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Estimating shareholder risk premia using analysts' growth forecasts.

by Robert S. Harris and Felicia C. Marston

This paper presents estimates of shareholder required rates of return and risk premia which are derived using forward-looking analysts' growth forecasts. We update through 1991 earlier work which, due to data availability, was restricted to the period 1982-1984. Using stronger tests, we also reexamine the efficacy of using such an expectational approach as an alternative to the use of historical averages. Using the S&P 500 as a proxy for the market portfolio, we find an average market risk premium (1982-1991) of 6.47% above yields on long-term U.S. government bonds and 5.13% above yields on corporate bonds. We also find that required returns for individual stocks vary directly with their risk (as proxied by beta) and that the market risk premium varies over time. These findings show that, in addition to fitting the theoretical requirement of being forward-looking, use of analysts' forecasts in estimating return requirements provides reasonable empirical results that can be useful in practical applications. (Reprinted by permission of the publisher.)

One of the most widely used concepts in finance is that shareholders require a risk premium over bond yields to bear the additional risk of equity investments. While models such as the two-parameter capital asset pricing model (CAPM) or arbitrage pricing theory offer explicit methods for varying risk premia across securities, the models are invariably linked to some underlying market (or factor-specific) risk premium. Unfortunately, the theoretical models provide limited practical advice on establishing empirical estimates of such a benchmark market risk premium. As a result, the typical advice to practitioner is to estimate the market risk premium based on historical realizations of share and bond returns (see Brealey and Myers !3^).

In this paper, we present estimates of shareholder required rates of return and risk premia which are derived using forward-looking analysts' growth forecasts. We update, through 1991, earlier work which, due to data availability, was restricted to the period 1982-1984 (Harris !12^). Using stronger tests, we also reexamine the efficacy of using such an expectation approach as an alternative to the use of historical averages. Using the S&P 500 as a proxy for the market portfolio, we find an average market risk premium (1982-1911) of 6.47% above yields on long-term U.S. government bonds and 5.13% above yields on corporate bonds. We also find that required returns for individual stocks vary directly with their risk (as proxied by beta) and that market risk premium varies over time. In particular, the equity market premium over government bond yields is higher in low interest rate environments and when there is a larger spread between corporate and government bond yields. Thee findings show that, in addition to fitting the theoretical requirement of being forward-looking, the utilization of analysts' forecasts in estimating return requirements provides reasonable empirical results that can be useful in practical applications.

Section I provides background on the estimation of equity required returns and a brief discussion of related literature on financial analysts' forecasts (FAF). In Section II models and data are discussed. Following a comparison of the results to historical risk premia, the estimates are subjected to economic tests of both their time-series and cross-sectional characteristics in Section III. Finally, conclusions are offered in Section IV.

I. Background and Literature Review

In establishing economic criteria for resource allocation, it is often convenient to use the notion of a shareholder's required rate of return. Such a rate (k) is the minimum level of expected return necessary to compensate the investor for bearing risks and receiving dollars in the future rather than in the present. In general, k will depend on returns available on alternative investments (e.g., bonds or other equities) and the riskiness of the stock. To isolate the effects of risk, it is useful to work in terms of a risk premium (rp), defined as

rp = k - 1, (1)

where i = required return for a zero risk investment.(1)

Lacking a superior alternative, investigators often use averages of historical realizations to estimate a benchmark "market"

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risk of individual stocks (e.g., using the CAPM or a variant). The historical studies of Ibbotson Associates !13^ have been used frequently to implement his approach.(2) This historical approach requires the assumptions that past realizations are a good surrogate for future expectations and, as typically applied, that risk premia are constant over time. Carleton and Lakonishok !5^ demonstrate empirically some of the problems with such historical premia when they disaggregated for different time periods or groups of firms.

As an alternative to historical estimates, the current paper derives estimates of k, and hence, implied values of rp, using publicly available expectational data. This expectational approach employs the dividend growth model (hereafter referred to as the discounted cash flow or DCF model) in which a consensus measure of financial analysts' forecasts (FAF) of earnings is used as a proxy for investor expectations. Earlier works by Malkiel !17^, Brigham, Vinson, and Shome !4^, and Harris !12^ have used FAF in DCF models, and this approach has been employed in regulatory settings (see Harris !12^) and suggested by consultants as an alternative to use of historical data (e.g., Ibbotson Associates !13, pp. 127, 128^). Unfortunately, the published studies use data extending to 1984 at the latest. Our paper draws on this earlier work but extends it through 1991.(3) Our work is closest to that done by Harris !12^, who reviews literature showing a strong link between equity prices and FAF and supporting the use of FAF as a proxy for investor expectations. Using data from 1982 to 1984, Harris' results suggest that this expectational approach to estimating equity risk premia is an encouraging alternative to the use of historical averages. He also demonstrates that such risk premia vary both cross-sectionally with the riskiness of individual stocks and over time with financial market conditions.

