PARKER CENTER
FOR INVESTMENT RESEARCH

Working Paper Series
98-6

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William R. Gebhardt
Cornell University

Charles M.C. Lee
Cornell University

Bhaskaran Swaminathan
Cornell University

Preliminary Draft: November 4, 1998
Current Draft: January 8, 1999

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UNIVERSITY
Johnson Graduate School
of Management

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By

William R. Gebhardt*
Johnson Graduate School of Management
Cornell University, Ithaca, NY 14853

Charles M. C. Lee
Johnson Graduate School of Management
Cornell University, Ithaca, NY 14853

Bhaskaran Swaminathan
Johnson Graduate School of Management
Cornell University, Ithaca, NY 14853

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*Email addresses for the authors are: WRG4@cornell.edu, CL86@cornell.edu, and BS30@cornell.edu, respectively. We thank workshop participants at the 1998 Financial, Economics and Accounting Conference for helpful comments. Analyst forecast information was provided by I/B/E/S Inc.

Toward an Ex Ante Cost-of-capital

Abstract

We use a discounted residual-income valuation model to compute an ex-ante cost-of-capital for a large sample of U.S. stocks that are covered by I/B/E/S analysts. We show that the ex ante cost-of-capital computed in this manner is correlated with a firm's degree of leverage, market liquidity, information environment, and earnings variability. Specifically, the market demands a higher risk premia for stocks with high book leverage and market leverage, low dollar trading volume or market capitalization, low analyst coverage, and more volatile (less predictable) earnings. The market also demands a higher risk premia for stocks with high book-to-market ratios and low price momentum. Traditional market risk proxies such as beta and return volatility are not significantly correlated with the ex ante cost-of-capital.

1. Introduction

Tests of asset pricing theory call for ex ante, or expected, cost-of-capital measures. However, academic studies have generally used ex post (realized) returns to estimate cost-of-capital and to test asset pricing models.[1] The widespread use of ex post mean returns is necessitated by the fact that expected returns are not observable. Moreover, in an efficient market where risk is appropriately priced, the average ex post realized returns should be an *unbiased* estimator of expected returns of firms.

Unfortunately, cost-of-capital estimates derived from ex post returns have proven disappointing in many regards. For example, after extensive testing of CAPM and three-factor based industry costs of capital, Fama and French (1997) conclude that these cost-of-capital estimates are "unavoidably imprecise." They identify three potential problems with ex post risk premia measures: 1) difficulties in identifying the right asset pricing model, 2) imprecision in the estimates of risk loadings, and 3) imprecision in the estimates of factor risk premia. In their tests, these problems lead to market equity premium estimates that range from less than zero to more than 10% (using a confidence band of +/- two standard errors).[2]

In this study, we use a discounted residual income valuation model to estimate ex ante cost-of-capital for a large sample of firms covered by I/B/E/S analysts between 1979-1995.[3] We define this ex ante cost-of-capital as the internal rate of return (IRR) that equates the current stock price to the present value of all future cash flows to common shareholders. In other words, we compute the discount rate the market implicitly uses to discount the expected future cash flows of the firm. We then examine the relation

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[1] We include in this literature the extensive work done on testing the CAPM and APT models (see Fama, 1991), as well as recent work by Fama and French (1992) using an "empirically inspired" three-factor model.

[2] One consequence of these measurement problems is that the ex post risk premium is also extremely sensitive to the historical time period over which it is estimated. For example, date from Ibbotson Associates shows that the average equity risk premium over long-term government bonds over the past 30 years (1967-96) is 4.9%, whereas it is 7.3% if measured over the sixty-year period since 1926.

[3] The residual income or economic profit model is algebraically equivalent to the dividend discount model in infinite horizons. As discussed later, we employ this model because it offers a new method for estimating long-term earnings, using a return-on-equity (ROE) "fade" toward the industry median.

between these implicit discount rates and a large number of firm characteristics that have either been suggested as risk proxies, or are associated with ex post average returns.[4]

Financial practitioners have long used different versions of discounted cash flow models to infer ex ante cost-of-capital from the current stock price.[5] More recently, several academic studies have used an ex ante cost-of-capital estimated from current stock price and the residual income model to examine various issues. For example, Botosan (1997) finds some weak evidence of a negative relationship between corporate disclosure and a firm's cost-of-capital. However, her cross-sectional results are based on a limited sample of 122 firm-years. Claus and Thomas (1998) use an ex ante cost of equity measure to examine the intertemporal variations in the aggregate market risk premia and show that the ex ante equity risk premium in U.S over 1979-95 is much lower than that computed from historical realized returns.

None of these studies examine the cross-sectional relation between cost-of-capital and various firm risk characteristics. Nor have the ex ante cost-of-capital estimates been subjected to the same type of detailed cross-sectional analysis as the ex post estimates. Indeed, we are aware of no study that provides large-sample evidence on how the ex ante risk premia relate to various firm characteristics – such as beta, liquidity, leverage, analyst coverage, earnings variability, the book-to-market ratio (B/P), firm size, and others. While we know a great deal about the firm characteristics that are associated with ex-post mean returns, we know very little about firm characteristics that are related to the ex ante risk premium.

As an exploratory study, our research goals are descriptive rather than prescriptive. Our main goal is to document which risk and non-risk firm characteristics are related to the market's perception of ex ante risk and perhaps offer some insights as to why. We do not

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[4] In all our tests, we use the ex-ante risk premium defined as the difference between the ex-ante cost-of-capital and the risk-free rate. Therefore, we use the term cost-of-capital and risk premium interchangeably.

[5] A quick survey of practitioner-oriented publications reveal a number of references to ex ante cost-of-capital estimates. For example, Madden (1998), Damodaran (1994), Ibbotson (1996), Gordon and Gordon (1997), Pratt (1998). Most of these sources use a either a Gordon constant-growth model or a multi-stage

assume that the market price is correct. Nor do we suggest that the ex ante cost-of-capital we compute should be used in lieu of cost-of-capital computed from historical realized returns. Rather, our objective is to provide a set of empirical results that helps link the practitioner literature on ex ante cost-of-capital to the academic literature on the determinants of expected returns. In so doing, we hope to better understand the market's perception of risk, and how much this perception varies across firms and industries.

Our initial findings are encouraging. Confirming the work of Claus and Thomas (1998), we find that the ex ante risk premium on the market during 1979-95 is much lower than the ex post risk premium. In addition, we show that the ex ante risk premia are more stable than ex post measures. This stability is observed over time, across different industries, and across various firm characteristics. The market appears to consistently ascribe a higher discount rate to the cash flows of certain firms and industries over those of others. These patterns are much more attenuated, or are non-existent, when we use ex post mean returns.

We find that certain firm characteristics are consistently associated with higher ex-ante cost-of-capital. Specifically, the ex ante risk premium is higher for firms with greater leverage, lower liquidity, lower analyst coverage, smaller market capitalization, greater absolute earnings forecast errors, and more variable earnings streams. These results imply that market participants regard a firm's degree of leverage, market liquidity, information environment, and the variability (predictability) of its earnings stream as relevant factors in establishing discount rates for its expected cash flows. Our results on analyst coverage, earnings variability and earnings predictability are consistent with theoretical studies (e.g., Glosten and Milgrom (1985) and Diamond and Verrecchia (1991)) in which increased disclosure reduces investors' transaction costs. Our results also establish an empirical link between cost-of-capital and market liquidity, as predicted by Copeland and Galai (1983).

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dividend discount model. Madden (1998) uses a CFROI-based model, which is closest in spirit to our valuation model.

Interestingly, we find no significant positive correlation between a firm's pre-ranking beta and its ex ante risk premium.[6] In fact, we find that the market uses a slightly larger discount rate for firms with lower betas.[7] Nor do we find a significant correlation between return volatility (pre-ranking standard deviation of daily returns) and ex ante risk premium. These results suggest that market participants do not consider beta or daily volatility as significant risk proxies when discounting a firm's expected cash flows.

We also examine the relation between ex ante risk premium and various market pricing anomaly variables, such as the book-to-market ratio (B/P), price momentum in the past six months, and the mean long-term growth rate from analyst earnings forecasts (Ltg) (see La Porta, 1996). These variables are not nominated by risk theory, per se, but prior empirical studies have found them to be correlated with subsequent realized returns. We find that the book-to-market ratio is positively correlated with the ex-ante risk premium, while the long-term growth rate and price momentum are negatively correlated with the ex-ante risk premium. Since low B/P stocks, high long-term growth stocks, and high price momentum stocks are all known to be over-valued based on ex-post return studies, they tend to have lower cost-of-capital.

We also examine the variation of ex ante cost-of-capital across 48 industries. In general, the industry risk premium estimated using the ex ante approach is much less variable than the risk premia obtained with historical realized returns. The dispersion of risk premia for each industry *across time,* as well as the dispersion of risk premia *across industries*, are both much lower for the ex ante measures. In other words, the range of discount rates across industries is much tighter than might be inferred from historical realized returns. As we discuss in more detail later, this evidence alone does not imply the ex ante method is superior. However, we do interpret it as an encouraging endorsement of the general approach.

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[6] Fama and French (1992) showed that there is no significant cross-sectional relationship between empirical betas and ex-post mean returns.

[7] Botosan includes Beta as a control variable in her study of the effect of accounting disclosure policies on the cost-of-capital. She reports a positive relation between beta and the ex ante risk premium. However, her sample is limited to 122 firms in a single year (1990). Our most restricted sample includes more than 10,000 firm-years.

Finally, we examine the ability of a combination of firm characteristics to explain cross-sectional differences in the ex ante risk premium. We find that our set of 14 explanatory variables can explain a large percentage of the cross-sectional variation in the ex ante risk premia. Using percentile rankings of the same explanatory variables, we find the adjusted r-squares to be in the range of 25 to 56 percent. The R-squares are even higher for raw or log-scaled regressions (not reported). These cross-sectional results are robust over time, suggesting that much of the cross-sectional variation in implied discount rates are captured by these firm characteristics.

Our computation of ex ante cost-of-capital suffers from a potentially important measurement error. Our discounted residual income model is implemented with a fixed forecast horizon for all firms. For the results reported here, we use a 12 year forecast horizon, plus a terminal value at the end of the twelfth year. If the 12-period expansion is too short for growth firms, and too long for mature firms, then our implementation could systematically underestimate the cost of capital of growth firms and overestimate the cost of capital of mature firms. As a result, growth firms, and firms for whom a greater proportion of market value depends on future cash flows, will appear to have a lower cost-of-capital while mature firms will appear to have a higher cost-of-capital.

We address this potential problem in several ways. First, we include the mean long-term earnings growth rate from I/B/E/S (Ltg) and the book-to-market (B/P) ratio in cross-sectional regressions. As discussed earlier, our results are robust to the inclusion of Ltg and B/P. We have also estimated the ex ante cost-of-capital from discounted residual income model implementations involving 6, 9, 15, 18 and 21 periods. The results, not reported in the paper, are very similar. Finally, we form five portfolios based on long-term growth and examine the relation between our *ex ante* cost of capital measure and various firm characteristics within each long-term growth portfolio. The results once again suggest that the key results of the paper are unlikely to be driven by this measurement error.

The remainder of the paper is organized as follows. In Section 2, we briefly describe the approaches that are available to test multi-factor asset pricing models and highlight the approach adopted by us. In Section 3, we discuss the residual income valuation model used to compute the implied risk premium. Section 4 describes the data and motivates and describes the various firm characteristics used in the study. Section 5 reports our empirical findings and Section 6 concludes.

2. Empirical Asset Pricing Methodology

In its most general form, an asset pricing model typically begins by assuming that asset returns are described by a linear multi-factor model. For example, the arbitrage pricing theory (APT) (see Ross (1976)) assumes the following (we suppress the time subscripts for ease of notation):

$$r_i = a_i + \sum_{j=1}^{N} \beta_{ij} F_j + u_i \tag{1}$$

where r_i is the realized return on asset *i*, F_j , j=1,..N are orthogonal zero-mean systematic risk factors, u_i is the zero-mean idiosyncratic error term, and β_{ij} is asset *i*'s factor loading (beta) with respect to factor F_j.

