known Ibbotson Associates 1926-2002 data series for stationarity, i.e. time invariance of the mean ERP. We show by several statistical tests that stationarity cannot be rejected and the best estimate going forward, ceteris paribus, is the realized mean. This paper will examine the principal strains of the recent research on the ERP and catalogue the empirical values of the ERP implied by that research.[4]

We first discuss how the Social Security Administration derives estimates of the equity risk premium. Then, we survey the puzzle research, that is, the literature written in response to the Equity Premium Puzzle suggested by Mehra and Prescott (1985). We cover five major approaches from the literature. Next, we report from two surveys of "experts" on the equity risk premium. Finally, after we describe the main strains of research, we explore some of the implications for practicing actuaries.

We do not discuss the important companion problem of estimating the risk relationship of an individual company, line of insurance, or project with the overall market. Within a CAPM or Fama-French framework, the problem is estimating a market beta.[5] Actuaries should be aware, however, that simple 60-month regression betas are biased low where size or non-synchronous trading is a substantial factor (Kaplan and Peterson (1998), Pratt (1998), p86). Adjustments are made to historical betas in order to remove the bias and derive more accurate estimates. Elton and Gruber (1995) explain that by testing the relationship of beta estimates over time, empirical studies have shown that an adjustment toward the mean should be made to project future betas.[6]

The Equity Risk Premium

Based on the definition in Brealey and Myers, *Principles of Corporate Finance* textbook, the equity risk premium (ERP) is the "expected additional return for making a risky investment rather than a safe one". In other words, the ERP is the difference between the market return and a risk-free return. Market returns include both dividends and capital gains. Because both the historical ERP and the prospective ERP have been referred to simply as the equity risk premium, the terms *ex post* and *ex ante* are used to differentiate between them but are often omitted. Table 1 shows the historical annual

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[4] The research catalogued appears as Appendix B.

[5] According to CAPM, investors are compensated only for non-diversifiable, or market, risk. The market beta becomes the measurement of the extent to which returns on an individual security covary with the market. The market beta times the ERP represents the non-diversifiable expected return from an individual security.

[6] Elton and Gruber (1995), p148.

average returns from 1926-2002 for large company equities (S&P 500), Treasury Bills and Bonds, and their arithmetic differences using the Ibbotson data (Ibbotson Associates, 2003).[7]

US Equity Risk Premia 1926-2002 Annual Equity Returns and Premia versus Treasury Bills, Intermediate, and Long Term Bonds			
Horizon	**Equity Returns**	**Risk-Free Return**	**ERP**
Short	12.20%	3.83%	8.37%
Intermediate	12.20%	4.81%	7.40%
Long	12.20%	5.23%	6.97%
Source: Ibbotson Yearbook (2003)			

Table 1

In 1985, Mehra and Prescott introduced the idea of the equity risk premium puzzle. The puzzling result is that the historical realized ERP for the stock market using 1889-1978 data appeared to be at odds with and, relative to Treasury bills, far in excess of asset pricing theory values based on normal parametrizations of risk aversion. When using standard frictionless return models and historical growth rates in consumption, the real risk-free rate, and the equity risk premium, the resulting relative risk aversion parameter appears too high. By choosing a maximum relative risk aversion parameter to be 10 and using the growth in consumption, Mehra and Prescott's model produces an ERP much lower than the historical.[8] Their result inspired a stream of finance literature that attempts to solve the puzzle. Two different research threads have emerged. One thread, including behavioral finance, attempts to explain the historical returns with new models and different assumptions about investors.[9] A second thread is from a group that provides estimates of the ERP that are derived from historical data and/or standard economic models. Some in this latter group argue that historical returns may have been higher than those that should be required in the future. In a curiously asymmetric way, there are no serious studies yet concluding that the historical results are too low to serve as ex ante estimates. Although both groups have made substantial and provocative contributions, the behavioral models do not give any ex ante ERP estimates other than explaining and supporting the historical returns. We presume, until results show otherwise, the behavioralists support the historical average as the ex ante unconditional long-run expectation. Therefore, we focus on the latter to catalogue equity risk premium estimates other than the historical approach, but we will discuss both as important strains for puzzle research.

Equity Risk Premium Types

Many different types of equity risk premium estimates can be given even though they are labeled by the same general term. These estimates vary widely; currently the estimates range from about nine percent to a small negative. When ERP estimates are

[7] Ibbotson's 1926-2002 series from the 2003 Yearbook, Valuation Edition. The entire series is shown in Appendix A.

[8] Campbell, Lo, and MacKinlay (1997) perform a similar analysis as Mehra and Prescott and find a risk-aversion coefficient of 19, larger than the reasonable level suggested in Mehra and Prescott's paper, pp307-308.

[9] See, for example, Benartzi and Thaler (1995) and Mehra (2002).

given, one should determine the type before comparing to other estimates. We point out seven important types to look for when given an ERP estimate. They include:

- Geometric vs. arithmetic averaging
- Short vs. long investment horizon
- Short vs. long-run expectation
- Unconditional vs. conditional on some related variable
- Domestic US vs. international market data
- Data sources and periods
- Real vs. nominal returns

The average market return and ERP can be stated as a geometric or arithmetic mean return. An arithmetic mean return is a simple average of a series of returns. The geometric mean return is the compound rate of return; it is a measure of the actual average performance of a portfolio over a given time period. Arithmetic returns are the same or higher than geometric returns, so it is not appropriate to make a direct comparison between an arithmetic estimate and a geometric estimate. However, those two returns can be transformed one to the other. For example, arithmetic returns can be approximated from geometric returns by the formula.[10]

$$AR = GR + \frac{s^2}{2}, s^2 \text{ the variance of the (arithmetic) return process}$$

Arithmetic averages of periodic returns are to be preferred when estimating next period returns since they, not geometric averages, reproduce the proper probabilities and means of expected returns.[11] ERPs can be generated by arithmetic differences (Equity – Risk Free) or by geometric differences ([(1 + Equity)/(1 + Risk Free)]-1). Usually, the arithmetic and geometric differences produce similar estimates.[12]

A second important difference in ERP estimate types is the horizon. The horizon indicates the total investment or planning period under consideration. For estimation purposes, the horizon relates to the term or maturity of the risk-free instrument that is used to determine the ERP.[13] The Ibbotson Yearbook (2003) provides definitions for three different horizons.[14] The short-horizon expected ERP[15] is defined as "the large company stock total returns minus U.S. Treasury bill *total* returns". Note, the income return and total return are the same for U.S. Treasury bills. The intermediate-horizon expected ERP is "the large company stock total returns minus intermediate-term government bond *income* returns". Finally, the long-horizon expected ERP is "the large company stock total returns minus long-term government bond *income* returns". For the Ibbotson data, Treasury bills have a maturity of approximately one month; intermediate-term government bonds have a maturity around five years; long-term government bonds

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[10] See Welch (2000), Dimson et al. (2002), Ibbotson and Chen (2003).
[11] For example, see Ibbotson Yearbook, Valuation Edition (2003), pp71-73 for a complete discussion of the arithmetic/geometric choice. See also Dimson et al. (2000), p35 and Brennan and Schwartz (1985).
[12] The arithmetic difference is the geometric difference multiplied by 1 + Risk Free.
[13] See Table 1.
[14] See Ibbotson 2003 Yearbook, p177.
[15] Table 1 displays the short horizon ERP calculation for the 1926-2002 Ibbotson Data.

have a maturity of about 20 years. Although the Ibbotson definitions may not apply to other research, we will classify equity risk premium estimates based on these guidelines to establish some consistency among the current research. The reader should note that Ibbotson Associates recommends the income return (or the yield) when using a bond as the risk free rate rather than the total return.[16]

A third type is the length of time of the equity risk premium forecast. We distinguish between short-run and long-run expectations. Short-run expectations refer to the current equity risk premium, or for this paper, a prediction of up to ten years. In contrast, the long-run expectation is a forecast over ten years to as much as seventy-five years for social security purposes. Ten years appears an appropriate breaking point based on the current literature surveyed.

The next difference is whether the equity risk premium estimate is unconditional or conditioned on one or more related variables. In defining this type, we refer to an admonition by Constantinides (2002, p1568) of the differences in these estimates:

> "First, I draw a sharp distinction between *conditional, short-term forecasts* of the mean equity return and premium and *estimates of the unconditional mean*. I argue that the currently low conditional short-term forecasts of the return and premium do not lessen the burden on economic theory to explain the large unconditional mean equity return and premium, as measured by their sample average over the past one hundred and thirty years."

Many of the estimates we catalogue below will be conditional ones, conditional on dividend yield, expected earnings, capital gains, or other assumptions about the future.

ERP estimates can also exhibit a US versus international market type depending upon the data used for estimation purposes and the ERP being estimated. Dimson, et al. (2002) notes that at the start of 2000, the US equity market, while dominant, was slightly less than one-half (46.1%) of the total international market for equities, capitalized at 52.7 trillion dollars. Data from the non-US equity markets are clearly different from US markets and, hence, will produce different estimates for returns and ERP.[17] Results for the entire world equity market will, of course, be a weighted average of the US and non-US estimates.

[16] The reason for this is two-fold. First, when issued, the yield is the expected market return for the entire horizon of the bond. No net capital gains are expected for the market return for the entire horizon of the bond. No capital gains are expected at the default-free maturity. Second, historical annual capital gains on long-term Government Bonds average near zero (0.4%) over the 1926-2002 period (Ibbotson Yearbook, 2003, Table 6-7).

[17] One qualitative difference can arise from the collapse of equity markets during war time.

Worldwide Equity Risk Premia, 1900-2000 Annual Equity Risk Premium Relative to Treasury Bills		
Country	**Geometric Mean**	**Arithmetic Mean**
United States	5.8%	7.7%
World	4.9%	6.2%
Source: Dimson, et al. (2002), pages 166-167		

Table 2

The next type is the data source and period used for the market and ERP estimates. Whether given an historical average of the equity risk premium or an estimate from a model using various historical data, the ERP estimate will be influenced by the length, timing, and source of the underlying data used. The time series compilations are primarily annual or monthly returns. Occasionally, daily returns are analyzed, but not for the purpose of estimating an ERP. Some researchers use as much as 200 years of history; the Ibbotson data currently uses S&P 500 returns from 1926 to the present.[18] As an example, Siegel (2002) examines a series of real US returns beginning in 1802.[19] Siegel uses three sources to obtain the data. For the first period, 1802 to 1870, characterized by stocks of financial organizations involved in banking and insurance, he cites Schwert (1990). The second period, 1871-1925, incorporates Cowles stock indexes compiled in Shiller (1989). The last period, beginning in 1926, uses CRSP data; these are the same data underlying Ibbotson Associates calculations.

Goetzmann et al. (2001) construct a NYSE data series for 1815 to 1925 to add to the 1926-1999 Ibbotson series. They conclude that the pre-1926 and post-1926 data periods show differences in both risk and reward characteristics. They highlight the fact that inclusion of pre-1926 data will generally produce lower estimates of ERPs than relying exclusively on the Ibbotson post-1926 data, similar to that shown in Appendix A. Several studies that rely on pre-1926 data, catalogued in Appendix B, show the magnitudes of these lower estimates.[20] Table 3 displays Siegel's ERPs for three subperiods. He notes that subperiod III, 1926-2001, shows a larger ERP (4.7%), or a smaller real risk-free mean (2.2%), than the prior subperiods[21].

[18] For the Ibbotson analysis of the small stock premium, the NYSE/AMEX/NASDAQ combined data are used with the S&P 500 data falling within deciles 1 and 3 (Ibbotson 2002 Yearbook, pp122-136.)
[19] A more recent alternative is Wilson and Jones (2002) as cited by Dimson et al. (2002), p39.
[20] Using Wilson and Jones' 1871-2002 data series, time series analyses show no significant ERP difference between the 1871-1925 period and the 1926-2002 period; one cannot distinguish the old from the new. The overall average is lower with the additional 1871-1925 data, but on a statistical basis, they are not significantly different. Assuming the equivalency of the two data series for 1871 to 1925 (series of Goetzmann et al. and Wilson & Jones), the risk difference found by Goetzmann et al. must be determined by a significantly different ERP in the pre-1871 data. The 1871-1913 return is prior to personal income tax and appears to be about 35% lower than the 1926-2002 period average of 11.8%, might reflect a zero valuation for income taxes in the pre-1914 returns. Adjusting the pre-1914 data for taxes would most likely make the ERP for the entire period (1871-2002) approximately equal to 7.5%, the 1926-2002 average.
[21] The low risk-free return is indicative of the "risk-free rate puzzle", the twin of the ERP puzzle. For details see Weil (1989).

Short-Horizon Equity Risk Premium by Subperiods			
	Subperiod I	**Subperiod II**	**Subperiod III**
	1802-1870	**1871-1925**	**1926-2001**
Real Geometric Stock Returns	7.0%	6.6%	6.9%
Real Geometric Long Term Governments	4.8%	3.7%	2.2%
Equity Risk Premium	2.2%	2.9%	4.7%
Source: Siegel (2002), pages 13 and 15.			

Table 3

Smaller subperiods will show much larger variations in equity, bill and ERP returns. Table 4 displays the Ibbotson returns and short horizon risk premia for subperiods as small as 5 years. The scatter of results is indicative of the underlying large variation (20% sd) in annual data.

Average Short-Horizon Risk Premium over Various Time Period				
		Common Stocks	U. S. Treasury Bills	Short-Horizon
Year		Total Annual Returns	Total Annual Returns	Risk Premium
All Data	1926-2002	12.20%	3.83%	8.37%
50 Year	1953-2002	12.50%	5.33%	7.17%
40 Year	1963-2002	11.80%	6.11%	5.68%
30 Year	1943-1972	14.55%	2.54%	12.02%
	1973-2002	12.21%	6.61%	5.60%
15 Year	1928-1942	5.84%	0.95%	4.89%
	1943-1957	17.14%	1.20%	15.94%
	1958-1972	11.96%	3.87%	8.09%
	1973-1987	11.42%	8.20%	3.22%
	1988-2002	13.00%	5.03%	7.97%
10 Year	1933-1942	12.88%	0.15%	12.73%
	1943-1952	17.81%	0.81%	17.00%
	1953-1962	15.29%	2.19%	13.11%
	1963-1972	10.55%	4.61%	5.94%
	1973-1982	8.67%	8.50%	0.17%
	1983-1992	16.80%	6.96%	9.84%
	1993-2002	11.17%	4.38%	6.79%
5 Year	1928-1932	- 8.25%	2.55%	-10.80%
	1933-1937	19.82%	0.22%	19.60%
	1938-1942	5.94%	0.07%	5.87%
	1943-1947	15.95%	0.37%	15.57%
	1948-1952	19.68%	1.25%	18.43%
	1953-1957	15.79%	1.97%	13.82%
	1958-1962	14.79%	2.40%	12.39%
	1963-1967	13.13%	3.91%	9.22%
	1968-1972	7.97%	5.31%	2.66%
	1973-1977	2.55%	6.19%	- 3.64%
	1978-1982	14.78%	10.81%	3.97%
	1983-1987	16.93%	7.60%	9.33%
	1988-1992	16.67%	6.33%	10.34%
	1993-1997	21.03%	4.57%	16.46%
	1998-2002	1.31%	4.18%	- 2.88%

Table 4

In calculating an expected market risk premium by averaging historical data, projecting historical data using growth models, or even conducting a survey, one must determine a proxy for the "market". Common proxies for the US market include the S&P 500, the NYSE index, and the NYSE, AMEX, and NASDAQ index.[22] For the purpose of this paper, we use the S&P 500 and its antecedents as the market. However, in the various research surveyed, many different market proxies are assumed. We have already discussed using international versus domestic data when describing different MRP types. With international data, different proxies for other country, region, or world markets are used.[23] For domestic data, different proxies have been used over time as stock market exchanges have expanded.[24] Fortunately, as shown in the Ibbotson Valuation yearbook, the issue of a US market proxy does not have a large effect on the MRP estimate because the various indices are highly correlated. For example, the S&P 500 and the NYSE have a correlation of 0.95, the S&P 500 and NYSE/AMEX/NASDAQ 0.97, and the NYSE and NYSE/AMEX/NASDAQ 0.90.[25] Therefore, the market proxy selected is one reason for slight differences in the estimates of the market risk premium.

As a final note, stock returns and risk-free rates can be stated in nominal or real terms. Nominal includes inflation; real removes inflation. The equity risk premium should not be affected by inflation because either the stock return and risk-free rate both include the effects of inflation (both stated in nominal terms) or neither have inflation (both stated in real terms). If both returns are nominal, the difference in the returns is generally assumed to remove inflation. Otherwise, both terms are real, so inflation is removed prior to finding the equity risk premium. While numerical differences in the real and nominal approaches may exist, their magnitudes are expected to be small.

Equity Risk Premia 1926-2002

As an example of the importance of knowing the types of equity risk premium estimates under consideration, Table 5 displays ERP returns that each use the same historical data, but are based on arithmetic or geometric returns and the type of horizon. The ERP estimates are quite different.[26]

[22] 2003 Ibbotson Valuation Yearbook, p92.
[23] For example, Dimson (2002) and Claus and Thomas (2001) use international market data.
[24] For a data series that is a mixture of the NYSE exchange, NYSE, AMEX, and NASDAQ stock exchange, and the Wilshire 5000, see Dimson (2002), p306.
[25] 2003 Ibbotson Valuation Yearbook, p93; using data from October 1997 to September 2002.
[26] The nominal and real ERPs are identical in Table 5 because the ERPs are calculated as arithmetic differences, and the same value of inflation will reduce the market return and the risk-free return equally. Geometric differences would produce minimally different estimates for the same types.

ERP using same historical data (1926-2002)		
RFR Description	**ERP Description**	**ERP Historical Return**
Short nominal	Arithmetic Short-horizon	8.4%
Short nominal	Geometric Short-horizon	6.4%
Short real	Arithmetic Short-horizon	8.4%
Short real	Geometric Short-horizon	6.4%
Intermediate nominal	Arithmetic Inter-horizon	7.4%
Intermediate nominal	Geometric Inter-horizon	5.4%
Intermediate real	Arithmetic Inter-horizon	7.4%
Intermediate real	Geometric Inter-horizon	5.4%
Long nominal	Arithmetic Long-horizon	7.0%
Long nominal	Geometric Long-horizon	5.0%
Long real	Arithmetic Long-horizon	7.0%
Long real	Geometric Long-horizon	5.0%

Table 5

Historical Methods

The historical methodology uses averages of past returns to forecast future returns. Different time periods may be selected, but the two most common periods arise from data provided by either Ibbotson or Siegel. The Ibbotson series begins in 1926 and is updated each year. The Siegel series begins in 1802 with the most recent compilation using returns through 2001. Appendix A provides equity risk premium estimates using Ibbotson data for the 1926-2002 period that we use in this paper for most illustrations. We begin with a look at the ERP history through a time series analysis of the Ibbotson data.

Time Series Analysis

Much of the analysis addressing the equity risk premium puzzle relies on the annual time series of market, risk-free and risk premium returns. Two opposite views can be taken of these data. One view would have the 1926-2002 Ibbotson data, or the 1802-2001 Siegel data, represent one data point; i.e., we have observed one path for the ERP through time from the many possible 77 or 200 year paths. This view rests upon the existence or assumption of a stochastic process with (possibly) inter-temporal correlations. While mathematically sophisticated, this model is particularly unhelpful without some testable hint at the details of the generating stochastic process. The practical view is that the observed returns are random samples from annual distributions that are iid, independent and identically distributed about the mean. The obvious advantage is that we have at hand 77 or 200 observations on the iid process to analyze. We adopt the latter view.

Some analyses adopt the assumption of stationarity of ERP, i.e., the true mean does not change with time. Figure 1 displays the Ibbotson ERP data and highlights two subperiods, 1926-1959 and 1960-2002.[27] While the mean ERP for the two subperiods appear quite different (11.82% vs. 5.27%), the large variance of the process (std dev 20.24%) should make them indistinguishable statistically speaking.

[27] The ERP shown here are the geometric differences (calculated) rather than the simple arithmetic differences in Table 1; i.e. ERP = $[(1+r_m)/(1+r_f)] - 1$. The test results are qualitatively the same for the arithmetic differences.

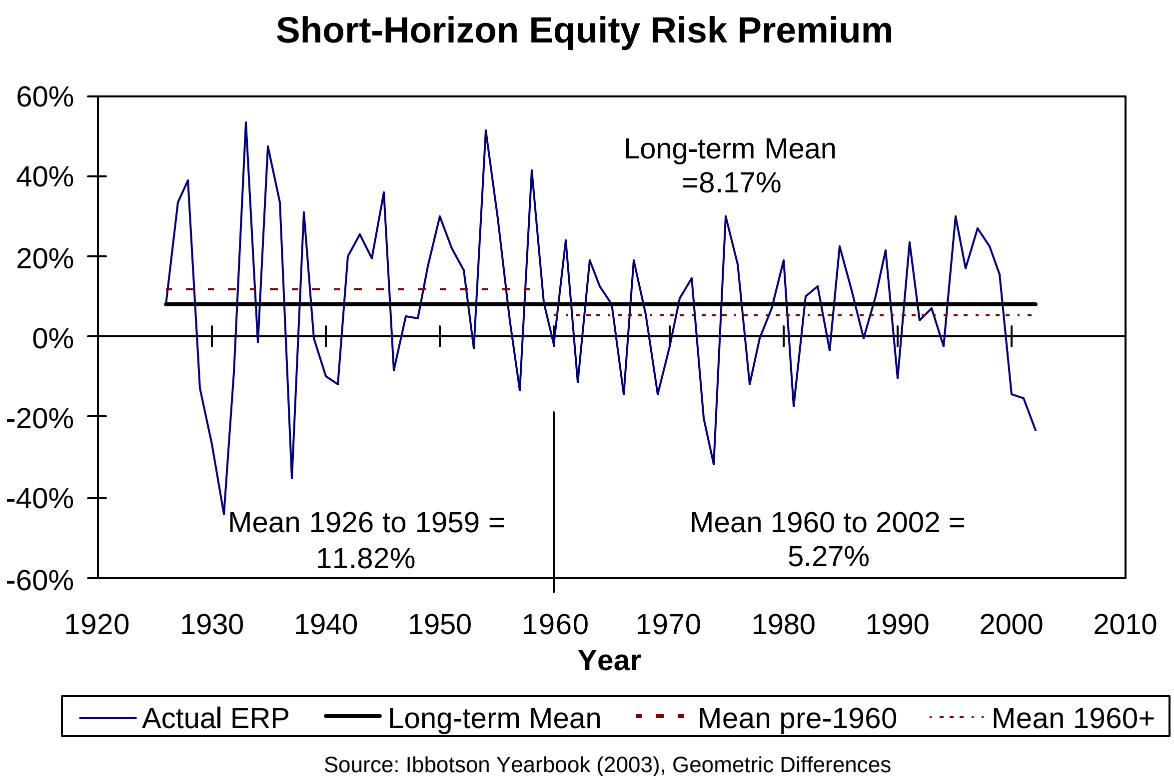

Figure 1

T-Tests

The standard T-test can be used for the null hypothesis H_o : mean 1960-2002 = 8.17%, the 77 year mean.[28] The outcome of the test is shown in Table 6; the null hypothesis cannot be rejected.

T-Test Under the Null Hypothesis that ERP (1960-2002) = ERP (1926-2002) = 8.17%	
Sample mean 1960-2002	5.27%
Sample s.d. 1960-2002	15.83%
T value (DF=42)	-1.20
PR > |T|	0.2374
Confidence Interval 95%	(0.0040, 0.1014)
Confidence Interval 90%	(0.0121, 0.0933)

Table 6

Another T-Test can be used to test whether the subperiod means are different in the presence of unequal variances.[29] The result is similar to Table 6 and the difference of subperiod means equal to zero cannot be rejected.[30]

[28] Standard statistical procedures in SAS 8.1 have been used for all tests.
[29] Equality of variances is rejected at the one percent level by an F test (F=2.39, DF=33,42)
[30] t-value 1.35, PR> |T| = 0.1850 with the Cochran method.

Time Trends

The supposition of stationarity of the ERP series can be supported by ANOVA regressions. The results of regressing the ERP series on time is shown in Table 7.

ERP ANOVA Regressions on Time		
Period	**Time Coefficient**	**P-Value**
1926-1959	0.004	0.355
1960-2002	0.001	0.749
1926-2002	-0.001	0.443

Table 7

There are no significant time trends in the Ibbotson ERP data.[31]

ARIMA Model

Time series analysis using the well established Box-Jenkins approach can be used to predict future series values through the lag correlation structure.[32] The SAS ARIMA procedure applied to the full 77 time series data shows:

(1) No significant autocorrelation lags.
(2) An identification of the series as white noise.
(3) ARIMA projection of year 78+ ERP is 8.17%, the 77 year average.

All of the above single time series tests point to the reasonability of the stationarity assumption for (at least) the Ibbotson ERP 77 year series.[33]

Social Security Administration

In the current debate on whether to allow private accounts that may invest in equities, the Office of the Chief Actuary of the Social Security Administration has selected certain assumptions to assess various proposals (Goss, 2001). The relevant selection is to use 7 percent as the real (geometric) annual rate of return for equities.[34] This assumption is based on the historical return of the 20th century. SSA received further support that showed the historical return for the last 200 years is consistent with this estimate, along with the Ibbotson series beginning in 1926. For SSA, the calculation of the equity risk premium uses a long-run real yield on Treasury bonds as the risk-free rate. From the assumptions in the 1995 Trustees Report, the long-run real yield on Treasury bonds that the Advisory Council proposals use is 2.3%. Using a future Treasury securities real yield of 2.3% produces a geometric equity risk premium of 4.7% over long-term Treasury securities. More recently, the Treasury securities assumption has increased to 3%[35], yielding a 4% geometric ERP over long-term Treasury securities.

[31] The result is confirmed by a separate Chow test on the two subperiods.
[32] See Harvey (1990), p30.
[33] The same tests applied to the Wilson and Jones 1871-2002 data series show similar results: Neither the 1871-1925 period nor the 1926-2002 period is different from the overall 1871-2002 period. The overall period and subperiods also show no trends over time.
[34] Compare Table 3, subperiod III.
[35] 1999 Social Security Trustees Report.

At the request of the Office of the Chief Actuary of the Social Security Administration (OCACT), John Campbell, Peter Diamond, and John Shoven were engaged to give their expert opinions on the assumptions Social Security mode. Each economist begins with the Social Security assumptions and then explains any difference he feels would be more appropriate.

In John Campbell's response, he considers valuation ratios as a comparison to the returns from the historical approach (Campbell 2001). The current valuation ratios are at unusual levels, with a low dividend-price ratio and high price-earnings ratio. He reasons that the prices are what have dramatically changed these ratios. Campbell presents two views as to the effect of valuation ratios in their current state. One view is that valuations will remain at the current level, suggesting much lower expected returns. The second view is a correction to the ratios, resulting in less favorable returns until the ratios readjust. He decides to give some weight to both possibilities, so he lowers the geometric equity return estimate to 5-5.5% from 7%. For the risk-free rate, he uses the yield on the long-term inflation-indexed bonds[36] of 3.5% or the OCACT assumption of 3%. Therefore, his geometric equity premium estimate is around 1.5 to 2.5%.

Peter Diamond uses the Gordon growth formula to calculate an estimate of the equity return (Diamond 2001). The classic Gordon Dividend Growth model is[37]:

$$K = (D_1 / P_0) + g$$

K = Expected Return or Discount Rate P_0 = Price this period
D_1 = Expected Dividend next period g = Expected growth in dividends in perpetuity

Based on his analysis, he feels that the equity return assumption of 7% for the next 75 years is not consistent with a reasonable level of stock value compared to GDP. Even when increasing the GDP growth assumption, he still does not feel that the equity return is plausible. By reasoning that the next decade of returns will be lower than normal, only then is the equity return beyond that time frame consistent with the historical return. By considering the next 75 years together, he would lower the overall projected equity return to 6-6.5%. He argues that the stock market is overvalued, and a correction is required before the long-run historical return is a reasonable projection for the future. By using the OCACT assumption of 3.0% for the long-term real yield on Treasury bonds, Diamond estimates a geometric equity risk premium of about 3-3.5%.

John Shoven begins by explaining why the traditional Gordon growth model is not appropriate, and he suggests a modernized Gordon model that allows share repurchases to be included instead of only using the dividend yield and growth rate (Shoven 2001). By assuming a long-term price-earnings ratio between its current and historical value, he comes up with an estimate for the long-term real equity return of 6.125%. Using his general estimate of 6-6.5% for the equity return and the OCACT assumptions for the long-term bond yield, he projects a long-term equity risk premium of approximately 3-3.5%. All the SSA experts begin by accepting the long-run historical

[36] See discussion of current yields on TIPS below.
[37] Brealey and Myers (2000), p67.

ERP analyses and then modifying that by changes in the risk-free rate or by decreases in the long-term ERP based on their own personal assessments. We now turn to the major strains in ERP puzzle research.

ERP Puzzle Research

Campbell and Shiller (2001) begin with the assumption of mean reversion of dividend/price and price/earnings ratios. Next, they explain the result of prior research which finds that the dividend-price ratio predicts future prices, and historically, the price corrects the ratio when it diverts from the mean.[38] Based on this result, they then use regressions of the dividend-price ratio and the price-smoothed-earnings[39] ratio to predict future stock prices out ten years. Both regressions predict large losses in stock prices for the ten year horizon. Although Campbell and Shiller do not rerun the regression on the dividend-price ratio to incorporate share repurchases, they point out that the dividend-price ratio should be upwardly adjusted, but the adjustment only moves the ratio to the lower range of the historical fluctuations (as opposed to the mean). They conclude that the valuation ratios indicate a bear market in the near future[40]. They predict for the next ten year period negative real stock returns. They caution that because valuation ratios have changed so much from their normal level, they may not completely revert to the historical mean, but this does not change their pessimism about the next decade of stock market returns.

Arnott and Ryan (2001) take the perspective of fiduciaries, such as pension fund managers, with an investment portfolio. They begin by breaking down the historical stock returns (past 74 years since December 1925) by analyzing dividend yields and real dividend growth. They point out that the historical dividend yield is much higher than the current dividend yield of about 1.2%. They argue that the changes from stock repurchases, reinvestment, and mergers and acquisitions, which affect the lower dividend yield, can be represented by a higher dividend growth rate. However, they cap real dividend or earnings growth at the level of real economic growth. They add the dividend yield and the growth in real dividends to come up with an estimate for the future equity return; the current dividend yield of 1.2% and the economic growth rate of 2.0% add to the 3.2% estimated real stock return. This method corresponds to the dividend growth model or earnings growth model and does not take into account changing valuation levels. They cite a TIPS yield of 4.1% for the real risk-free rate return.[41] These two estimates yield a negative geometric long-horizon conditional equity risk premium.

Arnott and Bernstein (2002) begin by arguing that in 1926 investors were not expecting the realized, historical compensation that they later received from stocks. They cite bonds' reaction to inflation, increasing valuations, survivorship bias[42], and changes in

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[38] Campbell and Shiller (1989).
[39] Earnings are "smoothed" by using ten year averages.
[40] The stock market correction from year-end 1999 to year-end 2002 is a decrease of 37.6% or 14.6% per year. Presumably, the "next ten years" refers to 2000 to 2010.
[41] See the current TIPS yield discussion near end of paper.
[42] See Brown et al. (1992, 1995) for details on potential survivorship bias.

regulation as positive events that helped investors during this period. They only use the dividend growth model to predict a future expected return for investors. They do not agree that the earnings growth model is better than the dividend growth model both because earnings are reported using accounting methods and earnings data before 1870 are inaccurate. Even if the earnings growth model is chosen instead, they find that the earnings growth rate from 1870 only grows 0.3% faster than dividends, so their results would not change much. Because of the Modigliani-Miller theorem[43], a change in dividend policy should not change the value of the firm. They conclude that managers benefited in the "era of 'robber baron' capitalism" instead of the conclusion reached by others that the dividend growth model under-represents the value of the firm.

By holding valuations constant and using the dividend yield and real growth of dividends, Arnott and Bernstein calculate the equity return that an investor might have expected during the historical time period starting in 1802. They use an expected dividend yield of 5.0%, close to the historical average of 1810 to 2001. For the real growth of dividends, they choose the real per capita GDP growth less a reduction for entrepreneurial activity in the economy plus stock repurchases. They conclude that the net adjustment is negative, so the real GDP growth is reduced from 2.5-3% to only 1%. A fair expectation of the stock return for the historical period is close to 6.1% by adding 5.0% for the dividend yield and a net real GDP per capita growth of 1.1%. They use a TIPS yield of 3.7% for the real risk-free rate, which yields a geometric intermediate-horizon equity risk premium of 2.4% as a fair expectation for investors in the past. They consider this a "normal" equity risk premium estimate. They also opine that the current ERP is zero; i.e. they expect stocks and (risk-free) bonds to return the same amounts.

Fama and French (2002) use both the dividend growth model and the earnings growth model to investigate three periods of historical returns: 1872 to 2000, 1872 to 1950, and 1951 to 2000. Their ultimate aim is to find an unconditional equity risk premium. They cite that by assuming the dividend-price ratio and the earnings-price ratio follow a mean reversion process, the result follows that the dividend growth model or earnings growth model produce approximations of the unconditional equity return. Fama and French's analysis of the earlier period of 1872 to 1950 shows that the historical average equity return and the estimate from the dividend growth model are about the same. In contrast, they find that the 1951 to 2000 period has different estimates for returns when comparing the historical average and the growth models' estimates. The difference in the historical average and the model estimates for 1951 to 2000 is interpreted to be "unexpected capital gains" over this period. They find that the unadjusted growth model estimates of the ERP, 2.55% from the dividend model and 4.32% from the earnings model, fall short of the realized average excess return for 1951-2000. Fama and French prefer estimates from growth models instead of the historical method because of the lower standard error using the dividend growth model. Fama and French provide 3.83% as the unconditional expected equity risk premium return (referred to as the annual bias-adjusted ERP estimate) using the dividend growth model with underlying data from 1951 to 2000. They give 4.78% as the unconditional expected equity risk

[43] Brealey and Myers (2000), p447. See also discussion in Ibbotson and Chen (2003).

premium return using the earnings growth model with data from 1951 to 2000. Note that using a one-month Treasury bill instead of commercial paper for the risk-free rate would increase the ERP by about 1% to nearly 6% for the 1951-2000 period.

Ibbotson and Chen (2003) examine the historical real geometric long-run market and long risk-free returns using their "building block" methodology.[44] They use the full 1926-2000 Ibbotson Associates data and consider as building blocks all of the fundamental variables of the prior researchers. Those blocks include (not all simultaneously):

- Inflation
- Real risk-free rates (long)
- Real capital gains
- Growth of real earnings per share
- Growth of real dividends
- Growth in payout ratio (dividend/earnings)
- Growth in book value
- Growth in ROE
- Growth in price/earnings ratio
- Growth in real GDP/population
- Growth in equities excess of GDP/POP
- Reinvestment

Their calculations show that a forecast real geometric long run return of 9.4% is a reasonable extrapolation of the historical data underlying a realized 1926-2000 return of 10.7%, yielding a long horizon arithmetic ERP of 6%, or a short horizon arithmetic ERP of about 7.5%.

The authors construct six building block methods; i.e., they use combinations of historic estimates to produce an expected geometric equity return. They highlight the importance of using both dividends and capital gains by invoking the Modigliani-Miller theorem. The methods, and their component building blocks are:

- Method 1: Inflation, real risk free rate, realized ERP
- Method 2: Inflation, income, capital gains and reinvestment
- Method 3: Inflation, income, growth in price/earnings, growth in real earnings per share and reinvestment.
- Method 4: Inflation, growth rate of price/earnings, growth rate of real dividends, growth rate of payout ratio dividend yield and reinvestment
- Method 5: Inflation, income growth rate of price/earnings, growth of real book value, ROE growth and reinvestment
- Method 6: Inflation, income, growth in real GDP/POP, growth in equities excess GDP/POP and reinvestment.

[44] See Appendix D for a summary of their building block estimates. See also Pratt (1998) for a discussion of the Building Block, or Build-Up Model, cost of capital estimation method.

All six methods reproduce the historical long horizon geometric mean of 10.70% as shown in Appendix D. Since the source of most other researchers' lower ERP is the dividend yield, the authors recast the historical results in terms of ex ante forecasts for the next 75 years. Their estimate of 9.37% using supply side methods 3 and 4 is approximately 130 basis points lower than the historical result. Within their methods, they also show how the substantially lower expectation of 5.44% for the long mean geometric return is calculated by omitting one or more relevant variables. Underlying these ex ante methods are the assumptions of stationarity of the mean ERP return and market efficiency, the absence of the assumption that the market has mispriced equities. All of their methods are aimed at producing an unconditioned estimate of the ex ante ERP.

As opposed to short-run, conditional estimates from Campbell and Shiller and others, Constantinides (2002) seeks to estimate the unconditional equity risk premium, more in line with the goal of Fama and French (2002) and Ibbotson and Chen (2003). He begins with the premise that the unconditional ERP can be estimated from the historical average using the assumption that the ERP follows a stationary path. He suggests most of the other research produces conditional estimates, conditioned upon beliefs about the future paths of fundamentals such as dividend growth, price-earnings ratio and the like. While interesting in themselves, they add little to the estimation of the unconditional mean ERP.