II. Models and Data

A. Model for Estimation

The simplest and most commonly used version of the DCF model to estimate shareholders' require rate of return, k, is shown in Equation (2):

!Mathematical Expression Omitted^

where !D.sub.1^ = dividend per share expected to be received at time one, !P.sub.o^ = current price per share (time 0), ad g = expected growth rate in dividends per share. The limitations of this model are well known, and it is straightforward to derive expressions for k based on more general specifications of the DCF model.(4) The primary difficulty in using the DCF model is obtaining an estimate of g, since it should reflect market expectations of future performance. Without a ready source for measuring such expectations, application of the DCF model is fraught with difficulties. This paper uses published FAF of long-run growth in earnings as a proxy for g.

B. Data

FAF for this research come from IBES (Institutional Broker's Estimate System), which is a product of Lynch, Jones, and Ryan, a major brokerage firm.(5) Representative of industry practice, IBES contains estimates of (i) EPS for the upcoming fiscal years (up to five separate years), and (ii) a five-year growth rate in EPS. Each item is available at monthly intervals.

The mean value of individual analysts' forecasts of five-year growth rate in EPS will e used as a proxy for g in the DCF model.(6) The five-year horizon is the longest horizon over which such forecasts are available from IBES and often is the longest horizon used by analysts. IBES requests "normalized" five-year growth rates from analysts in order to remove short-term distortions that might stem from using an unusually high or low earnings year as a base.

Dividend and other firm-specific information come from COMPUTSTAT. Interests rates (both government and corporate) are gathered from Federal Reserve Bulletins and Moody's Bond Record. Exhibit 1 describes key variables used in the study. Data collected cover all dividend paying stocks in the Standard & Poor's 500 stock (S&P 500) index, plus approximately 100 additional stocks of regulated companies. Since five-year growth rates are first available from IBES beginning in 1982, the analysis covers the 113-month period from January 1982 to May 1991.

Exhibit 1. Variable Definitions

k = Equity required rate of return.

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!P.sub.0^ = Average daily price per share.

!D.sub.1^ = Expected dividend per share measured as current indicated annual divided from COMPUSTAT multiplied by (1 + g).(a)

g = Average financial analysts' forecast of five-year growth rate in earnings per share (from IBES).

!i.sub.it^ = Yield to maturity on long-term U.S. government obligations (source: Federal Reserve Bulletin, constant maturity series).

!i.sub.c^ = Yield to maturity on long-term corporate bonds: Moody's average.(b)

rp = Equity risk premium calculated as rp = k - i.

!beta^ = beta, calculated from CRSP monthly data over 60 months.

Notes:

a See footnote 7 for a discussion of the (1 + g) adjustment.

b The average corporate bond yield across bond rating categories as reported by Moody's. See Moody's Bond Survey for a brief description and the latest published list of bonds included in the bond rating categories.

III. Risk Premia and Required Rates of Return

A. Construction of Risk Premia

For each month, a "market" required rate of return is calculated using each divided paying stock in the S&P 500 index for which data are available. The DCF model in Equation (2) is applied to each stock and the results weighted by market value of equity to produce the market required return.(7) The return is converted to a risk premium TABULAR DATA OMITTED over government bonds by subtracting !i.sub.lt^, the yield to maturity on long-term government bonds. A risk premium over corporate bond yields is also constructed by subtracting !i.sub.c^, the yield on long-term corporate bonds. Exhibit 2 reports the results by year (averages of monthly data).

The results are quite consistent with the patterns reported earlier (i.e., Harris !12^). The estimated risk premia in Exhibit 2 are positive, consistent with equity owners demanding additional rewards over an above returns on debt securities. The average expectational risk premium (1982 to 1991) over government bonds is 6.47%, only slightly higher than the 6.16% average for 1982 to 1984 reported earlier (Harris !12^). Furthermore, Exhibit 2 shows the estimated risk premia change over time, suggesting changes in the market's perception of the incremental risk of investing in equity rather than debt securities.