If asset returns follow the linear factor structure given in (1), then under the *no risk-free arbitrage* condition (and some other fairly general conditions), the expected return on the risky asset, according to APT, is given by:[8]

$$E(r_i) = \lambda_o + \sum_{j=1}^{N} \beta_{ij} \lambda_j \tag{2}$$

where λ_0 is the expected return on a zero-beta portfolio and λ_j is the factor risk premium corresponding to factor *j*. If there is a risk-free asset in the economy then λ_0 is the return on this asset, i.e., $\lambda_0=r_f$.

In general, empirical tests of the asset pricing relationship in equation (2) involve the following steps (see Fama and MacBeth (1973)): (a) identify the systematic risk factors

[8] This is the unconditional version of APT. The conditional version is similar except that all the expectations, factor loadings and risk premia are conditional on current period's information set.

in equation (1), (b) estimate the factor loadings through time-series regressions of portfolio returns on the risk factors, (c) estimate the factor risk premia in equation (2) from cross-sectional regressions of *ex-post* mean returns on estimated factor loadings, and (d) evaluate whether the factors are priced by testing whether factor risk premia are significantly different from zero.

One way to identify the common risk factors is to use statistical techniques such as factor analysis or asymptotic principal components analysis (see Roll and Ross (1980), Lehmann and Modest (1988), and Conner and Korajczyk (1988)). The disadvantage of these approaches is that the statistical factors have very little economic content and there is very little agreement on the number of relevant factors. A more economically intuitive approach is to use macroeconomic variables that are most likely to affect stock prices as proxies of common risk factors (see Chen, Roll, and Ross (1986)). A final way to identify common "risk" factors is to rely on security market regularities such as the size or the book-to-market effect (see Fama and French (1993)). Once the common risk factors are identified, the factor loadings are estimated from time-series regressions and second-stage cross-sectional regressions are performed.

An alternate approach to testing asset pricing models is to skip steps (a) and (b) and go to step (c) directly. Rather than identifying factor loadings from time-series regressions, this approach assumes that the factor loadings are a linear combination of firm characteristics such as beta, firm size, book-to-price, trading volume, etc (see Rosenberg (1974), Fama (1976) and Fama and French (1992)). Therefore, ex post mean stock returns are directly regressed on these firm characteristics to determine if the firm characteristics are priced. Using this approach, Fama and French (1992) investigate the power of several firm characteristics such as (size, book-to-market, leverage, beta, etc.) to explain the cross-sectional differences in stock returns. They find that a two-characteristic model involving firm size and book-to-market ratio is sufficient to explain the cross-section of U.S. stock returns. More recently, Brennan, Chordia, and Subrahmanyam (1998) have also used this approach to examine the role of risk and non-risk firm characteristics in explaining cross-sectional mean returns.

To sum up, much of the work in this line of research has focused on the right-hand-side of equation (2). Extensive efforts have been made to better identify risk factors and estimate the appropriate factor loadings on these factors. In contrast, very little work has been done to improve empirical estimates of the left-hand-side of the equation. In virtually all of these studies, the empirical proxy for the expected return on the risky asset (i.e., the risk premium) has been the ex post mean of realized returns.

In this paper, we use a forward-looking cost of capital measure estimated from a discounted cash flow model as a proxy for expected returns. This approach has some potential advantages. First, it is closer to the spirit of the original asset pricing models, which call for expected returns rather than ex post realized returns. Second, valuation theory shows that realized rates of return will, by their nature, be an order of magnitude more volatile than ex ante required rates of return. This is because, in the context of discounted cash flow models, a small change in expected return can have a much larger effect on realized returns. As a result, even if they are unbiased, mean realized returns will be inherently noisy.

Our approach is similar to Fama and French (1992) in that we relate mean returns directly to firm characteristics. However, rather than ex post mean returns, we use an implied cost of capital based on a discounted residual income valuation model. Given the limited progress that has been made using historical realized returns, we believe the ex ante approach merits further investigation. In the next section, we describe in detail the methodology we use to estimate the ex ante cost of capital.

3. Methodology for Estimating the Ex ante Cost-of-capital

We compute the ex ante cost-of-capital (equity) for each firm as the internal rate of return that equates the present value of all future cash flows to the current stock price. This requires forecasting cash flows up to a terminal period and the determination of an appropriate terminal value at the terminal period to capture the value of cash flows beyond the terminal period. We implement this procedure using a version of the discounted cash flow model referred to as the *residual income model* to compute the ex ante cost-of-capital.[9] The residual income model is algebraically equivalent to the familiar dividend discount model, but provides better intuition on the role of economic profits on stock valuation. We now derive the residual income model from the dividend discount model.

According to the dividend discount model, the stock price is the present value of its expected future dividends (free cash flows to equity) based on all currently available information. Therefore:

$$P_t = \sum_{i=1}^{\infty} \frac{E_t(D_{t+i})}{(1+r_e)^i} \tag{3}$$

where P_t is the current stock price, $E_t(D_{t+i})$ is the expected future dividends for period $t+i$ conditional on information available at time t, and r_e is the cost of equity capital based on the information set at time t. This definition assumes a flat term-structure of discount rates. It is not difficult to show that, as long as a firm's earnings and book value are forecast in a manner consistent with "clean surplus" accounting,[10] the stock price defined in equation (1) can be rewritten as the reported book value, plus an infinite sum of discounted residual income (economic profits):

$$\begin{aligned} P_t &= B_t + \sum_{i=1}^{\infty} \frac{E_t[NI_{t+i} - r_e B_{t+i-1}]}{(1+r_e)^i} \\ &= B_t + \sum_{i=1}^{\infty} \frac{E_t[(ROE_{t+i} - r_e)B_{t+i-1}]}{(1+r_e)^i} \end{aligned} \tag{4}$$

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9 The model is sometimes referred to as the Edwards-Bell-Ohlson (EBO) valuation equation. Recent implementations of this formula are most often associated with the theoretical work of Ohlson (1991, 1992, 1995) and Feltham and Ohlson (1995). Earlier theoretical treatments can be found in Preinreich (1938), Edwards and Bell (1961), and Peasnell (1982). Lee (1996) discusses implementation issues and the link to Economic Value Added (EVA) as proposed by Stewart (1991). Recent papers that empirically implement the residual income model include Bernard (1994), Abarbanell and Bernard (1995), Penman and Sougiannis (1997), Frankel and Lee (1997, 1998), Lee, Myers and Swaminathan (1998) and Dechow et al. (1997).

10 Clean surplus accounting requires that all gains and losses affecting book value are also included in earnings; that is, the change in book value from period to period is equal to earnings minus net dividends ($b_t = b_{t-1} + NI_t - D_t$).

where B_t = book value at time t

$E_t[.]$ = expectation based on information available at time t

NI_{t+i} = Net Income for period $t+i$

r_e = cost of equity capital

ROE_{t+i} = the after-tax return on book equity for period $t+i$

Note that this equation is identical to the dividend discount model, but expresses firm value in terms of accounting numbers. Therefore, equation (4) relies on the same theory and is subject to the same theoretical limitations as the dividend discount model. We now discuss the empirical implementation of the residual income model to compute the ex ante cost of equity.

3.1 Forecast horizons and Terminal values

Equation (4) expresses firm value in terms of an infinite series, but for practical purposes, an explicit forecast period must be specified. This limitation necessitates a "terminal value" estimate -- an estimate of the value of the firm based on the residual income earned after the explicit forecasting period. We use a two-stage approach to estimate the intrinsic value: 1) forecast earnings explicitly for the next three years, and 2) forecast earnings beyond year three implicitly, by linearly fading the period $t+3$ ROE to the median industry ROE by period $t+T$. By using a "fade rate," we attempt to capture the long-term erosion of abnormal ROE over time. The terminal value beyond period T is estimated by computing the present value of period T residual income as a perpetuity. This does not imply that earnings or cash flows do not grow after period T rather that any incremental economic profits (those from net new investments) after year T are zero. In other words, any growth in earnings or cash flows after year T is value neutral.[11] Specifically, we compute the following finite horizon estimate for each firm:[12]

[11] As a result, the overall ROE for the entire firm (not the incremental ROE on new investments) would decline slowly over time to the cost of equity.

[12] The equation for T=3 can be re-expressed as the sum of the discounted dividends for two years and a discounted perpetuity of period-3 earnings, thus eliminating the need for the current book value in the formulation.

$$P_t = B_t + \frac{FROE_{t+1} - r_e}{(1 + r_e)} B_t + \frac{FROE_{t+2} - r_e}{(1 + r_e)^2} B_{t+1} + TV \qquad (5)$$

where:

B_t = book value from the most recent financial statement divided by the number of shares outstanding in the current month from I/B/E/S

r_e = the cost of equity (discussed below)

$FROE_{t+i}$ = forecasted ROE for period $t+i$. For the first three years, this variable is computed as $FEPS_{t+i}/B_{t+i-1}$, where $FEPS_{t+i}$ is the I/B/E/S mean forecasted EPS for year $t+i$ and B_{t+i-1} is the book value per share for year $t+i$-1. Beyond the third year, *FROE* is forecasted using a linear fade-rate to the industry median ROE.

B_{t+i} = B_{t+i-1} + $FEPS_{t+i}$ - $FDPS_{t+i}$, where $FDPS_{t+i}$ is the forecasted dividend per share for year $t+i$, estimated using the current dividend payout ratio (k). Specifically, we assume $FDPS_{t+i} = FEPS_{t+i} * k$.

For any horizon T, The terminal value calculation is given below:

$$TV = \sum_{i=3}^{T-1} \frac{FROE_{t+i} - r_e}{(1 + r_e)^i} B_{t+i-1} + \frac{FROE_{t+T} - r_e}{r_e (1 + r_e)^{T-1}} B_{t+T-1} \qquad (6)$$

For the results reported in this paper, we forecast cash flows up to 12 future years and estimate a terminal value TV for cash flows beyond year 12 (T=12). However, we have also computed ex ante cost-of-capital using T=6, 9, 15, 18 or 21 and the cross-sectional results are very similar. To compute a target industry ROE, we group all stocks into the same 48 industry classifications as Fama and French (1997). The industry target ROE is a moving median of past ROEs from all firms in the same industry. At least five years, and up to ten years, of past data are used to compute this median.

3.2 Explicit Earnings forecasts

W use data from I/B/E/S to obtain earnings forecasts for the next three years. I/B/E/S analysts supply a one-year-ahead ($FEPS_{t+1}$) and a two-year-ahead ($FEPS_{t+2}$) EPS forecast, as well as an estimate of the long-term growth rate (*Ltg*). We use the mean one- and two-year-ahead EPS forecasts ($FEPS_{t+1}$ and $FEPS_{t+2}$). In addition, we use the long-term growth rate to compute a three-year-ahead earnings forecast: $FEPS_{t+3} = FEPS_{t+2} (1+ Ltg)$.[13] These earnings forecasts, combined with the dividend payout ratio, allow us to generate explicit forecasts of future book values and ROEs, using clean-surplus accounting.

3.3 Matching book value to I/B/E/S forecasts

I/B/E/S provides monthly consensus forecasts as of the third Thursday of each month. To ensure their forecasts are current, I/B/E/S "updates" (that is, "rolls forward" by one year) the fiscal year-end of all their forecasts in the month that the actual annual earnings are announced. For example, a December year-end firm may announce its annual earnings in the second week of February. In response to the announcement, I/B/E/S forecasts for that month will be moved to the next fiscal year. This ensures that the one-year-ahead forecast is always available for the next unannounced fiscal year-end.

A particular problem arises when I/B/E/S has updated its forecast, but the company has not yet released its annual reports. Because earnings announcements precede the release of financial statements, book value of equity for the fiscal year just ended may not be available when I/B/E/S updates its forecasting year-end. To ensure that our value estimates are based only on publicly available information, we create a synthetic book value using the clean surplus relation. Specifically, from the month of the earnings announcement until four months after the fiscal year end, we estimate the new book value using book value data for year t-1 plus earnings minus dividends ($B_t = B_{t-1} + EPS_t - D_t$). From the fourth month after the fiscal year end until the following year's earnings forecast is made, we use the actual reported book value from Compustat.