Constantinides uses the historical return and adjusts downward by the growth in the price-earnings ratio to calculate the unconditional equity risk premium. He removes the growth in the price-earnings ratio because he is assuming no change in valuations in the unconditional state. He gives estimates using three periods. For 1872-2000, he uses the historical equity risk premium which is 6.9%, and after amortizing the growth in the price-dividend ratio or price-earnings ratio over a period as long as 129 years, the effect of the potential reduction is no change. Therefore, he finds an unconditional arithmetic, short-horizon equity risk premium of 6.9% using the 1872-2000 underlying data. For 1951-2000, he again starts with the historical equity risk premium which is 8.7% and lowers this estimate by the growth in the price-earnings ratio of 2.7% to find an unconditional arithmetic, short-horizon equity risk premium of 6.0%. For 1926-2000, he uses the historical equity risk premium which is 9.3% and reduces this estimate by the growth in the price-earnings ratio of 1.3% to find an unconditional arithmetic, short-horizon equity risk premium of 8.0%. He appeals to behavioral finance to offer explanations for such high unconditional equity risk premium estimates.

From the perspective of giving practical investor advice, Malkiel (1999) discusses "the age of the millennium" to give some indication of what investors might expect for the future. He specifically estimates a reasonable expectation for the first few decades of the twenty-first century. He estimates the future bond returns by giving estimates if bonds are held to maturity with corporate bonds of 6.5-7%, long-term zero-coupon Treasury bonds of about 5.25%, and TIPS with a 3.75% return. Depending on the desired level of risk, Malkiel indicates bondholders should be more favorably compensated in the future compared to the historical returns from 1926 to 1998. Malkiel uses the earnings growth model to predict future equity returns. He uses the current dividend yield of 1.5% and an earnings growth estimate of 6.5%, yielding an 8% equity return estimate compared with an 11% historical return. Malkiel's estimated range of the equity risk premium is from 1% to 4.25%, depending on the risk-free instrument selected. Although his equity risk premium is lower than the historical return, his selection of a relatively high earnings growth rate is similar to Ibbotson and Chen's forecasted models. In contrast with Ibbotson and Chen, Malkiel allows for a changing equity risk premium and advises investors to not rely solely on the past "age of exuberance" as a guide for the future. Malkiel points out the impact of changes in valuation ratios, but he does not attempt to predict future valuation levels.

Finally, Mehra (2002) summarizes the results of the research since the ERP puzzle was posed. The essence of the puzzle is the inconsistency of the ERPs produced by descriptive and prescriptive economic models of asset pricing on the one hand and the historical ERPs realized in the US market on the other. Mehra and Prescott (1985) speculated that the inconsistency could arise from the inadequacy of standard models to incorporate market imperfections and transaction costs. Failure of the models to reflect reality rather than failure of the market to follow the theory seems to be Mehra's conclusion as of 2002. Mehra points to two promising threads of model-modifying research. Campbell and Cochrane (1999) incorporate economic cycles and changing risk aversion while Constantinides et al. (2002) propose a life cycle investing modification, replacing the representative agent by segmenting investors into young, middle aged, and older cohorts. Mehra sums up by offering:

> "Before we dismiss the premium, we not only need to have an understanding of the observed phenomena but also why the future is likely to be different. In the absence of this, we can make the following claim based on what we know. Over the long horizon the equity premium is likely to be similar to what it has been in the past and the returns to investment in equity will continue to substantially dominate those in bonds for investors with a long planning horizon."

<u>Financial Analyst Estimates</u>

Claus and Thomas (2001) and Harris and Marston (2001) both provide equity premium estimates using financial analysts' forecasts. However, their results are rather different. Claus and Thomas use an abnormal earnings model with data from 1985 to 1998 to calculate an equity risk premium as opposed to using the more common dividend growth model. Financial analysts project five year estimates of future earnings growth rates. When using this five year growth rate for the dividend growth rate in perpetuity in the Gordon growth model, Claus and Thomas explain that there is a potential upward bias in estimates for the equity risk premium. Therefore, they choose to use the abnormal earnings model instead and only let earnings grow at the level of inflation after five years. The abnormal earnings model replaces dividends with "abnormal earnings" and discounts each flow separately instead of using a perpetuity. The average estimate that they find is 3.39% for the equity risk premium. Although it is generally recognized that financial analysts' estimates have an upward bias, Claus and Thomas propose that in the current literature, financial analysts' forecasts have underestimated short-term earnings in order for management to achieve earnings estimates in the slower economy. Claus and Thomas conclude that their findings of the ERP using data from the past fifteen years are not in line with historical values.

Harris and Marston use the dividend growth model with data from 1982 to 1998. They assume that the dividend growth rate should correspond to investor expectations. By using financial analysts' longest estimates (five years) of earnings growth in the model, they attempt to estimate these expectations. They argue that if investors are in accord with the optimism shown in analysts' estimates, even biased estimates do not pose a drawback because these market sentiments will be reflected in actual returns. Harris and Marston find an equity risk premium estimate of 7.14%. They find fluctuations in the equity risk premium over time. Because their estimates are close to historical returns, they contend that investors continue to require a high equity risk premium.

Survey Methods

One method to estimate the ex ante equity risk premium is to find the consensus view of experts. John Graham and Campbell Harvey perform a survey of Chief Financial Officers to determine the average cost of capital used by firms. Ivo Welch surveys financial economists to determine the equity risk premium that academic experts in this area would estimate.

Graham and Harvey administer surveys from the second quarter of 2000 to the third quarter of 2002 (Graham and Harvey, 2002). For their survey format, they show the current ten year bond yield and then ask CFOs to provide their estimate of the S&P 500 return for the next year and over the next ten years. CFOs are actively involved in setting a company's individual hurdle[45] rate and are therefore considered knowledgeable about investors' expectations.[46] When comparing the survey responses of the one and ten year returns, the one year returns have so much volatility that they conclude that the ten-year equity risk premium is the more important and appropriate return of the two when making financial decisions such as hurdle rates and estimating cost of capital. The average ten-year equity risk premium estimate varies from 3% to 4.7%.

The most current Welch survey compiles the consensus view of about five hundred financial economists (Welch 2001). The average arithmetic estimate for the 30-year equity risk premium relative to Treasury bills is 5.5%; the one-year arithmetic equity risk premium consensus is 3.4%. Welch deduces from the average 30-year geometric

[45] A "hurdle" rate is a benchmark cost of capital used to evaluate projects to accept (expected returns greater than hurdle rate) or reject (expected returns less than hurdle rate).
[46] Graham and Harvey claim three-fourths of the CFOs use CAPM to estimate hurdle rates.

equity return estimate of 9.1% that the arithmetic equity return forecast is approximately 10%.[47]

Welch's survey question allows the participants to self select into different categories based upon their knowledge of ERP. The results indicate that the responses of the less ERP knowledgeable participants showed more pessimism than those of the self reported experts. The experts gave 30-year estimates that are 30 to 150 basis points above the estimates of the non-expert group.

Differences in Forecasts across Expertise Level				
Relative Expertise	**Statistic**	**Stock Market**	**Equity Premium**	
		30-Year Geometric	30-Year Arithmetic	30-Year Geometric
188 Less Involved	Mean	8.5%	4.9%	4.4%
	Median	8%	5%	4%
	IQ Range	6%-10%	3%-6%	2%-5.5%
235 Average	Mean	9.2%	5.8%	4.8%
	Median	9%	5%	4%
	IQ Range	7.5%-10%	3.5%-7%	3%-6%
72 Experts	Mean	10.1%	6.2%	5.4%
	Median	9%	5.4%	5%
	IQ Range	8%-11%	4%-7.5%	3.4%-6%
Data Source: Welch (2001), Table 5				

Table 8

Table 8 shows that there may be a "lemming" effect, especially among economists who are not directly involved in the ERP question. Stated differently, all the academic and popular press, together with the prior Welch survey[48] could condition the non-expert, the "less involved", that the expected ERP was lower than historic levels.

The Behavioral Approach

Benartzi and Thaler (1995) analyze the equity risk premium puzzle from the point of view of prospect theory (Kahneman and Tversky; 1979). Prospect theory[49] has "loss aversion", the fact that individuals are more sensitive to potential loss than gain, as one of its central tenets. Once an asymmetry in risk aversion is introduced into the model of the rational representative investor or agent, the unusual risk aversion problem raised initially by Mehra and Prescott (1985) can be "explained" within this behavioral model of decision-making under uncertainty. Stated differently, given the historical ERP series, there exists a model of investor behavior that can produce those or similar results. Benartzi and Thaler combine loss aversion with "mental accounting", the behavioral process people use to evaluate their status relative to gains and losses compared to expectations, utility and wealth, to get "myopic loss aversion". In particular, mental

[47] For the Ibbotson 1926-2002 data, the arithmetic return is about 190 basis points higher than the geometric return rather than the inferred 90 basis points. This suggests the participant's beliefs may not be internally consistent.
[48] The prior Welch survey in 1998 had a consensus ERP of about 7%.
[49] A current survey of the applications of prospect theory to finance can be found in Benartzi et al. (2001).

accounting for a portfolio needs to take place infrequently because of loss aversion, in order to reduce the chances of observing loss versus gain. The authors concede that there is a puzzle with the standard expected utility-maximizing paradigm but that the myopic loss aversion view may resolve the puzzle. The authors' views are not free of controversy; any progress along those lines is sure to match the advance of behavioral economics in the large.

The adoption of other behavioral aspects of investing may also provide support for the historical patterns of ERPs we see from 1802-2002. For example, as the true nature of risk and rewards has been uncovered by the virtual army of 20th century researchers, and as institutional investors held sway in the latter fifty years of the century, the demand for higher rewards seen in the later historical data may be a natural and rational response to the new and expanded information set. Dimson et al. (2002, Figure 4-6) displays increasing real US equity returns of 6.7, 7.4, 8.2 and 10.2 for periods of 101, 75, 50 and 25 years ending in 2001 consistent with this "risk-learning" view.

Next Ten Years

The "next ten years" is an issue that experts reviewing Social Security assumptions and Campbell and Shiller address either explicitly or implicitly. Experts evaluating Social Security's proposals predicted that the "next ten years", indicating a period beginning around 2000, of returns were likely to be below the historical return. However, a historical return was recommended as appropriate for the remaining 65 of the 75 years to be projected. For Campbell and Shiller (2001), the period they discuss is approximately 2000-2010. Based on the current state of valuation ratios, they predict lower stock market returns over "the next ten years". These expert predictions, and other pessimistic low estimates, have already come to fruition as market results 2000 through 2002.[50] The US equities market has decreased 37.6% since 1999, or an annual decrease of 14.6%. Although these forecasts have proved to be accurate in the short term, for future long-run projections, the market is not at the same valuation today as it was when these conditional estimates were originally given. Therefore, actuaries should be wary of using the low long-run estimates made prior to the large market correction of 2000-2002.

Treasury Inflation Protection Securities (TIPS)

Several of the ERP researchers refer to TIPS when considering the real risk free rates. Historically, they adjust Treasury yields downward to a real rate by an estimate of inflation, presumably for the term of the Treasury security. As Table 3 shows using the Siegel data, the modern era data show a low real long-term risk-free rate of return (2.2%). This contrasts with the initial[51] TIPS issue yields of 3.375%. Some researchers use those TIPS yields as (market) forecasts of real risk-free returns for intermediate and long-horizon, together with reduced (real) equity returns to produce low estimates of ex ante ERPs. None consider the volatility of TIPS as indicative of the accuracy of their ERP estimate.

[50] The Social Security Advisory Board will revisit the seventy five year rate of return assumption during 2003, Social Security Advisory Board (2002).
[51] TIPS were introduced by the Treasury in 1996 with the first issue in January, 1997.

Table 9 shows a recent market valuation of ten and thirty year TIPS issued in 1998-2002.

Inflation-Indexed Treasury Securities		
Maturity	**Coupon Issue Rate**	**Yield to Maturity**
1/11	3.500	1.763
1/12	3.375	1.831
7/12	3.000	1.878
4/28	3.625	2.498
4/29	3.875	2.490
4/32	3.375	2.408
Source: WSJ 1 2/24/2003		

Table 9

Note the large 90-180 basis point decrease in the current "real" yields from the issue yields as recent as ten months ago. While there can be several explanations for the change (revaluation of the inflation option, flight to Treasury quality, paucity of 30 year Treasuries), the use of these current "real" risk free yields, with fixed expected returns, would raise ERPs by at least one percent.

Conclusion

This paper has sought to bring the essence of recent research on the equity risk premium to practicing actuaries. The researchers covered here face the same ubiquitous problems that actuaries face daily: Do I rely on past data to forecast the future (costs, premiums, investments) or do I analyze the past and apply informed judgment as to future differences, if any, to arrive at actuarially fair forecasts? Most of the ERP estimates lower than the unconditional historical estimate have an undue reliance on recent lower dividend yields (without a recognition of capital gains[52]) and/or on data prior to 1926.

Despite a spate of research suggesting ex ante ERPs lower than recent realized ERPs, actuaries should be aware of the range of estimates covered here (Appendix B); be aware of the underlying assumptions, data and terminology; and be aware that their independent analysis is required before adopting an estimate other than the historical average. We believe that the Ibbotson-Chen (2003) layout, reproduced here as Appendix D, offers the actuary both an understanding of the fundamental components of the historical ERP and the opportunity to change the estimates based upon good judgment and supportable beliefs. We believe that reliance solely on "expert" survey averages, whether of financial analysts, academic economists, or CFOs, is fraught with risks of statistical bias to fair estimates of the forward ERP.

[52] Under the current US tax code, capital gains are tax-advantaged relative to dividend income for the vast majority of equity holders (households and mutual funds are 55% of the total equity holders, Federal Flow of Funds, 2002 Q3, Table L-213). Curiously, the reverse is true for property-liability insurers because of the 70% stock dividend exclusion afforded insurers.

It is dangerous for actuaries to engage in simplistic analyses of historical ERPs to generate ex ante forecasts that differ from the realized mean.[53] The research we have catalogued in Appendix B, the common level ERPs estimated in Appendix C, and the building block (historical) approach of Ibboston and Chen in Appendix D all discuss important concepts related to both ex post and ex ante ERPs and cannot be ignored in reaching an informed estimate. For example, Richard Wendt, writing in a 2002 issue of Risks and Rewards, a newsletter of the Society of Actuaries, concludes that a linear relationship is a better predictor of future returns than a "constant" ERP based on the average historical return. He arrives at this conclusion by estimating a regression equation[54] relating long bond yields with 15-year geometric mean market returns starting monthly in 1960. First, there is no significant relationship between short, intermediate or long-term income returns over 1926-2002 (or 1960-2002) and ERPs, as evidenced by simple regressions using Ibbotson data.[55] Second, if the linear structural equation indeed held, there would be no need for an ERP since the (15-year) return could be predicted within small error bars. Third, there is always a negative bias introduced when geometric averages are used as dependent variables (Brennan and Schwartz, 1985). Finally, the results are likely to be spurious due to the high autocorrelations of the target and independent variables; an autocorrelation correction would eliminate any significant relationship of long-yields to the ERP.

Actuaries should also be aware of the variability of both the ERP and risk-free rate estimates discussed in this paper (see Tables 4 and 9). All too often, return estimates are made without noting the error bars and that can lead to unexpected "surprises". As one example, recent research by Francis Longstaff (2002), proposes that a 1991-2001 "flight to quality" has created a valuation premium (and lowered yields) in the entire yield curve of Treasuries. He finds a 10 to 16 basis point liquidity premium throughout the zero coupon Treasury yield curve. He translates that into a 10% to 15% pricing difference at the long end. This would imply a simple CAPM market estimate for the long horizon might be biased low.

Finally, actuaries should know that the research catalogued in Appendix B is not definitive. No simple model of ERP estimation has been universally accepted. Undoubtedly, there will be still more empirical and theoretical research into this data rich financial topic. We await the potential advances in understanding the return process that the behavioral view may uncover.

Post Script: Appendices A-D

We provide four appendices that catalogue the ERP approaches and estimates discussed in the paper. Actuaries, in particular, should find the numerical values, and descriptions of assumptions underlying those values, helpful for valuation work that

[53] ERPs are derived from historical or expected after corporate tax returns. Pre-tax returns depend uniquely on the tax schedule for the differing sources of income.

[54] 15-year mean returns = 2.032 (Long Government Bond Yield) – 0.0242, R^2 = 0.882.

[55] The p-values on the yield-variables in an ERP/Yield regression using 1926-2002 annual data are 0.1324, 0.2246, and 0.3604 for short, intermediate and long term yields respectively with adjusted r square virtually zero.

adjusts for risk. Appendix A provides the annual Ibbotson data from 1926 through 2002 from Ibbotson Associates referred to throughout this paper. The equity risk-premium shown is a simple difference of the arithmetic stock returns and the arithmetic U.S. Treasury Bills total returns. Appendix B is a compilation of articles and books related to the equity risk premium. The puzzle research section contains the articles and books that were most related to addressing the equity risk premium puzzle. Page 1 of Appendix B gives each source, along with risk-free rate and equity risk premium estimates. Then, each source's estimate is classified by type (indicated with an X for the appropriate type). Page 2 of Appendix B shows further details collected from each source. This page adds the data period used, if applicable, and the projection period. We also list the general methodology used in the reference. The final three pages of Appendix B provide the footnotes which give additional details on the sources' intent.

Appendix C adjusts all the equity risk premium estimates to a short-horizon, arithmetic, unconditional ERP estimate. We begin with the authors' estimates for a stock return (the risk-free rate plus the ERP estimate). Next, we make adjustments if the ERP "type" given by the author(s) is not given in this format. For example, to adjust from a geometric to an arithmetic ERP estimate, we adjust upwards by the 1926-2002 historical difference in the arithmetic large company stocks' total return and the geometric large company stocks' total return of 2%. Next, if the estimate is given in real instead of nominal terms, we adjust the stock return estimate upwards by 3.1%, the 1926-2002 historical return for inflation.

We make an approximate adjustment to move the estimate from a conditional to unconditional estimate based on Fama and French (2002). Using the results for the 1951-2000 period shown in Table 4 of their paper and the standard deviations provided in Table 1, we have four adjustments based on their data. For the 1951-2000 period, Fama and French use an adjustment of 1.28% for the dividend growth model and 0.46% for the earnings growth model. Following a similar calculation, the 1872-2000 period would require a 0.82% adjustment using a dividend growth model; the 1872-1950 period would require a 0.54% adjustment using a dividend growth model. Earnings growth models were used by Fama and French only for the 1951-2000 data period. Therefore, we selected the lowest adjustment (0.46%) as a minimum adjustment from a conditional estimate to an unconditional estimate. Finally, we subtract the 1926-2002 historical U.S. Treasury Bills' total return to arrive at an adjusted equity risk premium.

These adjustments are only approximations because the various sources rely on different underlying data, but the changes in the ERP estimate should reflect the underlying concept that different "types" of ERPs cannot be directly compared and require some attempt to normalize the various estimates.

Page 1 of Appendix D is a table from Ibbotson and Chen which breaks down historical returns using various methods that correspond to their 2003 paper (reprinted with permission of Ibbotson Associates). The bottom portion provides forward-looking estimates. Page 2 of Appendix D is provided to show the formulas that Ibbotson and Chen develop within their paper.

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Appendix A
Ibbotson Market Data 1926-2002*

	Common Stocks	U. S. Treasury Bills	Arithmetic Short-Horizon
Year	Total Annual Returns	Total Annual Returns	Equity Risk Premia
1926	11.62%	3.27%	8.35%
1927	37.49%	3.12%	34.37%
1928	43.61%	3.56%	40.05%
1929	- 8.42%	4.75%	-13.17%
1930	-24.90%	2.41%	-27.31%
1931	-43.34%	1.07%	-44.41%
1932	- 8.19%	0.96%	- 9.15%
1933	53.99%	0.30%	53.69%
1934	- 1.44%	0.16%	- 1.60%
1935	47.67%	0.17%	47.50%
1936	33.92%	0.18%	33.74%
1937	-35.03%	0.31%	-35.34%
1938	31.12%	- 0.02%	31.14%
1939	- 0.41%	0.02%	- 0.43%
1940	- 9.78%	0.00%	- 9.78%
1941	-11.59%	0.06%	-11.65%
1942	20.34%	0.27%	20.07%
1943	25.90%	0.35%	25.55%
1944	19.75%	0.33%	19.42%
1945	36.44%	0.33%	36.11%
1946	- 8.07%	0.35%	- 8.42%
1947	5.71%	0.50%	5.21%
1948	5.50%	0.81%	4.69%
1949	18.79%	1.10%	17.69%
1950	31.71%	1.20%	30.51%
1951	24.02%	1.49%	22.53%
1952	18.37%	1.66%	16.71%
1953	- 0.99%	1.82%	- 2.81%
1954	52.62%	0.86%	51.76%
1955	31.56%	1.57%	29.99%
1956	6.56%	2.46%	4.10%

Appendix A
Ibbotson Market Data 1926-2002*

Year	Common Stocks Total Annual Returns	U. S. Treasury Bills Total Annual Returns	Arithmetic Short-Horizon Equity Risk Premia
1957	-10.78%	3.14%	-13.92%
1958	43.36%	1.54%	41.82%
1959	11.96%	2.95%	9.01%
1960	0.47%	2.66%	- 2.19%
1961	26.89%	2.13%	24.76%
1962	- 8.73%	2.73%	-11.46%
1963	22.80%	3.12%	19.68%
1964	16.48%	3.54%	12.94%
1965	12.45%	3.93%	8.52%
1966	-10.06%	4.76%	-14.82%
1967	23.98%	4.21%	19.77%
1968	11.06%	5.21%	5.85%
1969	- 8.50%	6.58%	-15.08%
1970	4.01%	6.52%	- 2.51%
1971	14.31%	4.39%	9.92%
1972	18.98%	3.84%	15.14%
1973	-14.66%	6.93%	-21.59%
1974	-26.47%	8.00%	-34.47%
1975	37.20%	5.80%	31.40%
1976	23.84%	5.08%	18.76%
1977	- 7.18%	5.12%	-12.30%
1978	6.56%	7.18%	- 0.62%
1979	18.44%	10.38%	8.06%
1980	32.42%	11.24%	21.18%
1981	- 4.91%	14.71%	-19.62%
1982	21.41%	10.54%	10.87%
1983	22.51%	8.80%	13.71%
1984	6.27%	9.85%	- 3.58%
1985	32.16%	7.72%	24.44%
1986	18.47%	6.16%	12.31%
1987	5.23%	5.47%	- 0.24%
1988	16.81%	6.35%	10.46%
1989	31.49%	8.37%	23.12%

Appendix A
Ibbotson Market Data 1926-2002*

Year	Common Stocks Total Annual Returns	U. S. Treasury Bills Total Annual Returns	Arithmetic Short-Horizon Equity Risk Premia
1990	- 3.17%	7.81%	-10.98%
1991	30.55%	5.60%	24.95%
1992	7.67%	3.51%	4.16%
1993	9.99%	2.90%	7.09%
1994	1.31%	3.90%	- 2.59%
1995	37.43%	5.60%	31.83%
1996	23.07%	5.21%	17.86%
1997	33.36%	5.26%	28.10%
1998	28.58%	4.86%	23.72%
1999	21.04%	4.68%	16.36%
2000	- 9.11%	5.89%	-15.00%
2001	-11.88%	3.83%	-15.71%
2002	-22.10%	1.65%	-23.75%
mean=	**12.20%**	**3.83%**	**8.37%**
Standard Dev=	**20.49%**	**3.15%**	**20.78%**

* *2003 SBBI Yearbook pages 38 and 39*

Appendix B

Source	Risk-free-Rate	ERP Estimate	Real risk-free rate	Nominal risk-free rate	Geometric	Arithmetic	Long-horizon	Short-horizon	Short-run expectation	Long-run expectation	Conditional	Unconditional
Historical												
Ibbotson Associates	3.8% [7]	8.4% [31]		X		X		X		X		X
Social Security												
Office of the Chief Actuary [1]	2.3%,3.0% [8]	4.7%,4.0% [32]	X		X		X			X		X
John Campbell [2]	3% to 3.5% [9]	1.5-2.5%, 3-4% [33]	X		X	X	X	X		X	X	
Peter Diamond	2.2% [10]	<4.8% [34]	X		X		X			X	X	
Peter Diamond [3]	3.0% [11]	3.0% to 3.5% [35]	X		X		X			X	X	
John Shoven [4]	3.0%,3.5% [12]	3.0% to 3.5% [36]	X		X		X			X	X	
Puzzle Research												
Robert Arnott and Peter Bernstein	3.7% [13]	2.4% [37]	X		X		X			X	X	
Robert Arnott and Ronald Ryan	4.1% [14]	-0.9% [38]	X		X		X			X	X	
John Campbell and Robert Shiller	N/A	Negative [39]	X		?		?		X		X	
James Claus and Jacob Thomas	7.64% [15]	3.39% or less [40]		X		X	X			X	X	
George Constantinides	2.0% [16]	6.9% [41]	X			X		X		X		X
Bradford Cornell	5.6%, 3.8% [17]	3.5-5.5%, 5-7% [42]		X		X	X	X		X	X	
Dimson, Marsh, & Staunton	1.0% [18]	5.4% [43]	X			X		X		X	X	
Eugene Fama and Kenneth French	3.24% [19]	3.83% & 4.78% [44]	X			X		X		X		X
Robert Harris and Felicia Marston	8.53% [20]	7.14% [45]		X		X	X		X		X	
Roger Ibbotson and Peng Chen	2.05% [21]	4% and 6% [46]	X		X	X	X			X		X
Jeremy Siegel	4.0% [22]	-0.9% to -0.3% [47]	X		X		X			X	X	
Jeremy Siegel	3.5% [23]	2-3% [48]	X		X		X			?	X	
Surveys												
John Graham and Campbell Harvey	? by survey [24]	3-4.7% [49]		X		?	X		X		X	
Ivo Welch	N/A [25]	7% [50]		X		X		X		X	X	
Ivo Welch [5]	5% [26]	5.0% to 5.5% [51]		X		X		X		X	X	
Misc.												
Barclays Global Investors	5% [27]	2.5%, 3.25% [52]		X	X		X		X		X	
Richard Brealey and Stewart Myers	N/A [28]	6 to 8.5% [53]		X		X		X		X		X
Burton Malkiel	5.25% [29]	2.75% [54]		X	X		X			X	X	
Richard Wendt [6]	5.5% [30]	3.3% [55]		X		X	X			X	X	

Long-run expectation considered to be a forecast of more than 10 years.
Short-run expectation considered to be a forecast of 10 years or less.

Source	Risk-free Rate	ERP Estimate	Data Period	Methodology
Historical				
Ibbotson Associates	3.8% [7]	8.4% [31]	1926-2002	Historical
Social Security				
Office of the Chief Actuary [1]	2.3%, 3.0% [8]	4.7%, 4.0% [32]	1900-1995, Projecting out 75 years	Historical
John Campbell [2]	3% to 3.5% [9]	1.5-2.5%, 3-4% [33]	Projecting out 75 years	Historical & Ratios (Div/Price & Earn Gr)
Peter Diamond	2.2% [10]	<4.8% [34]	Last 200 yrs for eq/ 75 for bonds, Proj 75 yrs	Fundamentals: Div Yld, GDP Gr
Peter Diamond [3]	3.0% [11]	3.0% to 3.5% [35]	Projecting out 75 years	Fundamentals: Div/Price
John Shoven [4]	3.0%, 3.5% [12]	3.0% to 3.5% [36]	Projecting out 75 years	Fundamentals: P/E, GDP Gr
Puzzle Research				
Robert Arnott and Peter Bernstein	3.7% [13]	2.4% [37]	1802 to 2001, normal	Fundamentals: Div Yld & Gr
Robert Arnott and Ronald Ryan	4.1% [14]	-0.9% [38]	Past 74 years, 74 year projection [56]	Fundamentals: Div Yld & Gr
John Campbell and Robert Shiller	N/A	Negative [39]	1871 to 2000, ten-year projection	Ratios: P/E and Div/Price
James Claus and Jacob Thomas	7.64% [15]	3.39% or less [40]	1985-1998, long-term	Abnormal Earnings model
George Constantinides	2.0% [16]	6.9% [41]	1872 to 2000, long-term	Hist. and Fund.: Price/Div & P/E
Bradford Cornell	5.6%, 3.8% [17]	3.5-5.5%, 5-7% [42]	1926-1997, long run forward-looking	Weighing theoretical and empirical evid
Dimson, Marsh, & Staunton	1.0% [18]	5.4% [43]	1900-2000, prospective	Adj hist ret, Var of Gordon gr model
Eugene Fama and Kenneth French	3.24% [19]	3.83% & 4.78% [44]	Estimate for 1951-2000, long-term	Fundamentals: Dividends and Earnings
Robert Harris and Felicia Marston	8.53% [20]	7.14% [45]	1982-1998, expectational	Fin analysts' est, div gr model
Roger Ibbotson and Peng Chen	2.05% [21]	4% and 6% [46]	1926-2000, long-term	Historical and supply side approaches
Jeremy Siegel	4.0% [22]	-0.9% to -0.3% [47]	1871 to 1998, forward-looking	Fundamentals: P/E, Div Yld, Div Gr
Jeremy Siegel	3.5% [23]	2-3% [48]	1802-2001, forward-looking	Earnings yield
Surveys				
John Graham and Campbell Harvey	? by survey [24]	3-4.7% [49]	2Q 2000 thru 3Q 2002, 1 & 10 year proj	Survey of CFO's
Ivo Welch	N/A [25]	7% [50]	30-Year forecast, surveys in 97/98 & 99	Survey of financial economists
Ivo Welch [5]	5% [26]	5.0% to 5.5% [51]	30-Year forecast, survey around August 2001	Survey of financial economists
Misc.				
Barclays Global Investors	5% [27]	2.5%, 3.25% [52]	Long-run (10-year) expected return	Fundamentals: Inc, Earn Gr, & Repricing
Richard Brealey and Stewart Myers	N/A [28]	6 to 8.5% [53]	1926-1997	Predominantly Historical
Burton Malkiel	5.25% [29]	2.75% [54]	1926 to 1997, estimate millennium [57]	Fundamentals: Div Yld, Earn Gr
Richard Wendt [6]	5.5% [30]	3.3% [55]	1960-2000, estimate for 2001-2015 period	Linear regression model

Footnotes:

[1] Social Security Administration.

[2] Presented to the Social Security Advisory Board.

[3] Presented to the Social Security Advisory Board. Update of 1999 article.

[4] Presented to the Social Security Advisory Board.

[5] Update to Welch 2000.

[6] Newsletter of the Investment Section of the Society of Actuaries.

[7] Arithmetic mean of U.S. Treasury bills annual total returns from 1926-2002.

[8] 2.3% Long-run real yield on Treasury bonds; used for Advisory Council proposals. 3.0% Long-term real yield on Treasury bonds; used in 1999 Social Security Trustees Report.

[9] Estimate for safe real interest rates in the future based on yield of long-term inflation-indexed Treasury securities of 3.5% and short-term real interest rates recently averaging about 3%.

[10] Real long-term bond yield using 75 year historical average.

[11] Real yield on long-term Treasuries (assumption by OCACT).

[12] 3.0% is the OCACT assumption. 3.5% is the real return on long-run (30-year) inflation-indexed Treasury securities.

[13] Long-term expected real geometric bond return (10 year-horizon).

[14] The yield on US government inflation-indexed bonds (starting bond real yield in Jan 2000).

[15] Average 10-year Government T-bond yield between 1985 and 1998 (yield of 11.43% in 1985 to 5.64% in 1998. The mean 30-year risk-free rate for each year of the U.S. sample period is 31 basis points higher than the mean 10-year risk-free rate.

[16] Rolled-over real arithmetic return of three-month Treasury bills and certificates.

[17] Historical 20-year Treasury bond return of 5.6%. Yield on 20-year Treasury bonds in 1998 was approximately 6%. Historical 1-month Treasury bill return of 3.8%. Yield on 1-month Treasury bills in 1998 was approximately 4%.

[18] United States historical arithmetic real Treasury bill return over 1900-2000 period. 0.9% geometric Treasury bill return.

[19] Average real return on six-month commercial paper (proxy for risk-free interest rate). Substituting the one-month Treasury bill rate for the six-month commercial paper rate causes estimates of the annual equity premium for 1951-2000 to rise by about 1.00%.

[20] Average yield to maturity on long-term U.S. government bonds, 1982-1998.

[21] Real, geometric risk-free rate. Geometric risk-free rate with inflation (nominal) 5.13%.
Nominal yield equivalent to historical geometric long-term government bond income return for 1926-2000.

[22] The ten- and thirty-year TIPS bond yielded 4.0% in August 1999.

[23] Return on inflation-indexed securities.

[24] Current 10-year Treasury bond yield. Survey administered from June 6, 2000 to June 4, 2002. The rate on the 10-year Treasury bond changes in each survey. For example, in the Dec. 1, 2000 survey, the current annual yield on the 10-year Treasury bond was 5.5%. For the June 6, 2001 survey, the current annual yield on the 10-year Treasury bond was 5.3%.

[25] Arithmetic per-annum average return on rolled-over 30-day T-bills.

[26] Average forecast of arithmetic risk-free rate of about 5% by deducting ERP from market return.

[27] Current nominal 10-year bond yield.

[28] Return on Treasury bills. Treasury bills yield of about 5 percent in mid-1998. Average historical return on Treasury bills 3.8 percent.

[29] Good quality corporate bonds will earn approximately 6.5% to 7%. Long-term zero-coupon Treasury bonds will earn about 5.25%. Long-term TIPS will earn a real return of 3.75%.

[30] 1/1/01 Long T-Bond yield; uses initial bond yields in predictive model.

[31] Arithmetic short-horizon expected equity risk premium. Arithmetic intermediate-horizon expected equity risk premium 7.4%. Arithmetic long-horizon expected equity risk premium 7.0%. Geometric short-horizon expected equity risk premium 6.4%.

[32] Geometric equity premium over long-term Treasury securities. OCACT assumes a constant geometric real 7.0% stock return.

[33] Long-run average equity premium of 1.5% to 2.5% in geometric terms and 3% to 4% in arithmetic terms.

[34] Lower return over the next decade, followed by a geometric, real 7.0% stock return for remaining 65 years or lower rate of return for entire 75-year period (obscures pattern of returns).

[35] Most likely poor return over the next decade followed by a return to historic yields. Working from OCACT stock return assumption, he gives a single rate of return on equities for projection purposes of 6.0 to 6.5% (geometric, real).

[36] Geometric real stock return over the geometric real return on long-term government bonds.

[37] Expected geometric return over long-term government bonds. Their current risk premium is approximately zero, and their recommended expectation for the future real return for both stocks and bonds is 2-4 percent. The "normal" level of the risk premium is modest (2.4 percent or quite possibly less).

[38] Geometric real returns on stocks are likely to be in the 3%-4% range for the foreseeable future (10-20 years).

[39] Substantial declines in real stock prices, and real stock returns below zero, over the next ten years (2001-2010).

[40] The equity premium for each year between 1985 and 1998 in the United States. Similar results for five other markets.

[41] Unconditional, arithmetic mean aggregate equity premium over the 1872-2000 period. Over the period 1951 to 2000, the adjusted estimate of the unconditional mean premium is 6.0%. The corresponding estimate over the 1926 to 2000 period is 8.0%. Sharp distinction between conditional, short-term forecasts of the mean equity return and premium and estimates of the unconditional mean.

[42] Long run arithmetic future ERP of 3.5% to 5.5% over Treasury bonds and 5% to 7% over Treasury bills. Compares estimates to historical returns of 7.4% for bond premium and 9.2% for bill premium.

[43] 5.4% United States arithmetic expected future ERP relative to bills. 4.0% World (16 countries) arithmetic expected future ERP relative to bills. 4.1% United States geometric expected future ERP relative to bills. 3.0% World (16 countries) geometric expected future ERP relative to bills.

[44] 3.83% unconditional expected annual simple equity premium return (referred to as the annual-bias adjusted estimate of the annual equity premium) using dividend growth model. 4.78% unconditional expected annual simple equity premium return (referred to as the annual-bias adjusted estimate of the annual equity premium) using earnings growth model. Compares these results against historical real equity risk premium of 7.43% for 1951-2000.

[45] Average expectational risk premium. Because of the possible bias of analysts' optimism, the estimates are interpreted as "upper bounds" for the market premium. The average expectational risk premium is approximately equal to the arithmetic (7.5%) long-term differential between returns on stocks and long-term government bonds.

[46] 4% geometric (real) and 6% arithmetic (real). Forward looking long-horizon sustainable equity risk premium.

[47] Using the dividend discount model, the forward-looking real long-term geometric return on equity is 3.3%. Based on the earnings yield, the forward-looking real long-term geometric retum on equity is between 3.1% and 3.7%.

[48] Future geometric equity premium. Future real return on equities of about 6%.

[49] The 10-year premium. The one-year risk premium averages between 0.4 and 5.2% depending on the quarter surveyed.

[50] Arithmetic 30-year forecast relative to short-term bills; 10-year same estimate. Second survey 6.8% for 30 and 10-year estimate. 1-year horizon between 0.5% and 1.5% lower. Geometric 30-year forecast around 5.2% (50% responded to this question).

[51] Arithmetic 30-year equity premium (relative to short-term T-bills). Geometric about 50 basis points below arithmetic. Arithmetic 1-year equity premium 3 to 3.5%.

[52] 2.5% current (conditional) geometric equity risk premium. 3.25% long-run, geometric normal or equilibrium equity risk premium.

[53] Extra arithmetic return versus Treasury bills. "Brealey and Myers have no official position on the exact market risk premium, but we believe a range of 6 to 8.5 percent is reasonable for the United States. We are most comfortable with figures towards the upper end of the range."

[54] The projected geometric (nominal) total return for the S&P 500 is 8 percent per year.

[55] Arithmetic mean 15 year horizon.

[56] 74 years since Dec 1925 and 74 years starting Jan 2000.

[57] Estimate the early decades of the twenty-first century.