For comparison purposes, Exhibit 3 contains historical returns and risk premia. The average expectational risk premium reported in Exhibit 2 falls roughly midway between the arithmetic (7.5%) and geometric (5.7%) long-term differentials between returns on stocks and long-term government bonds. Note, however, that the expectational risk premia appear to change over time. In the following sections, we examine the estimated risk premia to see if they vary cross-sectionally with the risk of individual stocks and over time with financial market conditions.

Exhibit 3: Average Historical Returns on Bonds, Stocks, Bills, and Inflation in the U.S., 1926-1989

Historical Realizations	Geometric	Arithmetic
Common stock	10.3%	12.4%
Long-term government bonds	4.6%	4.9%
Long-term corporate bonds	5.2%	5.5%
Treasury bills	3.6%	3.7%
Inflation rate	3.1%	3.2%

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Source: Ibbotson Associates, Inc., 1990 Stocks, Bonds, Bills and Inflation, 1990 Yearbook.

B. Cross-Sectional Tests

Earlier, Harris !12^ conducted crude tests of whether expectational equity risk premia varied with risk proxied by bond ratings and the dispersion of analysts' forecasts and found that required returns increased with higher risk. Here we examine the link between these premia and beta, perhaps the most commonly used measure of risk for equities.(8) In keeping with traditional work in this area, we adopt the methodology introduced by Fama and Macbeth !9^ but replace realized returns with expected returns from Equation (2) as the variable to be explained. For this portion of our tests, we restrict our sample to 1982-1987 and in ny month include firms that have at least three forecasts of earnings growth to reduce measurement error associated with individual forecasts.(9) This restricted sample still consists of, on average, 399 firms for each of the 72 months (or 28,744 company months).

For a given company in a given month, beta is estimated via the market model (using ordinary least squares) on the prior 60 months of return data taken from CRSP. Beta estimates are updated monthly and are calculated against an equally weighted index of all NYSE securities. For each month, we aggregate firms into 20 portfolios (consisting of approximately 20 securities each). The advantage of grouped data is the reduction in potential measurement error inherent in independent variables at the company level. Portfolios are formed based on a ranking of beta estimated from a prior time period (t = -61 to t = -120). Portfolio expected returns and beta are calculated as the simple averages for the individual securities.

Using these data, we estimate the following model for each of the 72 months:

!R.sub.p^ = !!alpha^.sub.0^ + !!alpha^.sub.1^ !!beta^.sub.p^ + !u.sub.p^, p = 1...20, (3)

where:

!R.sub.p^ = Expected return for portfolio p in the given month,

!!beta^.sub.p^ = Portfolio beta, estimated over 60 prior months, and

!u.sub.p^ = A random error term with mean zero.

As a result of estimating regression (3) for each month, 72 estimates of each coefficient (!!alpha.sub.0^ and !!alpha^.sub.1^^ are obtained. Using realized returns as the dependent variable, the traditional approach (e.g., Fama and Macbeth !9^) is to assume that realized returns are a fair game. Given this assumption, the mean of the 72 values of each coefficient is an unbiased estimate of the mean over that same time period if one could have actually used expected returns as the dependent variable. Note that if expected returns are used as the dependent variable the fair-game assumption is not required. Making the additional assumption that the true value of the coefficient is constant over the 72 months, a test of whether the mean coefficient is different from zero is performed using a t-statistic where the denominator is the standard error of the 72 values of the coefficient. This is the technique employed by Fama and Macbeth !9^. If one assumes the CAPM is correct, the coefficient !!alpha^.sub.1^ is an empirical estimate of the market risk premium, which should be positive.

To test the sensitivity of the results, we also repeat our procedures using individual security return rather than portfolios. To account, at least in part, for differences in precision of coefficient estimates in different months we also report results in which monthly parameter estimates are weighted inversely by the standard error of the coefficient estimate rather than being weighed equally (following Chan, Hamao, and Lakonishok !6^).

Exhibit 4 shows that there is a significant positive link between expectational required returns and beta. For instance, in Panel A, the mean coefficient of 2.78 on beta is significantly different from zero at better than the 0.001 level (t = 35.31), and each of the 72 monthly coefficients going into this average is positive (as shown by that 100% positive figure). Using individual stock returns, the significant positive link between beta and expected return remains, though it is smaller in magnitude than for portfolios.(10) Comparison of Panels A and B shows that the results are not sensitive to the weighing of monthly coefficients.