3.4 Dividend payout ratios

To compute book values, the model calls for an estimate of the expected proportion of earnings to be paid out in dividends. We estimate this ratio by dividing actual dividends

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13 Prior to 1981, I/B/E/S does not report *Ltg*. When this variable is missing, we use the composite growth rate implicit in FY1 and FY2 to forecast FY3.

from the last fiscal year by earnings over the same time period. We exclude share repurchases due to the practical problems associated with determining the likelihood of their recurrence in future periods. For firms experiencing negative earnings, we divide the dividends paid by (0.06*total assets) to derive an estimate of the payout ratio.[14] Payout ratios of less than zero (greater than one) are assigned a value of zero (one). We compute future book values using the dividend payout ratio and earnings forecasts as follows: $B_{t+1} = B_t + NI_{t+1}(1 - k)$, where k is the dividend payout ratio.

3.5 Examples

Appendices A and B provide a more detailed illustration of the valuation model for two firms. We deliberately chose two firms with strikingly different ex-ante cost of equity. The computation in Appendix A shows that currently the market uses a discount rate of approximately 13% for General Motors (GM). Conversely, Appendix B shows that the market uses a discount rate of around 5.13% for Johnson and Johnson (JNJ). The current yield on 10-year government bonds is 4.76%. Hence the market risk premium for GM is 8.23% while the corresponding risk premium for JNJ is 0.37%. Historically, the ex ante risk premium for pharmaceuticals has always been much lower than for automotive stocks. For example, Table III shows that the average risk premium for pharmaceuticals ("Drugs") is only 1.75%, while it is 4.31% for automotive stocks.

4. Data and Sample Description

Our original sample of firms consists of all domestic companies in the intersection of (a) the NYSE and AMEX return files from the Center for Research in Security Prices (CRSP) and (b) a merged COMPUSTAT annual industrial file, including PST, full coverage and research files. We require firms to meet the COMPUSTAT data requirements (for book values, earnings, dividends, and long-term debt) and have the necessary CRSP stock prices, trading volume, and shares outstanding information. Furthermore, we require firms to have a one-year-ahead and a two-years-ahead earnings-per-share (EPS) forecast from I/B/E/S. The I/B/E/S availability requirement limits our

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14 The long-run return-on-total assets in the United States is approximately six percent. Hence we use six percent of total assets as a proxy for normal earnings levels when current earnings are negative.

sample time period to 1979-95. The total number of firms in the sample varies from around 1000 in 1979 to around 1300 in 1995. Not all firms have all variables available. The number of firms for each variable in each year is reported in Panel A of Table 1.

We estimate the IRR for each firm at the end of June each year by inputting the forecasted future earnings, book values, and terminal values into equation (5) and solving the resulting non-linear equation. We then subtract the end-of-month yield on long-term (10-year) Treasury bonds from the IRR measure to obtain an (annualized) ex-ante risk premium for each firm in the sample.

4.1 Risk and Firm Characteristics

In this subsection, we describe the various risk and firm characteristics that we use in our cross-sectional analysis. We use 14 firm characteristics, which can be grouped into five categories: 1) market volatility, 2) leverage, 3) liquidity and information environment, 4) earnings variability, and 5) other pricing anomalies. We make sure that all firm characteristics are computed based on data available prior to June 30 of each year.

4.1.1 Market Volatility

The Capital Asset Pricing Model (CAPM) nominates a firm's systematic risk, as measured by its market beta. According to the CAPM, a stock's market beta should be positively correlated with its cost-of-equity. Second, some prior studies suggest a positive relation between a firm's future returns and its idiosyncratic risk, as measured by its return standard deviation (see Malkiel (1997)). Therefore, we include the standard deviation of total returns as a proxy of the idiosyncratic risk. The market beta of the stock is estimated based on a five-year rolling regression using monthly data and the value-weighted CRSP (NYSE/AMEX) index as the market proxy. We use the average standard deviation of the previous year's daily returns as a proxy of the idiosyncratic risk. At the individual security level, the standard deviation of daily returns, even though it includes systematic components, is likely to be a reasonable proxy of idiosyncratic risk.

4.1.2 Leverage

In theory, a firm's cost-of-equity should be an increasing function of the amount of debt in its capital structure. Using an extensive data set of historical returns, Fama and French (1992) document a weak positive relation between leverage and ex post mean stock returns. However, the relation between leverage and ex ante risk premia has not been examined. We use two measures of firm leverage: 1) D/B, the ratio of total long-term debt to total book value of equity from the most recent fiscal year end, and 2) D/M, the ratio of total long-term debt from the last fiscal year end to the total market value of equity as of the portfolio formation date (June 30th).

4.1.3 Information Environment and Liquidity

We hypothesize that the investment risk of a firm increases when information about a firm is more difficult to obtain. Because information is more easily available for larger firms than for smaller firms, we use firm size (market capitalization of equity) as one proxy for the availability of information. In addition, Brennan, Jegadeesh and Swaminathan (1993) report that stocks with greater analyst coverage react faster to market-wide common information compared to those with less analyst coverage. Therefore, we use number of analysts as another proxy of availability of information. Specifically, we expect larger firms and firms with greater analyst coverage to have a lower cost-of-capital.

Amihud and Mendelson (1986) suggest that cross-sectional differences in liquidity affect expected returns. The extant literature suggests several possible proxies for liquidity. Brennan and Subrahmanyam (1995) document that stocks with greater analyst coverage have greater market depth. Also, smaller firms are generally more illiquid. Indeed, size and number of analysts, which were included as proxies of information availability, may also proxy for illiquidity. In addition, Brennan, Chordia, and Subrahmanyam (1998) show that average dollar trading volume is negatively correlated with future returns and report that the size effect is attenuated in the presence of this trading volume measure.[15]

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[15] We have empirical measures of relative spread available for 1980-89. We find that there is a positive relationship between relative bid-ask spread and cost-of-capital. Not surprisingly we find this variable is

Therefore, we include average dollar trading volume as a direct proxy of illiquidity. This is likely to help clarify the role of firm size and number of analysts as proxies of information availability. We expect stocks with high trading volume to have lower cost-of-capital.

4.1.4 Earnings Variability

Financial practitioners often regard the variability of reported earnings as a source of risk for firm valuation (e.g., Madden (1998)). In addition, earnings variability is likely to capture fundamental cash flow risk. However, we know of no large sample academic study relating earnings variability to cost-of-capital. Our goal is to examine the extent to which such a relation exists. We use three empirical constructs to capture the variability of a firm's earning stream:

a) *MSE of Forecasts* – the average mean squared error of the last five annual I/B/E/S consensus forecasts. To compute this number, we take the square of the difference between the mean FY1 estimate and the realized earnings (from I/B/E/S) for each of the past five years. We average these squared errors, and divide it by the average earnings per share over the past five years. This variable captures a firm's proclivity to report earnings that surprise the analysts. By squaring the errors, we place more weight on large deviations from analyst expectations.
b) *Earnings Variability* – this number is simply the coefficient of variation of annual earnings over the past five years. It is computed as the standard deviation of annual earnings, divided by the mean over the past five years.
c) *Dispersion of Analyst Forecasts* – this is coefficient of variation of the current FY1 forecast as of the June statistical period. It captures the dispersion of analyst earnings forecasts for the current fiscal year.

4.1.5 Other Pricing Anomalies

We also include four variables that have been associated with cross-sectional expected returns in prior studies. These variables are not nominated by risk theory, per se, but

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highly (negatively) correlated with firm size. In multivariate regressions, bid-ask spread does not do as well in the presence of firm size.

prior empirical studies show they correlated with ex post mean returns. The variables are:

a) *Long Term Growth in Earnings (Ltg)* – this variable is the mean long-term earnings growth rate from I/B/E/S, if available.[16] We include this variable for two reasons. First, La Porta (1996) show that high (low) Ltg firms earn lower (higher) subsequent returns. He attributes this to analyst over-optimism in the higher Ltg firms. If high (low) Ltg firms tend to have over (under) stated earnings forecasts, we should expect a negative correlation between Ltg and ex ante cost-of-capital. Second, if our valuation model understates the expected cash flow of growth (high Ltg) firms, then these firms will appear to have lower implied discount rates. This effect would also lead to a negative relation between Ltg and the ex ante risk premium.

b) *Book/Market (B/M)* – Fama and French (1992), among others, show that high B/M firms earn higher ex post returns than low B/M firms. They hypothesize that high B/P firms must face a higher level of distress risk. We test directly for a relation between ex ante risk and the B/M ratio.

c) *Price Momentum* – This variable is a stock's past six-month returns and is based on Jegadeesh and Titman (1993)'s price momentum effect. Specifically, they find that past winners (ranked on the basis of returns over the past 3 to 12 months) earn substantially higher returns than past losers over the next 3 to 12 months. Fama and French (1996) find that this phenomenon cannot be explained by a three-factor risk model. On the other hand, Conrad and Kaul (1998) argue that past winners are firms that have become riskier over time and deserve a higher return. If Conrad and Kaul are correct, we should expect to see a positive relation between our price momentum variable and the ex ante risk premium.

d) *Turnover* – Lee and Swaminathan (1998) find that average daily turnover (defined as daily shares traded divided by daily shares outstanding) provides information on the level of investor neglect or attention in a stock and, therefore, on whether a stock is undervalued or overvalued. Unlike average dollar trading volume, the average daily

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[16] We use the ratio of FY2 to FY1 if Ltg is not available. In that case, we eliminate firms where FY1 or FY2 is negative.

turnover is not highly correlated with firm size (11.5% rank correlation). We include this variable as an additional pricing anomaly in our analysis.

4.1.6 Preliminary Statistics

Panel A of Table I reports the number of firms in our sample for each year from 1979 to 1995 for each variable of interest. For most variables, we have more than 1,000 firms per year. For our univariate tests, we use the largest possible sample of firms. However, five prior years of data is needed to estimate the MSE of earnings forecasts and the variance of reported earnings. For these variables, and for our multivariate analyses, we use the more restricted sample, which is only available from 1984 to 1995.

Panel B of Table I reports the median value for each variable by year. In the last column, we also report the mean ex ante risk premium. We also report the historical risk premium computed by averaging ex post excess returns for purposes of comparison. The historical risk premium is computed as follows. For each portfolio, each year, the annual excess return (in excess of returns on long-term Treasury bonds) for the 12 month period following the portfolio formation month (June of every year) is computed. The annual excess returns are averaged from 1980 to 1996 and reported as historical risk premia. The reported historical risk premia is cumulative, in that it incorporates all past years. Recall, that the ex ante risk premium is the IRR that equates the EBO value to the June 30th stock price, minus the ex ante yield on the 30-year treasury bond on June 30th. This number is not cumulative, and reflects market expectations as of June 30th each year. The other variables are computed as described earlier.

The last row of Panel B shows that the average historical risk premium for our sample of relatively large firms over the 1979 to 1995 period is 6.2%. The average ex ante risk premium over the same time period is between 2 and 3 percent depending on whether we are averaging cross-sectional means or medians. The results confirm the Claus and Thomas (1998) finding that ex ante risk premium for the market is significantly lower than estimates obtained using ex post returns.

5. Empirical Results

5.1 Univariate Results

Table II reports univariate results of the relationship between various risk and firm characteristics and ex ante risk premium. Specifically, we form five portfolios each year based on each firm characteristic and compute the mean and median cost-of-capital for firms in each portfolio. We then compute a time-series average of cross-sectional means and medians and report a Newey-West (1987), autocorrelation corrected, t-statistic for the difference in risk premia across the two extreme portfolios, Q1 and Q5.

Panel A presents results for market beta and standard deviation of daily returns. These results indicate the absence of a positive relationship between market beta and ex ante cost-of-capital. It appears that investors do not require higher (or lower) expected returns to hold high (or low) beta stocks. In fact, based on differences in the mean ex ante risk premia, the evidence seems to suggest that investors require higher expected returns to hold lower beta firms. Similarly, we find no significant correlation between the implied cost-of-capital and standard deviation of stock returns. The differences in historical risk premia across extreme beta or standard deviation portfolios, Q5-Q1, are also small and insignificant, confirming the findings of Fama and French (1992). Overall, the evidence suggests that investors do not pay much attention to traditional market-based proxies of risk in pricing stocks.

Panel B presents evidence on the relation between leverage and ex ante cost-of-capital. The book leverage measure, D/B, and the market leverage measure, D/M, both exhibit a significant positive relation with implied risk premium, although the relation between market leverage and implied cost-of-capital is much stronger. The difference in median risk premia across Q1 and Q5 firms is 1.11% per annum for book leverage and 3.02% per annum for market leverage. These differences are both economically and statistically significant and suggest that investors demand higher risk premia for firms with higher leverage. These results are consistent with the predictions of Modigliani and Miller (1958) that cost-of-equity increases with leverage. The differences in historical risk premia between the extreme leverage portfolios, Q5 and Q1, have the opposite sign and are not statistically different.