Appendix C
Estimating a Short-Horizon Arithmetic Unconditional Equity Risk Premium

Source	Risk-free Rate	ERP Estimate	Stock Return Estimate	Geometric to arithmetic	Real to nominal	Conditional to unconditional [60]	Fixed short-horizon RFR	Short-horizon arithmetic unconditional ERP estimate
	I	II	III	IV	V	VI	VII	VIII
Historical								
Ibbotson Associates	3.8% [7]	8.4% [31]	12.2%	0.0%	0.0%	0.00%	3.8%	8.4%
Social Security								
Office of the Chief Actuary [1]	2.3%,3.0% [8]	4.7%,4.0% [32]	7.0%	2.0%	3.1%	0.00%	3.8%	8.3%
John Campbell [2]	3% to 3.5% [9]	1.5-2.5%, 3-4% [33]	6.0%-7.5%	0.0%	3.1%	0.46%	3.8%	5.8%-7.3%
Peter Diamond	2.2% [10]	<4.8% [34]	<7.0%	2.0%	3.1%	0.46%	3.8%	<8.8%
Peter Diamond [3]	3.0% [11]	3.0% to 3.5% [35]	6.0%-6.5%	2.0%	3.1%	0.46%	3.8%	7.8%-8.3%
John Shoven [4]	3.0%,3.5% [12]	3.0% to 3.5% [36]	6.0%-7.0%	2.0%	3.1%	0.46%	3.8%	7.8%-8.8%
Puzzle Research								
Robert Arnott and Peter Bernstein	3.7% [13]	2.4% [37]	6.1%	2.0%	3.1%	0.46%	3.8%	7.9%
Robert Arnott and Ronald Ryan	4.1% [14]	-0.9% [38]	3.2%	2.0%	3.1%	0.46%	3.8%	5.0%
John Campbell and Robert Shiller	N/A	Negative [39]	Negative	N/A	N/A	N/A	N/A	N/A
James Claus and Jacob Thomas	7.64% [15]	3.39% or less [40]	11.03%	0.0%	0.0%	0.46%	3.8%	7.69%
George Constantinides	2.0% [16]	6.9% [41]	8.9%	0.0%	3.1%	0.00%	3.8%	8.2%
Bradford Cornell	5.6%, 3.8% [17]	3.5-5.5%, 5-7% [42]	8.8%-10.8%	0.0%	0.0%	0.46%	3.8%	5.5%-7.5%
Dimson, Marsh, & Staunton	1.0% [18]	5.4% [43]	6.4% [58]	0.0%	3.1%	0.46%	3.8%	6.2% [61]
Eugene Fama and Kenneth French	3.24% [19]	3.83% & 4.78% [44]	7.07%-8.02%	0.0%	3.1%	0.00%	3.8%	6.37%-7.32%
Robert Harris and Felicia Marston	8.53% [20]	7.14% [45]	12.34% [59]	0.0%	0.0%	0.46%	3.8%	9.00%
Roger Ibbotson and Peng Chen	2.05% [21]	4% and 6% [46]	8.05%	0.0%	3.1%	0.00%	3.8%	7.35%
Jeremy Siegel	4.0% [22]	-0.9% to -0.3% [47]	3.1%-3.7%	2.0%	3.1%	0.46%	3.8%	4.9%-5.5%
Jeremy Siegel	3.5% [23]	2-3% [48]	5.5%-6.5%	2.0%	3.1%	0.46%	3.8%	7.3%-8.3%
Surveys								
John Graham and Campbell Harvey	? by survey [24]	3-4.7% [49]	8.3%-10.2%	N/A	0.0%	0.46%	3.8%	5.0%-6.9%
Ivo Welch	N/A [25]	7% [50]	N/A	0.0%	0.0%	0.46%	0.0%	7.5%
Ivo Welch [5]	5% [26]	5.0% to 5.5% [51]	10.0%-10.5%	0.0%	0.0%	0.46%	3.8%	6.7%-7.2%
Misc.								
Barclays Global Investors	5% [27]	2.5%, 3.25% [52]	7.5%,8.25%	2.0%	0.0%	0.46%	3.8%	6.16%-6.91%
Richard Brealey and Stewart Myers	N/A [28]	6 to 8.5% [53]	N/A	0.0%	0.0%	0.00%	0.0%	6.0%-8.5%
Burton Malkiel	5.25% [29]	2.75% [54]	8.0%	2.0%	0.0%	0.46%	3.8%	6.7%
Richard Wendt [6]	5.5% [30]	3.3% [55]	8.8%	0.0%	0.0%	0.46%	3.8%	5.5%

Column formulas:
III = I + II
VIII = III + IV + V + VI – VII

Source for adjustments:
2003 Ibbotson Yearbook Table 2-1 page 33
Fama French 2002 (see footnote 60)

Footnotes (1-57 from Appendix B):
[58] World estimate of 5.0%.
[59] Long risk-free of 5.2% plus 7.14%.
[60] For the 1951-2000 period, Fama and French (2002) adjust the conditional dividend growth model estimate upwards by 1.28% for an unconditional estimate, and they make a 0.46% upwards adjustment to the earnings growth model. We select the smaller of the two as an approximate minimum adjustment. For the longer period of 1872-2000, a comparable adjustment would be 0.82% for the dividend growth model and 0.54% for the 1872-1950 period using a dividend growth model. Earnings growth rates are shown by Fama and French only for the 1951-2000 period.
[61] World estimate of 4.8%.

Appendix D

Historical and Forecasted Equity Returns- All Ibbotson and Chen Models (Percent).

Method/ Model	Sum	Inflation	Real Risk-Free Rate	Equity Risk Premium	Real Capital Gain	g(Real EPS)	g(Real Div)	- g (Pay out Ratio)	g (BV)	g (ROE)	g P/E)	g(Real GDP/ POP)	g(FS-GDP/ POP)	Income Return	Re-Investment + Interaction	Additional Growth	Forecast Earnings Growth
Column #	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
Historical																	
Method 1	10.70	3.08	2.05	5.24											0.33		
Method 2	10.70	3.08			3.02									4.28	0.32		
Method 3	10.70	3.08				1.75					1.25			4.28	0.34		
Method 4	10.70	3.08					1.23	0.51			1.25			4.28	0.35		
Method 5	10.70	3.08							1.46	0.31	1.25			4.28	0.31		
Method 6	10.70	3.08										2.04	0.96	4.28	0.32		
Forecast with Historical Dividend Yield																	
Model 3F	9.37	3.08				1.75								4.28	0.26		
Model 3F (ERP)	9.37	3.08	2.05	3.97											0.27		
Forecast with Current Dividend Yield																	
Model 4F	5.44	3.08					1.23							1.10 [a]	0.03		
Model 4F (ERP)	5.44	3.08	2.05	0.24											0.07		
Model $4F_2$	9.37	3.08					1.23	0.51						2.05 [b]	0.21	2.28	
Model $4F_2$ (FG)	9.37	3.08												1.10 [a]	0.21		4.98

Source: The data and format was made available by Ibbotson/Chen and is reprinted with permission by Ibbotson Associates. Corresponds to Ibbotson/Chen Table 2 Exhibit; column numbers have been added.

[a] 2000 dividend yield

[b] Assuming the historical average dividend-payout ratio, the 2000 dividend yield is adjusted up 0.95 pps.

	Formula*	Description of Method
Historical		
Method 1	I=(1+II)*(1+III)*(1+IV)-1	Building Blocks Method: inflation, real risk-free rate, and equity risk premium.
Method 2	I=[(1+II)*(1+V)-1]+XIV+XV	Capital Gain and Income Method: inflation, real capital gain, and income return.
Method 3	I=[(1+II)*(1+VI)*(1+XI)-1]+XIV+XV	Earnings Model: inflation, growth in earnings per share, growth in price to earnings ratio, and income return.
Method 4	I=[(1+II)*(1+XI)*(1+VII)/(1-VIII)-1]+XIV+XV	Dividends Model: inflation, growth rate of price earnings ratio, growth rate of the dollar amount of dividends after inflation, growth rate of payout ratio, and dividend yield (income return).
Method 5	I=[(1+II)*(1+XI)*(1+IX)*(1+X)-1]+XIV+XV	Return on Book Equity Model: inflation, growth rate of price earnings ratio, growth rate of book value, growth rate of ROE, and income return.
Method 6	I=[(1+II)*(1+XII)*(1+XIII)-1]+XIV+XV	GDP Per Capita Model: inflation, real growth rate of the overall economic productivity (GDP per capita), increase of the equity market relative to the overall economic productivity, and income return.
Forecast with Historical Dividend Yield		
Model 3F	I=[(1+II)*(1+VI)-1]+XIV+XV	Forward-looking Earnings Model: inflation, growth in real earnings per share, and income return.
Model 3F (ERP)	IV=(1+I)/[(1+II)*(1+III)]-1	Using Model 3F result to calculate ERP.
Forecast with Current Dividend Yield		
Model 4F	I=[(1+II)*(1+VII)-1]+XIV+XV	Forward-looking Dividends Model: inflation, growth in real dividend, and dividend yield (income return); also referred to as Gordon model.
Model 4F (ERP)	IV=(1+I)/[(1+II)*(1+III)]-1	Using Model 4F result to calculate ERP.
Model $4F_2$	I=[(1+II)*(1+VII)*(1+VIII)-1]+XIV+XV+XVI	Attempt to reconcile Model 4F and Model 3F.
Model $4F_2$ (FG)	XVII=[(1+I)/(1+II)-1]-XIV-XV	Using Method $4F_2$ result to calculate forecasted earnings.

Explanation of Ibbotson/Chen Table 2 Exhibit; using column numbers to represent formula.

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The Equity Risk Premium: A Review of Models

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Abstract

We estimate the equity risk premium (ERP) by combining information from twenty models. The ERP in 2012 and 2013 reached heightened levels—of around 12 percent—not seen since the 1970s. We conclude that the high ERP was caused by unusually low Treasury yields.

Key words: equity premium, stock returns

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1. Introduction

The equity risk premium —the expected return on stocks in excess of the risk-free rate— is a fundamental quantity in all of asset pricing, both for theoretical and practical reasons. It is a key measure of aggregate risk-aversion and an important determinant of the cost of capital for corporations, savings decisions of individuals and budgeting plans for governments. Recently, the equity risk premium (ERP) has also returned to the forefront as a leading indicator of the evolution of the economy, a potential explanation for jobless recoveries and a gauge of financial stability[3].

In this article, we estimate the ERP by combining information from twenty prominent models used by practitioners and featured in the academic literature. Our main finding is that the ERP has reached heightened levels. The first principal component of all models –a linear combination that explains as much of the variance of the underlying data as possible– places the one-year-ahead ERP in June 2012 at 12.2 percent, above the 10.5 percent that was reached during the financial crisis in 2009 and at levels similar to those in the mid and late 1970s. Since June 2012 and until the end of our sample in June 2013, the ERP has remained little changed, despite substantial positive realized returns. It is worth keeping in mind, however, that there is considerable uncertainty around these estimates. In fact, the issue of whether stock returns are predictable is still an active area of research.[4] Nevertheless, we find that the dispersion in estimates across models, while quite large, has been shrinking, potentially signaling increased agreement

[3] As an indicator of future activity, a high ERP at short horizons tends to be followed by higher GDP growth, higher inflation and lower unemployment. See, for example, Piazzesi and Schneider (2007), Stock and Watson (2003), and Damodaran (2012). Bloom (2009) and Duarte, Kogan and Livdan (2013) study connections between the ERP and real aggregate investment. As a potential explanation of the jobless recovery, Hall (2014) and Kuehn, Petrosky-Nadeau and Zhang (2012) propose that increased risk-aversion has prevented firms from hiring as much as would be expected in the post-crisis macroeconomic environment. Among many others, Adrian, Covitz and Liang (2013) analyze the role of equity and other asset prices in monitoring financial stability.

[4] A few important references among a vast literature are Ang and Bekaert (2007), Goyal and Welch (2008), Campbell and Thompson (2008), Kelly and Pruitt (2013), Chen, Da and Zhao (2013), Neely, Rapach, Tu and Zhou (2014).

even when the models are substantially different from each other and use more than one hundred different economic variables.

In addition to estimating the level of the ERP, we investigate the reasons behind its recent behavior. Because the ERP is the difference between expected stock returns and the risk-free rate, a high estimate can be due to expected stock returns being high or risk-free rates being low. We conclude the ERP is high because Treasury yields are unusually low. Current and expected future dividend and earnings growth play a smaller role. In fact, expected stock returns are close to their long-run mean. One implication of a bond-yield-driven ERP is that traditional indicators of the ERP like the price-dividend or price-earnings ratios, which do not use data from the term structure of risk-free rates, may not be as good a guide to future excess returns as they have been in the past.

As a second contribution, we present a concise and coherent taxonomy of ERP models. We categorize the twenty models into five groups: predictors that use historical mean returns only, dividend-discount models, cross-sectional regressions, time-series regressions and surveys. We explain the methodological and practical differences among these classes of models, including the assumptions and data sources that each require.

2. The Equity Risk Premium: Definition

Conceptually, the ERP is the compensation investors require to make them indifferent at the margin between holding the risky market portfolio and a risk-free bond. Because this compensation depends on the future performance of stocks, the ERP incorporates expectations of future stock market returns, which are not directly observable. At the end of the day, any model of the ERP is a model of investor expectations. One challenge in estimating the ERP is that it is not clear what truly constitutes the market return and the risk-free rate in the real world. In practice, the most common measures of total market returns are based on broad stock market indices, such as the S&P 500 or the Dow Jones Industrial

Average, but those indices do not include the whole universe of traded stocks and miss several other components of wealth such as housing, private equity and non-tradable human capital. Even if we restricted ourselves to all traded stocks, we still have several choices to make, such as whether to use value or equal-weighted indices, and whether to exclude penny or infrequently traded stocks. A similar problem arises with the risk-free rate. While we almost always use Treasury yields as measures of risk-free rates, they are not completely riskless since nominal Treasuries are exposed to inflation[5] and liquidity risks even if we were to assume there is no prospect of outright default. In this paper, we want to focus on how expectations are estimated in different models, and not on measurement issues regarding market returns and the risk-free rate. Thus, we follow common practice and always use the S&P 500 as a measure of stock market prices and either nominal or real Treasury yields as risk-free rates so that our models are comparable with each other and with most of the literature.

While implementing the concept of the ERP in practice has its challenges, we can precisely define the ERP mathematically. First, we decompose stock returns[6] into an expected component and a random component:

$$R_{t+k} = E_t[R_{t+k}] + error_{t+k}. \qquad (1)$$

In equation (1), R_{t+k} are *realized* returns between *t* and *t*+*k*, and $E_t[R_{t+k}]$ are the returns that were expected from *t* to $t+k$ using information available at time t. The variable $error_{t+k}$ is a random variable that is unknown at time t and realized at $t+k$. Under rational expectations, $error_{t+k}$ has a mean of zero and is orthogonal to $E_t[R_{t+k}]$. We keep the discussion as general as possible and do not assume rational

[5] Note that inflation risk in an otherwise risk-free nominal asset does not invalidate its usefulness to compute the ERP. If stock returns and the risk-free rate are expressed in nominal terms, their difference has little or no inflation risk. This follows from the following formula, which holds exactly in continuous time and to a first order approximation in discrete time: real stock returns – real risk-free rate = (nominal stock returns – expected inflation) – (nominal risk-free rate – expected inflation) = nominal stock returns– nominal risk-free rate. Hence, there is no distinction between a nominal and a real ERP.

[6] Throughout this article, all returns are *net* returns. For example, a five percent return corresponds to a net return of 0.05 as opposed to a *gross* return of 1.05.

expectations at this stage, although it will be a feature of many of the models we consider. The ERP at time t for horizon k is defined as

$$ERP_t(k) = E_t[R_{t+k}] - R^f_{t+k}, \tag{2}$$

where R^f_{t+k} is the risk-free rate for investing from t to $t+k$ (which, being risk-free, is known at time t).

This definition shows three important aspects of the ERP. First, future expected returns and the future ERP are stochastic, since expectations depend on the arrival of new information that has a random component not known in advance[7]. Second, the ERP has an investment horizon k embedded in it, since we can consider expected excess returns over, say, one month, one year or five years from today. If we fix t, and let k vary, we trace the *term structure* of the equity risk premium. Third, if expectations are rational, because the unexpected component $error_{t+k}$ is stochastic and orthogonal to expected returns, the ERP is always less volatile than realized excess returns. In this case, we expect ERP estimates to be smoother than realized excess returns.

3. Models of the Equity Risk Premium

We describe twenty models of the equity risk premium, comparing their advantages, disadvantages and ease of implementation. Of course, there are many more models of the ERP than the ones we consider. We selected the models in our study based on the recent academic literature, their widespread use by practitioners and data availability. Table I describes the data we use and their sources, all of which are either readily available or standard in the literature[8]. With a few exceptions, all data is monthly from January 1960 to June 2013. Appendix A provides more details.

[Insert Table I here]

[7] More precisely, $E_t[R_{t+k}]$ and $ERP_t(k)$ are known at time t but random from the perspective of all earlier periods.

[8] In fact, except for data from I/B/E/S and Compustat, all sources are public.

We classify the twenty models into five categories based on their underlying assumptions; models in the same category tend to give similar estimates for the ERP. The five categories are: models based on the historical mean of realized returns, dividend discount models, cross-sectional regressions, time-series regressions and surveys.

All but one of the estimates of the ERP are constructed in real time, so that an investor who lived through the sample would have been able to construct the measures at each point in time using available information only[9]. This helps minimize look-ahead bias and makes any out-of-sample evaluation of the models more meaningful. Clearly, most of the models themselves were designed only recently and were not available to investors in real time, potentially introducing another source of forward-looking and selection biases that are much more difficult to quantify and eliminate.

3.1 Historical mean of realized returns

The easiest approach to estimating the ERP is to use the historical mean of realized market returns in excess of the contemporaneous risk-free rate. This model is very simple and, as shown in Goyal and Welch (2008), quite difficult to improve upon when considering out-of-sample predictability performance measures. The main drawbacks are that it is purely backward looking and assumes that the future will behave like the past, i.e. it assumes the mean of excess returns is either constant or very slow moving over time, giving very little time-variation in the ERP. The main choice is how far back into the past we should go when computing the historical mean. Table II shows the two versions of historical mean models that we use.

[Insert Table II here]

[9] The one exception is Adrian, Crump and Moench's (2014) cross-sectional model, which is constructed using full-sample regression estimates.

3.2 Dividend discount models (DDM)

All DDM start with the basic intuition that the value of a stock is determined by no more and no less than the cash flows it produces for its shareholders, as in Gordon (1962). Today's stock price should then be the sum of all expected future cash flows, discounted at an appropriate rate to take into account their riskiness and the time value of money. The formula that reflects this intuition is

$$P_t = \frac{D_t}{\rho_t} + \frac{E_t[D_{t+1}]}{\rho_{t+1}} + \frac{E_t[D_{t+2}]}{\rho_{t+2}} + \frac{E_t[D_{t+3}]}{\rho_{t+3}} + \cdots, \tag{3}$$

where P_t is the current price of the stock, D_t are current cash flows, $E_t[D_{t+k}]$ are the cash flows k periods from now expected as of time t, and ρ_{t+k} is the discount rate for time $t + k$ from the perspective of time t. Cash flows to stockholders certainly include dividends, but can also arise from spin-offs, buy-outs, mergers, buy-backs, etc. In general, the literature focuses on dividend distributions because they are readily available data-wise and account for the vast majority of cash flows. The discount rate can be decomposed into

$$\rho_{t+k} = 1 + R^f_{t+k} + ERP_t(k). \tag{4}$$

In this framework, the risk-free rate captures the discounting associated with the time value of money and the ERP captures the discounting associated with the riskiness of dividends. When using a DDM, we refer to $ERP_t(k)$ as the *implied* ERP. The reason is that we plug in prices, risk-free rates and estimated expected future dividends into equation (3), and then derive what value of $ERP_t(k)$ makes the right-hand side equal to the left-hand side in the equation, i.e. what ERP value is *implied* by equation (3).

DDM are forward looking and are consistent with no arbitrage. In fact, equation (3) must hold in any economy with no arbitrage[10]. Another advantage of DDM is that they are easy to implement. A drawback of DDM is that the results are sensitive to how we compute expectations of future dividends. Table III displays the DDM we consider and a brief description of their different assumptions.

[Insert Table III here]

3.3 Cross-sectional regressions

This method exploits the variation in returns and exposures to the S&P 500 of different assets to infer the ERP[11]. Intuitively, cross-sectional regressions find the ERP by answering the following question: what is the level of the ERP that makes expected returns on a variety of stocks consistent with their exposure to the S&P 500? Because we need to explain the relationship between returns and exposures for multiple stocks with a single value for the ERP (and perhaps a small number of other variables), this model imposes tight restrictions on estimates of the ERP.

The first step is to find the exposures of assets to the S&P 500 by estimating an equation of the following form:

$$R^i_{t+k} - R^f_{t+k} = \alpha^i \times state\ variables_{t+k} + \beta^i \times risk\ factors_{t+k} + idiosyncratic\ risk^i_{t+k}. \quad (5)$$

In equation (5), R^i_{t+k} is the realized return on a stock or portfolio i from time t to $t+k$. $State\ variables_{t+k}$ are any economic indicators that help identify the state of the economy and its likely future path. $Risk\ factors_{t+k}$ are any measures of systematic contemporaneous co-variation in returns across all stocks or portfolios. Of course, some economic indicators can be both state variables and risk

[10] Note that when performing the infinite summation in equation (3) we have not assumed the n^{th} term goes to zero as n tends to infinity, which allows for rational bubbles. In this sense, DDM do allow for a specific kind of bubble.

[11] See Polk, Thompson and Vuolteenaho (2006) and Adrian, Crump and Moench (2014) for a detailed description of this method.

factors at the same time. Finally, $idiosyncratic\ risk_{t+k}^{i}$ is the component of returns that is particular to each individual stock or portfolio that is not explained by $state\ variables_{t+k}$ or $risk\ factors_{t+k}$ (both of which, importantly, are common to all stocks and hence not indexed by i). Examples of state variables are inflation, unemployment, the yield spread between Aaa and Baa bonds, the yield spread between short and long term Treasuries, and the S&P 500's dividend-to-price ratio. The most important risk factor is the excess return on the S&P 500, which we must include if we want to infer the ERP consistent with the cross-section of stock returns. Other risk-factors usually used are the Fama-French (1992) factors and the momentum factor of Carhart (1997). The values in the vector α^{i} give the strength of asset-specific return predictability and the values in the vector β^{i} give the asset-specific exposures to risk factors[12]. For the cross-section of assets indexed by i, we can use the whole universe of traded stocks, a subset of them, or portfolios of stocks grouped, for example, by industry, size, book-to-market, or recent performance. It is important to point out that equation (5) is not a predictive regression; the left and right-hand side variables are both associated with time $t + k$.

The second step is to find the ERP associated with the S&P 500 by estimating the cross-sectional equations

$$R_{t+k}^{i} - R_{t+k}^{f} = \lambda_t(k) \times \hat{\beta}^{i} , \tag{6}$$

where $\hat{\beta}^{i}$ are the values found when estimating equation (5). Equation (6) attempts to find, at each point in time, the vector of numbers $\lambda_t(k)$ that makes exposures β^{i} as consistent as possible with realized excess returns of all stocks or portfolios considered. The element in the vector $\hat{\lambda}_t(k)$ that is multiplied by

[12] The vectors α^{i} and β^{i} could also be time-varying, reflecting a more dynamic relation between returns and their explanatory variables. In this case, the estimation of equation (5) is more complicated and requires making further assumptions. The model by Adrian, Crump and Moench (2014) is the only cross-sectional model we examine that uses time-varying α^{i} and β^{i} .

the element in the $\hat{\beta}^i$ vector corresponding to the S&P 500 is $ERP_t(k)$, the equity risk premium we are seeking.

One advantage of cross-sectional regressions is that they use information from more asset prices than other models. Cross-sectional regressions also have sound theoretical foundations, since they provide one way to implement Merton's (1973) Intertemporal Capital Asset Pricing Model. Finally, this method nests many of the other models considered. The two main drawbacks of this method are that results are dependent on what portfolios, state variables and risk factors are used (Harvey, Liu and Zhu (2014)), and that it is not as easy to implement as most of the other options. Table IV displays the cross-sectional models in our study, together with the state variables and risk factors they use.

[Insert Table IV here]

3.4 Time-series regressions

Time-series regressions use the relationship between economic variables and stock returns to estimate the ERP. The idea is to run a predictive linear regression of realized excess returns on lagged "fundamentals":

$$R_{t+k} - R_{t+k}^f = a + b \times Fundamental_t + error_t. \tag{7}$$

Once estimates $\hat{a}$ and $\hat{b}$ for a and b are obtained, the ERP is obtained by ignoring the error term:

$$ERP_t(k) = \hat{a} + \hat{b} \times Fundamental_t. \tag{8}$$

In other words, we estimate only the forecastable or expected component of excess returns. This method attempts to implement equations (1) and (2) as directly as possible in equations (7) and (8), with the assumption that "fundamentals" are the right sources of information to look at when computing expected returns, and that a linear equation is the correct functional specification.

The use of time-series regressions requires minimal assumptions; there is no concept of equilibrium and no absence of arbitrage necessary for the method to be valid[13]. In addition, implementation is quite simple, since it only involves running ordinary least-square regressions. The challenge is to select what variables to include on the right-hand side of equation (7), since results can change substantially depending on what variables are used to take the role of "fundamentals". In addition, including more than one predictor gives poor out-of-sample predictions even if economic theory may suggest a role for many variables to be used simultaneously (Goyal and Welch (2008)). Finally, time-series regressions ignore information in the cross-section of stock returns. Table V shows the time-series regression models that we study.

[Insert Table V here]

3.5 Surveys

The survey approach consists of asking economic agents about the current level of the ERP. Surveys incorporate the views of many people, some of which are very sophisticated and/or make real investment decisions based on the level of the ERP. Surveys should also be good predictors of excess returns because in principle stock prices are determined by supply and demand of investors such as the ones taking the surveys. On the other hand, Greenwood and Shleifer (2014) document that investor expectations of future stock market returns are positively correlated with past stock returns and with the current level of the stock market, but strongly *negatively* correlated with model-based expected returns and future realized stock market returns. Other studies such as Easton and Sommers (2007) also argue that survey measures of the ERP can be systematically biased. In this paper, we use the survey of CFOs by Graham and Harvey (2012), which to our knowledge is the only large-scale ERP survey that has more than just a few years of data (see Table VI).

[Insert Table VI here]

[13] However, the Arbitrage Pricing Theory of Ross (1976) provides a strong theoretical underpinning for time-series regressions by using no-arbitrage conditions.

4. Estimation of the Equity Risk Premium

We now study the behavior of the twenty models we consider by conducting principal component analysis. Since forecast accuracy can be substantially improved through the combination of multiple forecasts[14], the optimal strategy to forecast excess stock returns may consist of combining together all these models. The first principal component of the twenty models that we use is the linear combination of ERP estimates that captures as much of the variation in the data as possible. The second, third, and successive principal components are the linear combinations of the twenty models that explain as much of the variation of the data as possible and are also uncorrelated to all the preceding principal components. If the first few principal components —say one or two— account for most of the variation of the data, then we can use them as a good summary for the variation in all the measures over time, reducing the dimensionality from twenty to one or two. In addition, in the presence of classical measurement error, the first few principal components can achieve a higher signal-to-noise ratio than other summary measures like the cross-sectional mean of all models (Geiger and Kubin (2013)).

To compute the first principal component, we proceed in three steps. We first de-mean all ERP estimates and find their variance-covariance matrix. In the second step, we find the linear combination that explains as much of the variance of the de-meaned models as possible. The weights in the linear combination are the elements of the eigenvector associated with the largest eigenvalue of the variance-covariance matrix found in the first step. In the third step, we add to the linear combination just obtained, which has mean zero, the average of ERP estimates across all models and all time periods. Under the assumption that each of the models is an unbiased and consistent estimator of the ERP, the average across all models and all time periods is an unbiased and consistent estimator of the unconditional mean of the ERP. The time

[14] See, *inter alia*, Clemen (1989), Diebold and Lopez (1996) and Timmermann (2006).

variation in the first principal component then provides an estimate of the conditional ERP[15]. The share of the variance of the underlying models explained by this principal component is 76 percent, suggesting that there is not too much to gain from examining principal components beyond the first[16].

We now focus on the one-year-ahead ERP estimates and study other horizons in the next section.

The first two columns in Table VII show the mean and standard deviation of each model's estimates. The unconditional mean of the ERP across all models is 5.7 percent, with an average standard deviation of 3.2 percent. DDM give the lowest mean ERP estimates and have moderate standard deviations. In contrast, cross-sectional models tend to have mean ERP estimates on the high end of the distribution and very smooth time-series. Mean ERP estimates for time-series regressions are mixed, with high and low values depending on the predictors used, but uniformly large variances. The survey of CFOs has a mean and standard deviation that are both about half as large as in the overall population of models. The picture that emerges from Table VII is that there is considerable heterogeneity across model types, and even sometimes within model types, thereby underscoring the difficulty inherent in finding precise estimates of the ERP.

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[15] As is customary in the literature, we perform the analysis using ERP estimates in levels, even though they are quite persistent. Results in first-differences do not give economically reasonable estimates since they feature a pro-cyclical ERP and unreasonable magnitudes.

One challenge that arises in computing the principal component is when we have missing observations, either because some models can only be obtained at frequencies lower than monthly or because the necessary data is not available for all time periods (Appendix A contains a detailed description of when this happens). To overcome this challenge, we use an iterative linear projection method, which conceptually preserves the idea behind principal components. Let X be the matrix that has observations for different models in its columns and for different time periods in its rows. On the first iteration, we make a guess for the principal component and regress the non-missing elements of each row of X on the guess and a constant. We then find the first principal component of the variance-covariance matrix of the fitted values of these regressions, and use it as the guess for the next iteration. The process ends when the norm of the difference between consecutive estimates is small enough. We thank Richard Crump for suggesting this method and providing the code for its implementation.

[16] The second and third principal components account for 13 and 8 percent of the variance, respectively.

[Insert Table VII here]

Figure 1 shows the time-series for all one-year-ahead ERP model estimates, with each class of models in a different panel. The green lines are the ERP estimates from the twenty underlying models. The black line, reproduced in each of the panels, is the principal component of all twenty models. The shaded areas are NBER recessions. The figure gives a sense of how the time-series move together, and how much they co-vary with the first principal component. Table VIII shows the correlations among models. Figure 1 and Table VIII give the same message: despite some outliers, there is a fairly strong correlation within each of the five classes of models. Across classes, however, correlations are small and even negative. Interestingly, the correlation between some DDM and cross-sectional models is as low as -91 percent. This negative correlation, however, disappears if we look at lower frequencies. When aggregated to quarterly frequency, the smallest correlation between DDM and cross-sectional models is -22 percent, while at the annual frequency it is 12 percent.

[Insert Figure 1 here]

[Insert Table VIII here]

Figure 1 also shows that the first principal component co-varies negatively with historical mean models, but positively with DDM and cross-sectional regression models. Time-series regression models are also positively correlated with the first principal component, although this is not so clearly seen in Panel 4 of Figure 1 because of the high volatility of time-series ERP estimates. The last panel shows that the survey of CFOs does track the first principal component quite well at low frequencies (e.g. annual), although any conclusions about survey estimates should be interpreted with caution given the short length of the sample.

As explained earlier, the first principal component is a linear combination of the twenty underlying ERP models:

$$PC_t^{(1)} = \sum_{m=1}^{20} w^{(m)} ERP_t^{(m)}. \qquad (9)$$

In the above equation, m indexes the different models, $PC_t^{(1)}$ is the first principal component, $ERP_t^{(m)}$ is the estimate from model m and $w^{(m)}$ is the weight that the principal component places on model m. The third column in Table VII, labeled "PC coefficients", shows the weights $w^{(m)}$ normalized to sum up to one to facilitate comparison, i.e. the table reports the weights $\widehat{w}^{(m)}$ where

$$\widehat{w}^{(m)} = \frac{w^{(m)}}{\sum_{m=1}^{20} w^{(m)}}. \qquad (10)$$

The first principal component puts positive weight on models based on the historical mean, cross-sectional regressions and the survey of CFOs. It weights DDM and time-series regressions mostly negatively. The absolute values of the weights are very similar for many of the models, and there is no single model or class of models that dominates. This means that the first principal component uses information from many of the models.

The last column in Table VII, labeled "Exposure to PC", shows the extent to which models *load* on the first principal component. By construction, each of the twenty ERP models can be written as a linear combination of twenty principal components:

$$ERP_t^{(m)} = \sum_{i=1}^{20} load_i^{(m)} PC_t^{(i)}, \qquad (11)$$

where m indexes the model and i indexes the principal components. The values in the last column of Table VII are the loadings on the first principal component ($i = 1$) for each model ($m = 1, 2, \ldots, 20$), again normalized to one for ease of comparability:

$$\widehat{load}_1^{(m)} = \frac{load_1^{(m)}}{\sum_{m=1}^{20} load_i^{(m)}}. \tag{12}$$

Most models have a positive loading on the first principal component; whenever the loading is negative, it tends to be relatively small. This means the first principal component, as expected, is a good explanatory variable for most models. Looking at the third and fourth columns of Table VII together, we can obtain additional information. For example, a model with a very high loading (fourth column) accompanied by a very small PC coefficient (third column) is likely to mean that the model is almost redundant, in the sense that it is close to being a linear combination of all other models and does not provide much independent information to the principal component. On the other hand, if the PC coefficient and loading are both high, the corresponding model is likely providing information not contained in other measures.

Figure 2 shows the first principal component of all twenty models in black, with recessions indicated by shaded bars (the black line is the same principal component shown in black in each of the panels of Figure 1). As expected, the principal component tends to peak during financial turmoil, recessions and periods of low real GDP growth or high inflation. It tends to bottom out after periods of sustained bullish stock markets and high real GDP growth. Evaluated by the first principal component, the one-year-ahead ERP reaches a local peak in June of 2012 at 12.2 percent. The surrounding months have ERP estimates of similar magnitude, with the most recent estimate in June 2013 at 11.2 percent. This behavior is not so clearly seen by simply looking at the collection of individual models in Figure 1, highlighting the usefulness of principal components analysis. Similarly high levels were seen in the mid and late 1970s, during a period of stagflation, while the recent financial crisis had slightly lower ERP estimates closer to 10 percent.

[Insert Figure 2 here]

Figure 2 also displays the 10th, 25th, 75th and 90th percentiles of the cross-sectional distribution of models. These bands can be interpreted as confidence intervals, since they give the range of the distribution of ERP estimates at each point in time. However, they do not incorporate other relevant sources of uncertainty, such as the errors that occur during the estimation of each individual model, the degree of doubt in the correctness of each model, and the correlation structure between these and all other kinds of errors. Standard error bands that capture all sources of uncertainty are therefore likely to be wider.

The difference in high and low percentiles can also be interpreted as measures of agreement across models. The interquartile range –the difference between the 25th and 75th percentiles— has compressed, mostly because the models in the bottom of the distribution have had higher ERP estimates since 2010. It is also interesting to note that the 75th percentile has remained fairly constant over the last 10 years at a level somewhat below its long-run mean. The cross-sectional standard deviation in ERP estimates (not shown in the graph) also decreased from 10.2% in January of 2000 to 4.3% in June of 2013, confirming that the disagreement among models has decreased.

Another *a priori* reasonable summary statistic for the ERP is the cross-sectional mean of estimates across models. In Figure 3, we can see that by this measure the ERP has also been increasing since the crisis. However, unlike the principal component, it has not reached elevated levels compared to past values. The cross-sectional mean can be useful, but it has a few undesirable features as an overall measure of the ERP compared to the first principal component. First, it is procyclical, which contradicts the economic intuition that expected returns are highest in recessions, when risk aversion is high and future prospects look brighter than current ones. Second, it overloads on DDM simply because there is a higher number of DDM models in our sample. Lastly, it has a smaller correlation with the realized returns it is supposed to predict.

[Insert Figure 3 here]

5. The Term Structure of Equity Risk Premia

In Section 2, we described the term structure of the ERP – what expected excess returns are over different investment horizons. In practical terms, we estimate the ERP at different horizons by using the inputs for all the models at the corresponding horizons[17]. For example, if we want to take the historical mean of returns as our estimate, we can take the mean of returns over one month, six months, or a one-year period. In cross-sectional and time-series regressions, we can predict monthly, quarterly or annual returns using monthly, quarterly or annual right-hand side variables. DDM, on the other hand, have little variation across horizons. In fact, all the DDM we consider have a constant term structure of expected stock returns, and the only term structure variation in ERP estimates comes from risk-free rates[18].

Figure 4 plots the first principal components of the ERP as a function of investment horizon for some selected dates. We picked the dates because they are typical dates for when the ERP was unusually high or unusually low at the one-month horizon. As was the case for one-year-ahead ERP estimates, we can capture the majority of the variance of the underlying models at all horizons by a single principal component. The shares of the variance explained by the first principal components at horizons of one month to three years range between 68 and 94 percent. The grey line in Figure 4 shows the average of the term structure across all periods. It is slightly upward sloping, with a short-term ERP at just over 6 percent and a three-year ERP at almost 7 percent.

[Insert Figure 4 here]

[17] For other ways to estimate the term structure of the ERP using equilibrium models or derivatives, see Ait-Sahalia, Karaman and Mancini (2014), Ang and Ulrich (2012), van Binsbergen, Hueskes, Koijen and Vrugt (2014), Boguth, Carlson, Fisher and Simutin (2012), Durham (2013), Croce, Lettau and Ludvigson (2014), Lemke and Werner (2009), Lettau and Wachter (2011), Muir (2013), among others.

[18] In equation (3), ρ_{t+k} is assumed to be the same for all k, while risk-free rates are allowed to vary over the investment horizon k in equation (4). Of course, with additional assumptions, it is possible to have DDM with a non-constant term structure of expected excess returns.