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While the findings in Exhibit 4 TABULAR DATA OMITTED suggest a strong positive link between beta and risk premia (a result often not supported when realized returns are used as a proxy for expectations; e.g., see Tinic and West !22^), the results do not support the predictions of a simple CAPM. In particular, the intercept is higher than a proxy for the risk-free rate over the sample period and the coefficient of beta is well below estimates of a market risk premium obtained from either expectational (Exhibit 2) or historical data (Exhibit 3).(11) Nonetheless, the results show that the estimated risk premia conform to the general theoretical relationship between risk and required return that is expected when investors are risk-averse.

C. Time Series Tests -- Changes in Market Risk Premia

A potential benefit of using ex ante risk premia is the estimation of changes in market risk premia over time. With changes in the economy and financial markets, equity investments may be perceived to change in risk. For instance, investor sentiment about future business conditions likely affects attitudes about the riskiness of equity investments compared to investments in the bond markets. Moreover, since bonds are risky investments themselves, equity risk premia (relative to bonds) could change due to changes in perceived riskiness of bonds, even if equities displayed no shifts in risk. For example, during the high interest rate period of the early 1980s, the high level of interest rate volatility made fixed income investment more risky holdings than they were in a world of relatively stable rates.

Studying changes in risk premia for utility stocks, Brigham, et al !4^ conclude that, prior to 1980, utility risk premia increased with the level of interest rates, but that this pattern reversed thereafter, resulting in an inverse correlation between risk premia and interest rates. Studying risk premia for both utilities and the equity market generally, Harris !12^ also reports that risk premia appear to change over time. Specifically, he finds that equity risk premia decreased with the level of government interest rates, increased with the increases in the spread between corporate and government bond yields, and increased with increases in the dispersion of analysts' forecasts. Harris' study is, however, restricted to the 36-month period, 1982 to 1984.

Exhibit 5 TABULAR DATA OMITTED reports results of analyzing the relationship between equity risk premia, interest rates, and yield spreads between corporate and government bonds. Following Harris !12^, these bond yield spreads are used as a time series proxy for equity risk. As the perceived riskiness of corporate activity increases, the difference between yields on corporate bonds and government bonds should increase. One would expect the sources of increased riskiness to corporate bonds to also increase risks to shareholders. All regressions in Exhibit 5 are corrected for serial correlation.(12)

For the entire sample period, Panel A shows that risk premia re negatively related to the level of interest rate -- as proxied by yields on government bonds, !i.sub.lt^. ThiPortfolios are formed based on a ranking of beta estimated from a pompany level. uity investments compared to investments in may result from increases in the perceived riskiness of investment in government debt at high levels of interest rates. A direct measure of uncertainty about investments in government bonds would be necessary to test this hypothesis directly.

For the entire 1982 to 1991 period, the addition of the yield spread risk proxy to the regression dramatically lowers the magnitude of the coefficient on government bond yields, as can be seen by comparing Equation 1 and 2 of Panel A. Furthermore, the coefficient of the yield spread (0.666) is itself significantly positive. This pattern suggests that a reduction in the risk differential between investment in government bonds and in corporate activity is translated into a lower equity market risk premium. Further examination of Panels B through D, however, suggests that the yield spread variable is much more important in explaining changes in equity risk premia in the early portion of the 1980s than in the 1988 to 1991 period.

In summary, market equity risk premia change over time and appear inversely related to the level of government interest rates but positively related to the bond yield spread, which proxies for the incremental risk of investing in equities as opposed to government bonds.

IV. Conclusions

Shareholder required rates of return and risk premia are based on theories about investors' expectations for the future. In practice, however, risk premia are often estimated using averages of historical returns. This paper applies an alternative

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approach to estimating risk premia that employs publicly available expectational data. At least for the decade studied (1982 to 1991), the resultant average marek equity risk premium over government bonds is comparable in magnitude to long-term differences (1926 to 1989) in historical returns between stocks and bonds. There is strong evidence, however, that market risk premia change over time and, as a result, use of a constant historical average risk premium is not likely to mirror changes in investor return requirements. The results also show that the expectational risk premia vary cross-sectionally with the relative risk (beta) of individual stocks.

The approach offers a straightforward and powerful aid in establishing required rates of return either for corporate investment decisions or in the regulatory arena. Since data are readily available on a wide range of equities, an investigator can analyze various proxy groups (e.g., portfolios of utility stocks) appropriate for a particular decision as well as analyze changes in equity return requirements over time.