Panel C summarizes evidence on information and liquidity variables. As expected, large firms, firms followed by more analysts, and firms with higher dollar trading volume, all have a lower cost-of-capital. The difference in means, Q5-Q1, for number of analysts, dollar trading volume, and firm size are -1.95%, -1.97%, and –3.57% per annum, respectively. These differences are statistically significant. The historical risk premia in the extreme quintiles have the right sign and are comparable in magnitude (-1.77%, -3.77%, and –1.96% respectively). However, they are not statistically significant. This result again highlights the lack of power inherent in tests based on ex-post returns.

Panel D reports the cross-sectional relation between the ex ant cost-of-capital and earnings variability. Results based on all three measures of earnings variability indicate that investors, ex ante, demand a higher risk premium for stocks with higher earnings variability. The difference in risk premium between the extreme quintiles ranges between 0.50% and 4.0%. Interestingly, while investors appear to demand a higher ex ante risk premium for stocks with greater earnings variability, we see that these stocks earned lower returns ex post. The difference in historical risk premium (Q5-Q1) for the three measures of earnings variability ranges from –2.5% to -4.8% per year, although they not statistically distinguishable from zero. Taken together, the evidence suggests that the market's ex ante expectations for higher earnings variability firms are not realized ex post.

Panel E presents evidence with respect to other pricing anomalies. As expected, we find that the cost-of-capital for low B/M stocks, high long-term growth stocks, or high momentum stocks, are lower. These results are not surprising because these stocks tend to be overvalued. The risk premium difference in extreme quintiles (Q5-Q1) is significant for all three mispricing characteristics. By far the biggest difference in ex ante risk premium is found across high and low B/M stocks with a mean difference 8.46% per annum. On the other hand, the difference in historical risk premium across high and low

B/M stocks is only 2.40%. This is probably because the bulk of the returns for book-to-market strategies tends to be earned in years 2 and 3 after the portfolio formation.

The difference in ex ante cost-of-capital for price momentum is –2.13% per annum while the difference in ex post risk premia for price momentum strategies is 7.77%. The results with respect to stock turnover are very interesting. Ex ante, we find no significant correlation between the cost-of-capital and turnover. It appears that investors do not pay attention to differences in turnover across stocks in setting prices. On the other hand, ex post, low turnover (neglected) stocks outperform high turnover (glamour) stocks to the tune of –3.77% per annum.

5.2 Industry Cost-of-capital

Table III presents ex ante risk premia for the 48 industry groups classified by Fama and French (1997), sorted by the mean ex ante risk premium. We compute equal-weighted average risk premium for each industry group each year, and then average the annual cross-sectional averages over time to come up with a final number. For comparison, we also provide the historical risk premium for each industry group. We also report the time-series standard error of the mean, which is useful for constructing confidence intervals around the mean.

Examining the ex ante risk premia across industries provided in column 3 of Table III, we find that the 5 industries with the highest ex ante risk premia are *Recreational Products, Tobacco Products, Banking, Computers,* and *Automobile and Truck* industries. Investors demanded risk premia of 8.38%, 7.90%, 6.27%, 5.70%, and 4.31% respectively for firms in these industries. The 5 industries with the lowest ex ante risk premia are *Real Estate, Precious Metals, Agriculture, Trading,* and *Medical Equipment* industries. Investors demanded –2.79%, -0.73%, 0.08%, 0.31%, and 0.82% risk premia respectively for these industries. The average ex ante risk premium across all industries is 2.50% during this time period. Compare this to an average risk premium of 7.16% based on ex post mean returns. The risk premium based on ex-post realized returns is about three times as large as the ex ante risk premium. Moreover, ex ante risk premia have much lower standard errors than the risk premia based on ex post realized returns.

Table III also reports industry risk premia measured relative to that of the market as a whole, where the market risk premia is an equal-weighted average of all the individual stock risk premia for a given year. The relative risk premia allow us to compute a cost-of-capital for an industry based on the current market risk premium. This two-stage technique, used by some practitioners, takes into account the intertemporal variation in the market risk premium.

5.3 Cross-Sectional Regression Tests

Table IV reports the time-series average of (cross-sectional) Spearman rank correlations computed annually among the various firm characteristics. This table shows a high degree of correlation among firm characteristics within each of the four risk categories that we discussed in Section III. For instance beta and standard deviation of daily returns are correlated at 54.2%. The number of analysts, firm size, and dollar trading volume are all highly correlated, with pair-wise rank correlations on the order of 80%-90%. Similarly, the three earnings variability variables also exhibit strong positive correlation with one another. On the other hand, correlations across the risk groups are not as high. This implies that each group of firm characteristics contains some fairly independent information about the firm.

In Table V, we examine the cross-sectional relation between our IRR measure and various firm chracteristics in a multivariate framework. To minimize the effect of outliers, we use the percentile ranking of each variable rather than the measure itself. To construct this table, firms are sorted in ascending order based on each firm characteristic and grouped into 100 portfolios. Each firm is assigned a percentile ranking based on a given characteristic. We run annual Fama-MacBeth regressions using data from 1984 to 1995. Table V reports the time-series means of the slope coefficients for each firm characteristic, and the corresponding Newey-West autocorrelation adjusted t-statistics.

This table reports multiple regression results involving various specifications. Model 1 involves all 14 firm characteristics. This model shows that approximately 56% of the total cross-sectional variance in ex ante risk premia can be explained by these 14 variables. Model 2 repeats Model 1, but omits the book-to-market variable. The other five models repeat Model 2, but sequentially omits the variables in each of the five risk categories. The last column reports the adjusted R^2 for each model. Also reported is the p-value for an F-test against model 2. In other words, we test the null hypothesis that the omission of a particular risk category does not significantly affect the explanatory power of the model.

In model 2, we drop the book-to-market (B/M) variable, because is it captured by the combination of the two leverage measures, D/B and D/M. It is easy to understand this if we take logs. Log (D/M) – Log (D/B) = Log (B/M), and the debt term, D, cancels out. Therefore, one can interpret the book-to-market effect as an effect involving differences in book leverage and market leverage. Because we retain both D/M and D/B in the regression, the adjusted R^2 drops only slightly with the omission of B/P.

Model 3 is identical to Model 2, except we drop Beta and the standard deviation of daily returns. From all 7 models, we see no reliably positive relation between beta and the ex ante cost-of-capital. In fact, there is weak evidence of a negative relation between beta and ex ante cost of equity. The results involving standard deviation of daily returns are similar. Standard deviation of daily returns only exhibit a positive relation with ex ante risk premium when the liquidity and information environment variables are omitted. Moreover, the F-statistic for Model 3 is insignificant, indicating that beta and return volatility do not play a statistically significant role in explaining ex ante risk premia.

Model 4 removes the two leverage ratios. This has a dramatic effect on the overall explanatory power of the model. While the market leverage, D/M, is positively correlated with ex ante cost of equity, in a multivariate framework, the book leverage, D/B, is negatively correlated with the cost of equity. However, the slope coefficients on D/B and D/M have approximately the same magnitude. Fama and French (1992) report a similar result in cross-sectional regressions involving ex post mean returns. The amount of market-leverage, as well as the difference between market and book leverage, are clearly important in explaining investor perceptions of investment risk.

The results involving size, analysts, and dollar trading volume are mixed. While firm size and number of analysts have the expected negative relationship with ex ante cost of equity, trading volume has a (statistically significant) positive relationship with ex ante cost-of-capital. This is in contrast to the findings of Brennan, Chordia, and Subrahmanyam (1998), who report a positive relation between firm size and ex post mean returns in the presence of dollar trading volume. We find the opposite effect with respect to ex ante cost-of-capital. However, given the level of multicollinearity, the individual coefficients need to be interpreted with caution. The F-test for Model 5 shows that, as a group, these liquidity and information environment variables contribute significantly to the explanation of ex ante risk premia.

The multivariate results concerning the three earnings variability variables are also somewhat mixed. In univariate results presented in Table II, all three variables exhibited positive correlation with the ex ante cost-of-capital. However, in the multivariate context, only the earnings forecast error variable, MSE Earnings, has the hypothesized positive relationship with the ex ante cost-of-capital. However, signs on the individual coefficients are difficult to interpret given the multicollinearity among the variables. Perhaps more telling is the F-statistic for Model 6, which is strongly significant. This result shows that, as a group, the earnings variability measures play an important role in explaining the market's perception of risk.

Finally, Model 7 presents a regression with the four pricing anomaly variables omitted. This regression shows that the variables from the four risk categories together explain approximately 52% of the ex post risk premia. The relatively small decline in total explanatory power between Model 1 and Model 7 shows that, taken as a group, the pricing anomaly variables do not play a large role in investors' perception of risk.

5.4 Measurement Errors

Now we discuss a possible measurement error problem in our computation of ex ante cost of equity. This measurement error may underestimate the cost-of-capital of growth firms and overestimate the cost-of-capital of mature firms. This is due to the use of fixed forecasting horizon for all firms in our sample. The use of 12-year forecasting period may be too short for growth firms and too long for mature firms. This would understate the value of future cash flows for growth firms and overstate the value of mature firms. This, in turn, would translate to a lower cost-of-capital for growth firms and higher cost-of-capital for mature firms. Because some of our firm chracteristics are likely to be correlated with growth chracteristics, it is possible that the observed empirical relationships are caused by measurement errors.

It is impossible to fully address this problem without knowing the correct forecast horizon for each firm in the sample. However, we attempt to deal with the problem in two ways. First, we estimate the implied cost-of-capital using forecast horizons of 6, 9, 15, 18, and 21 years and all our tests using these alternate cost-of-capital measures (not reported here) are similar. Second, to better control for growth, we form portfolios based on analyst long-term growth estimates and examine the robustness of our results within each long-term growth portfolio. The dispersion in long-term growth is likely to be much smaller within each long-term growth portfolio than across the entire sample. Therefore, this procedure is likely to minimize spurious relations induced by measurement errors.

Specifically, we perform the following exercise to directly address the measurement error problems induced by differences in growth. Each year, we form five portfolios based on analyst long-term growth estimates, with approximately equal number of firms in each portfolio. We then sub-divide each long-term growth portfolio into five portfolios based on a given firm characteristic, for instance firm size. Finally, within each long-term growth portfolio, we compute the difference in risk premia between the largest size portfolio (Q5) and the smallest size portfolio (Q1). We compute mean and median differences (Q5-Q1) for each firm characteristic and report them in Table VI, along with t-statistics to test the significance of the differences.[17]

Before we discuss the results in Table VI, we want to comment on how successful we have been in minimizing the correlation between long-term growth and each of the firm characteristics within each long-term growth portfolio. We find that within each long-term growth portfolio, the correlation between long-term growth and various firm characteristics is extremely low. The difference in Ltg across the extreme firm characteristic portfolios (Q5-Q1) is less than 0.5% for more than ¾ of the cells in the table. In no case was the difference in Ltg across extreme portfolios more than 2%. In other words, within each Ltg category, the firms in Q5 and Q1 have essentially the same forecasted long-term earnings growth rate.

The results in Table VI are generally similar to those presented in Table II. As in the prior table, we find a strong relationship between ex ante risk premia and debt-to-market equity, dollar volume, firm size, earnings forecast errors, book-to-price, and momentum. For several other variables, such as the standard deviation of daily returns, the number of analysts, and the dispersion of analyst forecasts, the correlation with ex ante risk premia is stronger among high growth firms. The results with respect to beta and debt-to-book are mixed, and it is difficult to draw any patterns in those results. However, overall, the evidence in Table VI suggests that measurement errors are unlikely to explain our earlier cross-sectional findings.

Finally, we want to point out that measurement errors are a problem only if the direction of the potential bias is the same as the direction of our results. For some of our earlier results, the bias appears to work against our findings. For instance, we find that greater earnings variability is associated with higher risk premia. This result would only be suspect only if the low risk premia firms (firms whose risk premia are biased downward) tend to be growth firms. In other words, our results could be caused by this bias only if

[17] The mean and median differences are time-series averages of the differences in cross-sectional means and medians respectively.

growth firms generally have lower earnings variability. This strikes us as being unlikely. In the more likely scenario, growth firms have greater earnings variability and greater absolute earnings forecast errors. In that case, the bias causes our results to be understated.