The first observation is that the term structure of the ERP has significant time variation and can be flat, upward or downward sloping. Figure 4 also shows some examples that hint at lower future expected excess returns when the one-month-ahead ERP is elevated and the term structure is downward sloping, and higher future expected excess returns when the one-month-ahead ERP is low and the term structure is upward sloping. In fact, this is generally true: There is a strong negative correlation between the level and the slope of the ERP term structure of -71 percent. Figure 5 plots monthly observations of the one-month-ahead ERP against the slope of the ERP term structure (the three-year-ahead minus the one-month-ahead ERP) together with the corresponding ordinary least squares regression line in black. Of course, this is only a statistical pattern and should not be interpreted as a causal relation.

[Insert Figure 5 here]

6. Why is the Equity Risk Premium High?

There are two reasons why the ERP can be high: low discount rates and high current or expected future cash flows.

Figure 6 shows that earnings are unlikely to be the reason why the ERP is high. The green line shows the year-on-year change in the mean expectation of one-year-ahead earnings per share for the S&P 500. These expectations are obtained from surveys conducted by the Institutional Brokers' Estimate System (I/B/E/S) and available from Thomson Reuters. Expected earnings per share have been declining from 2010 to 2013, making earnings growth an unlikely reason for why the ERP was high in the corresponding period. The black line shows the realized monthly growth rates of real earnings for the S&P 500 expressed in annualized percentage points. Since 2010, earnings growth has been declining, hovering around zero for the last few months of the sample. It currently stands at 2.5 percent, which is near its long-run average.

[Insert Figure 6 here]

Another way to examine whether a high ERP is due to discount rates or cash flows is shown in Figure 7. The black line is the same one-year-ahead ERP estimate shown in Figure 2. The green line simply adds the realized one-year Treasury yield to obtain expected stock returns. The figure shows expected stock returns have increased since 2000, similarly to the ERP. However, unlike the ERP, expected stock returns are close to their long-run mean, and nowhere near their highest levels, achieved in 1980. The discrepancies between the two lines are due to exceptionally low bond yields since the end of the financial crisis.

[Insert Figure 7 here]

Figure 8 displays the term structure of the ERP under a simple counterfactual scenario, in addition to the mean and current term structures already displayed in Figure 4. In this scenario, we leave expected stock returns unmodified but change the risk-free rates in June 2012 from their actual values to the average nominal bond yields over 1960-2013. In other words, we replace R^f_{t+k} in equation (2) by the mean of R^f_{t+k} over t. The result of this counterfactual is shown in Figure 8 in green. Using average levels of bond yields brings the whole term structure of the ERP much closer to its mean level (the grey line), especially at intermediate horizons. This shows that a "normalization" of bond yields, everything else being equal, would bring the ERP close to its historical norm. This exercise shows that the current environment of low bond yields is capable, quantitatively speaking, of significantly contributing to an ERP as high as was observed in 2012-2013.

[Insert Figure 8 here]

7. Conclusion

We have analyzed twenty different models of the ERP by considering the assumptions and data required to implement them, and how they relate to each other. When it comes to the ERP, we find that there is substantial heterogeneity in estimation methodology and final estimates. We then extract the first principal component of the twenty models, which signals that the ERP in 2012 and 2013 is at heightened levels compared to previous periods. Our analysis provides evidence that the current level of the ERP is consistent with a bond-driven ERP: expected excess stock returns are elevated not because stocks are expected to have high returns, but because bond yields are exceptionally low. The models we consider suggest that expected stock returns, on their own, are close to average levels.

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Appendix A: Data Variables

Fama and French (1992)	http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html Monthly frequency; 1/1/1960 to 6/30/2013. We use 25 portfolios sorted on size and book to market, 10 portfolios sorted on momentum, realized excess market returns, HML, SMB, and the momentum factor.
Shiller (2005)	http://www.econ.yale.edu/~shiller/data.htm Monthly frequency; 1/1/1960 to 6/30/2013. We use the nominal and real price, nominal and real dividends and nominal and real earnings for the S&P 500, CPI, and 10 year nominal treasury yield.
Baker and Wurgler (2007)	http://people.stern.nyu.edu/jwurgler/data/Investor_Sentiment_Data_v23_POST.xlsx Monthly frequency; 7/1/1965 to 12/1/2010. We use the "sentiment measure".
Graham and Harvey (2012)	http://www.cfosurvey.org/index.htm Quarterly frequency; 6/6/2000 to 6/5/2013. We use the answer to the question "Over the next 10 years, I expect the average annual S&P 500 return will be: Expected return:" and the analogous one that asks about the next year.
Damodaran (2012)	http://www.stern.nyu.edu/~adamodar/pc/datasets/histimpl.xls Annual frequency; 1/1/1960 to 12/1/2012. We use the ERP estimates from his dividend discount models (one uses free-cash flow, the other one doesn't).
Gurkaynak, Sack and Wright (2007)	http://www.federalreserve.gov/pubs/feds/2006/200628/200628abs.html Daily frequency; starting on 6/14/61 for one- to seven-year yields; 8/16/71 for nine- and ten-year yields; 11/15/71 for eleven- to fifteen-year yields; 7/2/81 for sixteen- to twenty-year yields; 11/25/85 for twenty-one- to thirty-year yields. We use all series until 6/30/2013.
Gurkaynak, Refet, Sack and Wright (2010)	http://www.federalreserve.gov/econresdata/researchdata.htm Monthly frequency; 1/1/2003 to 7/1/2013. We use yields on TIPS of all maturities available.
Compustat	Variable BKVLPS Annual frequency; 12/31/1977 to 12/31/2012.
Thomson Reuters I/B/E/S	Variables EPS 1 2 3 4 5 Monthly frequency; 1/14/1982 to 4/18/2013 for current and next year forecasts; 9/20/84 to 4/18/2013 for two-year-ahead forecasts; 9/19/85 to 3/15/2012 for three-year-ahead forecasts; 2/18/88 to 3/15/07 for four-year-ahead forecasts.
FRED (St. Louis Federal Reserve)	http://research.stlouisfed.org/fred2/graph/?g=D9J and http://research.stlouisfed.org/fred2/graph/?g=KKk Monthly frequency. 1/1/1960 to 7/1/2013 for Baa minus Aaa bond yield spread and recession indicator.

Tables and Figures

Table I: Data sources	
Fama and French (1992)	Fama-French factors, momentum factor, twenty-five portfolios sorted on size and book-to-market
Shiller (2005)	Inflation and ten-year nominal treasury yield. Nominal price, real price, earnings, dividends and cyclically adjusted price-earnings ratio for the S&P 500
Baker and Wurgler (2007)	Debt issuance, equity issuance, sentiment measure
Graham and Harvey (2012)	ERP estimates from the Duke CFO survey
Damodaran (2012)	ERP estimates
Gurkaynak, Sack and Wright (2007)	Zero coupon nominal bond yields for all maturities[19]
Gurkaynak, Refet, Sack and Wright (2010)	Zero coupon TIPS yields for all maturities
Compustat	Book value per share for the S&P 500
Thomson Reuters I/B/E/S	Mean analyst forecast of expected earnings per share
FRED (St. Louis Federal Reserve)	Corporate bond Baa-Aaa spread and the NBER recession indicator

Note: All variables start in January 1960 (or later, if unavailable for early periods) and end in June 2013 (or until no longer available). CFO surveys are quarterly; book value per share and ERP estimates by Damodaran (2012) are annual; all other variables are monthly. Appendix A provides more details.

[19] Except for the 10-year yield, which is from Shiller (2005). We use the 10-year yield from Shiller (2005) for ease of comparability with the existing literature. Results are virtually unchanged if we use all yields, including the 10-year yield, from Gurkaynak, Sack and Wright (2007).

Table II: Models based on the historical mean of realized returns	
Long-run mean	Average of realized S&P 500 returns minus the risk-free rate using all available historical data
Mean of the previous five years	Average of realized S&P 500 returns minus the risk-free rate using only data for the previous five years

Table III: Dividend Discount Models	
Gordon (1962) with nominal yields	S&P 500 dividend-to-price ratio minus the ten-year nominal Treasury yield
Shiller (2005)	Cyclically adjusted price-earnings ratio (CAPE) minus the ten-year nominal Treasury yield
Gordon (1962) with real yields	S&P 500 dividend-to-price ratio minus the ten year real Treasury yield (computed as the ten-year nominal Treasury rate minus the ten year breakeven inflation implied by TIPS)
Gordon (1962) with earnings forecasts	S&P 500 expected earnings-to-price ratio minus the ten-year nominal Treasury yield
Gordon (1962) with real yields and earnings forecasts	S&P 500 expected earnings-to-price ratio minus the ten-year real Treasury yield (computed as the ten-year nominal Treasury rate minus the ten-year breakeven inflation implied by TIPS)
Panigirtzoglou and Loeys (2005)	Two-stage DMM. The growth rate of earnings over the first five years is estimated by using the fitted values in a regression of average realized earnings growth over the last five years on its lag and lagged earnings-price ratio. The growth rate of earnings from years six and onwards is 2.2 percent
Damodaran (2012)	A six-stage DDM. Dividend growth the first five stages are estimated from analyst's earnings forecasts. Dividend growth in the sixth stage is the ten-year nominal Treasury yield
Damodaran (2012) free cash flow	Same as Damodaran (2012), but uses free-cash-flow-to-equity as a proxy for dividends plus stock buybacks

Table IV: Models with cross-sectional regressions	
Fama and French (1992)	Uses the excess returns on the market portfolio, a size portfolio and a book-to-market portfolio as risk factors
Carhart (1997)	Identical to Fama and French (1992) but adds the momentum measure of Carhart (1997) as an additional risk factor
Duarte (2013)	Identical to Carhart (1997) but adds an inflation risk factor
Adrian, Crump and Moench (2014)	Uses the excess returns on the market portfolio as the single risk factor. The state variables are the dividend yield, the default spread, and the risk free rate

Table V: Models with time-series regressions	
Fama and French (1988)	Only predictor is the dividend-price ratio of the S&P 500
Goyal and Welch (2008)	Uses, at each point in time, the best out-of-sample predictor out of twelve predictive variables proposed by Goyal and Welch (2008)
Campbell and Thompson (2008)	Same as Goyal and Welch (2008), but imposes two restrictions on the estimation. First, the coefficient *b* in equation (9) is replaced by zero if it has the "wrong" theoretical sign. Second, we replace the estimate of the ERP by zero if the estimation otherwise finds a negative ERP
Fama and French (2002)	Uses, at each point in time, the best out-of-sample predictor out of three variables: the price-dividend ratio adjusted by the growth rate of earnings, dividends or stock prices
Baker and Wurgler (2007)	The predictor is Baker and Wurgler's (2007) sentiment measure. The measure is constructed by finding the most predictive linear combination of five variables: the closed-end fund discount, NYSE share turnover, the number and average first-day returns on IPOs, the equity share in new issues, and the dividend premium

Table VI: Surveys	
Graham and Harvey (2012)	Chief financial officers (CFOs) are asked since 1996 about the one and ten-year-ahead ERP. We take the mean of all responses

Table VII: ERP models		Mean	Std. dev.	PC coefficients $\widehat{w}^{(m)}$	Exposure to PC $\widehat{load}_1^{(m)}$
Based on historical mean	Long-run mean	9.3	1.3	0.78	-0.065
	Mean of previous five years	5.7	5.8	0.42	-0.160
DDM	Gordon (1926): E/P minus nominal 10yr yield	-0.1	2.1	-0.01	0.001
	Shiller (2005): 1/CAPE minus nominal 10yr yield	-0.4	1.8	-0.10	0.011
	Gordon (1962): E/P minus real 10yr yield	3.5	2.1	0.69	-0.077
	Gordon (1962): Expected E/P minus real 10yr yield	5.3	1.7	-0.78	0.208
	Gordon (1962): Expected E/P minus nominal 10yr yield	0.4	2.3	-0.79	0.077
	Panigirtzoglou and Loeys (2005): Two-stage DDM	-1.0	2.3	0.07	-0.011
	Damodaran (2012): Six-stage DDM	3.4	1.3	-0.26	0.032
	Damodaran (2012): Six-stage free cash flow DDM	4.0	1.1	-0.62	0.053
Cross-sectional regressions	Fama and French (1992)	12.6	0.7	0.80	-0.040
	Carhart (1997): Fama-French and momentum	13.1	0.8	0.81	-0.042
	Duarte (2013): Fama-French, momentum and inflation	13.1	0.8	0.82	-0.044
	Adrian, Crump and Moench (2014)	6.5	6.9	-0.05	0.114
Time-series regressions	Fama and French (1988): D/P	2.4	4.0	-0.27	0.069
	Best predictor in Goyal and Welch (2008)	14.5	5.2	-0.07	0.023
	Best predictor in Campbell and Thompson (2008)	3.1	9.8	-0.12	0.081
	Best predictor in Fama French (2002)	11.9	6.8	-0.72	0.321
	Baker and Wurgler (2007) sentiment measure	3.0	4.7	-0.32	0.184
Surveys	Graham and Harvey (2012) survey of CFOs	3.6	1.8	0.72	0.264
	All models	5.7	3.2	0.78	-0.065

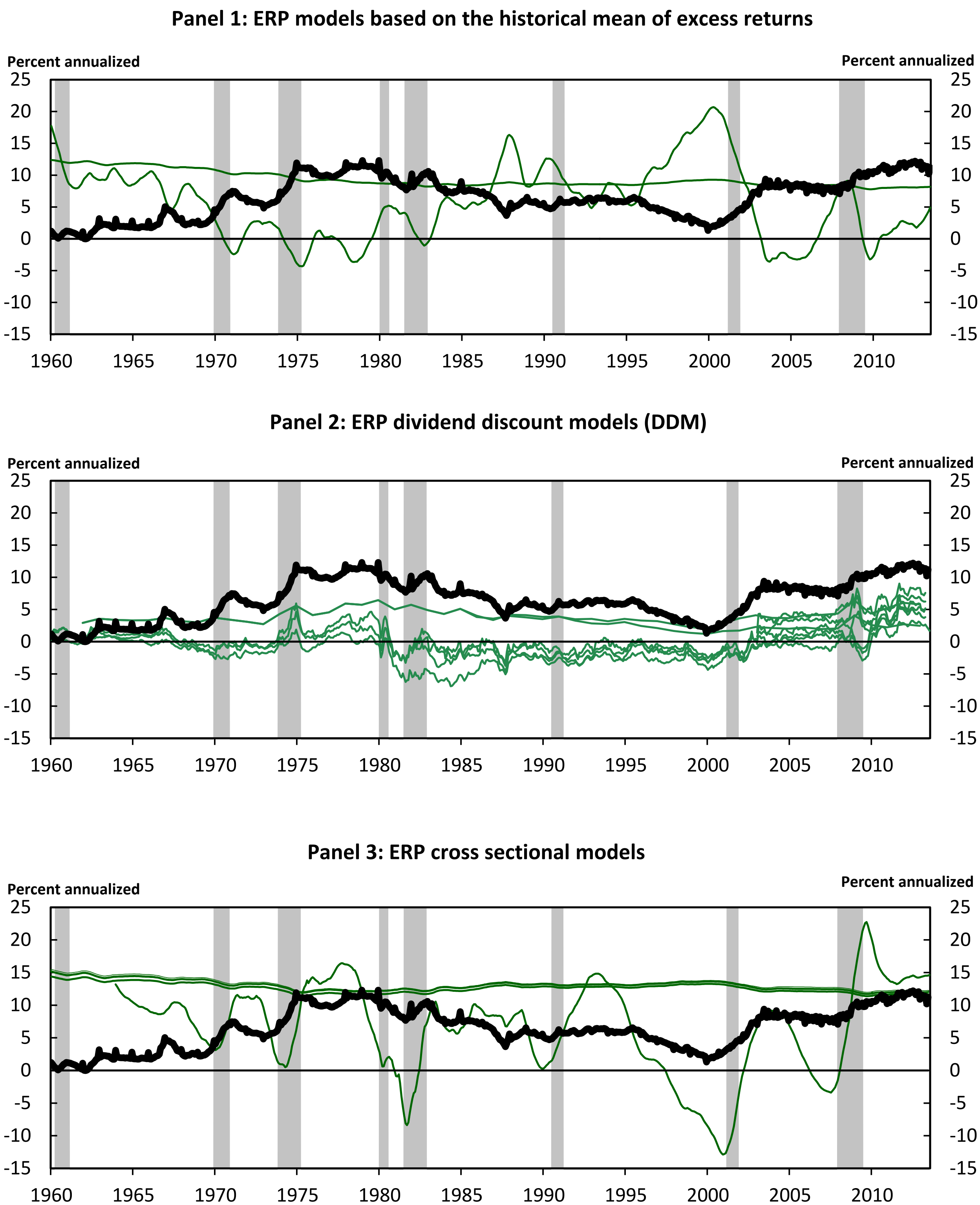
For each of the twenty models of the equity risk premium, we show four statistics. The first two are the time-series means and standard deviations for monthly observations from January 1960 to June 2013 (except for surveys, which are quarterly). The units are annualized percentage points. The third statistic, "PC coefficients $\widehat{w}^{(m)}$", is the weight that the first principal component places on each model (normalized to sum to one). The fourth is the "Exposure to PC $\widehat{load}_1^{(m)}$", the weight on the first principal component when each model is written as a weighted sum of all principal components (also normalized to sum to one).

Table VIII: Correlation of ERP models

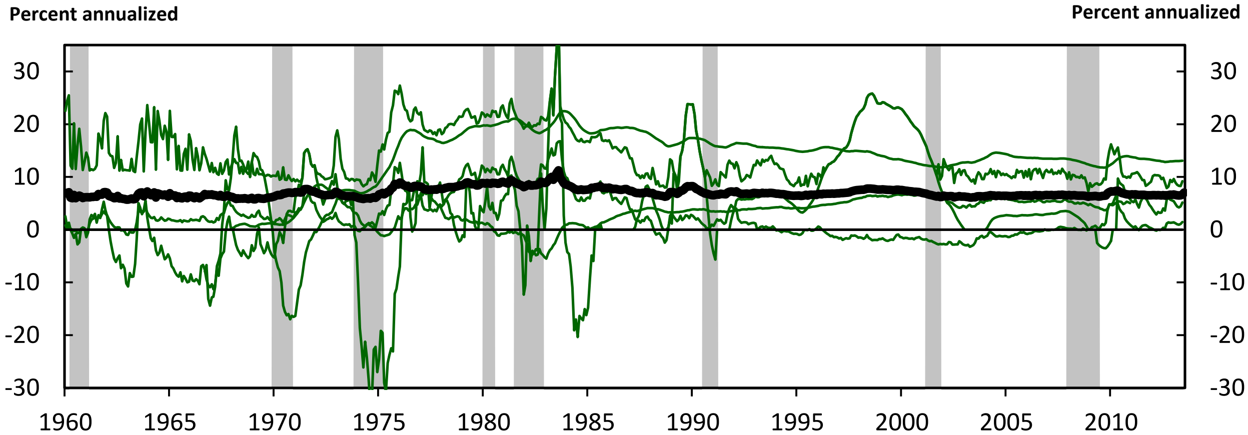
	LR mean	Mean past 5yr	E/P - 10yr	1/CAPE-10yr	E/P-real 10yr	Exp E/P-real 10yr	Exp E/P- 10yr	Two-stage DDM	Six-stage DDM	Free cash flow	FF	Carhart	Duarte	ACM	D/P	G and W	C and T	FF	Sentiment	CFO Survey
LR mean	100																			
Mean past 5yr	32	100																		
E/P - 10yr	8	15	100																	
1/CAPE-10yr	-9	0	78	100																
E/P-real 10yr	-11	25	98	23	100															
Exp E/P-real 10yr	-58	42	70	84	60	100														
Exp E/P- 10yr	-83	-61	84	95	46	98	100													
Two-stage DDM	17	27	88	54	89	66	79	100												
Six-stage DDM	3	-38	26	39	-30	32	52	-31	100											
Free cash flow	-43	-55	59	70	35	80	94	27	62	100										
FF	69	29	-8	-36	-21	-69	-91	9	-29	-77	100									
Carhart	71	30	-5	-31	-24	-71	-91	10	-25	-75	99	100								
Duarte	71	30	-3	-29	-22	-70	-91	11	-28	-74	99	100	100							
ACM	-1	-52	36	62	6	54	63	27	23	33	-28	-28	-25	100						
D/P	49	12	27	12	27	42	54	24	74	42	44	54	55	21	100					
G and W	25	12	25	21	-7	-36	-60	20	29	-9	7	13	14	-24	61	100				
C and T	27	31	14	-7	81	49	-60	28	-51	-40	60	57	58	-33	54	50	100			
FF	1	-30	-24	-29	37	-27	-37	-18	22	38	36	38	37	-9	40	23	43	100		
Sentiment	-10	33	-4	-20	68	-23	-29	27	-38	-20	18	17	18	-12	-38	-8	21	6	100	
CFO survey	-43	-33	12	30	1	1	13	16	5	-3	-36	-37	-39	60	14	-21	-32	-3	-36	100

This table shows the correlation matrix of the twenty equity risk premium models we consider. Numbers are rounded to the nearest integer. Thick lines group models by their type (see Tables II to VI). Except for the CFO survey, the observations used to compute correlations are monthly for January 1960 to June 2013. For the CFO survey, correlations are computed by taking the last observation in the quarter for monthly series and then computing quarterly correlations.

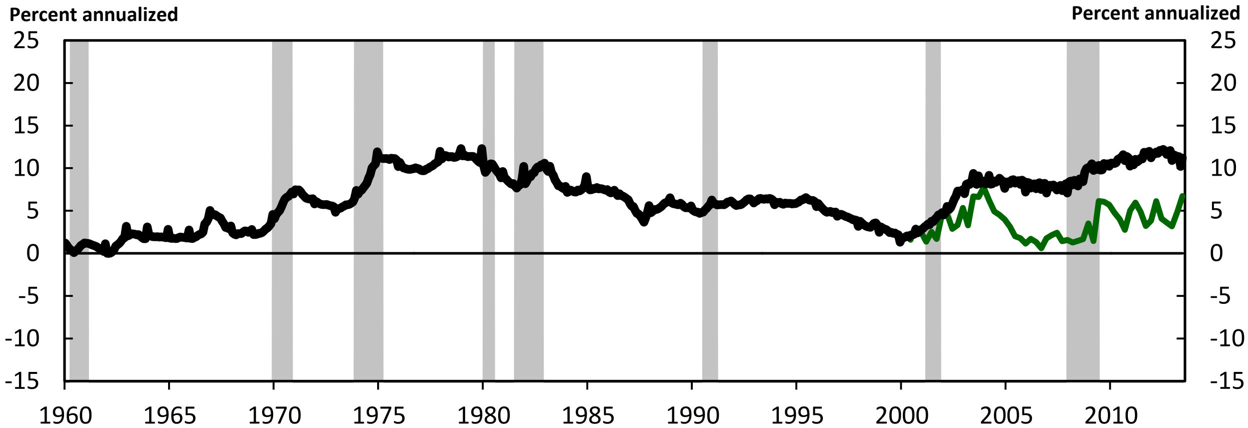
Figure 1: ERP estimates for all models



Panel 4: ERP time series models



Panel 5: ERP surveys

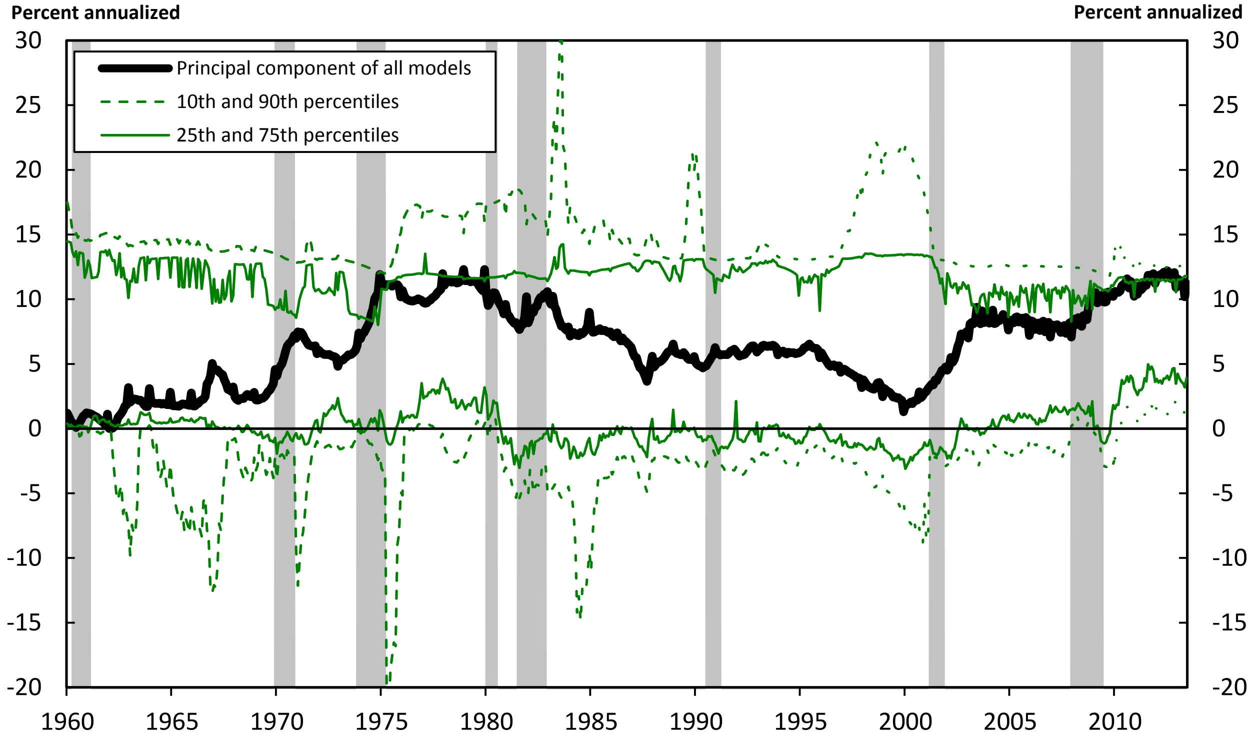


Each green line gives the one-year-ahead equity risk premium from each of the models listed in Tables II to VI. All numbers are in annualized percentage points.

Panel 1 shows the estimates for models based on the historical mean of excess returns, which are listed in Table II. Panel 2 shows estimates computed by the dividend discount models in Table III. Panel 3 uses the cross-sectional regression models from Table IV. Panel 4 shows the equity risk premium computed by the time-series regression models in Table V. Panel 5 gives the estimate obtained from the survey cited in Table VI.

In all panels, the black line is the first principal component of all twenty models (it can look different across panels due to different scales in the y-axis).

Figure 2: One-year-ahead ERP

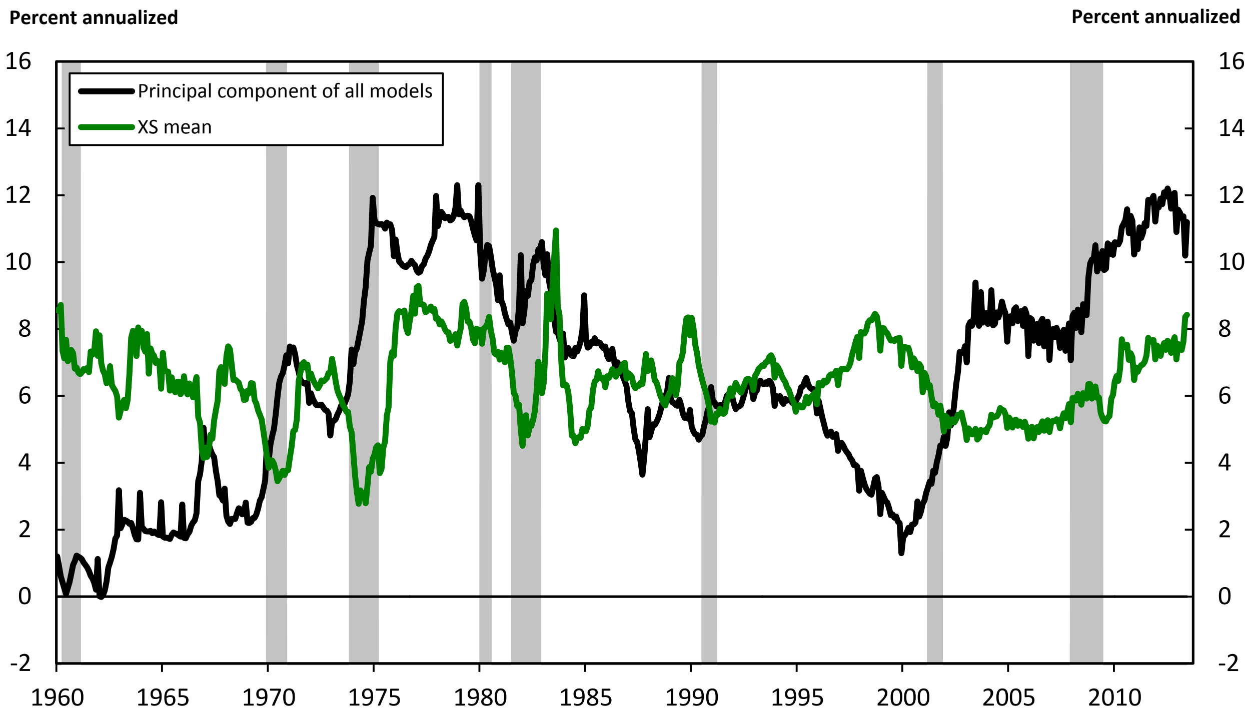


The black line is the first principal component of twenty models of the one-year-ahead equity risk premium (this is the same principal component shown in black in all panels of Figure 1). The models are listed in Tables II to VI.

The 25th and 75th percentiles (solid green lines) give the corresponding quartile of the 20 estimates for each time period, and similarly for the 10th and 90th percentiles (dashed green line).

Shaded bars indicate NBER recessions.

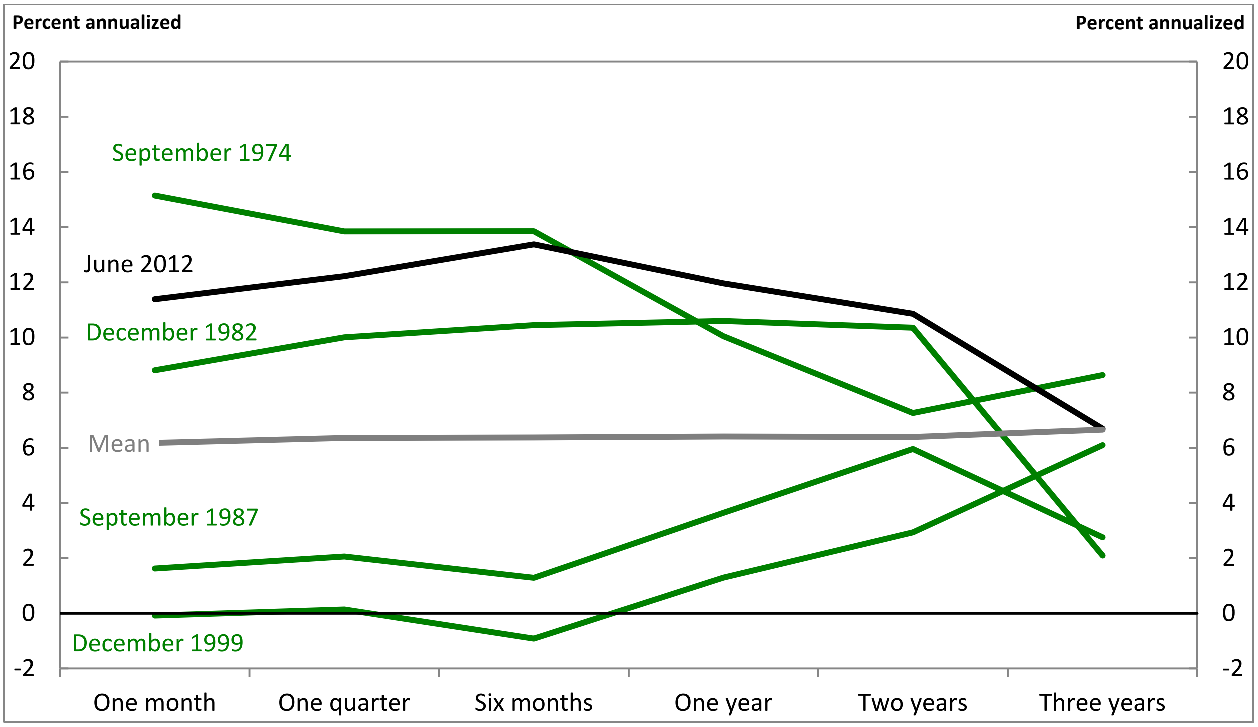
Figure 3: One-year-ahead ERP and cross-sectional mean of models



The black line is the first principal component of twenty models of the one-year-ahead equity risk premium (also shown in Figures 1 and 2). The green line is the cross-sectional average of models for each time period.

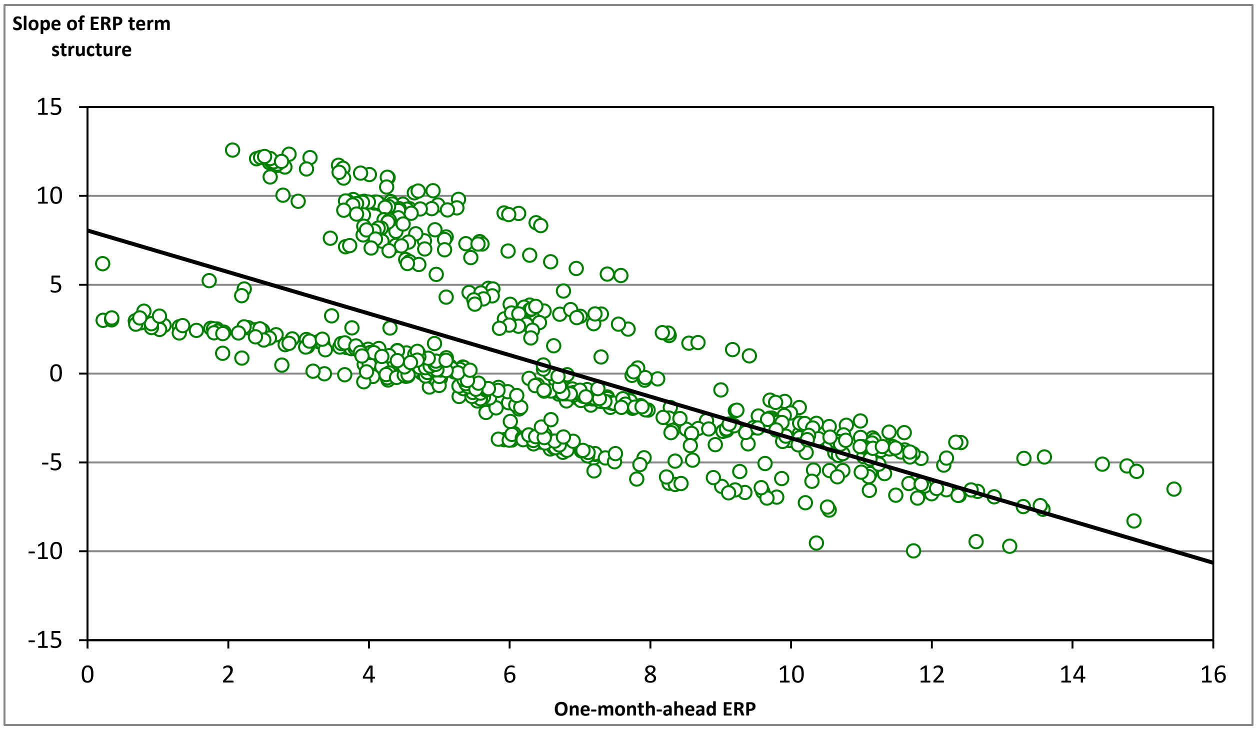
Shaded bars are NBER recessions.

Figure 4: Term structure of the ERP



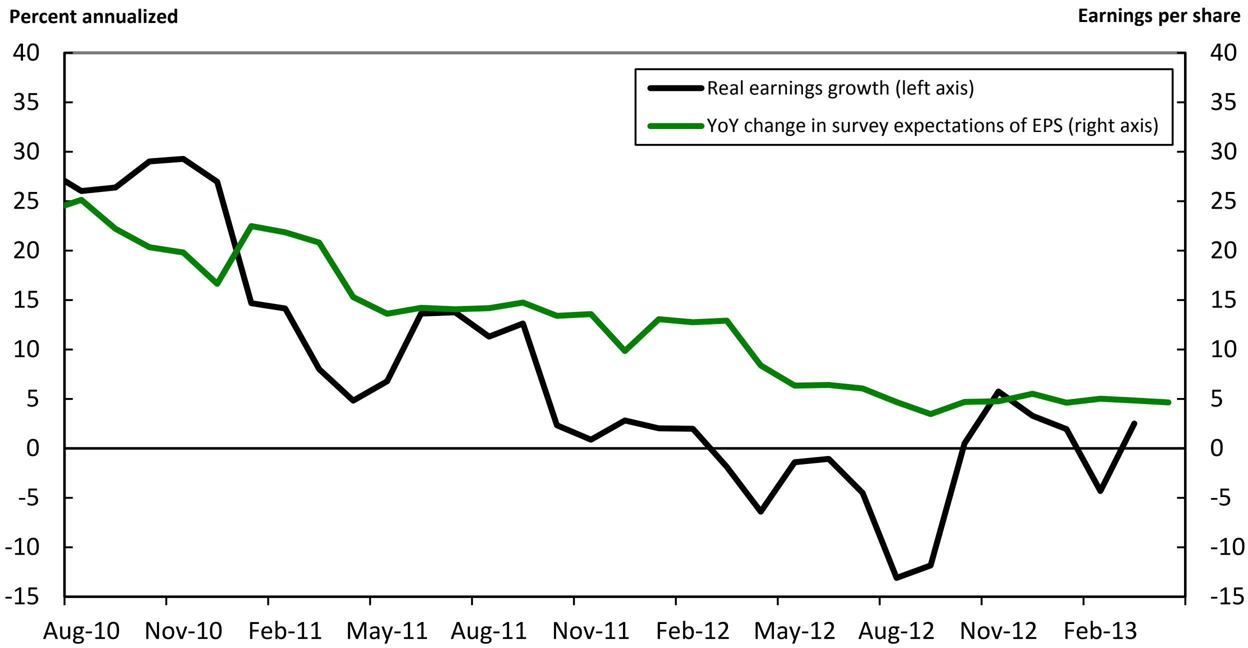
Each line, except for the grey one, shows equity risk premia as a function of investment horizon for some specific months in our sample. We consider horizons of one month, one quarter, six months, one year, two years and three years. The grey line (labeled "Mean") shows the average risk premium at different horizons over the whole sample January 1960 to June 2013. September 1987 and December 1999 were low points in one-month-ahead equity premia. In contrast, September 1974, December 1982 and June 2012 were peaks in the one-month-ahead equity premium.