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1 Theoretically, i is a risk-free rate, though empirically its proxy (e.g., yield to maturity on a government bond) is only a "least risk" alternative that is itself subject to risk. In this development, the effects of tax codes on required returns are ignored.

2 Many leading texts in financial management use such historical risk premia to estimate a market return. See, for example, Brealey ad Myers !3^. Often a market risk premium is adjusted for the observed relative risk of a stock.

3 See Harris !12^ for a discussion of the earlier work and a detailed discussion of the approach employed here.

4 As stated, Equation (2) requires expectations of either an infinite horizon of dividend growth at a rate g or a finite horizon of dividend growth at rate g and special assumptions about the price of the stock at the end of that horizon. Essentially, the assumption must ensue that the stock price grows at a compound rate of g over the finite horizon. One could alternatively estimate a nonconstant growth models. These findings illustrate empirical difficulties in finding empirical proxies for multistage growth models for large samples.

5 Harris !12^ provides a discussion of IBES data and its limitations. In more recent years, IBES has begun collecting forecasts for each of the next five years. Since this work was completed, the FAF used here have become available from IBES Inc., now a subsidiary of CitiBank.

6 While the model calls for expected growth in dividends, no source of data on such projections is readily available. In addition, in the long run, dividend growth is sustainable only via growth in earnings. As long as payout ratios are not expected to change, the two growth rates will be the same.

7 The construction of !D.sub.1^ is controversial since dividends are paid quarterly and may be expected to change during the year; whereas, Equation(2), as is typical, is being applied to annual data. Both the quarterly payment of dividends (due to investors' reinvestment income before year's end, see Linke and Zumwalt !15^) and any growth during the year require an upward adjustment of the current annual rate of dividends to construct !D.sub.1^. If quarterly dividends grow at a constant rate, both factors could be accommodated straightforwardly by applying Equation (2) to quarterly data with a quarterly growth rate and then annualizing the estimated quarterly required return. Unfortunately, with lumpy changes in dividends, the precise nature of the adjustment depends on both an individual company's pattern of growth during the calendar year and an individual company's required return (and hence reinvestment income in the risk class).

In this work, !D.sub.1^ is calculated as !D.sub.0^ (1 + g). The full g adjustment is a crude approximation to adjust for both growth and reinvestment income. For example, if one expected dividends to have been raised on average, six months ago, a "1/2 g" adjustment would allow for growth, and the remaining "1/2 g" would be justified on the basis of reinvestment income. Any precise accounting for both reinvestment income and growth would require tracking each company's divided change history and making explicit judgments about the quarter of the next change. Since no organized "market" forecast of such a detailed nature exists, such a procedure is not possible. To get a feel for the magnitudes involved, during the sample period the divided yield (!D.sub.1^/!P.sub.0^ and growth (market value weighted) for the S&P 500 were typically

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4% to 6% and 11% to 13%, respectively. As a result, a "full g" adjustment on average increases the required return by 60 to 70 basis points (relative to no g adjustment).

8 For other efforts using expectational data in the context of the two-parameter CAPM, see Friend, Westerfield, and Granito !10^, Cragg and Malkiel !7^, Marston, Crawford, and Harris !19^, Marston and Harris !20^, and Linke, Kannan, Whitford, and Zumwalt !16^. For a more complete treatment of the subject, see Marston and Harris !20^ from which we draw some of these results. Marston and Harris !20^ also investigate the role of unsystematic risk and the difference in estimates found when using expected versus realized returns.

9 Firms for which the standard deviation of individual FAF exceeded 20 in any month were excluded since we suspect some of these involve errors in data entry. This screen eliminated very few companies in any month. The 1982-1987 period was chosen due to the availability of data on betas.

10 The smaller coefficients on beta using individual stock portfolio returns are likely due in part to the higher measurement error in measuring individual stock versus portfolio betas.

11 Estimation difficulties confound precise interpretation of the intercept as the risk-free rate and the coefficient on beta as the market risk premium (see Miller and Scholes !21^, and Black, Jensen, and Scholes !2^). The higher than expected intercept and lower than expected slope coefficient on beta are consistent with the prior studies of Black, Jensen, and Scholes !2^, and Fama and MacBeth !9^ using historical returns. Such results are consistent with Black's !1^ zero beta model, although alternative explanations for these findings exist as well (as noted by Black, Jensen, and Scholes !2^).

12 Ordinary least squares regressions showed severe positive autocorrelation in many cases, with Durbin Watson statistics typically below one. Estimation used the Prais-Winsten method. See Johnston !14, pp. 321-325^.

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