To sum up, while our tests have probably not fully eliminated measurement error, we believe it is highly unlikely that the cross-sectional results are attributable solely to these measurement error problems.

6. Conclusions

In this paper, we estimate an ex ante cost-of-capital using a residual income model and provide preliminary evidence on the cross-sectional relationship between ex ante cost of equity and various firm characteristics. The results indicate that investors view larger firms, firms with wide analyst following, firms with less variable earnings, or firms with less leverage as less risky. We find no evidence to suggest that investors pay much attention to traditional risk proxies, such as market beta and the volatility of daily returns, when they price stocks.

The consistence of the relations we document is encouraging. Over the past 17 years, the market appears to have consistently ascribed a higher risk premia to certain types of firms and industries. This consistency is in sharp contrast to the wide fluctuations observed for ex post mean returns over this time period. The evidence suggests an ex ante approach to estimating the cost-of-capital could be useful for investment decisions, firm valuations, and capital budgeting problems.

Our findings also establishes an interesting empirical link between a firm's cost-of-capital and several variables associated with its information environment. Specifically, we find that firms with greater analyst coverage, less variable earnings streams, and lower absolute analyst forecast errors tend to have lower costs-of-capital. This result is consistent with prior theoretical studies (e.g., Glosten and Milgrom (1985) and Diamond and Verrecchia (1991)) in which improved disclosure leads to reduced transaction costs.

If greater analyst coverage and lower earnings variability are proxies for better overall disclosure, our finding suggests that firms with better disclosure tend to be rewarded by the market with a lower cost of capital.

How our approach can be implemented would depend on the decision context. For purposes of valuation and stock selection, it would obviously be tautological to estimate the implied cost-of-capital based on current prices. Instead, our results suggest individual firms' cost-of-capital can be estimated using a multiple regression framework that includes many of the variables we have tested. Most of the valuation studies in the literature currently either assign a constant cost-of-capital to all firms (e.g., Dechow et. al. (1998)), or uses a simple multi-factor model (e.g., Frankel and Lee (1998)). The high explanatory power of our multiple regressions, and the stability of the individual coefficient estimates, suggest it is possible to compute cost-of-capital estimates based on these variables. Indeed, intrinsic value estimates computed using this new cost-of-capital estimation technique may prove superior in returns prediction applications than the value estimates based on constant rate assumptions. We believe this is a fruitful area for future research.

A similar approach can be used for purposes of capital budgeting and other internal applications. For publicly traded firms, it is possible to directly compute a cost-of-capital based on current prices. However, the cost-of-capital estimates derived from current prices may be subject to wide variations as stock prices fluctuate. As an alternative, for both public and private firms, we recommend using a multiple regression to estimate the appropriate cost-of-capital. Detailed tests of alternative models are beyond the scope of this study. However, our evidence does provide guidance on the variables that are likely to contribute to the success of such a model.

As a final word of caution, our results are subject to a few caveats. First, despite our efforts, this approach is still subject to measurement errors. In particular, the risk premia of growth (mature) firms may be biased downwards (upwards). Second, our (17-year) study period may not be long enough for us to conclude with confidence that these relations will continue to hold in the future. Despite these limitations, it is our hope and expectation that the relations we document here will stimulate interest and further research among academics in various ex ante cost-of-capital measures.

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Appendix A: General Motor

This appendix provides an example of the implicit rate calculation for General Motors (GM) as of October 28th, 1998. The stock price for GM at the close of trading is $61 3/16. Key parameters of the model are the analysts' mean EPS forecasts for the next two years ($4.42 and $7.93), the mean expected long-term growth rate (Ltg=7%), the dividend payout ratio (12.9%), and the target ROE for the industry (15%). For years 1998 to 2000, we use explicit earnings forecasts to derive the implicit forecasted ROEs. From the year 2001 to 2009, we mean revert the forecasted ROE from 19.3% back to the industry median of 15%. To compute the implied discount rate, we adjust this parameter until the implied price over the 12-year horizon ($61.22) is approximately equal to the current market price. The process yields a current cost-of-equity for GM of 12.99%.

GM	**11**	**PARAMETERS**	**FY1**	**FY2**	**Ltg**	
as of		**EPS Forecasts**	4.42	7.93	7.00%	**(using the mean analyst forecast)**
10/28/98		**Book value/share (last fye)**	33.31			
		Discount Rate	12.99%			
		Dividend Payout Ratio	0.129			
		Current Fsc Mth (1 to 12)	10			
		Target ROE (industry avg.)	0.1500			

	Year		**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	Long-term EPS Growth Rate (Ltg)				0.0700									
	Forecasted EPS		4.42	7.93	8.49									
	Beg. of year BV/Shr		33.31	37.16	44.07									
	Implied ROE			0.213	0.193									
ROE	Beg. ROE		0.133	0.213	0.193	0.188	0.183	0.178	0.174	0.169	0.164	0.159	0.155	0.150
Abnormal ROE	(ROE-r)		0.003	0.084	0.063	0.058	0.053	0.048	0.044	0.039	0.034	0.030	0.025	0.020
growth rate for B	(1-k)*(ROEt-1)		0.000	0.116	0.186	0.168	0.164	0.159	0.155	0.151	0.147	0.143	0.139	0.135
Compounded growth			1.000	1.116	1.323	1.545	1.798	2.084	2.408	2.772	3.180	3.635	4.140	4.697
growth*AROE			**0.003**	**0.093**	**0.083**	**0.089**	**0.096**	**0.101**	**0.105**	**0.108**	**0.109**	**0.107**	**0.103**	**0.094**
required rate (r)		0.1299	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
discount rate			1.130	1.277	1.443	1.630	1.842	2.081	2.351	2.657	3.002	3.392	3.832	4.330
div. payout rate (k)		0.129												
Add to P/B	PV(growth*AROE)		0.00	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.02
Cum P/B			1.00	1.08	1.13	1.19	1.24	1.29	1.33	1.37	1.41	1.44	1.47	1.49
Add: Perpetuity beyond current yr			0.02	0.56	0.44	0.42	0.40	0.37	0.34	0.31	0.28	0.24	0.21	0.17
Total P/B	(P/B if we stop est. this period)		1.02	1.64	1.58	1.61	1.64	1.66	1.68	1.69	1.69	1.69	1.68	1.66
Implied price			**37.71**	**60.44**	**58.15**	**59.45**	**60.52**	**61.35**	**61.94**	**62.28**	**62.38**	**62.23**	**61.84**	**61.22**

Appendix B: Johnson and Johnson

This appendix provides an example of the implicit rate calculation for Johnson and Johnson (JNJ) as of October 28th, 1998. The stock price for JNJ at the close of trading is $82 5/16. Key parameters of the model are the analysts' mean EPS forecasts for the next two years ($2.68 and $3.00), the mean expected long-term growth rate (13%), the dividend payout ratio (34.4%), and the target ROE for the industry (15%). For years 1998 to 2000, we use explicit earnings forecasts to derive the implicit forecasted ROEs. From the year 2001 to 2009, we mean revert the forecasted ROE from 26.4% back to the industry median of 15%. To compute the implied discount rate, we adjust this parameter until the implied price over the 12-year horizon ($82.26) is approximately equal to the current market price. The process yields a current cost-of-equity for JNJ of 5.31%.

JNJ	**PARAMETERS**	**FY1**	**FY2**	**Ltg**	
as of mkt close	**EPS Forecasts**	2.68	3.00	13.00%	**(using the mean analyst forecast)**
10/28/98	**Book value/share (last fye)**	9.11			
	Discount Rate	5.31%			
	Dividend Payout Ratio	0.344			
	Next Fsc Year end	1998			
	Current Fsc Mth (1 to 12)	10			
	Target ROE (industry avg.)	0.1500			

			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Year		**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	Long-term EPS Growth Rate (Ltg)				0.1300									
	Forecasted EPS		2.68	3.00	3.39									
	Beg. of year BV/Shr		9.11	10.8677	12.83534									
	Implied ROE			0.27604	0.264114									
ROE	Beg. ROE		0.294	0.276	0.264	0.251	0.239	0.226	0.213	0.201	0.188	0.175	0.163	0.150
Abnormal ROE	(ROE-r)		0.241	0.223	0.211	0.198	0.186	0.173	0.160	0.148	0.135	0.122	0.110	0.097
growth rate for B	(1-k)*(ROEt-1)		0.000	0.193	0.181	0.173	0.165	0.157	0.148	0.140	0.132	0.123	0.115	0.107
Compounded			1.000	1.193	1.409	1.653	1.926	2.227	2.557	2.915	3.299	3.706	4.132	4.573
growth*AROE			**0.241**	**0.266**	**0.297**	**0.328**	**0.357**	**0.385**	**0.410**	**0.430**	**0.445**	**0.453**	**0.453**	**0.443**
required rate (r)		0.0531	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
discount rate			1.053	1.109	1.168	1.230	1.295	1.364	1.436	1.513	1.593	1.678	1.767	1.861
div. payout rate (k)		0.344129555												
Add to P/B	PV(growth*AROE)		0.23	0.24	0.25	0.27	0.28	0.28	0.29	0.28	0.28	0.27	0.26	0.24
Cum P/B			1.23	1.47	1.72	1.99	2.27	2.55	2.83	3.12	3.40	3.67	3.92	4.16
Add: Perpetuity beyond current yr			4.31	4.52	4.79	5.02	5.20	5.32	5.37	5.36	5.26	5.09	4.83	4.49
Total P/B	(P/B if we stop est. this period)		5.54	5.99	6.52	7.01	7.46	7.87	8.21	8.48	8.66	8.75	8.75	8.65
Implied price			**52.70**	**56.94**	**62.00**	**66.68**	**71.00**	**74.84**	**78.08**	**80.63**	**82.39**	**83.28**	**83.25**	**82.26**

Table I
Summary Statistics

Our sample consists of all NYSE and AMEX stocks in the I/B/E/S database on June 30th of each of the years 1979 to 1995. Panel A shows the number of firms by year with non-missing values for the fourteen ex-ante firm characteristics examined in this paper. Panel B shows the median values of these characteristics. The firm characteristics are: five year rolling market beta based on monthly returns; the standard deviation of the previous year's daily returns; long-term debt-to-book ratio; long-term debt-to-market value of equity ratio; number of analysts one-year-ahead forecasts; average daily dollar volume over the previous year in millions; firm size in millions; the average mean squared error of the last five annual I/B/E/S consensus forecasts, divided by the average actual earnings over the same period; the coefficient of variation of annual EPS over the previous five years; the dispersion (standard deviation) of current one-year-ahead analyst earnings forecasts; the mean long-term earnings growth estimate; the book-to-price ratio; prior six month price momentum (returns); and the average daily turnover calculated over the previous year. Also shown are both historical and ex-ante risk premiums. Ex-ante risk premiums are calculated by first solving for the discount rate required to equate the fundamental value derived from an Edwards-Bell-Ohlson (EBO) valuation model with the current stock price, and then subtracting the yield on the current government long-term bond. A twelve-year version of the EBO model is used which incorporates consensus earnings forecasts from the I/B/E/S database and allows long-term growth estimates to revert to historical industry ROEs. Historical risk premiums for each year are estimated by averaging annual historical risk premiums for all prior years. Historical risk premium is defined as the annual equal weighted return minus the bond return. Data on returns, volume, and shares outstanding comes from the CRSP stock files. Book values, earnings, dividends and long-term debt come from Compustat annual files. The number of analysts making forecasts, the standard deviation of those forecasts, and the consensus forecasts themselves come from IBES. The period covered is 1979 to 1995 with one exception. Both mean square error of earnings forecasts and coefficient of variation of actual earnings require five years of prior data for calculation so figures are only available from 1984 to 1995.