Figure 5: Regression of the slope of the ERP term structure on one-month-ahead ERP



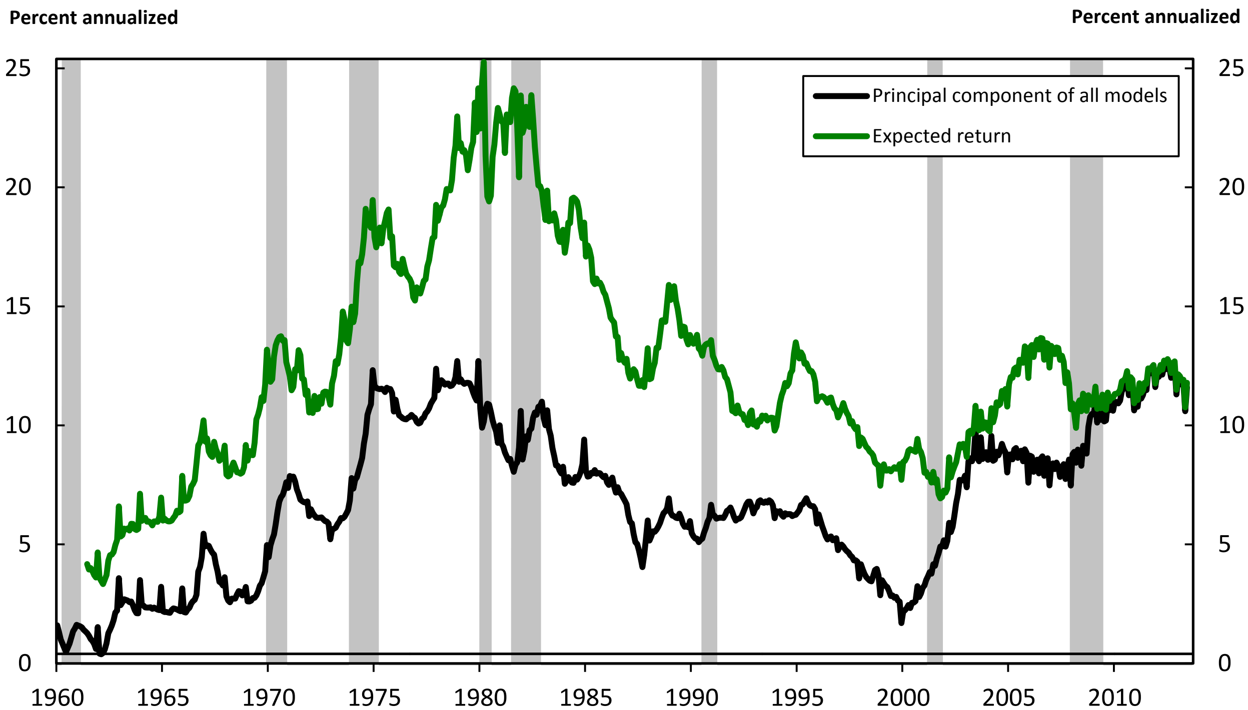
The figure shows monthly observations and the corresponding OLS regression for of the one-month-ahead ERP plotted against the slope of the ERP term structure for the period January 1960 to June 2013. The slope of the ERP term structure is the difference between the three-year-ahead ERP and the one-month-ahead ERP. All units are in annualized percentage points. The one-month-ahead and three-year-ahead ERP estimates used are the first principal components of twenty one-month-ahead or three-year-ahead ERP estimates from models described in Tables II-VI. The OLS regression slope is -1.17 (significant at the 99 percent level) and the R^2 is 50.1 percent.

Figure 6: Earnings behavior



The black line shows the monthly growth rate of real S&P 500 earnings, annualized and in percentage points. The green line shows the year-on-year change in the mean expectation of one-year-ahead earnings per share for the S&P 500 from a survey of analysts provided by Thomson Reuters I/B/E/S.

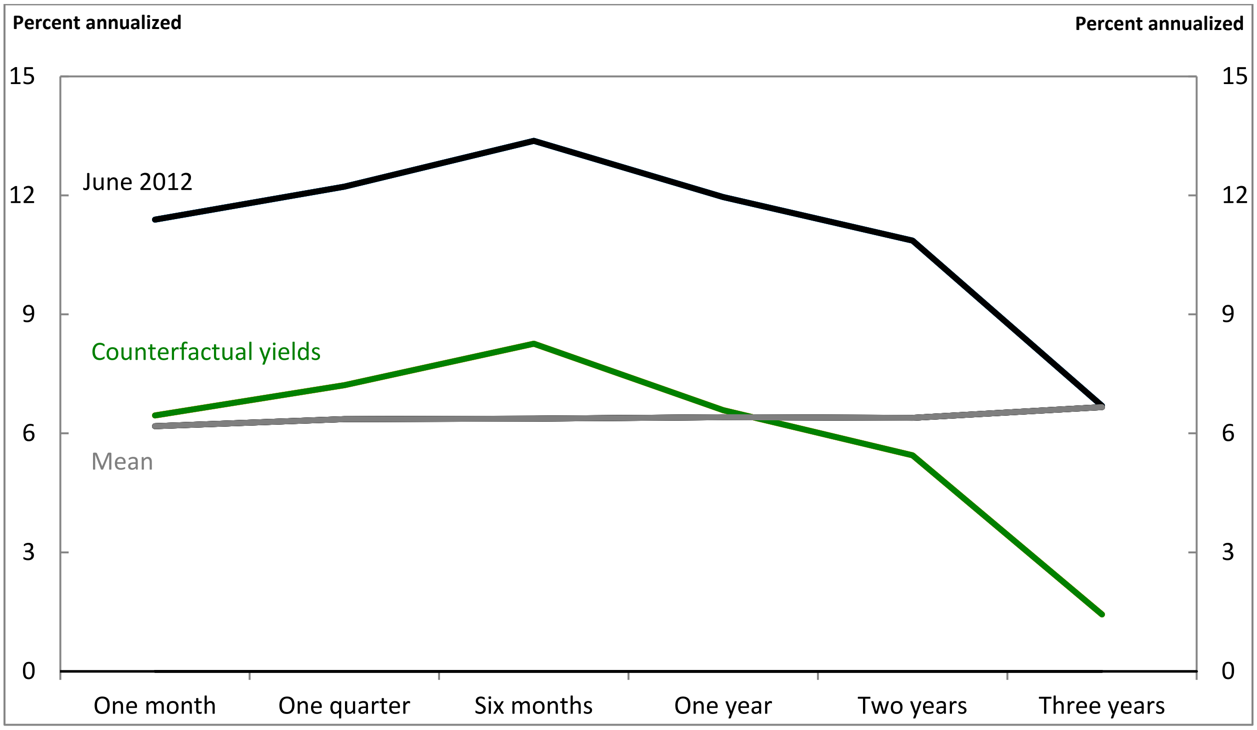
Figure 7: One-year-ahead ERP and expected returns



The black line is the first principal component of twenty models of the one-year-ahead equity risk premium (also shown in Figures 1, 2 and 3). The green line is the one-year-ahead expected return on the S&P 500, obtained by adding the realized one-year maturity Treasury yield from the principal component (the black line).

Shaded bars are NBER recessions.

Figure 8: Term structure of ERP using counterfactual bond yields



The grey line, labeled "Mean", shows the mean term structure of the equity risk premium over the sample January 1960 to June 2013. The black line, labeled "June 2012", shows the term structure for the most recent peak in the one-month-ahead ERP. These two lines are the same as in Figure 4. The green line, labeled "Counterfactual yields", shows what the term structure of equity risk premia would be in June 2012 if instead of subtracting June 2012's yield curve from expected returns we subtracted the average yield curve for January 1960 to June 2013.

Client Alert: January 12, 2017

Duff & Phelps' U.S. Normalized Risk-Free Rate Decreased from 4.0% to 3.5% Effective November 15, 2016

Executive Summary

The Equity Risk Premium (ERP) changes over time. Fluctuations in global economic and financial conditions warrant periodic reassessments of the selected ERP and accompanying risk-free rate.

Based on current market conditions, Duff & Phelps is reaffirming its U.S. Equity Risk Premium recommendation of 5.5% to be used in conjunction with a normalized risk-free rate. However, based on declining real interest rates and long-term growth estimates for the U.S. economy, we are lowering the U.S. normalized risk-free rate from 4.0% to 3.5%, when developing discount rates as of November 15, 2016 and thereafter, until further guidance is issued. In summary:

- Equity Risk Premium: Reaffirmed at 5.5%
- Risk-Free Rate: Decreased from 4.0% to 3.5% (normalized)
- Base U.S. Cost of Equity Capital: 9.0% (5.5% + 3.5%)

Background

The Equity Risk Premium (ERP) is a key input used to calculate the cost of capital within the context of the Capital Asset Pricing Model (CAPM) and other models for developing discount rates to be used in discounting expected net cash flows. Duff & Phelps regularly reviews fluctuations in global economic and financial market conditions that warrant a periodic reassessment of the ERP.[1]

Based on current market conditions, we are reaffirming the recommended U.S. ERP of 5.5%, which was previously established as of January 31, 2016 and thereafter. We will maintain our recommendation to use a 5.5% U.S. ERP when developing discount rates until there is evidence indicating equity risk in financial markets has materially changed. We are closely monitoring the aftermath of the U.S. presidential election held on November 8, 2016 and its impact on cost of capital assumptions.

The current ERP recommendation was developed in conjunction with a "normalized" 20-year yield on U.S. government bonds as a proxy for the risk-free rate (R_f). Based on recent academic literature and market evidence of a secular decrease in real interest rates (a.k.a. the "rental" rate) and lower long-term real GDP growth estimates for the U.S. economy, we lowered our concluded normalized risk-free rate from 4.0% to 3.5% for valuation dates as of November 15, 2016 and thereafter.

Methods of Estimating a Normalized Risk-Free Rate

Estimating a normalized risk-free rate can be accomplished in a number of ways, including (i) simple averaging, and (ii) various "build-up" methods.[2]

The first method of estimating a normalized risk-free rate entails calculating averages of yields to maturity on long-term government securities over various periods. This method's implied assumption is that government bond yields revert to the mean. For example, as of October 31, 2016, the trailing 10-year average for the yield on 20-year U.S. Treasury bonds was 3.5%. In contrast, the corresponding spot yield on October 31, 2016 was 2.3%.

Taking the average over the last 10 years is a simple way of "normalizing" the risk-free rate. An issue with using historical averages, though, is selecting an appropriate comparison period that can be used as a reasonable proxy for the future.

The second method of estimating a normalized risk-free rate entails using a simple build-up method, where the components of the risk-free rate are estimated and then added together. Conceptually, the risk-free rate can be (loosely) illustrated as the return on the following two components:[3]

Risk-Free Rate = Real Rate + Expected Inflation

In Exhibit 1, we summarize long-term real rate estimates and inflation expectations for the United States at the end of October 2016, based on data assembled from a variety of sources. We also display the spot 20-year U.S. Treasury yield and its long-term (10-year) trailing average as of October 31, 2016.

Exhibit 1: Long-Term Spot and Normalized Risk-Free Rates for the United States October 2016 (approximately)[4, 5]

Estimated Long-term Real Risk-Free Rate	0.0% to 2.0%
Expected Long-term Inflation	1.7% to 2.4%
Range of Normalized Risk-Free Rates	**1.7% to 4.4%**
Midpoint	3.1%
20-Year U.S. Government Securities	
-Spot Rate	2.3%
-Long-Term (10-year) Trailing Average Yield	3.5%
Concluded Normalized Risk-Free Rate	**3.5%**

Academics and economic analysts have documented a declining trend in global ***real*** interest rates

The long-term real rate estimate of 0.0% to 2.0% represents a lower range relative to prior Duff & Phelps analyses. Recently, research in this area has been very active. Academic researchers and economic analysts have proposed a number of explanations for the secular (i.e., not cyclical or temporary) decline in global real interest rates, which they argue precedes the onset of the 2008 global financial crisis. The following are some of the most-often-cited factors:[6]

- Lower global long-run output and productivity growth
- Shifting demographics (aging population leading to slower labor force expansion)
- Global "savings glut"
- Safe asset shortage (increased demand for safe-haven assets, accompanied by a declining supply)

With regards to long-term inflation expectations, the same declining trend has been taking hold in the United States and across several other developed markets over the last few years. Inflation has been persistently below the 2.0% target set by major central banks, such as the Federal Reserve Bank (Fed), the European Central Bank, the Bank of England, and the Bank of Japan. The sharp decline in oil prices from mid-2014 until early 2016 has put additional pressure on an already very low inflation environment.

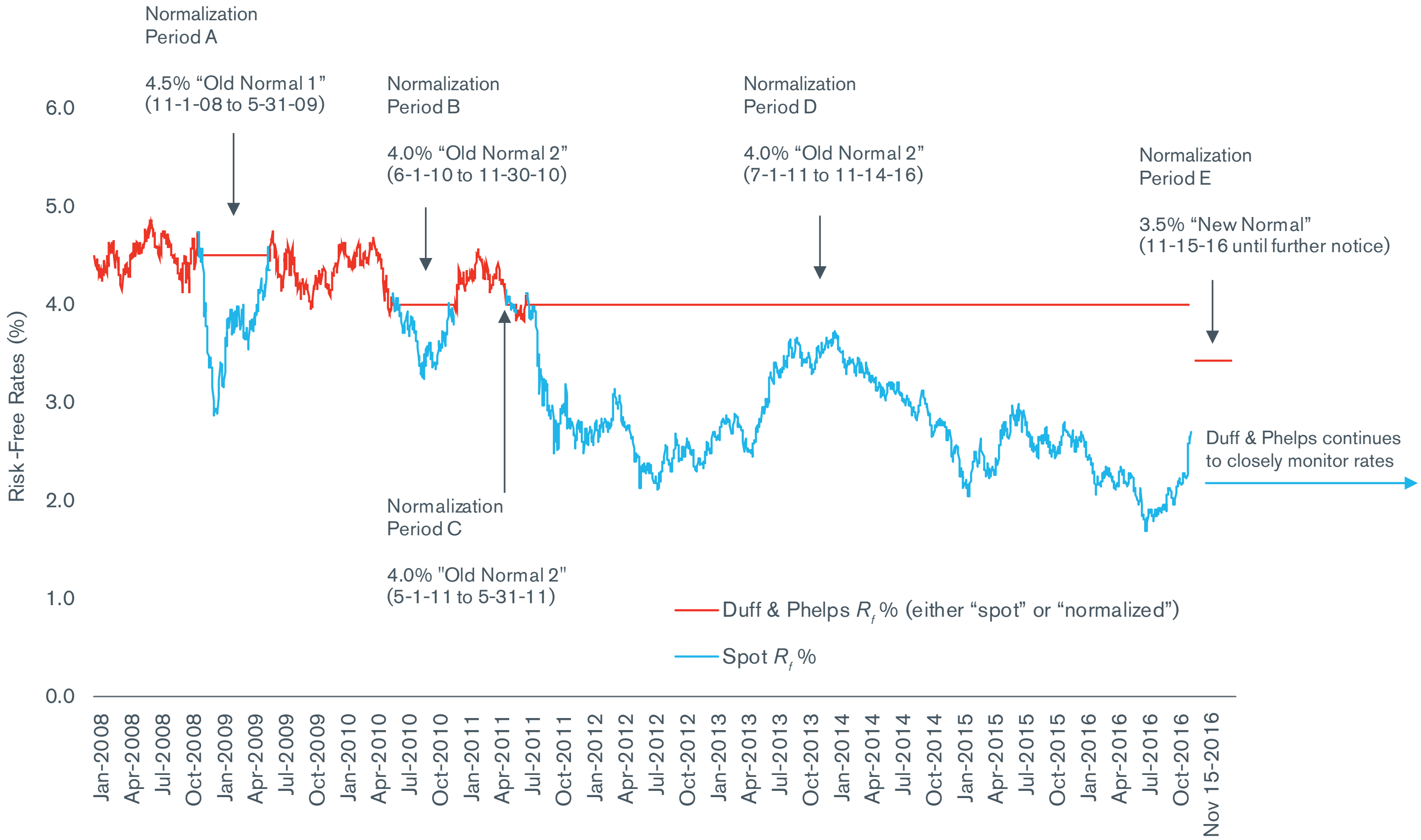
However, the results of the U.S. presidential election seem to have spurred higher inflation expectations for global investors. Long-term government bond yields rose sharply in (for example) the United States, United Kingdom, and Germany in the short period between the election day and the date of writing this alert. This is the opposite of what happened following the June 23, 2016 vote by the U.K. electorate to leave the European Union (known in the financial press as "Brexit"). We will continue to monitor the aftermath of the U.S. presidential election and its potential impact on inflation expectations and consequent effects on the normalized long-term risk-free rate.

Can the Normalized Risk-Free Rate Decline While the Spot Yield is Increasing?

A long-term "normalized" risk-free rate attempts to capture the sustainable average return of long-term bonds issued by a government considered "safe" or free of default risk (e.g., U.S. Treasuries).[7, 8] However, the use of a normalized risk-free rate during certain periods does *not* preclude "spot" rates from fluctuating during these periods.

Exhibit 2 is a graphical illustration of both the daily "spot" long-term U.S. risk-free rate (using 20-year U.S. Treasury yields), and the Duff & Phelps recommended "normalized" long-term U.S. risk-free rate from January 1, 2008 through November 15, 2016. The red line in Exhibit 2 is the Duff & Phelps suggested risk-free rate, which has been the "spot" rate during certain periods (the red, spiky areas in the graph) and has been a "normalized" rate during certain periods (the areas in the graph that are red, straight, horizontal lines). The blue lines in Exhibit 2 represent the "spot" rate (during times that Duff & Phelps suggested using a normalized rate).

Exhibit 2: (i) Duff & Phelps Recommended U.S. Long-term Risk-Free Rate (both "spot" and "normalized"), and (ii) Spot 20-Year U.S. Treasury Yield During Normalization Periods[9]
January 1, 2008–November 15, 2016



During periods that Duff & Phelps suggested using a normalized rate (the areas in the graph that are red, straight, horizontal lines), the spot rate (the blue lines) still fluctuated, at times significantly.[10] Spot rates will almost undoubtedly fluctuate during the current period as well, just as they have fluctuated in all previous periods of normalization. This fluctuation in itself does not alter our recommendation based on economic fundamentals.

Duff & Phelps will continue to monitor risk-free rates and other cost of capital inputs very closely. If and when (i) long-term spot yields increase to a level that approaches the Duff & Phelps recommended U.S. normalized risk-free rate (e.g., differences are lower than 50 b.p.), and (ii) there is evidence that this increase in spot yields is not transitory, we will then consider recommending a return to using the spot rate as the basis for the risk-free rate to be used in conjunction with our recommended U.S. ERP.

Duff & Phelps' U.S. Equity Risk Premium Recommendation and "Base" Cost of Equity

Duff & Phelps last changed its U.S. ERP recommendation on January 31, 2016. On that date, our ERP recommendation was increased to 5.5% (from 5.0%) in response to evidence that suggested a heightened level of risk in financial markets and deteriorating economic conditions.

Duff & Phelps monitors various economic and financial market indicators, as well as two quantitative models as corroboration to arrive at its U.S. ERP recommendation. While the current evidence seems to be pointing to a decline in equity risk in financial markets relative to January 31, 2016, from a qualitative perspective we deem it prudent to let some time elapse, in order to better assess the impact of the U.S. presidential election's results on the forward-looking ERP. We took a similar "wait-and-see" approach when evaluating the impact of Brexit on cost of capital assumptions.

Accordingly, Duff & Phelps is reaffirming the recommended U.S. ERP of 5.5%, to be used in conjunction with a normalized risk-free rate of 3.5%, when developing discount rates as of November 15, 2016 and thereafter. The combination of the new normalized risk-free rate (3.5%) and the reaffirmed U.S. recommended ERP (5.5%) results in an implied U.S. "base" cost of equity capital estimate of 9.0% (3.5% + 5.5%). Were we to use the spot yield-to-maturity on 20-year U.S. Treasuries of 2.6% as of November 15, 2016, one would have to increase the ERP assumption accordingly. One can determine the ERP against the spot 20-year yield as of November 15, 2016, inferred by Duff & Phelps' recommended U.S. ERP (used in conjunction with the normalized risk-free rate), by using the following formula:

U.S. ERP Against Spot 20-Year Yield (Inferred) =

= D&P Recommended U.S. ERP + Normalized Risk-Free Rate – Spot 20-Year U.S. Treasury Yield

= 5.5% + 3.5% – 2.6% = 6.4%

Endnotes

[1] For a discussion of some of the studies and factors we evaluate, refer to Chapter 3 of the Duff & Phelps *2016 Valuation Handbook – Guide to Cost of Capital* or to Duff & Phelps' Client Alert entitled "Duff & Phelps Increases U.S. Equity Risk Premium Recommendation to 5.5%, Effective January 31, 2016". To obtain a free copy of this Client Alert, visit www.duffandphelps.com/costofcapital.

[2] For a more detailed discussion on reasons for normalization and methods that can be used to normalize risk-free rates, refer to Chapter 3 of the Duff & Phelps *2016 Valuation Handbook – Guide to Cost of Capital.*

[3] This is a simplified version of the "Fisher equation", named after Irving Fisher. Fisher's "The Theory of Interest" was first published by Macmillan (New York), in 1930.

[4] Sources of real rates: Haubrich, Joseph, George Pennacchi, and Peter Ritchken, "Inflation Expectations, Real Rates, and Risk Premia: Evidence from Inflation Swaps," Review of Financial Studies Vol. 25 (5) (2012): 1588-1629; Andrew Ang and Geert Bekaert "The Term Structure of Real Rates and Expected Inflation," *The Journal of Finance*, Vol. LXIII (2) (April 2008); Olesya V Grishchenko and Jing-zhi Huang "Inflation Risk Premium: Evidence From the TIPS Market," *The Journal of Fixed Income*, Vol. 22 (4) (2013); Pescatori, Andrea and Jarkko Turunen, "Lower for Longer: Neutral Rates in the United States", IMF Working Paper No. 15/135 (June 2015); Kiley, Michael T., "What Can the Data Tell Us About the Equilibrium Real Interest Rate?", Finance and Economics Discussion Series 2015-077. Washington: Board of Governors of the Federal Reserve System (August 2015); Lubik, Thomas A. and Christian Matthes "Calculating the Natural Rate of Interest: A Comparison of Two Alternative Approaches", Richmond Fed Economic Brief (October 2015); Reza, Abeer and Subrata Sarker, "Is Slower Growth The New Normal In Advanced Economies?", Bank Of Canada Review (Autumn 2015); Hamilton, James, Ethan Harris, Jan Hatzius, and Kenneth West, "The Equilibrium Real Funds Rate: Past, Present and Future", working paper (May 2016); Holston, Kathryn, Thomas Laubach, and John C. Williams, "Measuring the Natural Rate of Interest: International Trends and Determinants", Federal Reserve Bank of San Francisco Working Paper 2016-11 (August 2016); Lansing, Kevin J., "Projecting the Long-Run Natural Rate of Interest", FRBSF Economic Letter 2016-25 (August 2016).

[5] Sources of long-term inflation expectations: The Livingston Survey, dated June 8, 2016; Survey of Professional Forecasters, Third Quarter 2016; (August 12, 2016) Cleveland Federal Reserve's Inflation Expectations, released October 18, 2016; *Blue Chip Financial Forecasts* dated June 1, 2016 and November 1, 2016; *Blue Chip Economic Indicators*, dated October 10, 2016; Philadelphia Federal Reserve, Aruoba Term Structure of Inflation, October 2016; the University of Michigan Inflation Expectations, October 2016.

[6] For a more detailed discussion of some of these and other factors, see, for example, Rachel, Lukasz and Thomas D Smith "Secular drivers of the global real interest rate", Bank of England Staff Working Paper No. 571, December 2015. Also, consider reviewing Chapter 3 of the Duff & Phelps *2016 Valuation Handbook – Guide to Cost of Capital* (Hoboken, NJ: John Wiley & Sons, 2016).

[7] Beginning with the global financial crisis of 2008 (the "Financial Crisis"), analysts have had to reexamine whether the "spot" rate is still a reliable building block upon which to base their cost of equity capital estimates. The Financial Crisis challenged long-accepted practices and highlighted potential problems of simply continuing to use the spot yield-to-maturity on a safe government security as the risk-free rate, together with historical equity risk premiums, without any further adjustments.

[8] The general framework for the normalization argument could be described as follows: (i) that the extremely-low rates we have experienced in recent years would not exist without the market intervention by "non-market" participants (i.e., central banks) pushing rates down "artificially", (ii) that these abnormally-low rates are not sustainable in the long-term, and (iii) that rates tend to revert to a mean that reflects the long-term relationship between nominal and real interest rates.

[9] Source of government bond yields used herein is the Board of Governors of the Federal Reserve System website at: https://www.federalreserve.gov/datadownload/Choose.aspx?rel=H15.

[10] For a complete table with Duff & Phelps recommended ERP and corresponding recommended risk-free rate since January 2008 through the present, visit: www.duffandphelps.com/costofcapital.

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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:

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

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:

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

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

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[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.

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[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_{jt+1}^{IBES}) and for those based on perfect foresight forecast of earnings (eps_{jt+1}^{PF}). 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, $p_{jt+\tau} \big/ (1+\hat{r})^{\tau/365}$, 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

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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 $\gamma_{0,}$ 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 $\gamma_{1,}$ 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

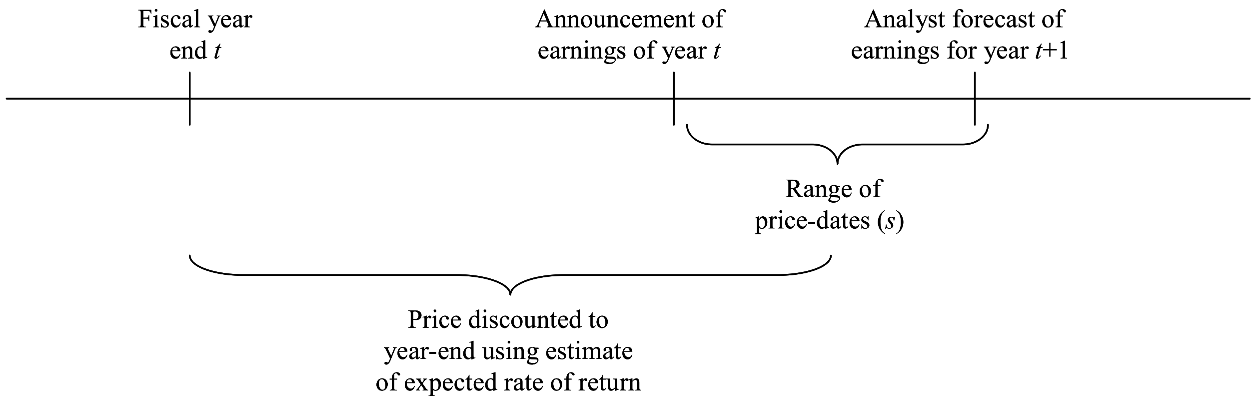

Table 1: Descriptive statistics on forecast errors for the consensus sample

		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

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

		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	0.057	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

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

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)

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

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

Mean of annual means	Decile of market capitalization at time t									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$\|FE_{jt+1}\|$	0.419	0.397	0.398	0.443	0.428	0.455	0.466	0.488	0.579	2.369
$\|FE_{jt+1}\|/p_{jt}$	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
$eps_{jt+1}^{Cons}/bps_{jt}$	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

Mean of annual medians	Decile of market capitalization at time t									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$\|FE_{jt+1}\|$	0.218	0.200	0.211	0.225	0.225	0.221	0.238	0.223	0.242	0.246
$\|FE_{jt+1}\|/p_{jt}$	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
$eps_{jt+1}^{Cons}/bps_{jt}$	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

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

		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

	$90 \leq$ % Buy ≤ 100		$70 \leq$ % Buy ≤ 90		$50 \leq$ % Buy < 70		$30 \leq$ % Buy < 50		$0 \leq$ % 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
$eps_{jt+1}^{Cons} / bps_{jt}$	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.

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Discount Rate (Risk-Free Rate and Market Risk Premium) used for 41 countries in 2017: a survey

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ABSTRACT

This paper contains the statistics of a survey about the Risk-Free Rate (RF) and the Market Risk Premium (MRP) used in 2017 for **41 countries**. We got answers for 68 countries, but we only report the results for 41 countries with more than 25 answers.

The average (RF) used in 2017 was smaller than the one used in 2015 in 12 countries (in 5 of them the difference was more than 1%). In 10 countries the average (RF) used in 2017 was more than a 1% higher than the one used in 2015 (see table 6).

The change between 2015 and 2017 of the average Market risk premium used was higher than 1% for 11 countries (see table 6).

Most of the respondents use for Europe and UK a Risk-Free Rate (RF) higher than the yield of the 10-year Government bonds. Due to Quantitative Easing, the Risk-Free Rate (RF) and the Market Risk Premium (MRP) reported for Euro countries are negatively correlated (Spain -51%; Germany -28%; France -47%; Italy -30%)

JEL Classification: G12, G31, M21

Keywords: equity premium; required equity premium; expected equity premium; risk-free rate; heterogeneous expectations

April 17, 2017

xPpLhMaO

1. Market Risk Premium (MRP), Risk Free Rate (RF) and Km [RF + MRP)] used in 2015 in 41 countries

We sent a short email (see exhibit 1) on March, 2017 to more 20,000 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 Risk Free Rate and the Market Risk Premium (**MRP**) **used** ***"to calculate the required return to equity in different countries"***.

By April 17, 2017, we had received 1,874 emails. 193 persons answered that they do not use MRP for different reasons (see table 1). The remaining emails had specific Risk Free Rates and MRPs used in 2017 for one or more countries.[1] We would like to sincerely thank everyone who took the time to answer us.

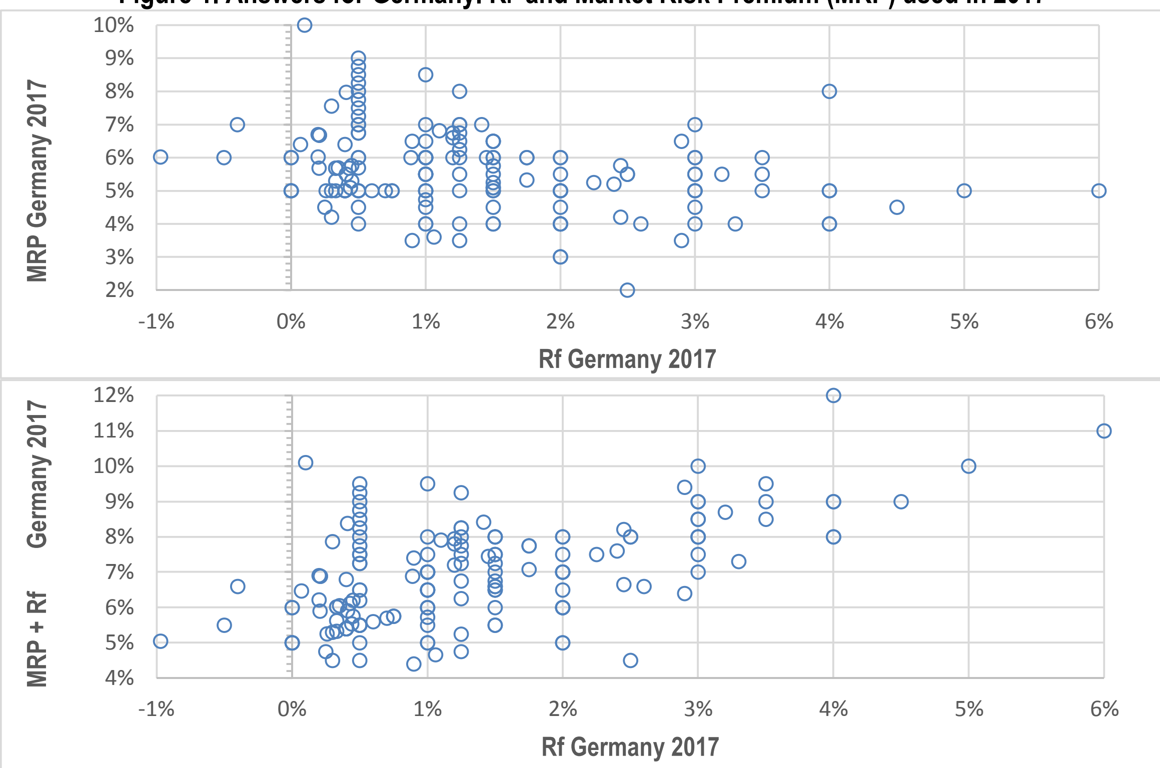
Table 1. MRP and RF used in 2017: 1,874 emails

	Total
Answers reported (MRP figures)	**4,368**
Outliers	**37**
Answers for 27 countries with less than 25 answers	**243**
Only MRP or RF (not both)	**72**
Answers that do not provide figures	**193**

Table 2 contains the statistics of the **MRP** used in 2017 **for 41 countries**. We got answers for 68 countries, but we only report the results for 41 countries with more than 25 answers. **Table 3** contains the statistics of the Risk-Free Rate (**RF**) used in 2017 in the 41 countries and **Table 4** contains the statistics of **Km** (required return to equity: Km = Risk-Free Rate + MRP).

Figure 1 is a graphic representation of the answers (MRP and RF) we got for Germany.

Figure 1. Answers for Germany. RF and Market Risk Premium (MRP) used in 2017



[1] We considered 37 of them as outliers because they provided a very small MRP (for example, -1% and 0% for the USA) or a very high MRP (for example, 27% for the USA).