Panel A - Number of Firms

Year	Beta	Returns Volatility	D/B	D/E	Number Analyst	Dollar Volume	Size	MSE Of Forcasts	Disp. Of Earn.	Disp. Of Forcasts	Forcast Growth	B/P	Momtm	Turnover	Hist. Risk Pr.	Ex-Ante Risk Pr. Median	Ex-Ante Risk Pr. Mean
79	1040	1056	1052	1052	1051	1057	1057			801	1057	1057	1057	1057	1044	1057	1057
80	1027	1043	1040	1040	1041	1046	1046			830	1044	1046	1046	1046	1040	1046	1046
81	1031	1044	1038	1038	1040	1044	1046			859	1046	1046	1046	1044	1044	1046	1046
82	1034	1053	1048	1048	1048	1055	1056			880	1056	1056	1056	1055	1054	1056	1056
83	1015	1057	1048	1048	1050	1056	1057			899	1057	1057	1057	1056	1056	1057	1057
84	1006	1063	1055	1055	1055	1062	1063	781	834	908	1062	1063	1063	1062	1060	1063	1063
85	974	1040	1031	1031	1034	1041	1041	779	813	915	1040	1041	1041	1041	1038	1041	1041
86	951	1028	1015	1015	1020	1022	1028	770	818	905	1025	1028	1028	1023	1018	1028	1028
87	916	1029	1018	1018	1023	1021	1029	772	816	908	1025	1029	1029	1021	1025	1029	1029
88	845	1027	1018	1018	1027	1023	1031	702	750	919	1029	1031	1031	1023	1019	1031	1031
89	875	1061	1053	1053	1061	1059	1064	717	761	951	1060	1064	1064	1059	1049	1064	1064
90	902	1093	1090	1090	1094	1089	1097	737	777	987	1095	1097	1097	1089	1092	1097	1097
91	918	1096	1095	1095	1095	1091	1098	738	779	980	1094	1098	1098	1091	1091	1098	1098
92	993	1151	1149	1149	1150	1133	1152	767	844	1045	1151	1152	1152	1133	1150	1152	1152
93	1021	1234	1234	1234	1237	1214	1239	817	891	1138	1239	1239	1239	1214	1230	1239	1239
94	1051	1273	1270	1270	1277	1260	1278	847	916	1173	1277	1278	1278	1260	1269	1278	1278
95	1065	1341	1329	1329	1340	1322	1341	877	937	1217	1340	1341	1341	1322	1333	1341	1341

Table 1. Continued

Panel B - Medians																		
		Returns			Number	Dollar		MSE Of	Disp. Of	Disp. Of	Forcast				Cum.Hist.	Ex-Ante Risk Pr.	
Year	Beta	Volatility	D/B	D/E	Analyst	Volume	Size	Forcasts	Earn.	Forcasts	Growth	B/P	Momtm	Turnover	Risk Pr.	Median	Mean
79	1.16	2.0%	41.4%	41.0%	4	0.20	161.3			0.042	5.0%	0.98	14.8%	1.21	18.7%	4.9%	5.2%
80	1.22	1.9%	41.8%	40.9%	5	0.25	178.5			0.056	5.0%	1.01	3.0%	1.37	35.9%	4.1%	4.1%
81	1.15	2.3%	40.9%	32.4%	6	0.36	243.5			0.055	5.2%	0.83	12.6%	1.54	15.3%	-0.2%	0.2%
82	1.13	2.0%	40.6%	45.8%	7	0.27	191.8			0.073	13.5%	1.07	-8.6%	1.28	25.7%	1.5%	1.9%
83	1.13	2.3%	39.0%	25.8%	7	0.52	330.4			0.075	13.2%	0.67	28.5%	2.06	20.0%	0.3%	0.6%
84	1.06	2.1%	34.2%	28.2%	7	0.52	269.9	0.35	0.33	0.057	13.1%	0.81	-8.1%	1.87	13.9%	-0.7%	-0.2%
85	1.01	1.9%	35.0%	25.2%	8	0.49	326.6	0.37	0.35	0.070	12.7%	0.71	16.4%	1.90	11.3%	1.1%	1.6%
86	1.05	1.7%	41.2%	23.7%	8	0.78	414.7	0.44	0.38	0.070	11.7%	0.59	18.4%	2.21	12.1%	2.2%	2.6%
87	1.04	1.9%	44.3%	23.1%	8	0.98	467.4	0.51	0.38	0.068	11.7%	0.54	22.4%	2.39	9.5%	1.1%	1.7%
88	1.11	2.7%	45.9%	25.6%	8	1.02	469.4	0.46	0.38	0.060	11.6%	0.60	18.1%	2.34	8.3%	2.0%	2.8%
89	1.10	1.8%	46.7%	27.7%	9	0.94	480.2	0.42	0.37	0.059	11.2%	0.60	14.3%	1.97	7.7%	2.8%	3.8%
90	1.07	1.6%	51.0%	30.6%	8	1.00	474.1	0.45	0.38	0.062	11.0%	0.63	-0.4%	2.00	6.6%	2.4%	3.3%
91	1.11	2.0%	52.3%	33.1%	8	1.01	522.9	0.41	0.37	0.064	11.3%	0.66	19.8%	2.00	6.0%	2.0%	3.1%
92	1.12	1.9%	51.2%	29.4%	8	1.31	569.5	0.40	0.39	0.057	11.5%	0.60	0.7%	2.12	5.8%	2.4%	3.4%
93	1.05	1.8%	49.3%	24.9%	8	1.41	631.1	0.41	0.44	0.051	11.7%	0.52	7.2%	2.25	6.0%	3.0%	4.4%
94	1.06	1.8%	49.5%	24.3%	8	1.64	654.0	0.44	0.48	0.046	11.9%	0.53	-5.0%	2.37	5.5%	2.4%	3.6%
95	1.06	1.7%	48.3%	24.1%	8	1.49	691.5	0.41	0.44	0.041	11.8%	0.53	13.0%	2.23	6.2%	3.4%	4.6%

Table II
Ex Ante Risk Premia and Firm Characteristics

On June 30th of each year, stocks are sorted into quintiles based on each of fourteen firm characteristics. This table reports the time-series average historical and ex-ante risk premia for each quintile. The firm characteristics are: five year rolling market beta (Beta); standard deviation of the previous years daily returns (Std. Dev); long-term debt-to-book ratio (D/B); long-term debt-to-market value of equity ratio (D/M); number of analysts making annual forecasts (#Ann); average daily transaction dollar volume over the previous year in millions ($Vol); firm size in millions (Size); mean squared error of last five annual earnings forecasts divided by the average actual earnings over the same period (MSE Ern); coefficient of variation of annual earnings per share over previous five years (Var Ern); dispersion of one-year-ahead analyst earnings forecasts (Disp Fcst); long-term growth earnings estimate (Ltg); book-to-price ratio (B/P); prior six month price momentum (Mtm); average daily turnover calculated over the previous year (Trnovr). Ex-ante risk premia are calculated by first solving for the discount rate required to equate the fundamental value derived from an Edwards-Bell-Ohlson (EBO) valuation model with the current stock price, then subtracting the current yield on the 10-year government bond. A twelve-year version of the EBO model is used. Historical risk premia are defined as the annual equal-weighted returns for each portfolio in the year after the ranking, minus the realized returns on the 10-year government bond, and averaged across all years. Data on returns, volume, and shares outstanding come from the CRSP stock files. Book values, earnings, dividends and long-term debt come from Compustat annual files. The number of analysts making earnings forecasts, the standard deviation of those forecasts, and the consensus forecasts themselves come from I/B/E/S. The period covered is 1979 to 1995 with one exception. Both the MSE of earnings forecasts and the coefficient of variation of actual earnings require five years of prior data for the calculation, so figures are only available from 1984 to 1995. Risk premium differences for quintile 5 minus quintile 1 are reported (Q5-Q1), along with Newey-West autocorrelation corrected t-statistics. ***, **, * indicate 1%, 5%, and 10% significance in the direction predicted.

	Smallest				Largest			
Ranked by:	Q1	Q2	Q3	Q4	Q5	Q5-Q1	t-Stat	
Panel A. Market Volatility								
Beta (Rolling 5 Year)	0.51	0.86	1.10	1.33	1.71			
Mean Ex-ante Risk Premium	3.47%	2.56%	2.35%	2.04%	2.35%	-1.12%	-3.60	
Median Ex-ante Risk Premium	1.97%	1.83%	1.91%	1.92%	2.19%	0.22%	0.58	
Historical Risk Premium	6.74%	6.66%	8.33%	5.80%	4.63%	-2.12%	-0.40	
Std. Dev. Of Daily Returns	1.18%	1.62%	1.96%	2.39%	3.21%			
Mean Ex-ante Risk Premium	2.59%	2.88%	2.75%	2.64%	2.82%	0.23%	0.78	
Median Ex-ante Risk Premium	2.05%	1.84%	1.90%	2.01%	2.50%	0.45%	1.25	
Historical Risk Premium	6.04%	7.30%	6.47%	7.31%	3.81%	-2.23%	-0.44	
Panel B. Leverage								
Debt/Book	3.10%	22.00%	44.34%	75.90%	151.56%			
Mean Ex-ante Risk Premium	2.30%	2.70%	3.40%	2.62%	2.55%	0.25%	2.89	***
Median Ex-ante Risk Premium	1.51%	1.81%	2.17%	2.08%	2.62%	1.11%	5.52	***
Historical Risk Premium	6.37%	6.63%	6.18%	7.07%	5.04%	-1.33%	-0.89	
Debt/Mkt. Val. Equity	1.62%	12.81%	29.81%	59.04%	146.71%			
Mean Ex-ante Risk Premium	0.97%	1.37%	1.90%	2.52%	6.86%	5.89%	15.22	***
Median Ex-ante Risk Premium	0.87%	1.19%	1.88%	2.50%	3.89%	3.02%	15.46	***
Historical Risk Premium	5.85%	6.29%	6.87%	6.07%	6.22%	0.37%	0.17	
Panel C. Liquidity and Information Environment								
Number of Analysts	1.12	3.71	7.47	13.35	23.06			
Mean Ex-ante Risk Premium	3.78%	3.82%	2.43%	1.81%	1.82%	-1.95%	-4.05	***
Median Ex-ante Risk Premium	2.53%	2.48%	1.98%	1.64%	1.63%	-0.90%	-3.22	***
Historical Risk Premium	6.68%	6.77%	6.76%	5.93%	4.91%	-1.77%	-0.52	
Average $ Volume Previous Year (millions)	0.08	0.29	0.83	2.58	9.57			
Mean Ex-ante Risk Premium	4.08%	2.90%	2.32%	2.25%	2.11%	-1.97%	-4.56	***
Median Ex-ante Risk Premium	2.73%	2.14%	1.80%	1.75%	1.76%	-0.97%	-3.95	***
Historical Risk Premium	8.35%	6.98%	5.58%	5.59%	4.59%	-3.77%	-0.97	
Size (millions)	55.2	166.7	414.0	1,034.4	3,686.9			
Mean Ex-ante Risk Premium	5.18%	3.01%	2.03%	1.88%	1.61%	-3.57%	-5.86	***
Median Ex-ante Risk Premium	3.17%	2.29%	1.81%	1.62%	1.45%	-1.71%	-5.02	***
Historical Risk Premium	7.12%	6.58%	6.72%	5.50%	5.15%	-1.96%	-0.41	