Table 2. Market Risk Premium (MRP) used for 41 countries[2] in 2017

MRP	Number of answers	average	Median	St. Dev.	max	min
USA	1613	5,7%	5,7%	1,5%	12,0%	1,5%
Spain	472	6,6%	6,8%	1,7%	15,0%	2,7%
Germany	297	5,7%	5,9%	1,3%	10,0%	1,9%
France	134	6,5%	6,7%	1,1%	9,0%	4,0%
United Kingdom	91	5,9%	6,2%	1,2%	8,4%	2,4%
Italy	86	6,4%	6,7%	1,2%	9,0%	3,6%
Canada	106	6,0%	6,4%	1,3%	8,6%	1,6%
Portugal	68	7,6%	8,0%	1,3%	10,4%	4,0%
Switzerland	64	7,1%	7,5%	1,2%	9,9%	4,0%
Belgium	65	6,4%	6,6%	0,9%	8,5%	4,0%
Sweden	81	6,8%	7,1%	1,2%	10,0%	4,0%
Denmark	81	6,1%	6,3%	0,8%	8,1%	4,0%
Finland	78	5,9%	6,1%	0,7%	7,7%	4,0%
Japan	84	6,0%	6,1%	1,3%	8,5%	2,8%
Norway	42	6,1%	6,3%	0,8%	8,1%	4,0%
Brazil	43	9,0%	9,6%	2,3%	15,0%	3,0%
Ireland	68	6,7%	6,8%	0,7%	8,6%	5,0%
China	63	7,5%	7,8%	1,3%	10,3%	3,6%
Mexico	51	9,3%	10,1%	3,1%	21,5%	2,0%
Russia	43	7,7%	8,1%	1,5%	10,8%	4,3%
India	42	8,5%	9,0%	2,3%	13,0%	2,2%
South Africa	29	7,5%	7,8%	1,1%	10,0%	4,0%
Australia	26	7,3%	7,6%	1,2%	10,0%	5,0%
Chile	39	6,2%	6,4%	0,7%	8,1%	4,1%
Uruguay	78	8,0%	8,3%	1,1%	10,7%	5,0%
Poland	32	6,4%	6,6%	0,8%	8,5%	4,0%
Peru	41	7,6%	7,8%	0,9%	10,0%	4,8%
Czech Republic	28	6,2%	6,4%	0,7%	8,1%	4,0%
Indonesia	38	8,9%	9,1%	0,8%	11,4%	7,0%
Israel	41	6,5%	6,6%	0,7%	8,5%	5,0%
Korea (South)	39	6,6%	6,8%	0,7%	8,6%	5,0%
Netherlands	43	6,0%	6,2%	0,8%	8,0%	4,0%
New Zealand	27	5,6%	5,9%	1,5%	8,2%	1,6%
Thailand	29	8,2%	8,5%	1,0%	10,8%	6,0%
Turkey	27	8,0%	8,6%	1,7%	11,3%	3,1%
Austria	32	6,4%	6,6%	0,9%	8,5%	4,0%
Greece	31	16,2%	17,6%	3,8%	23,3%	5,0%
Colombia	29	7,6%	8,1%	1,5%	10,6%	2,7%
Hungary	27	8,4%	8,6%	0,9%	10,8%	6,0%
Venezuela	29	17,4%	18,2%	3,4%	24,3%	8,4%
Argentina	31	16,3%	17,5%	5,5%	35,0%	5,0%

[2] We maintain the order of the countries that we had in the paper of the 2015 survey: *"Discount Rate (Risk-Free Rate and Market Risk Premium) Used for 41 Countries in 2015: A Survey"* https://ssrn.com/abstract=2598104

Table 3. Risk Free Rate (RF) used for 41 countries in 2017

RF	Number of answers	average	Median	St. Dev.	max	min
USA	1613	2,5%	2,5%	1,0%	6,9%	0,0%
Spain	472	2,2%	2,4%	1,0%	5,0%	0,0%
Germany	297	1,4%	1,3%	1,2%	6,0%	-1,0%
France	134	1,8%	2,2%	1,2%	4,0%	0,1%
United Kingdom	91	2,2%	2,5%	1,0%	4,0%	0,4%
Italy	86	2,6%	3,0%	1,1%	5,0%	0,4%
Canada	106	3,0%	3,2%	1,7%	9,4%	0,5%
Portugal	68	3,5%	4,0%	1,0%	5,0%	1,8%
Switzerland	64	1,3%	1,4%	1,0%	4,0%	-0,2%
Belgium	65	1,7%	2,0%	1,1%	4,0%	0,2%
Sweden	81	1,7%	2,0%	1,0%	4,0%	0,2%
Denmark	81	1,6%	1,9%	1,1%	4,0%	0,1%
Finland	78	1,7%	2,3%	1,2%	4,0%	0,0%
Japan	84	0,3%	0,4%	0,3%	1,2%	-0,1%
Norway	42	2,3%	2,6%	0,8%	4,0%	0,4%
Brazil	43	9,0%	9,8%	2,1%	12,3%	4,0%
Ireland	68	1,7%	2,0%	0,7%	3,5%	0,7%
China	63	3,3%	3,6%	0,9%	4,5%	0,1%
Mexico	51	6,7%	7,0%	0,7%	8,3%	5,0%
Russia	43	8,7%	9,2%	1,1%	10,2%	5,3%
India	42	6,5%	6,7%	0,7%	7,5%	5,0%
South Africa	29	7,5%	8,3%	1,3%	9,2%	4,0%
Australia	26	3,0%	3,1%	0,6%	4,8%	2,0%
Chile	39	4,5%	4,4%	1,3%	9,4%	2,5%
Uruguay	78	4,5%	4,7%	0,6%	5,6%	3,4%
Poland	32	3,4%	3,6%	0,5%	4,0%	1,5%
Peru	41	5,5%	5,7%	0,5%	6,0%	4,0%
Czech Republic	28	2,5%	2,9%	1,3%	6,3%	0,7%
Indonesia	38	7,2%	7,4%	0,6%	8,5%	6,0%
Israel	41	1,9%	2,2%	0,7%	2,8%	0,1%
Korea (South)	39	2,4%	2,5%	0,5%	3,5%	1,4%
Netherlands	43	1,7%	2,1%	1,1%	4,0%	0,2%
New Zealand	27	2,9%	3,3%	0,9%	4,0%	1,4%
Thailand	29	3,0%	3,0%	0,6%	4,5%	2,0%
Turkey	27	10,5%	10,8%	0,8%	11,5%	8,0%
Austria	32	1,6%	2,0%	1,1%	4,0%	0,0%
Greece	31	4,8%	6,0%	2,3%	7,6%	0,2%
Colombia	29	6,6%	6,8%	1,0%	8,2%	3,8%
Hungary	27	3,6%	3,9%	0,7%	5,0%	2,5%
Venezuela	29	11,5%	12,1%	1,5%	15,0%	8,0%
Argentina	31	10,5%	12,7%	6,4%	23,0%	1,6%

Table 4. Km [Required return to equity (market): RF + MRP)] used for 41 countries in 2017

Km	Number of answers	**average**	Median	**St. Dev.**	max	min
USA	1613	8,2%	8,4%	1,8%	15,0%	3,5%
Spain	472	8,8%	8,7%	1,6%	15,2%	4,1%
Germany	297	7,2%	7,0%	1,4%	12,0%	4,4%
France	134	8,3%	7,9%	1,1%	10,6%	5,7%
United Kingdom	91	8,1%	7,7%	1,1%	10,3%	5,8%
Italy	86	9,0%	8,5%	1,1%	11,3%	6,5%
Canada	106	9,0%	8,4%	1,4%	11,8%	5,5%
Portugal	68	11,1%	10,6%	1,3%	13,5%	8,0%
Switzerland	64	8,4%	8,3%	1,5%	12,9%	4,9%
Belgium	65	8,1%	7,7%	0,9%	10,0%	6,3%
Sweden	81	8,5%	8,2%	1,2%	12,0%	5,8%
Denmark	81	7,6%	7,3%	0,9%	9,5%	5,9%
Finland	78	7,6%	7,6%	1,0%	9,5%	6,0%
Japan	84	6,3%	6,5%	1,2%	8,7%	3,7%
Norway	42	8,4%	7,9%	0,8%	10,0%	7,0%
Brazil	43	18,0%	17,0%	2,6%	26,8%	9,5%
Ireland	68	8,4%	8,1%	0,7%	9,7%	6,5%
China	63	10,8%	10,6%	1,3%	13,0%	6,4%
Mexico	51	16,0%	16,6%	3,0%	28,0%	8,0%
Russia	43	16,5%	16,0%	1,4%	19,5%	13,6%
India	42	15,0%	15,4%	2,1%	19,2%	8,6%
South Africa	29	15,0%	14,4%	1,5%	17,5%	8,0%
Australia	26	10,3%	10,4%	1,1%	13,0%	8,0%
Chile	39	10,8%	10,6%	1,1%	13,5%	9,0%
Uruguay	78	12,5%	12,5%	1,1%	15,1%	9,0%
Poland	32	9,8%	9,6%	0,8%	11,7%	7,5%
Peru	41	13,0%	13,0%	1,0%	15,9%	9,8%
Czech Republic	28	8,7%	8,6%	1,1%	11,3%	6,7%
Indonesia	38	16,1%	15,8%	1,0%	19,1%	13,0%
Israel	41	8,4%	8,0%	0,9%	10,8%	5,4%
Korea (South)	39	9,0%	8,8%	0,7%	10,6%	7,5%
Netherlands	43	7,7%	7,3%	0,9%	9,6%	5,7%
New Zealand	27	8,5%	8,3%	1,3%	10,8%	5,3%
Thailand	29	11,2%	11,0%	0,9%	13,5%	9,0%
Turkey	27	18,5%	18,6%	1,8%	22,7%	12,0%
Austria	32	8,0%	7,6%	1,0%	9,9%	5,9%
Greece	31	20,9%	20,6%	3,7%	26,9%	8,5%
Colombia	29	14,1%	13,9%	1,5%	16,9%	6,5%
Hungary	27	12,0%	11,6%	0,9%	14,0%	9,5%
Venezuela	29	28,9%	29,1%	3,0%	35,7%	22,4%
Argentina	31	26,7%	22,5%	7,2%	58,0%	13,0%

Table 5. Market Risk Premium (MRP), Risk Free Rate (R_F) and Km
(Required return to equity: Km = R_F + MRP**) used for 41 countries in 2017**

	n	average			st dev			Median		
		Km	R_F	MRP	Km	R_F	MRP	Km	R_F	MRP
USA	1613	8,2%	2,5%	5,7%	1,8%	1,0%	1,5%	8,4%	2,5%	5,7%
Spain	472	8,8%	2,2%	6,6%	1,6%	1,0%	1,7%	8,7%	2,4%	6,8%
Germany	297	7,2%	1,4%	5,7%	1,4%	1,2%	1,3%	7,0%	1,3%	5,9%
France	134	8,3%	1,8%	6,5%	1,1%	1,2%	1,1%	7,9%	2,2%	6,7%
United Kingdom	91	8,1%	2,2%	5,9%	1,1%	1,0%	1,2%	7,7%	2,5%	6,2%
Italy	86	9,0%	2,6%	6,4%	1,1%	1,1%	1,2%	8,5%	3,0%	6,7%
Canada	106	9,0%	3,0%	6,0%	1,4%	1,7%	1,3%	8,4%	3,2%	6,4%
Portugal	68	11,1%	3,5%	7,6%	1,3%	1,0%	1,3%	10,6%	4,0%	8,0%
Switzerland	64	8,4%	1,3%	7,1%	1,5%	1,0%	1,2%	8,3%	1,4%	7,5%
Belgium	65	8,1%	1,7%	6,4%	0,9%	1,1%	0,9%	7,7%	2,0%	6,6%
Sweden	81	8,5%	1,7%	6,8%	1,2%	1,0%	1,2%	8,2%	2,0%	7,1%
Denmark	81	7,6%	1,6%	6,1%	0,9%	1,1%	0,8%	7,3%	1,9%	6,3%
Finland	78	7,6%	1,7%	5,9%	1,0%	1,2%	0,7%	7,6%	2,3%	6,1%
Japan	84	6,3%	0,3%	6,0%	1,2%	0,3%	1,3%	6,5%	0,4%	6,1%
Norway	42	8,4%	2,3%	6,1%	0,8%	0,8%	0,8%	7,9%	2,6%	6,3%
Brazil	43	18,0%	9,0%	9,0%	2,6%	2,1%	2,3%	17,0%	9,8%	9,6%
Ireland	68	8,4%	1,7%	6,7%	0,7%	0,7%	0,7%	8,1%	2,0%	6,8%
China	63	10,8%	3,3%	7,5%	1,3%	0,9%	1,3%	10,6%	3,6%	7,8%
Mexico	51	16,0%	6,7%	9,3%	3,0%	0,7%	3,1%	16,6%	7,0%	10,1%
Russia	43	16,5%	8,7%	7,7%	1,4%	1,1%	1,5%	16,0%	9,2%	8,1%
India	42	15,0%	6,5%	8,5%	2,1%	0,7%	2,3%	15,4%	6,7%	9,0%
South Africa	29	15,0%	7,5%	7,5%	1,5%	1,3%	1,1%	14,4%	8,3%	7,8%
Australia	26	10,3%	3,0%	7,3%	1,1%	0,6%	1,2%	10,4%	3,1%	7,6%
Chile	39	10,8%	4,5%	6,2%	1,1%	1,3%	0,7%	10,6%	4,4%	6,4%
Uruguay	78	12,5%	4,5%	8,0%	1,1%	0,6%	1,1%	12,5%	4,7%	8,3%
Poland	32	9,8%	3,4%	6,4%	0,8%	0,5%	0,8%	9,6%	3,6%	6,6%
Peru	41	13,0%	5,5%	7,6%	1,0%	0,5%	0,9%	13,0%	5,7%	7,8%
Czech Republic	28	8,7%	2,5%	6,2%	1,1%	1,3%	0,7%	8,6%	2,9%	6,4%
Indonesia	38	16,1%	7,2%	8,9%	1,0%	0,6%	0,8%	15,8%	7,4%	9,1%
Israel	41	8,4%	1,9%	6,5%	0,9%	0,7%	0,7%	8,0%	2,2%	6,6%
Korea (South)	39	9,0%	2,4%	6,6%	0,7%	0,5%	0,7%	8,8%	2,5%	6,8%
Netherlands	43	7,7%	1,7%	6,0%	0,9%	1,1%	0,8%	7,3%	2,1%	6,2%
New Zealand	27	8,5%	2,9%	5,6%	1,3%	0,9%	1,5%	8,3%	3,3%	5,9%
Thailand	29	11,2%	3,0%	8,2%	0,9%	0,6%	1,0%	11,0%	3,0%	8,5%
Turkey	27	18,5%	10,5%	8,0%	1,8%	0,8%	1,7%	18,6%	10,8%	8,6%
Austria	32	8,0%	1,6%	6,4%	1,0%	1,1%	0,9%	7,6%	2,0%	6,6%
Greece	31	20,9%	4,8%	16,2%	3,7%	2,3%	3,8%	20,6%	6,0%	17,6%
Colombia	29	14,1%	6,6%	7,6%	1,5%	1,0%	1,5%	13,9%	6,8%	8,1%
Hungary	27	12,0%	3,6%	8,4%	0,9%	0,7%	0,9%	11,6%	3,9%	8,6%
Venezuela	29	28,9%	11,5%	17,4%	3,0%	1,5%	3,4%	29,1%	12,1%	18,2%
Argentina	31	26,7%	10,5%	16,3%	7,2%	6,4%	5,5%	22,5%	12,7%	17,5%

2. Changes from 2015 to 2017

In this section, we compare the results of 2017 with the results of a similar survey collected in 2015 (see https://ssrn.com/abstract=2598104).

Table 6. Market Risk Premium (MRP), Risk Free Rate (RF) and Km
Difference of the averages of the surveys of 2017 and 2015

	Average 2017			Average 2017 - Average 2015		
	Km	RF	MRP	Km	RF	MRP
USA	8,2%	2,5%	5,7%	0,3%	0,1%	0,2%
Spain	8,8%	2,2%	6,6%	0,7%	0,0%	0,7%
Germany	7,2%	1,4%	5,7%	0,6%	0,1%	0,4%
France	8,3%	1,8%	6,5%	1,1%	0,3%	0,9%
United Kingdom	8,1%	2,2%	5,9%	0,9%	0,1%	0,7%
Italy	9,0%	2,6%	6,4%	2,0%	1,1%	1,0%
Canada	9,0%	3,0%	6,0%	0,7%	0,7%	0,1%
Portugal	11,1%	3,5%	7,6%	3,8%	1,9%	1,9%
Switzerland	8,4%	1,3%	7,1%	1,9%	0,2%	1,7%
Belgium	8,1%	1,7%	6,4%	1,4%	0,4%	0,9%
Sweden	8,5%	1,7%	6,8%	2,0%	0,6%	1,4%
Denmark	7,6%	1,6%	6,1%	0,8%	0,3%	0,6%
Finland	7,6%	1,7%	5,9%	0,7%	0,5%	0,2%
Japan	6,3%	0,3%	6,0%	-0,3%	-0,4%	0,2%
Norway	8,4%	2,3%	6,1%	1,6%	0,9%	0,6%
Brazil	18,0%	9,0%	9,0%	1,5%	0,0%	1,5%
Ireland	8,4%	1,7%	6,7%	1,7%	0,4%	1,2%
China	10,8%	3,3%	7,5%	-1,8%	-1,2%	-0,6%
Mexico	16,0%	6,7%	9,3%	3,8%	2,4%	1,3%
Russia	16,5%	8,7%	7,7%	-0,6%	1,3%	-2,0%
India	15,0%	6,5%	8,5%	-0,8%	-0,9%	0,1%
South Africa	15,0%	7,5%	7,5%	-0,9%	-0,7%	-0,2%
Australia	10,3%	3,0%	7,3%	1,1%	-0,1%	1,3%
Chile	10,8%	4,5%	6,2%	0,4%	0,6%	-0,3%
Uruguay	12,5%	4,5%	8,0%	1,9%	0,9%	0,9%
Poland	9,8%	3,4%	6,4%	1,9%	0,7%	1,2%
Peru	13,0%	5,5%	7,6%	1,8%	1,5%	0,4%
Czech Republic	8,7%	2,5%	6,2%	1,3%	0,7%	0,6%
Indonesia	16,1%	7,2%	8,9%	-0,3%	-0,3%	0,0%
Israel	8,4%	1,9%	6,5%	2,3%	1,0%	1,3%
Korea (South)	9,0%	2,4%	6,6%	0,5%	0,1%	0,4%
Netherlands	7,7%	1,7%	6,0%	0,1%	-0,1%	0,1%
New Zealand	8,5%	2,9%	5,6%	-1,0%	0,0%	-1,0%
Thailand	11,2%	3,0%	8,2%	-4,8%	-5,7%	0,9%
Turkey	18,5%	10,5%	8,0%	1,3%	2,7%	-1,3%
Austria	8,0%	1,6%	6,4%	-0,4%	-1,2%	0,7%
Greece	20,9%	4,8%	16,2%	-8,4%	-10,2%	1,9%
Colombia	14,1%	6,6%	7,6%	2,0%	2,8%	-0,7%
Hungary	12,0%	3,6%	8,4%	2,5%	3,0%	-0,4%
Venezuela	28,9%	11,5%	17,4%	5,8%	8,0%	-2,2%
Argentina	26,7%	10,5%	16,3%	-8,8%	-2,1%	-6,6%

Table 7. Market Risk Premium (MRP), Risk Free Rate (RF) and Km
Difference of the averages and of the St. Dev. of the surveys of 2017 and 2015

	Average 2017 -Average 2015			average	St. Dev. 2017 -St. Dev. 2015		
	Km	RF	MRP	Km 2017	Km	RF	MRP
Venezuela	5,8%	8,0%	-2,2%	28,9%	-1,7%	-0,1%	-0,3%
Mexico	3,8%	2,4%	1,3%	16,0%	1,4%	-0,3%	1,6%
Portugal	3,8%	1,9%	1,9%	11,1%	-0,6%	0,1%	-0,2%
Hungary	2,5%	3,0%	-0,4%	12,0%	-0,5%	-0,3%	0,1%
Israel	2,3%	1,0%	1,3%	8,4%	-1,0%	-0,3%	-0,4%
Italy	2,0%	1,1%	1,0%	9,0%	-1,0%	0,0%	-0,3%
Colombia	2,0%	2,8%	-0,7%	14,1%	-0,1%	-0,2%	0,1%
Sweden	2,0%	0,6%	1,4%	8,5%	-0,5%	0,2%	-0,1%
Switzerland	1,9%	0,2%	1,7%	8,4%	-0,1%	0,3%	0,0%
Uruguay	1,9%	0,9%	0,9%	12,5%	-0,1%	0,2%	0,2%
Poland	1,9%	0,7%	1,2%	9,8%	-0,6%	0,0%	-0,2%
Peru	1,8%	1,5%	0,4%	13,0%	-0,6%	-0,4%	-0,3%
Ireland	1,7%	0,4%	1,2%	8,4%	-1,1%	-0,2%	-0,6%
Norway	1,6%	0,9%	0,6%	8,4%	-1,1%	-0,3%	-0,4%
Brazil	1,5%	0,0%	1,5%	18,0%	-1,2%	-0,7%	0,2%
Belgium	1,4%	0,4%	0,9%	8,1%	-0,9%	0,2%	-0,4%
Turkey	1,3%	2,7%	-1,3%	18,5%	-0,5%	0,1%	-0,8%
Czech Republic	1,3%	0,7%	0,6%	8,7%	-0,3%	0,2%	0,0%
Australia	1,1%	-0,1%	1,3%	10,3%	-3,2%	-0,5%	-2,8%
France	1,1%	0,3%	0,9%	8,3%	-0,5%	0,2%	-0,3%
United Kingdom	0,9%	0,1%	0,7%	8,1%	-0,8%	0,2%	-0,5%
Denmark	0,8%	0,3%	0,6%	7,6%	-0,9%	0,1%	-0,4%
Finland	0,7%	0,5%	0,2%	7,6%	-0,6%	0,3%	-0,4%
Canada	0,7%	0,7%	0,1%	9,0%	0,0%	0,7%	0,0%
Spain	0,7%	0,0%	0,7%	8,8%	-0,4%	-0,2%	0,1%
Germany	0,6%	0,1%	0,4%	7,2%	-0,3%	0,4%	-0,2%
Korea (South)	0,5%	0,1%	0,4%	9,0%	-1,3%	-0,1%	-0,8%
Chile	0,4%	0,6%	-0,3%	10,8%	-0,2%	0,2%	-0,2%
USA	0,3%	0,1%	0,2%	8,2%	0,1%	-0,1%	0,1%
Netherlands	0,1%	-0,1%	0,1%	7,7%	0,0%	0,5%	0,2%
Japan	-0,3%	-0,4%	0,2%	6,3%	-1,2%	-0,7%	-0,7%
Indonesia	-0,3%	-0,3%	0,0%	16,1%	-0,4%	0,2%	-0,4%
Austria	-0,4%	-1,2%	0,7%	8,0%	-0,4%	-0,1%	0,6%
Russia	-0,6%	1,3%	-2,0%	16,5%	-2,9%	-1,6%	-1,4%
India	-0,8%	-0,9%	0,1%	15,0%	-0,9%	-0,4%	-0,2%
South Africa	-0,9%	-0,7%	-0,2%	15,0%	-1,4%	0,4%	-1,2%
New Zealand	-1,0%	0,0%	-1,0%	8,5%	0,5%	0,0%	0,2%
China	-1,8%	-1,2%	-0,6%	10,8%	-4,4%	-1,2%	-4,3%
Thailand	-4,8%	-5,7%	0,9%	11,2%	-1,5%	-1,5%	0,1%
Greece	-8,4%	-10,2%	1,9%	20,9%	-5,0%	-3,2%	-2,0%
Argentina	-8,8%	-2,1%	-6,6%	26,7%	-7,5%	1,9%	-6,8%

3. RF used in 2013, 2015 and 2017 for US, Europe and UK vs. yield of the 10-year Government bonds

Figure 5. Yield on 10-year Gov. Bonds. 4 Countries

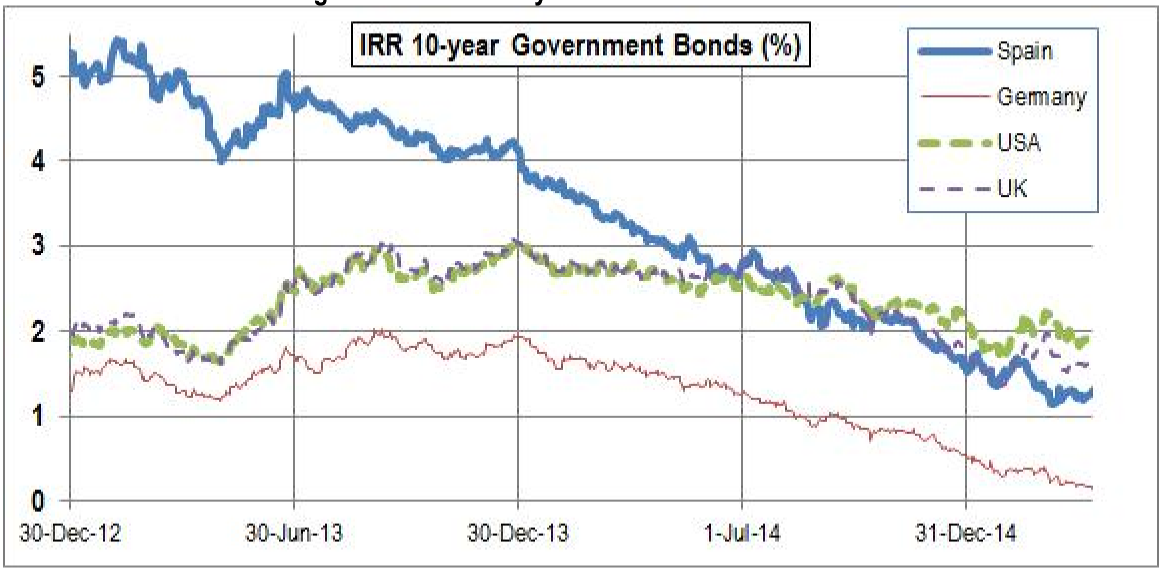


Table 8 shows that most of the respondents use Europe and UK a Risk-Free Rate (RF) higher than the yield of the 10-year Government bonds.

Table 8. Yield on 10-year Gov. Bonds and RF used in 2013, 2015 and 2017
4 Countries: USA, Germany, Spain and UK

		USA	Germany	Spain	UK
Average 10-year Government Bonds	May 2013	**1,9%**	**1,4%**	**4,2%**	**1,9%**
	March-april 2015	**2,0%**	**0,2%**	**1,3%**	**1,7%**
	March 2017	**2,3%**	**0,2%**	**1,6%**	**1,1%**
RF used in May 2013	**average**	**2.4%**	**1.9%**	**4.4%**	**2.4%**
	St. Dev.	1.0%	0.6%	0.9%	1.0%
	max	6.0%	6.5%	6.0%	7.0%
	min	0.1%	0.1%	0.5%	0.2%
RF used in March-April 2015	**average**	**2,4%**	**1,3%**	**2,2%**	**2,1%**
	St. Dev.	1,1%	0,8%	1,2%	0,8%
	max	8,0%	5,1%	7,0%	6,0%
	min	0,0%	-0,2%	0,0%	0,4%
RF used in March-April 2017	**average**	**2,5%**	**1,4%**	**2,2%**	**2,2%**
	St. Dev.	1,0%	1,2%	1,0%	1,0%
	max	6,9%	6,0%	5,0%	4,0%
	min	0,0%	-1,0%	0,0%	0,4%

4. Previous surveys

Previous surveys. Market risk premium used

2008	http://ssrn.com/abstract=1344209
2010	http://ssrn.com/abstract=1606563; http://ssrn.com/abstract=1609563
2011	http://ssrn.com/abstract=1822182; http://ssrn.com/abstract=1805852
2012	http://ssrn.com/abstract=2084213
2013	http://ssrn.com/abstract=914160
2014	http://ssrn.com/abstract=1609563
2015	https://ssrn.com/abstract=2598104
2016	https://ssrn.com/abstract=2776636

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.[3] 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 4 of Fernandez et al (2011a) 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).

Table 9. 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)

[3] At that time, the most recent Ibbotson Associates Yearbook reported an arithmetic HEP versus T-bills of 8.9% (1926–1997).

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 10. 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
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[4] publishes and 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. Expected and Required Equity Premium: different concepts

Fernandez and F. Acín (2015) claim and show that Expected Return and Required Return are two very different concepts. Fernandez (2007, 2009b) claims 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 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

[4] See http://icf.som.yale.edu/Confidence.Index

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,

$P_0 = d_1 / (Ke - g)$, which implies: $IEP = d_1/P_0 + g - R_F$ (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 previous surveys have been interested in the Expected MRP, but this survey asks about the Required MRP.

This paper contains the statistics of a survey about the Risk-Free Rate (R_F) and of the Market Risk Premium (MRP) used in 2015 for **41 countries**. We got answers for 68 countries, but we only report the results for 41 countries with more than 25 answers.

The average (R_F) used in 2017 was smaller than the one used in 2015 in 12 countries (in 5 of them the difference was more than 1%). In 10 countries the average (R_F) used in 2017 was more than a 1% higher than the one used in 2015 (see table 6).

The change between 2015 and 2017 of the average Market risk premium used was higher than 1% for 11 countries (see table 6).

Most of the respondents use for Europe and UK a Risk-Free Rate (R_F) higher than the yield of the 10-year Government bonds.

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, the undervaluation and the high ex-post risk premium are self fulfilling prophecies.

EXHIBIT 1. Mail sent on March 2017

Survey Market Risk Premium and Risk-Free Rate 2017

We are doing a **survey** about the **Market Risk Premium** (MRP or Equity Premium) and **Risk Free Rate** that companies, analysts, regulators and professors use to calculate the **required return on equity (Ke)** in different countries.

I would be grateful if you would kindly answer the following 2 questions. No companies, individuals or universities will be identified, and only aggregate data will be made public. I will send you the results in a month.

Best regards and thanks,
Pablo Fernandez. Professor of Finance. IESE Business School. Spain.

2 questions:
1. The Market Risk Premium that I am using in 2017
for USA is: ________ %
for____________ is: ________ %
for____________ is: ________ %
for____________ is: ________ %

2. The Risk Free rate that I am using in 2017
for USA is: ________ %
for ____________ is: ________ %
for ____________ is: ________ %
for ____________ is: ________ %

EXHIBIT 2. Some comments and webs recommended by respondents

Equity premium: http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html
http://www.market-risk-premia.com/market-risk-premia.html
http://www.marktrisikoprämie.de/marktrisikopraemien.html

US risk free rate: http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2015

risk free rate: http://www.basiszinskurve.de/basiszinssatz-gemaess-idw.html

http://www.econ.yale.edu/~shiller/

http://www.cfosurvey.org/pastresults.htm

http://alephblog.com/

In my DCF valuation I use a global perspective of the marginal investor hence a global MRP.

I match rf with currency/inflation of cash flows being discounted and do not rely too much on current interest rates due to imperfections in the market. The MRP is made consistent with the level of interest rate I use in my model (E(Rm)-Rf) end end up with 6%

For equities we use a 10% as a cost of opportunity independently of the level of interest.

Rf: average last 5-year 10 year Treasury

I would like to help you with these two questions, but the problem is that in no any literature sources or analytical reports I met the calculation of Market Risk Premium and Risk Free rate for Uzbekistan.

The risk free rate that I use depends upon the timing of the future cash flows. I refer to the interest rate swap market and the US treasury market for starters. These days, one has to bear in mind currency volatility as that has a bigger effect on PV than market cost-of-capital.

We use the same Market Risk Premium for any country: 5,75% (source: Damodaran). Only Rf changes.

I am happy that you are asking the second question, because it accounts for what I consider to be a historical anomaly in the reply to the first question. I've concluded that the ERP was recently 3-4 percent. But I think US monetary policy (the various "QE" programs) have in the past couple of years distorted the traditional relationship between expected total market returns and the risk free rate. QE has been driving the US Treasury rate down, while the expected total market return has held steady, leading to a larger than usual market risk premium. This higher market risk premium is not a sign of higher market equity risk, but of the perverse impact of aggressive monetary policy.

For the US in 2015: MRP: 14% (as US equities are even more highly priced than last year).

Interest rates are artificially well below historic levels. Thus, bonds and equities values are artificially inflated.

I do not use "canned" rates applicable for a whole year. The rates I use are time-specific and case-specific, depending on conditions prevailing as of the valuation date.

I must confess I am still surprised with the rates suggested that are at the upper bound of respondent answers.

One hint: It might make sense to ask more precisely about the premium before/after personal income tax. For Germany the premium would differ and I am not sure how people would interpret the question.

The Risk-Free Rate we use is based on rates published by the Federal Reserve. We use the 20 year rate, currently 2.73%. The Equity Risk Premium we use is based on Duff & Phelps Annual Valuation Handbook.

For foreign countries, I generally look at it in dollar terms and assume that purchasing power parity held; hence, I'd use US rates. If I had to do it in a foreign currency, I would use the local 10-year treasury for the risk-free rate. I would use the US equity risk premium, adjust for inflation to real terms, and then adjust for foreign inflation to put it in local nominal terms.

USA. MRP 6.4% - essentially bloomberg/ibbotson number. RF 10 year U.S. treasury yield.

Exijo un mínimo de un 15% de retorno neto de impuestos a cualquier acción, independientemente de su nacionalidad.

No creo que exista un activo libre de riesgo en absoluto. Y menos en estos distorsionados entornos debido a la intervención de los bancos centrales. En mi modesta opinión, creo que nunca sido tan riesgosa la renta fija como lo es ahora.

No creo especialmente en el modelo de CAPM y prefiero usar una cifra basada en el sentido común.

En Uruguay la práctica más aceptada es descontar flujos convertidos a USD dada la debilidad de la moneda local y dolarizacion de la economía.

Exigimos una rentabilidad de fondos propios del 8% (que puede variar según la posibilidad percibida de adjudicación o las ganas de ser competitivos). Pero cuál el tipo libre de riesgo que los financieros consideran, no lo sé.

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Equity Premium: Historical, Expected, Required and Implied

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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

Nominal Returns 1926-2005	Average return Arithmetic	Average return Geometric	Standard deviation	Serial 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

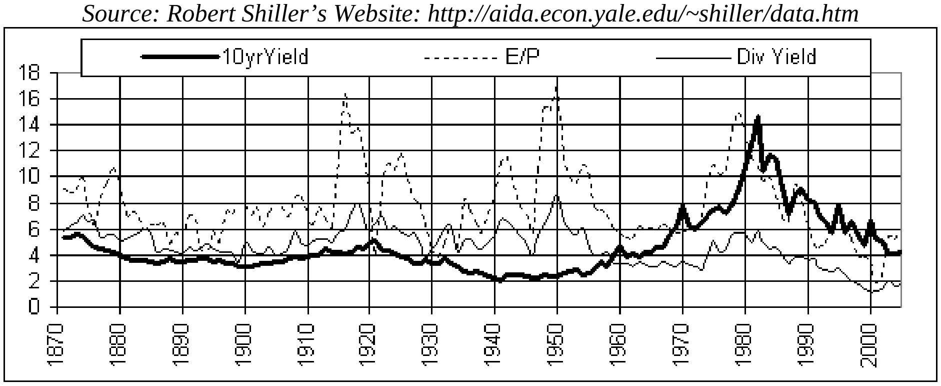


Figure 2. 20-year rolling correlation of (dividend yield – R_F) versus R_F (yield on T-Bonds). Monthly data.
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

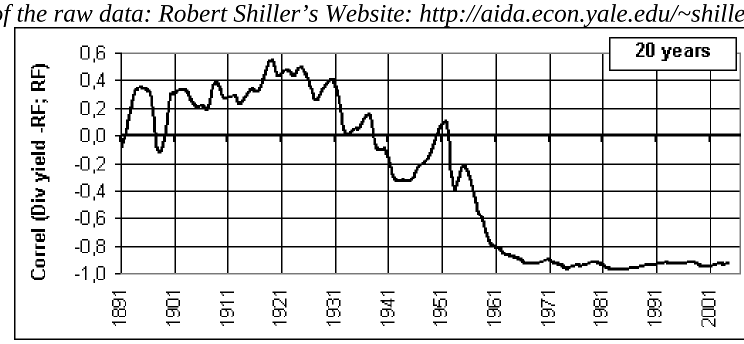


Figure 3. (Dividend yield – R_F) versus R_F (yield on Government long-term bonds)
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

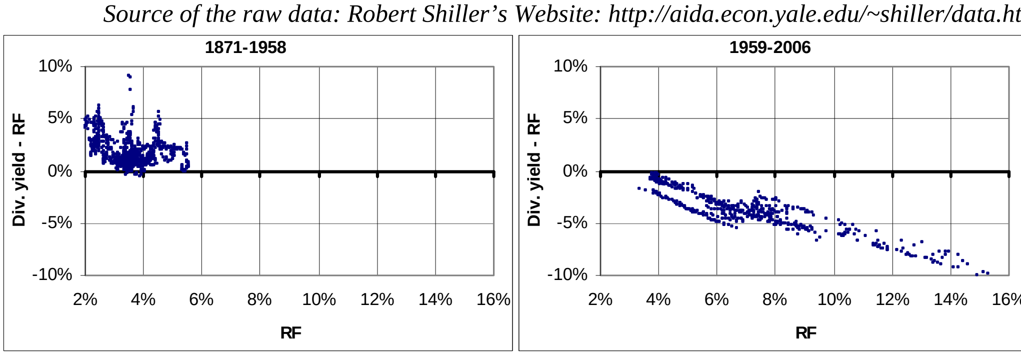


Figure 4. 20-year rolling HEP versus the T-Bills.
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm

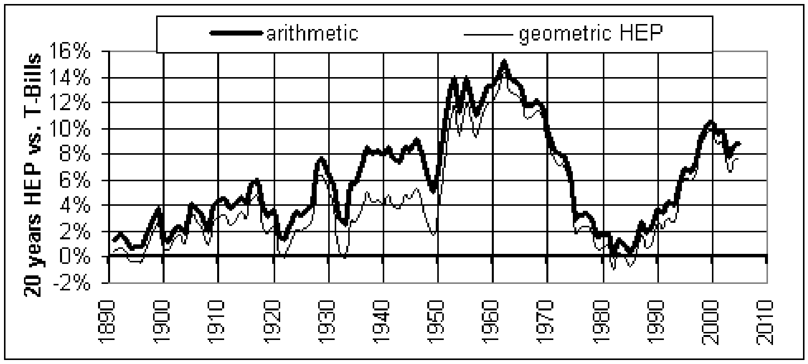
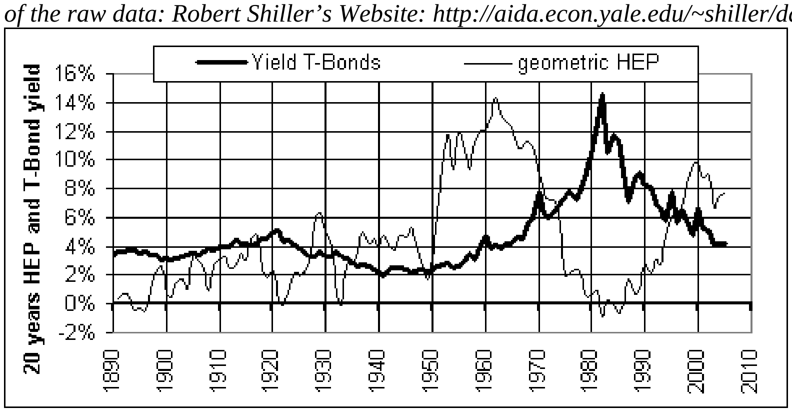


Figure 5. 20-year rolling geometric HEP versus the T-Bills, and T-Bond yield
Source of the raw data: Robert Shiller's Website: http://aida.econ.yale.edu/~shiller/data.htm



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: $\text{Equity Premium}_t = a + b \cdot X_{t-1} + \varepsilon_t$

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[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%.

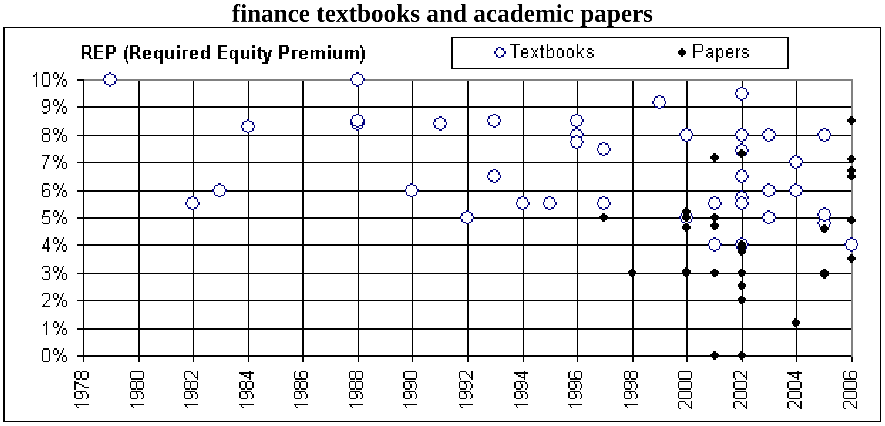
Bodie, Kane and Marcus (1993, 2nd edition) used a REP = EEP = 6.5% to value Hewlett-Packard. In the 3rd edition (1996, page 535), they used a REP = EEP = HEP – 1% = 7.75% to value Motorola. In the 5th edition (2002, page 575), they valued Motorola using a REP = 6.5%. In the 6th edition (2003), they used 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)

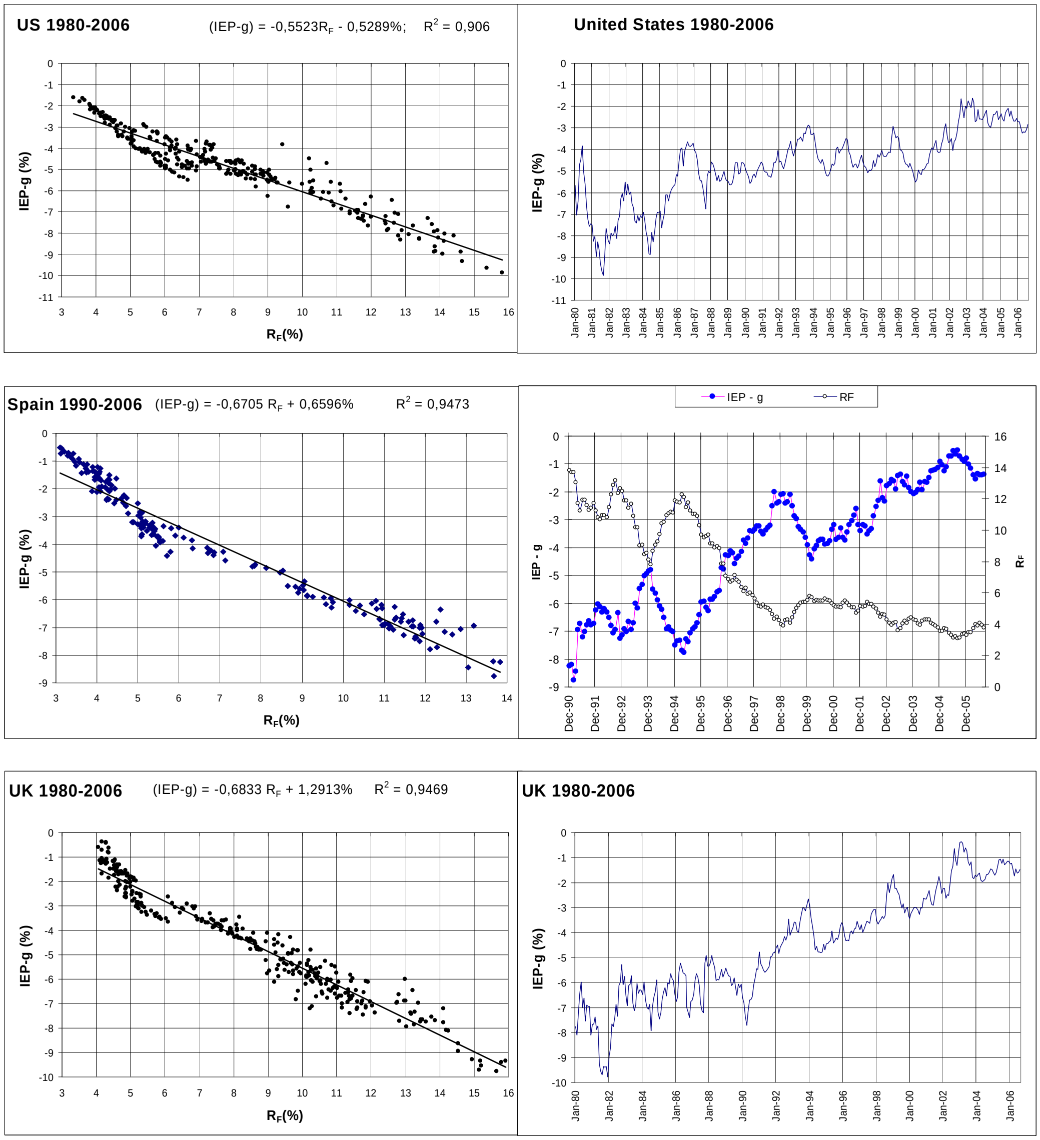


Table 15. Regressions with monthly data of Y (IEP – g) on R_F (10 year Gov. Bond Yield)
Monthly data. $(d_1/P_0 - R_F)$ = IEP – g. *Source of the data: Datastream*

	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.

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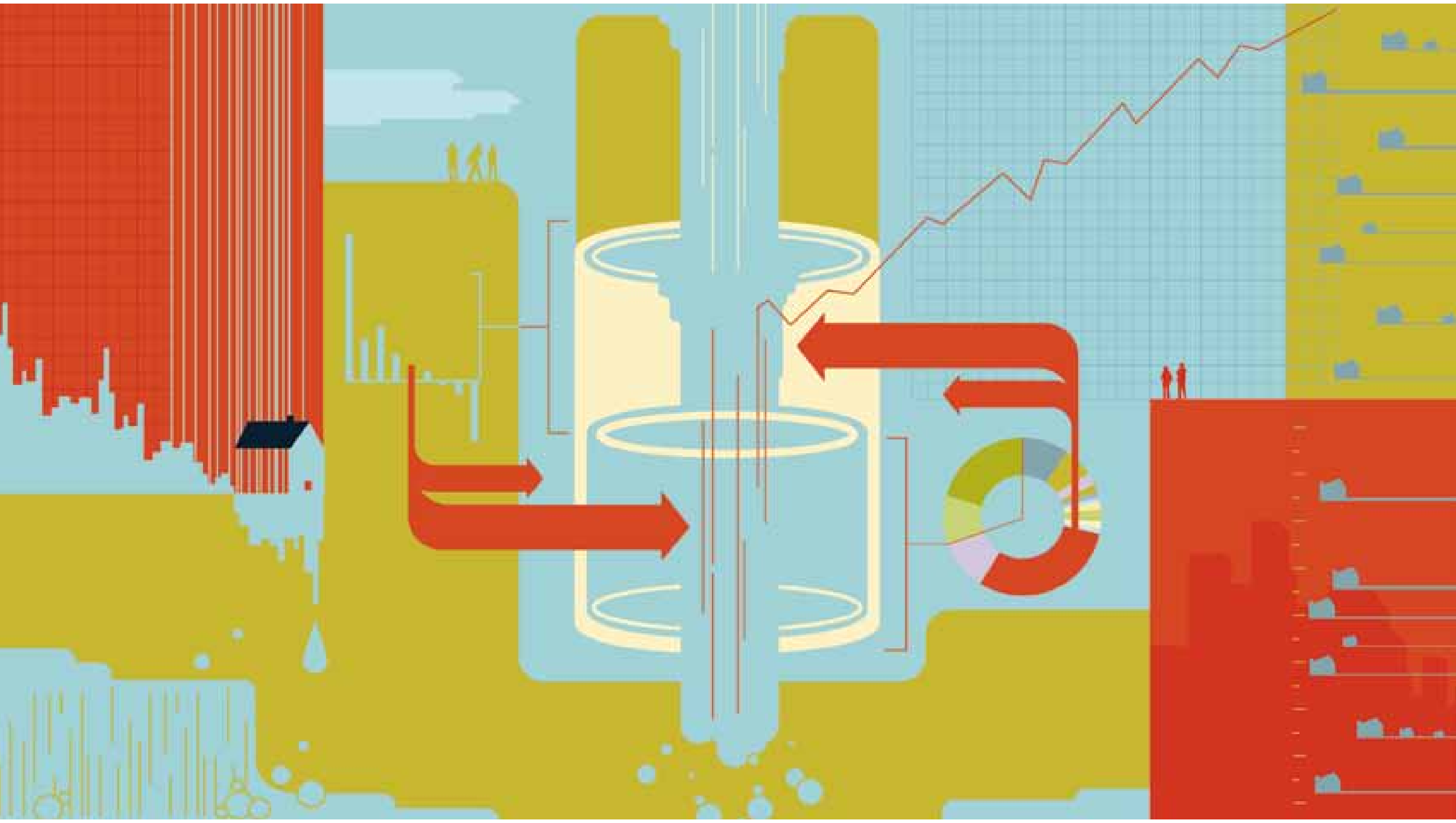
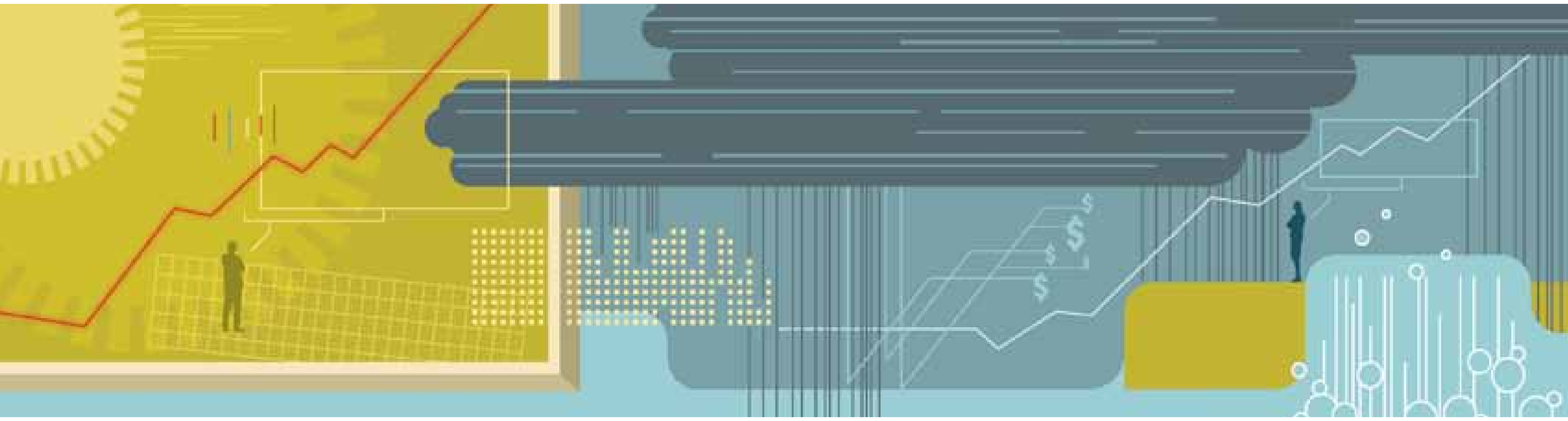




Equity analysts: Still too bullish

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.

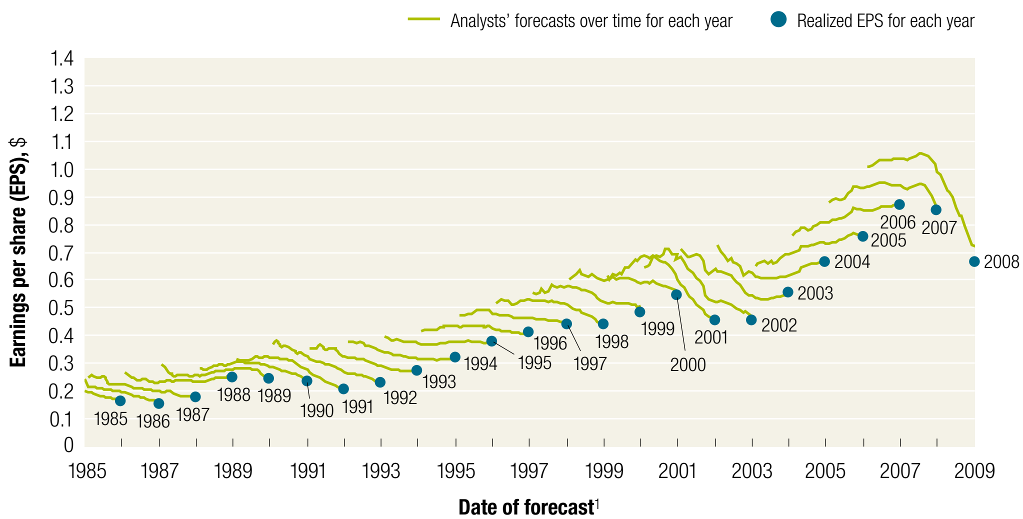
Exceptions to the long pattern of excessively optimistic forecasts are rare, as a progression of consensus earnings estimates for the S&P 500 shows (Exhibit 1). Only in years such as 2003 to 2006, when strong economic growth generated actual earnings that caught up with earlier predictions, do forecasts 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.

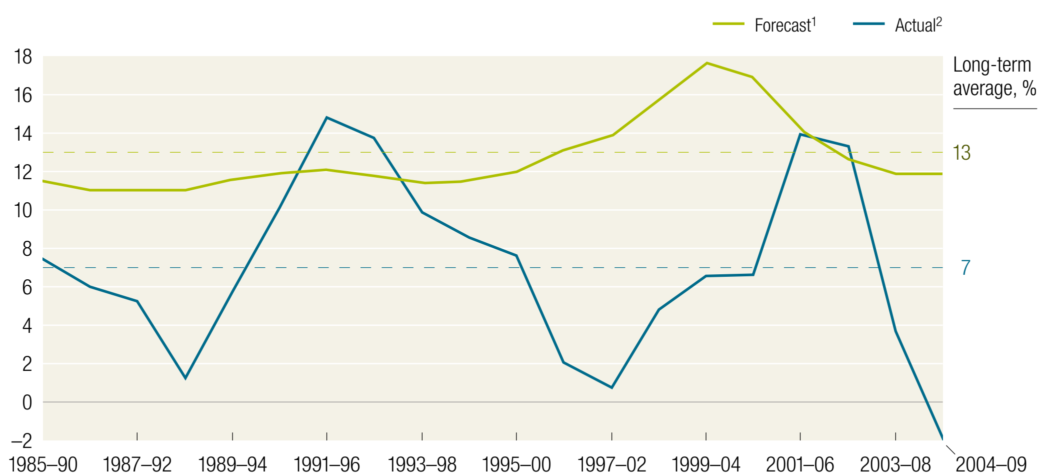
Source: Thomson Reuters I/B/E/S Global Aggregates; McKinsey analysis

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.

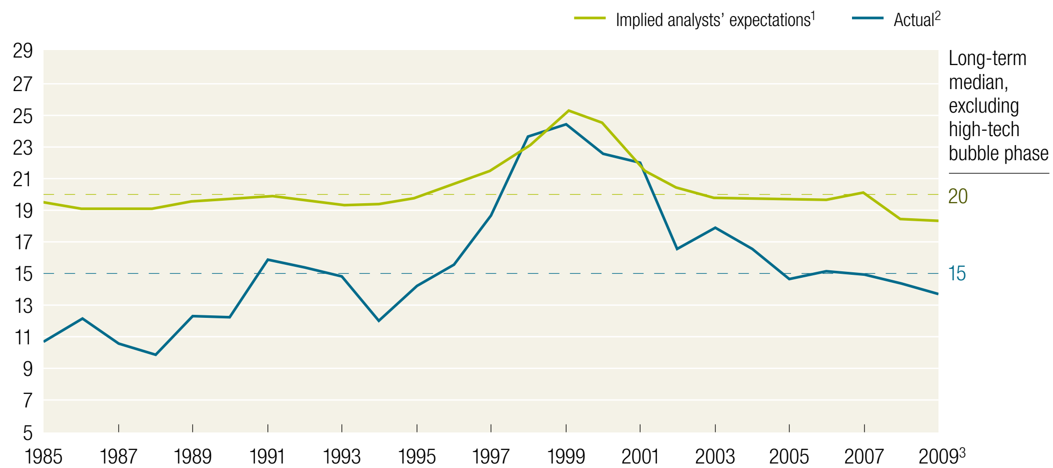
Source: Thomson Reuters I/B/E/S Global Aggregates; McKinsey analysis

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.

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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

OF

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-

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1 For an extensive discussion, see M.J. Gordon, The Cost of Capital to a Public Utility, 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.

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[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:

$$P_0 = \frac{D_1}{k-g} \tag{2}$$

Solving Equation (2) for k results in an expression for the yield that investors require:

$$k = \frac{D_1}{P_0} + g. \tag{3}$$

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:

$$P_0 = \frac{D_1 + P_1}{1 + k}. \tag{4}$$

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. Measurement of Dividend Yield

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) <u>more than 15%</u>, 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) <u>only 15%</u>, 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. <u>Measurement of Expected Growth</u>

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. Alternative Measures of Expected Growth

It might be thought that past rates of growth in

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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 rate 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, current expectations of b and r provide the best basis for forecasting future growth.

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

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[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. <u>Growth Rate - Past Financial Data</u>

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

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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

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[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 [illegible]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 interes[illegible] will lead to an upward revision in the [illegible] of return allowed by the numerous regulatory commis[illegible] that [illegible] rates for AT&T. A generous allowance for [illegible] favorable impact of increases in the allowed rates of return on inves[illegible]ecasts of the AT&T growth rate [illegible] rise in its value from the above 4.63% to 5.25%. This latter growth rate [illegible] with the 10.31% dividend yield re[illegible] equity capital of 1[illegible] 56%. In our judg[illegible] the AT&T cost of equity capital may well be as low as [illegible] unlikely to be above 15.5%, and 15.25% [illegible] our base estimate as of March 28, 1980.

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[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.

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The Accuracy, Bias and Efficiency of Analysts' Long Run Earnings Growth Forecasts

Richard D.F. Harris*

1. INTRODUCTION

Considerable research has now been undertaken into professional analysts' forecasts of companies' earnings in respect of both their accuracy relative to the predictions of time series models of earnings, and their rationality. The evaluation of the reliability of analysts' earnings growth forecasts is an important aspect of research in accounting and finance for a number of reasons. Firstly, many empirical studies employ analysts' consensus forecasts as a proxy for the market's expectation of future earnings in order to identify the unanticipated component of earnings. The use of consensus forecasts in this way is predicated on the assumption that they are unbiased and efficient forecasts of future earnings growth. Secondly, institutional investors make considerable use of analysts' forecasts when evaluating and selecting individual shares. The quality of the forecasts that they employ therefore has important practical consequences for portfolio performance. Finally, from an academic point of view, the performance of analysts' forecasts is interesting because it sheds light on the process by which agents form expectations about key economic and financial variables.

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Nearly all of the research to date, however, has been concerned with analysts' forecasts of quarterly and annual earnings per share.[1] While the properties of analysts' short run forecasts are undoubtedly important in their own right, it is long run expectations of earnings growth that are more relevant for security pricing (see, for instance, Brown et al., 1985). A number of papers have suggested that there is substantial mis-pricing in the stock market as a consequence of irrational long run earnings growth forecasts being incorporated into the market expectation of earnings growth (DeBondt, 1992; La Porta, 1996; Bulkley and Harris, 1997; and Dechow and Sloan, 1997). The evaluation of the performance of analysts' long run forecasts is clearly important as corroborating evidence.

This paper provides a detailed study of the accuracy, bias and efficiency of analysts' long run earnings growth forecasts for US companies. It identifies a number of characteristics of forecast earnings growth. Firstly, the accuracy of analysts' long run earnings growth forecasts is shown to be extremely low. So low, in fact, that they are inferior to the forecasts of a naïve model in which earnings are assumed to follow a martingale. Secondly, analysts' long run earnings growth forecasts are found to be significantly biased, with forecast earnings growth exceeding actual earnings growth by an average of about seven percent per annum. Thirdly, analysts' forecasts are shown to be weakly inefficient in the sense that forecast errors are correlated with the forecasts themselves. In particular, low forecasts are associated with low forecast errors, while high forecasts are associated with high forecast errors. The bias and inefficiency in analysts' long run forecasts are considerably more pronounced than in their short run and interim forecasts.

It is investigated whether analysts incorporate information about future earnings that is contained in current share prices. It is demonstrated that consistent with their short run and interim forecasts, analysts' long run earnings growth forecasts can be enhanced by assuming that each individual firm's earnings will evolve in such a way that its price-earnings ratio will converge to the current market average price-earnings ratio. Analysts therefore neglect valuable information about future earnings that is readily available at the time that their forecasts are made.

The source of analyst inaccuracy is explored by decomposing the mean square error of analysts' forecasts into two systematic components, representing the error that arises as a result of forecast bias and forecast inefficiency, and a random, unpredictable component. In principle, the systematic components of analysts' forecast errors can be eliminated by taking into account the bias and inefficiency in their forecasts. However, it is shown that the bias and inefficiency of analysts' forecasts contribute very little to their inaccuracy. Over eighty-eight percent of the mean square forecast error is random, while less than twelve percent is due to the systematic components. This is an important result for the users of analysts' forecasts since it means that correcting forecasts for their systematic errors can potentially yield only a small improvement in their accuracy.

A second decomposition is used to examine the level of aggregation at which forecast errors are made. The mean square forecast error is decomposed into the error in forecasting average earnings growth in the economy, the error in forecasting the deviation of average growth in each industry from average growth in the economy, and the error in forecasting the deviation of earnings growth for individual firms from average industry growth. It is demonstrated that the error in forecasting average earnings growth in the economy contributes relatively little to analysts' inaccuracy. Over half of total forecast error arises from the error in forecasting deviations of individual firm growth from average industry growth. The error in forecasting deviations of average industry growth from average growth in the economy is smaller, but also significant. However, there is evidence that this pattern is changing over time, with increasing accuracy at the industry level, and diminishing accuracy at the individual firm level.

Finally, it is shown that the performance of analysts' long run earnings growth forecasts varies substantially both with the characteristics of the company whose earnings are being forecast and of the forecast itself. The accuracy, bias and efficiency of analysts' forecasts is examined for sub-samples of firms partitioned by market capitalisation, price-earnings ratio, market-to-book ratio and the level of the forecast itself. The most reliable earnings growth forecasts are low forecasts issued for large companies with low price-earnings ratios and high market-to-book ratios. Again, this is of considerable practical importance since it offers users of analysts' forecasts some opportunity to discriminate between good and bad forecasts.

The organisation of this paper is as follows. The following section gives a detailed description of the data sources and the sample selection criteria. Section 3 describes the methodology used to evaluate forecast accuracy, bias and efficiency. Section 4 reports the results, while Section 5 concludes.

2. DATA

The sample is drawn from all companies listed on the New York, American and NASDAQ stock exchanges. Data on long run earnings growth expectations are taken from the Institutional Brokers Estimate System (IBES). The data item used in this paper is the 'expected EPS long run growth rate' (item 0), which has been reported by IBES since December 1981, and is defined as:

> the anticipated growth rate in earnings per share over the longer term. IBES Inc. requests that contributing firms focus on the five-year interval that begins on the first day of the current fiscal year and make their calculations based on projections of EPS before extraordinary items.

The expected long term growth rate is therefore taken to be the forecast average annual growth in earnings per share before extraordinary items, over the five year period that starts at the beginning of the current fiscal year.[2] The measure used in this paper is the median forecast calculated and reported in April of each year, *t*. The analysis was also conducted using the mean forecast, but the quantitative results are virtually identical, and the qualitative conclusions unchanged.[3]

Only December fiscal year end companies are included in the sample and so the use of the consensus forecast reported in April should ensure that the previous fiscal year's earnings are public information at the time that the individual forecasts that make up the consensus forecast are made (see Alford, Jones and Zmijewski, 1994). Restricting the sample to December fiscal year-end companies ensures that observations for a particular fiscal year span the same calendar period, thus allowing the identification of macroeconomic shocks that contemporaneously affect the earnings of all firms.

Actual growth in earnings is calculated using data on earnings per share, excluding extraordinary items, taken from the Standard and Poor's Compustat database (item EPSFX). Average annual earnings growth is computed as the average change in earnings over each five year period, from December of year $t-1$ to December of year $t+5$, scaled by earnings in December of year $t-1$. The need for five years' subsequent earnings growth data limits the sample period to the eleven years 1982–92. Data on a number of other variables are also used in the analysis. The share price and market capitalisation are both taken at the end of April of year t (Compustat items PRCCM and MKVALM). The market price-earnings ratio, used to test whether information contained in the share price is incorporated in analysts' forecasts, is computed as the price at the end of April in year t (item PRCCM) divided by earnings per share in the fiscal year ending December $t-1$ (item EPSFX). The market-to-book ratio is computed as the market value of the company in April of year t (item MKVALM) divided by the book value of the company in the fiscal year ending December of year $t-1$ (item CEQ).

There are a total of 7,660 firm-year observations that satisfy the data requirements for all the variables used in the analysis, and that have a December fiscal year-end. However, for 658 of these, earnings reported at the end of the preceding fiscal year are zero or negative. These are omitted from the sample since forecast growth has no natural interpretation when earnings in the base year are non-positive.[4] When initial earnings are close to zero, actual growth in earnings may take extreme values, resulting in outliers that have a disproportionately high degree of influence on the least squares regression results. There is no immediately obvious way to circumvent this problem without dropping some observations from the sample. The approach most commonly adopted is to omit observations for which the calculated growth rate, the forecast growth rate or the forecast error is above a certain threshold in absolute value, or for which calculated initial earnings are below a certain level. For instance, Fried and Givoly (1982) truncate observations for which forecast error exceeds 100%. Elton et al. (1984) include in their sample only those companies for which initial earnings are above 0.20 dollars per share. O'Brien (1988), in order to test the robustness of her results to outliers, also uses 0.20 dollars as a threshold value.

Capstaff et al. (1995) omit observations for which forecast earnings growth or forecast error exceeds 100%, while Capstaff et al. (1998) exclude companies for which forecast earnings growth or actual earnings growth exceeds 100%. In this paper, all observations for which actual earnings growth or forecast earnings growth exceeds 100% in absolute value are omitted from the analysis, reducing the sample by a further 336 firm-year observations. The final pooled sample comprises 6,666 firm-year observations.[5]

3. METHODOLOGY

(i) Forecast Accuracy

The metric used to evaluate forecast performance is the forecast error, defined as the difference between actual and forecast earnings growth:

$$fe_{it} = g_{it} - g_{it}^{f} \tag{1}$$

where fe_{it} is the forecast error for firm i corresponding to the forecast made at date t, g_{it} is actual earnings growth over the five year forecast period and g_{it}^{f} is forecast five year earnings growth. Forecast accuracy is evaluated using the mean square forecast error, which is computed in each year t as:

$$\text{MSFE}_t = \frac{1}{N}\sum_{i=1}^{N}(g_{it} - g_{it}^{f})^2. \tag{2}$$

The mean square forecast error for the pooled sample is computed over all firms and years. The mean square forecast error was chosen in preference to the mean absolute forecast error to maintain consistency with the subsequent analysis which uses the former measure rather than the latter. However, it should be noted that the use of the mean square forecast error is consistent with a quadratic loss function of risk averse economic agents (see Theil, 1964; and Mincer and Zarnovitz, 1969). It can be reported that the conclusions drawn about forecast accuracy are not sensitive to the choice of measure.

As a benchmark against which to compare the accuracy of analysts' long run forecasts, the performance of two 'naïve' forecasts is also considered. The first is the forecast generated by a martingale model of earnings, in which expected earnings growth is zero. The second is the forecast generated by a sub-martingale model, in which expected earnings is equal to a drift parameter that is identical for all firms. In each forecast year, the common drift parameter is set equal to the average growth rate in earnings over all firms, over the previous five year period.[6] This choice of naïve forecasts is motivated by the early evidence on the time series properties of earnings, which suggests that annual earnings follow a random walk, or a random walk with drift (see, for instance, Brooks and Buckmaster, 1976; or Foster, 1977). Although more recent evidence finds that annual earnings may have a mean reverting component (see Ramakrishnan and Thomas, 1992), the martingale and sub-martingale models of earnings nevertheless provide simple alternative models that are approximately consistent with the reported evidence.

(ii) Forecast Bias

In order for a forecast to be unbiased, the unconditional expectation of the forecast error must be zero. If the average forecast error is greater than zero then analysts are systematically over-pessimistic (since their forecasts are on average exceeded) while if the average forecast error is less than zero analysts are systematically over-optimistic (since their forecasts are on average unfulfilled). Unbiasedness is tested using the mean forecast error, which is computed in each year t as:

$$\mathrm{MFE}_t = \frac{1}{N}\sum_{i=1}^{N}(g_{it} - g_{it}^{f}). \tag{3}$$

The mean forecast error for the pooled sample is computed over all firms and years. The hypothesis that the mean forecast error is zero is tested using the standard error of the mean forecast error across all firms and years for the pooled sample, and across all firms for each of the annual samples.

(iii) Forecast Efficiency

A forecast is efficient if it optimally reflects currently available information, and is therefore associated with a forecast error that is unpredictable. If a forecast is strongly efficient, the forecast error is uncorrelated with the entire information set at time *t*. Strong efficiency is a stringent condition, and so more usually forecasts are instead tested for weak efficiency, which requires that the forecast error is uncorrelated with the forecast itself (see Nordhaus, 1987). Weak efficiency is tested by estimating the following regression:

$$g_{it} = \alpha + \beta g_{it}^{f} + v_{it}. \qquad (4)$$

Under the null hypothesis that analysts' forecasts are weakly efficient, the intercept, α, should be zero, while the slope coefficient, β, should be unity. If β is significantly different from one then conditioning on the forecast itself, the forecast error is predictable.[7] If β is significantly less than one then analysts' forecasts are too extreme, in the sense that high forecasts are associated with high forecast errors, while low forecasts are associated with low forecast errors. If β is significantly greater than one then forecasts are too compressed.

(iv) The Incremental Information Content of Price-Earnings Based Forecasts

A stronger form of forecast efficiency can be tested by examining whether analysts' forecasts incorporate particular sources of publicly available information. One such source of information is the current share price. In an efficient market, the share price is the present discounted value of all rationally expected future economic earnings of the company, and hence it should reflect, *inter alia*, the market's expectation of long run earnings growth. To extract the information about future earnings embodied in the share price, some assumption must be made about the company's cost of equity, or risk. The simplest assumption is that all companies face the same constant cost of equity in the long run, so that the earnings of each company evolve in such a way that its price-earnings ratio converges to the current market average price-earnings ratio. The earnings growth forecast that is implicit in this assumption can then be used to supplement the analysts' earnings growth forecast in the following regression:

$$g_{it} = \alpha + \beta g_{it}^{f} + \gamma g_{it}^{p} + v_{it}, \qquad (5)$$

where

$$g_{it}^{p} = \frac{p_{it}/pe_{mt} - e_{it}}{e_{it}}, pe_{mt} = \frac{1}{N}\sum_{i=1}^{N}\frac{p_{it}}{e_{it}}$$

and p_{it} is the share price of firm i at time t. If analysts incorporate all information contained in the current share price, the coefficient, γ, should be zero (see Capstaff et al., 1995 and 1998). Naturally, the assumption that all firms have the same long run price-earnings ratio is a strong simplification, and a superior forecast would almost certainly be obtained by assuming that price-earnings ratios differ between industries. Nevertheless, the assumption of a single market-wide long run price-earnings ratio has been shown to forecast earnings growth over shorter horizons (see, for instance, Ou and Penman, 1989).

(v) Forecast Error Decomposition

In order to analyse the source of analysts' forecast errors, two decompositions of the mean square forecast error are used. The first decomposes the mean square forecast error into systematic and unsystematic components. The systematic component is further divided into a component due to forecast bias and a component due to forecast inefficiency. In each year t, the decomposition of the MSFE is given by:

$$\text{MSFE}_t = \frac{1}{N_t}\sum_{i=1}^{N_t}(g_{it} - g_{it}^{f})^2 = (\overline{g}_t - \overline{g}_t^{f})^2 + (1-\beta_t)^2\sigma_{g^f t}^2 + (1-\rho_t^2)\sigma_{gt}^2 \tag{6}$$

where N_t is the sample size in year t, $\overline{g}_t$ and $\overline{g}_t^{f}$ are the average values of g_{it} and g_{it}^{f}, β_t is the slope coefficient from regression (4), above, ρ_t is the correlation coefficient between g_{it} and g_{it}^{f}, and $\sigma_{g^f t}^2$ and σ_{gt}^2 are the variances of g_{it} and g_{it}^{f}. The first term in the decomposition gives the error that is due to the inability of analysts to forecast earnings growth for the whole sample. When computed over all years, it is therefore a measure of the error that is due to forecast bias. The second term captures the error that is due to forecast inefficiency. Together, these two terms capture the systematic error in analysts' forecasts. In contrast, the third term captures the component of the error that is purely random. This decomposition is particularly useful since it reveals to what extent forecasts can be improved through 'optimal linear correction' procedures (see Mincer and Zarnovitz, 1969; and Theil, 1966). For instance, if the main component of mean square error is systematic, rather than random, then assuming that the data generating process for both the actual data and the forecast data remains constant, the accuracy of analysts' forecasts can be substantially improved by using the predicted values from regression (4), above, rather than the forecasts themselves. The extent to which this reduces the inaccuracy of the forecasts depends upon the fraction of the mean square forecast error that is due to the systematic component.

The second decomposition breaks the mean square forecast error into economy, industry and firm components. The decomposition of the MSFE is given each year t by:

$$
\begin{aligned}
\mathrm{MSFE}_t &= \frac{1}{N}\sum_{i=1}^{N_t}(g_{it} - g_{it}^f)^2 \\
&= (\overline{g}_t - \overline{g}_t^f)^2 + \frac{1}{N_t}\sum_{j=1}^{J_t} N_{jt}[(\overline{g}_{jt} - \overline{g}_t) - (\overline{g}_{jt}^f - \overline{g}_t^f)]^2 \qquad (7) \\
&\quad + \frac{1}{N_t}\sum_{i=1}^{Nt}[(g_{it} - \overline{g}_{jt}) - (g_{it}^f - \overline{g}_{jt}^f)]^2,
\end{aligned}
$$

where J_t is the number of industries in the sample, N_{jt} is the number of firms in industry j, $\overline{g}_{jt}$ and $\overline{g}_{jt}^f$ are the average values of g_{it} and g_{it}^f in industry j. The decomposition has the following interpretation. As before, the first term measures the error that is due to analysts' inability to forecast the average growth for the whole sample, which in this context may be interpreted as their inability to forecast earnings growth for the economy. The second term measures the error that is due to an inability to forecast the deviation of average growth in an industry from average growth in the economy. The third term measures the error that is due to an inability to forecast deviation of individual firm growth from average growth in its industry. The decomposition for the pooled sample is computed by taking the weighted average of the decomposition for the annual samples, with weights proportional to the sample size each year. Such a decomposition is useful because it reveals the level of aggregation at which forecast errors are made, and may reflect the particular approach used to generate earnings growth forecasts (see Elton, Gruber and Gultekin, 1984). In the present study, each industry is defined by a two digit SIC code. This yields a total of 56 industries, with an average of about twelve firms in each industry. The use of three digit SIC codes yields a large number of industries that comprise only a single firm. In these cases, the firm-specific error and industry specific error are not separately identifiable, and are reflected in the third component of the decomposition. The effect of using two digit, rather than three digit SIC codes is therefore to increase the firm specific error and reduce the industry specific error.

For both decompositions, it is convenient to express each term as a percentage of the total mean square forecast error. For the pooled samples, the mean square forecast error components are averaged over the individual years, with weights proportional to the sample size each year.

(vi) The Performance of Analysts' Forecasts Conditional on Firm and Forecast Characteristics

In order to explore possible heterogeneity in the performance of analysts' long run earnings growth forecasts, the sample is partitioned by various characteristics of the firm whose earnings are being forecast and of the forecast itself. Specifically, the sample is split into equally sized quintiles on the basis of market capitalisation, market-to-book ratio, price-earnings ratio and the level of the forecast itself. Forecast accuracy, bias and efficiency is then examined for each sub-sample. Forecast accuracy is measured by the mean square forecast error given by (2), forecast bias is measured by the mean forecast error given by (3), while forecast efficiency is measured by the estimated slope parameter in regression (4).

In order to identify the marginal effects of each of the firm and forecast characteristics on forecast accuracy, bias and weak form efficiency, the following regressions are estimated:

$$(g_{it} - g_{it}^f)^2 = \alpha + \beta_1 \ln m_{it} + \beta_2 mb_{it} + \beta_3 pe_{it} + \beta_4 g_{it}^f + v_{it}, \qquad (10)$$

$$g_{it} - g_{it}^f = \alpha + \beta_1 \ln m_{it} + \beta_2 mb_{it} + \beta_3 pe_{it} + \beta_4 g_{it}^f + v_{it} \qquad (11)$$

and

$$(g_{it}^f - \overline{g}_t^f)[(g_{it} - \overline{g}_t) - (g_{it}^f - \overline{g}_t^f)] = \alpha + \beta_1 \ln m_{it} + \beta_2 mb_{it} + \beta_3 pe_{it} + \beta_4 g_{it}^f + v_{it}, \quad (12)$$

where $\ln m_{it}$ is the natural logarithm of the market capitalisation of firm i at the beginning of the forecast period, mb_{it} is the market-to-book ratio and pe_{it} is the price-earnings ratio. The dependent variables in the three regressions are the summands in (a) the mean square forecast error, (b) the mean forecast error and (c) the estimated covariance between $(g_{it} - g_{it}^f)$ and g_{it}^f.[8]

(vii) Estimation Procedure

In order to allow for time specific market wide shocks, each of the regression equations (4), (5), (9), (10), (11) and (12) is estimated by OLS, including fixed time effects. However, inference based on OLS estimates of the variance-covariance matrix of the disturbance term may be misleading since both heteroscedasticity and cross-sectional correlation are likely to be present in the data. One potential solution is to use GLS, in which the heteroscedasticity and cross-section correlation are parameterised and estimated. However, in the present case, GLS is infeasible since the number of cross-section observations is large relative to the number of time series observations. This paper employs instead the non-parametric approach of Froot (1989), which is robust to both contemporaneous correlation and heteroscedasticity. This involves partitioning the data by a two digit SIC code and assuming that the intra-industry correlation is zero. This then allows the consistent estimation of the parameter covariance matrix. The Froot estimator is modified using the Newey-West (1987) procedure in order to allow for the serial correlation in the regression error term that is induced by the use of overlapping data.