Table II. Continued

Ranked by:	Smallest Q1	Q2	Q3	Q4	Largest Q5	Q5-Q1	t-Stat
Panel D. Variability of Earnings							
MSE of Forcast Earnings	0.05	0.19	0.43	1.07	7.82		
Mean Ex-ante Risk Premium	1.72%	1.62%	1.61%	1.90%	5.49%	3.77%	7.05 ***
Median Ex-ante Risk Premium	1.63%	1.55%	1.45%	1.80%	2.83%	1.21%	5.96 ***
Historical Risk Premium	1.59%	1.71%	1.43%	1.12%	-0.23%	-1.83%	-0.55
Coef. Of Variation Of EPS (5 Years)	0.14	0.25	0.39	0.73	2.87		
Mean Ex-ante Risk Premium	2.01%	1.99%	2.76%	3.06%	2.75%	0.73%	4.35 ***
Median Ex-ante Risk Premium	1.61%	1.31%	1.72%	2.22%	2.44%	0.83%	5.32 ***
Historical Risk Premium	1.84%	2.21%	1.80%	0.50%	-1.56%	-3.40%	-0.95
Dispersion of Analyst Forcasts	0.018	0.035	0.059	0.107	0.321		
Mean Ex-ante Risk Premium	1.71%	2.29%	2.82%	3.46%	2.97%	1.26%	6.93 ***
Median Ex-ante Risk Premium	1.28%	1.74%	2.24%	2.61%	2.31%	1.03%	7.72 ***
Historical Risk Premium	8.38%	6.54%	6.49%	4.47%	4.39%	-3.98%	-1.07
Panel E. Other Pricing Anomalies							
Long Term Growth	3.38%	8.39%	10.79%	13.20%	18.26%		
Mean Ex-ante Risk Premium	3.93%	3.23%	2.63%	1.92%	1.97%	-1.96%	-5.19
Median Ex-ante Risk Premium	2.39%	2.71%	2.06%	1.48%	1.56%	-0.83%	-2.47
Historical Risk Premium	5.42%	6.58%	6.20%	6.61%	6.05%	0.64%	0.23
Book/Price	0.293	0.500	0.699	0.915	1.433		
Mean Ex-ante Risk Premium	-0.31%	1.00%	1.87%	2.99%	8.15%	8.46%	18.83
Median Ex-ante Risk Premium	-0.29%	1.01%	1.92%	2.99%	5.14%	5.44%	27.99
Historical Risk Premium	5.45%	5.91%	5.09%	6.78%	7.85%	2.40%	0.70
Momentum (6 Month)	-14.95%	-0.06%	9.82%	20.17%	39.84%		
Mean Ex-ante Risk Premium	3.98%	3.03%	2.50%	2.31%	1.86%	-2.13%	-7.13
Median Ex-ante Risk Premium	3.02%	2.28%	1.99%	1.68%	1.28%	-1.74%	-7.46
Historical Risk Premium	2.06%	5.45%	7.27%	6.41%	9.84%	7.77%	2.99
Avg. Daily Turnover Previous Year (x1000)	0.765	1.370	1.949	2.769	4.609		
Mean Ex-ante Risk Premium	2.84%	2.08%	2.32%	2.60%	3.83%	0.99%	1.57
Median Ex-ante Risk Premium	2.03%	1.80%	1.94%	2.09%	2.45%	0.43%	1.33
Historical Risk Premium	7.86%	6.76%	6.33%	6.07%	4.09%	-3.77%	-1.57

Table III
Industry Risk Premia

The table below shows time series mean ex-ante and historical risk premia firms in various industries. Firms are sorted into 48 industries following the groupings of Fama and French (1997). Industry portfolios are formed each year and include all exchange-listed stocks in the I/B/E/S database on June 30th for each of the years 1979 to 1995. Ex-Ante risk premia are calculated by first solving for the discount rate required to equate the fundamental value derived from the Edwards-Bell-Ohlson (EBO) valuation model with the current stock price and then subtracting the current yield on the 10-year government bond. A twelve-year version of the EBO model is used which incorporates consensus earnings forecasts from the I/B/E/S database and allows long-term growth estimates to revert to the historical industry ROEs. Historical risk premia are based on the average realized returns over the next year. The table reports both the risk premium in excess of yields/returns on ten-year government bonds (Excess Premium), and the risk premium in excess of the average risk premium for all firms in a given year (Relative Premium). Both the time-series mean and the time-series standard error for the mean are reported. Also reported is the average number of firms in each industry for each year in the sample (N). The last row reports the equal-weighted mean for each variable across all industries.

		Excess Premium				Relative Premium			
		Ex-Ante Risk Premium		Historical Risk Premium		Ex-Ante Risk Premium		Historical Risk Premium	
Industry	N	Mean	Std Err	Mean	Std Err	Mean	Std Err	Mean	Std Err
Toys	12	8.38%	0.67%	6.47%	6.53%	5.58%	0.58%	3.82%	4.23%
Smoke	2	7.90%	2.03%	26.87%	9.45%	5.69%	2.13%	16.90%	8.17%
Banks	58	6.27%	0.74%	7.28%	6.02%	3.52%	0.50%	1.48%	3.83%
Comps	25	5.70%	0.68%	5.65%	8.81%	2.95%	0.63%	-0.72%	3.85%
Autos	29	4.31%	0.58%	8.81%	8.91%	1.57%	0.30%	1.44%	4.82%
ElcEq	18	4.15%	0.56%	2.95%	6.23%	1.37%	0.26%	-2.68%	2.17%
Insur	45	4.02%	0.48%	7.11%	3.98%	1.32%	0.21%	0.69%	2.94%
Steel	34	3.81%	0.48%	-0.22%	6.23%	1.00%	0.27%	-6.56%	3.22%
Clths	20	3.56%	0.57%	8.36%	8.89%	0.83%	0.29%	2.18%	4.87%
Beer	7	3.54%	1.41%	12.08%	3.91%	0.81%	1.21%	6.22%	4.49%
Cnstr	17	3.53%	0.50%	1.12%	7.01%	0.78%	0.19%	-5.15%	2.77%
Coal	1	3.26%	0.51%	2.50%	9.39%	0.32%	0.58%	-8.00%	6.42%
BusSv	40	3.22%	0.52%	9.92%	6.47%	0.41%	0.19%	2.64%	1.58%
Aero	12	3.22%	0.45%	5.17%	7.22%	0.48%	0.33%	-1.03%	3.34%
Food	30	3.20%	0.38%	9.77%	3.85%	0.48%	0.33%	3.83%	4.05%
Chips	31	3.07%	0.62%	8.27%	8.82%	0.29%	0.43%	1.95%	5.14%
Guns	2	3.04%	0.97%	12.57%	5.66%	0.47%	0.78%	5.80%	2.72%
Chems	42	2.91%	0.54%	6.76%	5.32%	0.20%	0.27%	0.96%	2.73%
Trans	25	2.85%	0.39%	4.77%	7.15%	0.12%	0.14%	-1.21%	2.76%
Soda	3	2.57%	0.56%	3.76%	5.05%	0.13%	0.69%	-0.41%	5.51%
Rtail	63	2.48%	0.53%	9.94%	7.16%	-0.22%	0.21%	3.85%	3.31%
Telcm	18	2.48%	0.74%	13.09%	4.49%	-0.28%	0.46%	7.24%	3.19%
Ships	3	2.38%	0.49%	5.35%	8.72%	-0.36%	0.37%	-1.08%	6.25%
Paper	35	2.35%	0.37%	4.99%	5.51%	-0.39%	0.18%	-1.17%	2.40%
Util	103	2.33%	0.22%	4.35%	2.39%	-0.40%	0.29%	-1.78%	4.27%
Hlth	8	2.14%	0.82%	15.34%	10.54%	-0.66%	0.53%	7.00%	7.48%
Boxes	8	2.08%	0.56%	7.17%	5.26%	-0.66%	0.43%	1.83%	3.72%
Hshld	30	2.08%	0.41%	8.20%	5.66%	-0.66%	0.20%	1.57%	2.45%
Mines	6	2.06%	0.80%	5.90%	10.49%	-0.70%	0.59%	-0.62%	7.86%
BldMt	35	1.94%	0.38%	5.48%	6.00%	-0.82%	0.20%	-0.48%	1.63%
Txtls	17	1.76%	0.50%	9.45%	8.54%	-1.00%	0.19%	2.98%	5.31%
Drugs	25	1.75%	0.48%	12.55%	5.50%	-1.01%	0.18%	7.67%	3.99%
Rubbe	14	1.70%	0.42%	5.97%	5.38%	-1.03%	0.14%	0.05%	2.47%
PerSv	7	1.60%	0.72%	13.17%	12.26%	-1.16%	0.45%	6.26%	7.11%
Meals	13	1.60%	0.49%	4.24%	5.88%	-0.83%	0.36%	-3.25%	2.92%
FabPr	5	1.49%	0.54%	1.85%	8.30%	-1.25%	0.27%	-4.23%	4.63%
Fun	14	1.36%	0.40%	6.55%	6.53%	-1.40%	0.19%	-0.48%	3.26%
Books	19	1.35%	0.50%	10.21%	6.57%	-1.37%	0.19%	3.70%	3.17%
Mach	57	1.32%	0.36%	2.76%	6.11%	-1.43%	0.23%	-3.35%	2.45%
Enrgy	57	1.25%	0.33%	0.76%	8.28%	-1.44%	0.50%	-5.75%	6.36%
Whlsl	35	1.20%	0.46%	6.98%	6.42%	-1.55%	0.13%	0.93%	1.83%
LabEq	22	1.08%	0.31%	2.82%	6.54%	-1.66%	0.23%	-1.75%	3.18%
MedEq	9	0.82%	0.39%	11.96%	5.67%	-1.95%	0.20%	6.15%	5.98%
Fin	33	0.31%	0.53%	10.88%	7.32%	-2.39%	0.24%	2.36%	1.91%
Agric	1	0.08%	0.76%	8.17%	7.20%	-2.65%	0.48%	2.00%	6.86%
Misc	1	-0.06%	0.50%	5.66%	19.66%	-2.87%	0.41%	2.12%	17.52%
Gold	6	-0.73%	0.59%	4.46%	11.00%	-3.47%	0.74%	-1.72%	7.41%
RlEst	5	-2.79%	0.54%	-4.46%	7.23%	-5.24%	0.51%	-11.44%	5.86%
ALL		2.50%	0.58%	7.16%	7.20%	-0.22%	0.40%	0.85%	4.47%

Table IV
Correlations of Firm Characteristics

This table shows the time series average of the cross-sectional Spearman correlations for our fourteen ex-ante firm characteristics: five year rolling market beta (Beta); standard deviation of the previous years daily returns (Std. Dev); long-term debt-to-book ratio (D/B); long-term debt-to-market value of equity ratio (D/M); number of analysts making annual forecasts (#Ann); average daily transaction dollar volume over the previous year in millions ($Vol); firm size in millions (Size); mean squared error of last five annual earnings forecasts divided by the average actual earnings over the same period (MSE Ern); coefficient of variation of annual earnings per share over previous five years (Var Ern); dispersion of one-year-ahead analyst earnings forecasts (Disp Fcst); long-term growth earnings estimate (Ltg); book-to-price ratio (B/P); prior six month price momentum (Mtm); average daily turnover calculated over the previous year (Trnovr). Data on returns, volume, and shares outstanding comes from the CRSP stock files. Book values, earnings, dividends and long-term debt come from Compustat annual files. The number of analysts making forecasts, the standard deviation of those forecasts, and the consensus forecasts themselves come from I/B/E/S. The period covered is 1979 to 1995 with one exception. Both mean square error of earnings forecasts and dispersion of actual earnings require five years of prior data for calculation so figures are only available from 1984 to 1995. Newey-West autocorrelation corrected t-statistics are also given.

	Beta	Std. Dev	D/B	D/M	# Ann.	$ Vol	Size	MSE Ern	VarErn	DispFcst	Ltg	B/P	Mtm	Trnovr
Beta	100.0%	54.2%	-4.8%	-10.1%	-3.3%	6.9%	-9.6%	16.1%	24.9%	18.6%	37.1%	-10.8%	-1.8%	39.9%
		20.47	-5.00	-9.08	-1.15	3.06	-3.30	10.01	13.98	6.46	42.34	-4.47	-0.30	19.90
Std. Dev		100.0%	3.6%	3.0%	-26.4%	-17.9%	-37.0%	30.8%	46.6%	33.9%	20.8%	1.5%	-2.1%	36.8%
			3.27	2.34	-10.73	-11.67	-15.73	24.18	42.56	21.99	20.22	0.62	-0.50	11.90
D/B			100.0%	87.4%	-0.8%	0.7%	-2.3%	13.7%	15.5%	17.4%	-17.7%	15.9%	1.6%	6.7%
				194.40	-0.40	0.47	-1.41	15.01	20.96	19.39	-18.71	10.49	0.88	7.61
D/E				100.0%	-9.5%	-9.7%	-15.6%	21.5%	21.3%	27.5%	-33.8%	53.9%	-7.3%	4.9%
					-5.55	-5.99	-13.13	19.90	20.96	30.57	-17.68	40.67	-3.07	3.02
# Ann.					100.0%	84.1%	84.5%	-3.8%	-16.7%	-11.0%	12.6%	-21.3%	-0.5%	24.7%
						113.21	301.46	-2.18	-9.70	-11.48	9.56	-12.44	-0.16	7.37
$ Vol						100.0%	90.1%	4.0%	-13.0%	-11.5%	16.1%	-25.6%	-1.3%	48.6%
							245.64	2.12	-6.97	-7.12	9.96	-11.81	-0.40	23.13
Size							100.0%	-5.9%	-25.5%	-23.8%	9.4%	-31.9%	8.2%	12.6%
								-3.53	-14.05	-17.73	5.69	-15.53	2.24	4.10
MSE Ern								100.0%	74.4%	34.0%	-1.5%	17.4%	2.8%	23.7%
									93.29	27.37	-1.22	12.51	0.90	11.75
CoV Ern									100.0%	48.8%	2.3%	22.6%	0.4%	25.2%
										37.38	1.74	10.63	0.08	12.98
CoV Fcst										100.0%	-9.5%	34.1%	-10.8%	19.2%
											-4.61	20.20	-2.49	18.95
Ltg											100.0%	-46.1%	2.6%	22.7%
												-15.50	0.78	18.20
B/P												100.0%	-20.3%	-3.2%
													-6.16	-1.40
Mtm													100.0%	-0.2%
														-0.06
Trnovr														100.0%