4. RESULTS

(i) Forecast Accuracy

Panel A of Table 1 reports the mean square forecast error, given by (2), for the pooled sample and for each individual year. It also reports the mean square forecast errors for the naïve forecasts of the martingale model, where forecast earnings growth is zero, and the sub-martingale model, where forecast earnings growth is the historical economy wide average earnings growth rate.

The accuracy of analysts' long run earnings growth forecasts is extremely low. In the pooled sample, the mean square forecast error for analysts is 7.15%. For the martingale model, the mean square error is 6.63%, while for the sub-martingale model, it is marginally lower at 6.60%. On average, therefore, a superior forecast of long run earnings growth for individual companies can be obtained simply by assuming that average annual earnings growth will be zero. This is a strong indictment of the accuracy of analysts' long run forecasts, and in view of the additional information available to analysts, is surprising. It also contrasts with the evidence for shorter horizon forecasts where analysts appear to have some advantage over time series models. Furthermore, the alternative models used here are relatively simple. If in fact earnings are stationary, then it is likely that a yet superior forecast could be obtained from an estimated time series model for each firm, and so the relative inferiority of analysts' forecasts is probably understated here.

Turning to the annual samples, the martingale model generates superior forecasts in seven out of eleven years, while the sub-martingale model generates forecasts that are superior to analysts' forecast in nine of the eleven years, and superior to the forecasts of the martingale model in ten out of eleven years. This suggests that one can improve on the zero growth forecast of the martingale model by using the historical economy average earnings growth rate to predict subsequent growth for individual firms. However, the improvement is only marginal, reflecting both considerable variation in average earnings growth between years and considerable dispersion in earnings growth rates across the economy. The time-series pattern of forecast errors suggests that analyst inferiority is not caused by just one or two outlying years. Nor does it suggest that there is any improvement in the accuracy of analysts' forecasts over the sample period, either relative to the forecasts of the martingale and sub-martingale models, or in absolute terms. The (unweighted) average mean square forecast error for the first five years in the sample is 7.02%, while in the last five years it is 7.28%. This is in contrast with evidence reported elsewhere that analyst accuracy has increased over time (see Brown, 1997).

(ii) Forecast Bias

Panel B of Table 1 reports the mean forecast error for analysts' forecasts of long run earnings growth, given by (3), and its standard error. In the pooled sample, the mean forecast error is negative indicating that analysts' long run earnings growth forecasts are over-optimistic. The mean forecast error is very significant both in statistical and economic terms. On average, forecast growth exceeds actual growth by about seven percent per annum. Over-optimism in long run earnings growth forecasts is consistent with evidence reported for analysts' shorter horizon earnings forecasts (see, for instance, Fried and Givoly, 1982; Brown et al., 1985; and O'Brien, 1988). It is also consistent with international evidence on analysts short run and interim forecasts (see Capstaff et al., 1995 and 1998).

The mean forecast error is also negative in each individual year, and significantly negative in all but the last, ranging from 1.50% to 11.82% per annum. This is in contrast with analysts' shorter horizon forecasts where the direction of the reported bias displays considerable year to year variation (see, for instance, Givoly, 1985). It is again notable that the degree of over-optimism has not diminished significantly over time. The (unweighted) mean forecast error for the first five years of the sample is −6.99%, while for the last five years it is −7.20%. It is of course possible that the last year in the sample, where the mean forecast error is less than two percent, marks the start of a reduction in analyst over-optimism. Whether this is borne out by future studies will be of considerable interest.

(iii) Forecast Efficiency

Panel A of Table 2 presents the results of regression (4). The efficiency condition is very strongly rejected for analysts' long run earnings growth forecasts. In the pooled sample, $\hat{\beta}$ is significantly less than unity and at 0.20, only marginally greater than zero. This is a considerably stronger rejection of efficiency than found by other authors for shorter horizon forecasts. For instance,

Table 1

Forecast Accuracy and Forecast Bias

	Panel A: Forecast Accuracy			**Panel B: Forecast Bias**	
	MSFE of Analysts	*MSFE of Martingale*	*MSFE of Sub-martingale*	*MFE of Analysts*	*Standard Error*
Pooled sample	7.15	6.63	6.60	−7.33	(0.31)
1982	7.34	5.15	6.41	−11.39	(1.01)
1983	6.88	7.01	6.51	−5.48	(1.20)
1984	6.75	7.14	6.40	−4.01	(1.12)
1985	7.19	6.67	6.29	−6.61	(1.08)
1986	6.92	6.47	6.24	−7.44	(1.08)
1987	6.95	5.77	5.75	−10.78	(0.99)
1988	7.38	6.32	6.40	−10.20	(1.00)
1989	6.99	5.22	5.71	−11.82	(0.91)
1990	5.69	5.20	4.95	−7.40	(0.85)
1991	7.58	7.78	7.60	−5.04	(0.99)
1992	8.78	9.62	9.78	−1.50	(1.10)

Notes:
Panel A reports the mean square forecast error for analysts' forecasts and the forecasts of two naïve models.

The MSFE of analysts forecasts is calculated each year as $\frac{1}{N}\sum_{i=1}^{N}(g_{it} - g_{it}^{f})^2$;

the MSFE of the martingale model is calculated each year as $\frac{1}{N}\sum_{i=1}^{N}(g_{it})^2$;

the MSFE of the sub-martingale model is calculated each year as $\frac{1}{N}\sum_{i=1}^{N}(g_{it} - \overline{g}_{t-1})^2$;

where g_{it} is five year earnings growth from January year t to December year t+4, is forecast of g_{it} reported at April year t and $\overline{g}_{t-1}$ is the average value over all companies of five year earnings growth from January year t−5 to December year t−1. The MSFE for the pooled sample is computed over all firms and years.

Panel B reports the mean forecast error of analysts, calculated as:

$$\text{MFE} = \frac{1}{N}\sum_{i=1}^{N}(g_{it} - g_{it}^{f}),$$

and its standard error. The MFE for the pooled sample is computed over all firms and years.

DeBondt and Thaler (1990) find that while they reject the hypothesis that β is equal to unity for one and two year forecasts, their estimated parameters (0.65 for one year forecasts, 0.46 for two year forecasts) are much larger than those reported here, both statistically and economically. For annual earnings forecasts,

Table 2

Forecast Efficiency

	Panel A: Weak Efficiency			**Panel B: The Incremental Information Content of Price-Earnings Based Forecasts**				
	$\hat{\beta}$	*SE*	$\overline{R}^2$	$\hat{\beta}$	*SE*	$\hat{\gamma}$	*SE*	$\overline{R}^2$
Pooled sample	0.20	(0.08)	0.00	0.05	(0.09)	0.04	(0.01)	0.02
1982	−0.73	(0.26)	0.04	−0.81	(0.28)	0.03	(0.04)	0.05
1983	0.42	(0.25)	0.01	0.08	(0.27)	0.05	(0.02)	0.04
1984	0.19	(0.27)	0.00	0.03	(0.30)	0.04	(0.02)	0.01
1985	0.05	(0.29)	0.00	0.02	(0.33)	0.01	(0.02)	0.00
1986	0.31	(0.23)	0.01	−0.25	(0.22)	0.10	(0.02)	0.06
1987	0.46	(0.22)	0.01	0.41	(0.22)	0.01	(0.02)	0.01
1988	0.42	(0.21)	0.01	0.43	(0.21)	0.00	(0.01)	0.01
1989	0.08	(0.22)	0.00	−0.03	(0.23)	0.03	(0.02)	0.01
1990	0.28	(0.17)	0.01	0.20	(0.20)	0.02	(0.02)	0.01
1991	0.39	(0.17)	0.01	0.11	(0.50)	0.06	(0.03)	0.03
1992	0.09	(0.27)	0.00	−0.20	(0.31)	0.10	(0.03)	0.05

Notes:

Panel A reports the results of the test of the weak efficiency of analysts' forecasts. The regression for the pooled sample is $g_{it} = \alpha_t + \beta g^f_{it} + u_{it}$ where g_{it} is five year earnings growth from January year t to December year t+4 and g^f_{it} is the median forecast of g_{it} reported in April of year t. The regression for the annual samples is $g_{it} = \alpha_t + \beta_t g^f_{it} + u_{it}$. The Panel reports the estimated slope parameter, its Froot-Newey-West adjusted standard error and the adjusted *R*-squared statistic.

Panel B reports the results of the test for the incremental information content of price-earnings based forecasts. The regression for the pooled sample is $g_{it} = \alpha_t + \beta g^f_{it} + \gamma g^p_{it} + u_{it}$ where g_{it} is five year earnings growth from January year t to December year t+4, is the median forecast of g_{it} reported in April of year t,

$$g^p_{it} = \frac{p_{it}/pe_{mt} - e_{it}}{e_{it}}, \quad pe_{mt} = \frac{1}{N}\sum_{i=1}^{N}\frac{p_{it}}{e_{it}},$$

e_{it} is the earnings reported in December of year $t-1$, and p_{it} is the price in April of year t. The regression for the annual samples is $g_{it} = \alpha_t + \beta_t g^f_{it} + \gamma_t g^p_{it} + u_{it}$. The Panel reports the estimated slope parameter, its Froot-Newey-West adjusted standard error and the adjusted *R*-squared statistic.

Givoly (1985) cannot reject the hypothesis that β is unity. Using UK data on the forecasts of individual analysts, Capstaff et al. (1995) find that the estimated coefficient declines with the forecast horizon, with an estimated value of around 0.5 for 20 month forecasts (their longest horizon). The results of this paper therefore strongly support the view (first offered by DeBondt and Thaler, 1990) that forecast earnings growth is too extreme, and that the longer the horizon, the more extreme it becomes. In the annual regressions, β is significantly less than unity in all years, and significantly greater than zero in only three years. In one year, it is actually significantly negative.

(iv) The Incremental Information Content of Price-Earnings Based Forecasts

The results of regression (5), which supplements analysts' forecasts with forecasts that are derived from the assumption that earnings will evolve in such a way that each firm's price-earnings ratio will converge to the current market price-earnings ratio, are reported in Panel B of Table 2. Under the null hypothesis that analysts make optimal use of information about future earnings that is contained in share prices, the coefficient on the price-earnings based forecast, $\hat{\gamma}$, should be zero. In the pooled sample, the estimated coefficient is significantly greater than zero, implying that analysts do not make full use of information that is readily available at the time that their forecasts are made. However, there is much year to year variation in both the statistical and economic significance of the coefficient, with six years in which the coefficient is not statistically different from zero.

The marginal contribution of price-earnings based forecasts can be gauged by comparing the two Panels of Table 2. The inclusion of the price-earnings forecast explains an additional two percent of the variation in actual earnings growth in the pooled sample, while in individual years, this figure varies between zero and five percent. However, the price-earnings based forecast used in the present analysis is derived under the somewhat unrealistic assumption that all firms have a common long run price-earnings ratio. Undoubtedly, more accurate earnings growth forecasts could be imputed by making more sophisticated assumptions about how price-earnings ratios evolve over time. The results presented here therefore almost certainly understate the extent to which analysts neglect information embodied in share prices. The fact that analysts appear to neglect information contained in share prices when forming their long run earnings growth forecasts is consistent with analogous results for their forecasts over shorter horizons (see, for instance, Ou and Penman, 1989; Abarbanell, 1991; Elgers and Murray, 1992; and Capstaff et al., 1995 and 1998).

(v) Forecast Error Decomposition

The preceding results demonstrate that the accuracy of analysts' long run earnings forecasts is extremely low, and that they are very significantly biased and inefficient. In this sub-section, the source of analysts' forecast error is investigated using the two decompositions of mean square forecast error described in Section 3. The first decomposes forecast error into systematic and non-systematic components. The results of this decomposition are given in Panel A of Table 3. It can be seen that by far the largest component of mean square forecast error is random. In the pooled sample, less than twelve percent of the forecast error is the result of the systematic component of analysts' forecast errors. Of the systematic component, about seven percent is due to bias, and about four percent due to inefficiency. A similar pattern holds for the annual samples, although there is considerable year to year variation, with as much as ninety-five percent of mean square forecast error accounted for by the random component in some years. In principle, knowledge of the systematic error in analysts' forecasts permits the use of 'optimal linear correction' techniques in order to improve forecast accuracy. This involves employing the predicted values calculated using the estimated coefficients from regression (4), above, in place of the forecasts themselves. The effect of the ordinary least squares regression is to adjust the forecasts by compensating for their bias and inefficiency. The degree to which accuracy can be enhanced in this way depends upon the proportion of the mean square forecast error that is systematic. The results reported here imply that, assuming that the underlying data generating process for actual earnings growth and the method by which analysts form the expectations of earnings growth remain constant, optimal linear correction of the forecasts will reduce the forecast error only by about twelve percent. This is clearly an important result for the users of analysts' forecasts.

The second decomposition divides the mean square forecast error into the error in forecasting average earnings growth in the economy, the error in forecasting the deviation of average growth in each industry from average growth in the economy, and the error in forecasting the deviation of earnings growth for

Table 3

Forecast Error Decomposition

	Panel A : Decomposition by Error Type			**Panel B: Decomposition by Level of Aggregation**		
	Bias	*Inefficiency*	*Random*	*Economy*	*Industry*	*Firm*
Pooled sample	7.51	4.07	88.45	9.21	35.53	55.25
1982	17.67	15.41	67.23	17.67	46.06	36.27
1983	4.37	2.12	93.92	4.37	40.21	55.42
1984	2.38	4.64	93.34	2.38	52.27	45.34
1985	6.07	6.68	87.57	6.07	36.45	57.48
1986	8.00	2.96	89.37	8.00	40.59	51.41
1987	16.73	1.86	81.69	16.73	30.15	53.11
1988	14.10	2.04	84.13	14.10	29.77	56.13
1989	20.02	5.32	74.89	20.02	27.45	52.53
1990	9.62	4.49	86.13	9.62	31.68	58.69
1991	3.35	2.63	94.27	3.35	33.05	63.60
1992	0.26	4.78	95.24	0.26	32.13	67.61

Notes:
Panel A reports the results of the decomposition of mean square forecast error for each year t by error type, given by:

$$\text{MSFE} = \frac{1}{N_t}\sum_{i=1}^{N_t}(g_{it} - g_{it}^f)^2 = (\overline{g}_t - \overline{g}_t^f)^2 + (1-\beta_t)^2\sigma^2_{g^f t} + (1-\rho_t^2)\sigma^2_{gt}$$

where N_t is the sample size in year t, g_{it} is five year earnings growth from January year t to December year t+4, g_{it}^f is the median forecast of g_{it} reported in April of year t, $\overline{g}_t$ and $\overline{g}_t^f$ are the average values of g_{it} and g_{it}^f, β_t is the slope coefficient reported in Panel A of Table 2, ρ_t is the correlation coefficient between g_{it} and g_{it}^f, and σ^2_{gt} and $\sigma^2_{g^f t}$ are the variances of g_{it} and g_{it}^f. The decomposition for the pooled sample is computed over all firms and years.

Panel B reports the results of the decomposition of mean square forecast error for each year t by the level of aggregation, given by:

$$\text{MSFE} = \frac{1}{N_t}\sum_{i=1}^{N_t}(g_{it} - g_{it}^f)^2$$

$$= (\overline{g}_t - \overline{g}_t^f)^2 + \frac{1}{N_t}\sum_{j=1}^{J_t} N_{jt}[(\overline{g}_{jt} - \overline{g}_t) - (\overline{g}_{jt}^f - \overline{g}_t^f)]^2 + \frac{1}{N_t}\sum_{i=1}^{N_t}[(g_{it} - \overline{g}_{jt}) - (g_{it}^f - \overline{g}_{jt}^f)]^2$$

where J_t is the number of industries in the sample, N_{jt} is the number of firms in industry j, $\overline{g}_{jt}$ and $\overline{g}_{jt}^f$ are the average values of g_{it} and g_{it}^f in industry j. The decomposition for the pooled sample is the weighted average of the decompositions for the annual samples, with weights proportional to the sample size each year. The table reports each of the components of mean square forecast error as a percentage of total mean square forecast error.

individual firms from average industry growth. The results of this decomposition are reported in Panel B of Table 3. The results demonstrate that analysts' forecast inaccuracy derives mainly from an inability to forecast deviations of individual firm growth from the average growth rate in its industry. The error in forecasting deviations of industry growth from the average growth rate in the economy is also important, but somewhat smaller than the error in forecasting individual firm growth. In contrast, analysts' inability to forecast average earnings growth in the economy contributes relatively little to their inaccuracy. An interesting feature of this decomposition is that the proportion of forecast error generated at the industry level appears to be diminishing over time, while the proportion generated at the individual firm level is increasing. This is potentially related to changes in the methods used by analysts to forecast earnings growth, or changes in accounting standards.

(vi) The Performance of Analysts' Forecasts Conditional on Firm and Forecast Characteristics

The foregoing analysis has considered analysts' long run earnings growth forecasts as a homogenous group. However, it is likely that forecast performance will vary with the characteristics of the firm whose earnings are being forecast. For instance, one would expect that firms with highly variable cash flows, or those for which little information is available about future earnings prospects, would be associated with lower forecast accuracy. Additionally, forecast performance is likely to vary with the size of the forecast itself since the efficiency results indicate that low forecasts are less overly-optimistic than high forecasts.

In order to investigate this issue, the accuracy, bias and efficiency results are reproduced for sub-samples of companies, partitioned on the basis of market capitalisation, price-earnings ratio, market-to-book ratio and the level of the forecast itself. For each variable, the sample is sorted into ascending order of the partitioning variable and split into quintiles, with equal numbers of firms in each quintile.[10] For all the results of this section, results are reported for quintiles pooled across all years only.

Table 4 presents the results for forecast accuracy, with the mean square forecast error for each quintile reported in Panel A.

There is substantial variation in forecast accuracy across market capitalisation, price-earnings ratio and forecast earnings growth, while there is no obvious systematic variation in forecast accuracy across market-to-book. Forecast accuracy increases with market capitalisation, with forecasts for the quintile of largest firms more than twice as accurate as those for the quintile of smallest firms. There is an inverse relationship between forecast accuracy and price-earnings ratio, with forecasts for the lowest quintile almost three times as accurate as those for the highest quintile. The largest variation in forecast accuracy is with the level of the forecast itself, with low forecasts being five times more accurate than high forecasts. In all three cases, variation in forecast accuracy is monotonic (almost monotonic in the case of price-earnings and forecast size), although it does not appear to be linear, with the largest differences occurring in the lowest and highest quintiles.

The results of Panel A show that forecast accuracy varies substantially with market capitalisation, price-earnings ratio and the forecast itself. However, these variables are not independent, and so variation in forecast accuracy with one variable may merely reflect variation with another. In order to identify the marginal effects of firm and forecast characteristics on forecast accuracy, Panel B of Table 4 reports the regression of the squared forecast error on the natural logarithm of market capitalisation, market-to-book, price-earnings and forecast earnings growth. Interestingly, all four variables independently contribute to the explanation of forecast accuracy, with the most influential, in terms of statistical significance, being the price-earnings ratio, followed by the level of the forecast itself. The most accurate forecasts are therefore low forecasts issued for large companies with low price-earnings ratios and high market-to-book ratios. The four variables together explain more than thirteen percent of the variation in forecast accuracy.

The variation of forecast accuracy with market capitalisation is not surprising. Information about future earnings prospects is likely to be more readily available, and of a higher quality, for larger firms. The variation of forecast accuracy with the forecast itself is consistent with the results on forecast efficiency. The inverse relationship between forecast accuracy and price-earnings ratio is harder to explain, but may be driven by the fact that very

Table 4

Forecast Accuracy Conditional on Firm and Forecast Characteristics

Panel A: Forecast Accuracy by Firm and Forecast Characteristics

	Quintile 1 (lowest)	*Quintile 2*	*Quintile 3*	*Quintile 4*	*Quintile 5 (highest)*
Capitalisation	11.52	8.24	6.35	5.19	4.47
Market-to-Book	7.84	6.51	6.36	7.18	7.88
Price-Earnings	5.30	4.53	5.02	6.13	14.79
Forecast Size	2.77	6.56	5.70	7.46	13.38

Panel B: The Marginal Effect of Firm and Forecast Characteristics on Forecast Accuracy

	Estimated Coefficient	*Standard Error*
Capitalisation	−103.18	(14.39)
Market-to-Book	−17.02	(6.80)
Price-Earnings	24.47	(3.55)
Forecast Growth	42.67	(6.17)
$\overline{R}^2$	0.13	

Notes:

Panel A reports the MSFE in percent for each quintile of firm-year observations sorted in ascending order of market capitalisation, market-to-book ratio, price-earnings ratio and forecast earnings growth.

Panel B reports the estimated slope coefficients from the regression:

$$(g_{it} - g_{it}^f)^2 = \alpha_t + \beta_1 \ln m_{it} + \beta_2 mb_{it} + \beta_3 pe_{it} + \beta_4 g_{it}^f + v_{it}$$

where g_{it} is five year earnings growth from January year t to December year $t+4$, g_{it}^f is the median forecast of g_{it} reported in April of year t, m_{it} is the market capitalisation of firm i in April of year t, mb_{it} is the ratio of market capitalisation of firm i in April of year t to the book value of equity firm i in December of year $t-1$ and pe_{it} is the ratio of the share price of firm i in April of year t to the earnings for the fiscal year ending in December of year $t-1$. Froot-Newey-West adjusted standard errors are reported in parentheses. The regression is estimated for the sample pooled over all years.

high price-earnings ratios arise partly as a result of very low, but transitory earnings, the trajectory of which is likely to be difficult to forecast accurately. The positive relationship between forecast accuracy and market-to-book ratio is potentially explained by the fact that high market-to-book companies, *ceteris paribus*, should on average have high earnings growth. Since forecast earnings growth is generally too optimistic, the size of the forecast error for these companies should on average be lower.

Table 5 presents the results for forecast bias. Again, there is strong variation in forecast bias with market capitalisation, price-earnings ratio and the level of the forecast itself. Consistent with the results for forecast accuracy reported in Table 4, forecast bias decreases (in absolute value) with market capitalisation and increases with forecast size. However, while forecast inaccuracy increases with price-earnings ratio, forecast bias *decreases* with price-earnings ratio, implying that while forecasts become less biased as the price-earnings ratio increases, they nevertheless become less accurate. However, this merely implies that the random component of forecast inaccuracy decreases more rapidly with price-earnings ratio than does the systematic component. The largest variation in forecast bias is again with forecast size, with forecasts in the highest quintile being more than four times as biased as those in the lowest quintile. This is consistent with the results on efficiency reported earlier that demonstrate a significant negative relationship between forecast error and the level of the forecast. There is some variation in forecast bias with market-to-book value of equity, although it is not monotonic across quintiles, and the difference between the lowest and highest quintile is not large. There is no quintile of companies for which it can be concluded that analysts' forecasts are unbiased.

Panel B reports the results of the regression of forecast error on market capitalisation, market-to-book value of equity, price earnings ratio and forecast earnings growth. There is again independent variation in forecast bias with market capitalisation, price-earnings ratio and the level of the forecast itself, with the latter being the strongest factor, statistically speaking. There is no significant variation with market-to-book. The four variables together explain about six percent of the variation in forecast error.

These results are broadly consistent with Frankel and Lee (1996), who investigate the performance of analysts' shorter horizon forecasts in order to operationalise an accounting valuation model based on book value of equity and the market's expectation of earnings growth. They find that analyst over-optimism is associated with low book-to-price ratio (the inverse of the market-to-book ratio used in the present analysis) and high past sales growth. They also find that analyst over-optimism is

Table 5

Forecast Bias Conditional on Firm and Forecast Characteristics

Panel A: Forecast Bias by Firm and Forecast Characteristics

	Quintile 1 (lowest)	*Quintile 2*	*Quintile 3*	*Quintile 4*	*Quintile 5 (highest)*
Capitalisation	−12.28	−8.15	−5.99	−5.34	−5.00
	(0.87)	(0.75)	(0.67)	(0.60)	(0.56)
Market-to-Book	−5.32	−6.35	−8.61	−8.08	−8.38
	(0.75)	(0.68)	(0.65)	(0.70)	(0.73)
Price-Earnings	−11.66	−6.87	−7.42	−5.48	−5.32
	(0.54)	(0.55)	(0.58)	(0.66)	(1.04)
Forecast Size	−3.98	−3.56	−5.49	−7.59	−16.12
	(0.44)	(0.69)	(0.64)	(0.71)	(0.90)

Panel B: The Marginal Effect of Firm and Forecast Characteristics on Forecast Bias

	Estimated Coefficient	*Standard Error*
Capitalisation	0.76	(0.28)
Market-to-Book	0.05	(0.05)
Price-Earnings	0.23	(0.05)
Forecast Growth	−0.93	(0.09)
$\overline{R}^2$	0.06	

Notes:

Panel A reports the MFE in percent for each quintile of firm-year observations sorted in ascending order of market capitalisation, market-to-book ratio, price-earnings ratio and forecast earnings growth. Standard errors are reported in parentheses.

Panel B reports the estimated slope coefficients from the regression:

$$(g_{it} - g_t^f)^2 = \alpha_t + \beta_1 \ln m_{it} + \beta_2 mb_{it} + \beta_3 pe_{it} + \beta_4 g_{it}^f + v_{it}$$

where g_{it} is five year earnings growth from January year t to December year $t + 4$, g_{it}^f is the median forecast of g_{it} reported in April of year t, m_{it} is the market capitalisation of firm i in April of year t, mb_{it} is the ratio of market capitalisation of firm i in April of year t to the book value of equity firm i in December of year $t - 1$ and pe_{it} is the ratio of the share price of firm i in April of year t to the earnings for the fiscal year ending in December of year $t - 1$. Froot-Newey-West adjusted standard errors are reported in parentheses. The regression is estimated for the sample pooled over all years.

associated with forecasts that are high relative to the current level of earnings (i.e. optimistic forecasts). Since forecast earnings growth and actual earnings growth are largely uncorrelated in the present sample, this is consistent with the finding reported above that analyst over-optimism is associated with high forecast earnings growth.

Table 6

Forecast Efficiency Conditional on Firm and Forecast Characteristics

Panel A: Forecast Efficiency by Firm and Forecast Characteristics

	Quintile 1 (lowest)	*Quintile 2*	*Quintile 3*	*Quintile 4*	*Quintile 5 (highest)*
Capitalisation	0.01	0.25	0.12	0.56	1.15
	(0.10)	(0.09)	(0.09)	(0.12)	(0.13)
Market-to-Book	0.05	0.01	0.00	−0.08	0.28
	(0.14)	(0.12)	(0.11)	(0.11)	(0.09)
Price-Earnings	−0.31	0.24	0.08	−0.04	−0.21
	(0.09)	(0.10)	(0.11)	(0.12)	(0.11)
Forecast Size	0.84	0.59	0.57	0.60	−0.11
	(0.26)	(0.86)	(0.98)	(0.84)	(0.13)

Panel B: The Marginal Effect of Firm and Forecast Characteristics on Forecast Efficiency

	Estimated Coefficient	*Standard Error*
Capitalisation	3.87	(2.30)
Market-to-Book	1.99	(1.14)
Price-Earnings	0.12	(0.63)
Forecast Growth	−12.47	(2.31)
$\overline{R}^2$	0.11	

Notes:
Panel A reports the estimate of β in the regression $g_{it} = \alpha_t + \beta g_{it}^f + u_{it}$ for each quintile of firm-year observations sorted in ascending order of market capitalisation, market-to-book ratio, price-earnings ratio and forecast earnings growth. Froot-Newey-West adjusted standard errors are reported in parentheses.

Panel B reports the estimated slope coefficients from the regression:

$$(g_{it}^f - \overline{g}_t^f)[(g_{it} - \overline{g}_t) - (g_{it}^f - \overline{g}_t^f)] = \alpha_t + \beta_1 \ln m_{it} + \beta_2 mb_{it} + \beta_3 pe_{it} + \beta_4 g_{it}^f + v_{it}$$

where g_{it} is five year earnings growth from January year t to December year $t+4$, g_{it}^f is the median forecast of g_{it} reported in April of year t, m_{it} is the market capitalisation of firm i in April of year t, mb_{it} is the ratio of market capitalisation of firm i in April of year t to the book value of equity firm i in December of year $t-1$ and pe_{it} is the ratio of the share price of firm i in April of year t to the earnings for the fiscal year ending in December of year $t-1$. Froot-Newey-West adjusted standard errors are reported in parentheses. The regression is estimated for the sample pooled over all years.

Table 6 presents the results for forecast efficiency. Panel A reveals that there is considerable variation in forecast efficiency across both market capitalisation and the level of the forecast, with some variation across market-to-book. The estimated slope parameter, β, is close to zero for the quintile of smallest firms, and rises monotonically with firm size. For the quintile of largest firms, the efficiency condition that $\beta = 1$ cannot be rejected. The estimated slope parameter decreases with the level of forecast, and for the quintile of firms with the lowest forecasts, the null hypothesis that $\beta = 1$ cannot be rejected either. There is no systematic variation with price-earnings ratio. The most efficient forecasts are therefore low forecasts for large firms with high market-to-book ratios.

Panel B of Table 6 reports the marginal contribution of each of the independent variables to forecast efficiency. Consistent with results of Panel A, there is positive independent variation in forecast efficiency with market capitalisation and market-to-book ratio, although the significance is marginal. Also consistent with the quintile results, the relationship between forecast efficiency and forecast growth is very significantly negative. There is no significant variation in forecast efficiency with price-earnings ratio. The four variables together explain eleven percent of the variation in forecast efficiency.

5. SUMMARY AND CONCLUSIONS

This paper has undertaken a detailed study of the accuracy, bias and efficiency of analysts' forecasts of long run earnings growth for US companies. The results of the paper can be summarised as follows.

(i) The accuracy of analysts' long run earnings growth forecasts is extremely low. Superior forecasts can be achieved simply by assuming that long run earnings growth is zero.
(ii) Analysts' forecasts are excessively optimistic. Forecast earnings growth, on average, exceeds actual earnings growth by about seven percent per annum.
(iii) Analysts' forecasts are weakly inefficient. Forecast errors are not independent of the forecasts themselves. In particular, high forecasts are associated with high forecast errors, while low forecasts are associated with low forecast errors.
(iv) Analysts' forecasts do not incorporate all information contained in current share prices. A superior forecast can be obtained by assuming that each firm's earnings will

evolve in such a way that its price-earnings ratio will converge to the current market-wide price-earnings ratio.

(v) Despite the bias and inefficiency identified in (ii) and (iii) above, the systematic components of analysts' forecast errors contribute relatively little to their inaccuracy. More than eighty-eight percent of the mean square forecast error is random. This is an important result for the users of analysts' long run earnings growth forecasts, since it means that the accuracy of analysts' forecasts cannot be significantly improved using linear correction techniques.

(vi) The largest part of analysts' forecast error is made at the individual firm level. The inability of analysts to forecast average earnings growth in the economy does not contribute substantially to their inaccuracy. However, there is evidence that the level of aggregation at which analysts' errors are being made is changing over time, with increasing accuracy at the industry level, and decreasing accuracy at the individual firm level.

(vii) There is significant heterogeneity in the performance of analysts' forecasts. The most reliable earnings growth forecasts are low forecasts issued for large companies with low price-earnings and high market-to-book ratios. The least biased forecasts are those for low forecasts for companies with low price-earnings ratios, while the most efficient forecasts are low forecasts for large companies with high market-to-book ratios. This is again an important result for the users of analysts' forecasts since it offers some opportunity to discriminate between good and bad forecasts.

(viii) There is very little evidence to suggest that the inaccuracy, bias or inefficiency of analyst' forecasts have diminished over time.

The idea that analysts systematically make over-optimistic forecasts, is not necessarily an indictment of their rationality *per se* since they may have considerable incentives to do so. An earnings growth forecast is not generally the final product delivered by an analyst to the client. In particular, earnings growth forecasts will be typically provided as part of a package of services, including brokerage, advice on mergers and acquisitions, and underwriting, and these related activities may influence the forecasts that an analyst makes (see Schipper, 1991). Sell-side analysts, for instance, have a vested interest in their clients' reaction to earnings forecasts. If earnings forecasts are used to support stock recommendations then high forecasts will tend to generate more business than low forecasts, since there is a larger potential client base for buy recommendations than for sell recommendations. Francis and Philbrick (1993) provide evidence that suggests that analysts may be intentionally over-optimistic in order to cultivate and maintain good management relations.

The decomposition of mean square forecast error by error type revealed that by far the largest component of analysts' forecast errors is random, with the systematic component accounting for less than twelve percent. Inevitably, at such long forecasting horizons, the potential to make accurate forecasts of earnings growth is limited. However, the fact that such a large component of actual earnings growth is random may explain why analysts' forecasts are so biased. The larger the component of the forecast error that is random, the lower the impact of forecast bias on forecast error. Assuming that analysts do have conflicting objectives — one to produce *accurate* earnings growth forecasts, the other to produce *high* earnings growth forecasts — then if analysts know that the first objective is largely unattainable, they will use the forecasting process to satisfy the second. If analysts are also producing short term and interim forecasts for the same company, then the bias in their long term forecasts may be compounded.

A number of papers have now concluded that there is substantial mis-pricing in the stock market as a consequence of irrational long run earnings growth forecasts being incorporated into the market expectation of earnings growth. The results of this paper support the hypothesis that analysts' consensus long run earnings growth forecasts are indeed irrational if they are to be interpreted as optimal forecasts of future earnings growth. However, given the uncertainty over analysts' incentives, it is by no means inevitable that these forecasts will be incorporated without modification into the market expectation of earnings growth. An interesting topic for future research will be to examine to what extent the market recognises the characteristics in forecast long run earnings growth identified in this paper.

NOTES

1 A partial list would include Brown and Rozeff (1978), Brown et al. (1987a and 1987b) and O'Brien (1988) who consider the performance of analysts' quarterly earnings forecasts, and Collins and Hopwood (1980), Fried and Givoly (1982) and Brown et al. (1985), who consider analysts' annual forecasts. International evidence on analysts' forecasts is provided by Capstaff et al. (1995), who analyse the performance of UK analysts, and Capstaff et al. (1998), who consider the forecasts of European analysts. For a comprehensive survey of the literature on analysts' earnings forecasts, see Brown (1993).

2 This was confirmed in conversation with IBES staff.

3 The correlation between the mean and the median forecast in the sample is 0.98. This is accounted for by the fact that most stocks have long term forecasts originating from only one or two analysts.

4 IBES have confirmed that they do receive earnings growth forecasts for companies whose earnings are currently negative. This may be explained by the fact that while analysts use the latest reported earnings as a base for earnings growth when earnings are positive, they use some other unspecified base measure of earnings, such as forecast annual earnings or average historical annual earnings, when earnings are negative.

5 In order to establish the robustness of the results, the analysis was conducted using maximum earnings growth threshold values in the range 50% to 1,000%, and by trimming the sample instead on the basis of initial earnings per share, using a minimum earnings threshold of between 0.10 and 1.00 dollars. The sensitivity of the results to changes in the threshold values was low, and none of the qualitative conclusions were altered. The regressions were additionally estimated using the minimum absolute deviation estimator, which is considerably less sensitive to outliers. This produced results that were almost completely invariant with respect to the choice threshold values. As a further test of the robustness of the results, the analysis was conducted using the change in earnings scaled by price, with the corresponding forecast change in earnings computed using the forecast growth rate. The results of these robustness tests are not reported here, but are available from the author on request.

6 The average growth rate is taken over all firms for which earnings data are available, using the same sample selection criteria as for subsequent earnings growth, namely excluding observations for which earnings are negative at the beginning of the five year period, and those for which the calculated growth rate exceeds 100% in absolute value.

7 This can be seen by subtracting forecast earnings growth, g_{it}^f, from each side so that the regression becomes one of forecast error on forecast earnings growth — the constant remains the same while the slope parameter becomes $\beta-1$.

8 Taking the conditional expectation of equations (10) and (11) gives the mean square forecast error and the mean forecast error, respectively, as a function of the independent variables. Regressions (10) and (11) thus measure the marginal contribution of each of the independent variables to forecast accuracy and forecast bias. Taking the conditional expectation of equation (12) gives the covariance between $(g_{it} - g_{it}^f)$ and g_{it}^f as a function of the independent variables. This covariance is the numerator of the estimated slope coefficient in a regression of $g_{it} - g_{it}^f$ on g_{it}^f. Under the

null hypothesis that forecasts are weakly efficient, this covariance should be equal to zero. If it is less than zero, forecasts are too extreme, while if it is greater than zero, forecasts are too compressed. Regression (12) thus measures the marginal contribution of each of the independent variables to forecast efficiency.

9 See, for example, Brown et al. (1987a) and O'Brien (1988), who consider the accuracy of analysts' quarterly earnings forecasts relative to the forecasts of different time series models, and Fried and Givoly (1982), who consider the relative accuracy of analysts' annual earnings forecasts.

10 Except for the largest quintile, which has an additional observation.

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