Table V
Cross-Sectional Regression of Ex-Ante Risk Premium on Firm Characteristics

The following cross-sectional regression is estimated on June 30th of each year and the resulting time series average coefficients are reported below.

$$r_{i,t} - rf_t = a_t + \sum_{j=1}^{14} \delta_{j,t} F_{j,i,t} + \mu_{,t}$$

Where $r_{i,t} - rf_t$ is the year t ex-ante risk premium for firm i derived from a twelve year version of the EBO valuation model, expressed in percent. $F_{j,i,t}$ are fourteen corresponding ex-ante firm characteristics, expressed in percentile rankings: five year rolling market beta (Beta); standard deviation of the previous years daily returns (Std. Dev); long-term debt-to-book ratio (D/B); long-term debt-to-market value of equity ratio (D/M); number of analysts making annual forecasts (#Ann); average daily transaction dollar volume over the previous year in millions ($Vol); firm size in millions (Size); mean squared error of last five annual earnings forecasts divided by the average actual earnings over the same period (MSE Ern); coefficient of variation of annual earnings per share over previous five years (Var Ern); dispersion of one-year-ahead analyst earnings forecasts (Disp Fcst); long-term growth earnings estimate (Ltg); book-to-price ratio (B/P); prior six month price momentum (Mtm); average daily turnover calculated over the previous year (Trnovr). NYSE and AMEX stocks with available data are included in the sample. Data on returns, volume, and shares outstanding comes from the CRSP stock files. Book values, earnings, dividends and long-term debt come from Compustat quarterly files. The number of analysts making forecasts, the standard deviation of those forecasts, the one- and two-year-ahead consensus forecasts and the long-term growth forecast come from IBES. The last column shows the average adjusted R^2 for each model over the sample period. This column also reports the average p-value from cross-sectional f-tests of the difference in R^2 between Model 2 and subsequent models. Both mean square error of earnings forecasts and dispersion of actual earnings require five years of prior data for calculation. Therefore, data used for these regressions are from 1984 to 1995.

Model	a	Beta	Std. Dev	D/B	D/M	# Ann.	$ Vol	Size	MSE Ern	Var Ern	Disp Fcst	Ltg	B/P	Mtm	Trnovr	Adj-R^2
1	2.5510	-0.0048	-0.0027	-0.2864	0.3429	-0.0177	0.0727	-0.0730	0.0473	-0.0434	-0.0143	0.0191	-0.0368	0.0012	-0.0016	0.5556
	3.39	-1.98	-0.61	-11.95	12.64	-5.23	2.89	-4.11	4.23	-4.05	-4.78	5.40	-3.24	0.38	-0.12	
2	0.9820	-0.0074	0.0003	-0.2423	0.2873	-0.0197	0.0795	-0.0737	0.0502	-0.0467	-0.0181	0.0254		0.0037	-0.0041	0.5433
	2.11	-2.88	0.06	-20.12	24.00	-6.71	2.91	-3.72	4.43	-4.28	-6.53	9.71		1.27	-0.28	
3	0.8745			-0.2427	0.2885	-0.0199	0.0806	-0.0738	0.0513	-0.0481	-0.0192	0.0231		0.0034	-0.0067	0.5412
	2.08			-20.78	24.59	-7.31	2.90	-3.55	4.47	-4.22	-7.53	8.44		1.18	-0.48	p=0.169
4	7.2861	-0.0061	-0.0264			-0.0074	0.1565	-0.1973	0.0792	-0.0638	0.0077	-0.0157		-0.0077	-0.0077	0.2412
	14.17	-1.62	-3.84			-2.51	3.35	-6.05	5.60	-4.51	2.31	-5.94		-1.98	-0.35	p=0.00
5	-1.2658	-0.0084	0.0123	-0.2621	0.3096				0.0478	-0.0439	-0.0190	0.0271		-0.0013	0.0136	0.5220
	-4.30	-3.66	4.35	-22.12	26.30				5.12	-4.91	-6.57	9.97		-0.43	2.95	p=0.023
6	0.4679	-0.0109	-0.0099	-0.2499	0.2922	-0.0315	0.1083	-0.0765				0.0275		0.0075	-0.0134	0.5061
	0.92	-3.80	-1.56	-20.16	23.58	-7.24	4.28	-4.07				10.41		2.42	-0.89	p=0.00
7	2.3227	-0.0015	0.0068	-0.2363	0.2746	-0.0212	0.0709	-0.0691	0.0519	-0.0474	-0.0212					0.5222
	4.90	-0.69	1.83	-18.63	22.40	-6.15	7.36	-6.17	4.74	-4.67	-6.08					p=0.00

Table VI
Risk Premia for Firm Characteristics Conditional on Long-term Growth Forecasts

On June 30th of each year, stocks are sorted into quintiles based on analysts' long-term growth forecasts. In each growth quintile, firms are again sorted into quintiles by one of thirteen firm characteristics. The firm characteristics are: five year rolling market beta (Beta); standard deviation of the previous years daily returns (Std. Dev); long-term debt-to-book ratio (D/B); long-term debt-to-market value of equity ratio (D/M); number of analysts making annual forecasts (#Ann); average daily transaction dollar volume over the previous year in millions ($Vol); firm size in millions (Size); mean squared error of last five annual earnings forecasts divided by the average actual earnings over the same period (MSE Ern); coefficient of variation of annual earnings per share over previous five years (Var Ern); dispersion of one-year-ahead analyst earnings forecasts (Disp Fcst); book-to-price ratio (B/P); prior six month price momentum (Mtm); average daily turnover calculated over the previous year (Trnovr). Ex-ante risk premia are calculated by first solving for the discount rate required to equate the fundamental value derived from an Edwards-Bell-Ohlson (EBO) valuation model with the current stock price, then subtracting the current yield on the 10-year government bond. A twelve-year version of the EBO model is used. Historical risk premia are defined as the annual equal-weighted returns for each portfolio in the year after the ranking, minus the realized returns on the 10-year government bond, and averaged across all years. Data on returns, volume, and shares outstanding come from the CRSP stock files. Book values, earnings, dividends and long-term debt come from Compustat annual files. The number of analysts making earnings forecasts, the standard deviation of those forecasts, and the consensus forecasts themselves come from I/B/E/S. The period covered is 1979 to 1995 with one exception. Both the MSE of earnings forecasts and the coefficient of variation of actual earnings require five years of prior data for the calculation, so figures are only available from 1984 to 1995. Risk premium differences for quintile 5 minus quintile 1 are reported (Q5-Q1), along with Newey-West autocorrelation corrected t-statistics. ***, **, * indicate 1%, 5%, and 10% significance in the direction predicted.

	Quintiles based on long-term growth									
Characteristics	**Low Ltg (1)**		**2**		**3**		**4**		**High Ltg (5)**	
	Q5-Q1	**t-Stat**	**Q5-Q1**	**t-Stat**	**Q5-Q1**	**t-Stat**	**Q5-Q1**	**t-Stat**	**Q5-Q1**	**t-Stat**
Beta										
Mean Ex-ante Risk Premium	-0.94%	-1.05	-0.67%	-2.19	-0.56%	-2.00	0.75%	2.44	0.24%	0.87
Median Ex-ante Risk Premium	-0.21%	-0.30	1.02%	3.01	1.13%	4.37	1.52%	6.12	0.64%	1.98
Historical Risk Premium	1.28%	0.16	-3.98%	-0.83	-0.79%	-0.17	-4.67%	-1.40	-5.98%	-1.35
Std. Dev. Of Daily Returns										
Mean Ex-ante Risk Premium	-0.34%	-0.48	0.16%	0.51	1.47%	3.81	1.32%	5.65	1.72%	4.81
Median Ex-ante Risk Premium	-0.33%	-0.50	0.61%	1.63	1.33%	5.35	1.67%	7.45	1.73%	5.39
Historical Risk Premium	0.50%	0.06	-2.61%	-0.53	-3.98%	-1.04	-4.15%	-1.00	-6.23%	-1.30
Debt/Book										
Mean Ex-ante Risk Premium	-2.60%	-5.17	0.03%	0.11	0.88%	5.18	0.34%	1.22	0.95%	3.44
Median Ex-ante Risk Premium	-0.21%	-1.06	0.72%	4.17	1.44%	13.78	0.97%	3.90	1.19%	6.17
Historical Risk Premium	-4.01%	-1.21	-2.60%	-1.13	2.26%	1.06	0.42%	0.15	1.69%	0.69
Debt/Equity										
Mean Ex-ante Risk Premium	9.68%	7.58	5.60%	8.28	5.83%	10.26	3.68%	10.96	3.40%	14.58
Median Ex-ante Risk Premium	2.80%	10.73	2.79%	16.24	3.20%	22.61	2.86%	11.34	2.65%	11.53
Historical Risk Premium	-0.25%	-0.07	-0.36%	-0.15	2.11%	0.70	1.57%	0.44	1.31%	0.48
Number of Analysts										
Mean Ex-ante Risk Premium	-0.92%	-1.21	-0.56%	-1.12	-2.61%	-4.17	-2.39%	-6.49	-2.20%	-6.46
Median Ex-ante Risk Premium	0.33%	0.69	0.24%	0.81	-1.11%	-3.86	-1.68%	-6.73	-2.10%	-7.55
Historical Risk Premium	-0.26%	-0.05	-0.06%	-0.01	-3.50%	-0.94	-6.25%	-1.34	-3.73%	-0.98
Dollar Volume										
Mean Ex-ante Risk Premium	-2.44%	-2.83	-0.96%	-1.99	-2.28%	-4.31	-1.59%	-6.84	-1.60%	-5.88
Median Ex-ante Risk Premium	-0.12%	-0.25	-0.33%	-1.52	-1.33%	-5.56	-1.48%	-7.06	-1.53%	-5.09
Historical Risk Premium	-2.47%	-0.55	-1.75%	-0.46	-2.33%	-0.64	-8.61%	-1.64	-5.95%	-1.28

Table VI Contd. on the next page.

Table VI Contd.

Characteristics	Quintiles based on long-term growth									
	Low Ltg (1)		2		3		4		High Ltg (5)	
	Q5-Q1	t-Stat	Q5-Q1	t-Stat	Q5-Q1	t-Stat	Q5-Q1	t-Stat	Q5-Q1	t-Stat
Size										
Mean Ex-ante Risk Premium	-5.36%	-3.68	-2.21%	-3.37	-4.24%	-6.52	-3.08%	-8.59	-3.03%	-9.21
Median Ex-ante Risk Premium	-0.98%	-1.35	-0.88%	-2.73	-2.04%	-8.35	-2.36%	-10.37	-2.49%	-8.66
Historical Risk Premium	-1.10%	-0.18	-3.34%	-0.60	-2.88%	-0.61	-5.24%	-1.17	-0.78%	-0.17
MSE of Forecast Earnings										
Mean Ex-ante Risk Premium	6.21%	3.70	4.54%	6.75	3.21%	8.32	1.99%	4.04	2.58%	4.56
Median Ex-ante Risk Premium	1.01%	1.61	1.68%	7.96	1.21%	5.84	0.41%	1.38	0.97%	2.13
Historical Risk Premium	0.96%	0.13	-2.48%	-0.62	-0.98%	-0.40	-3.04%	-1.96	-2.23%	-0.74
Coef. Of Variation of EPS										
Mean Ex-ante Risk Premium	0.55%	0.71	0.46%	1.47	1.12%	3.85	1.28%	4.49	1.91%	3.69
Median Ex-ante Risk Premium	0.32%	0.66	0.90%	4.60	0.94%	4.81	1.14%	4.75	1.27%	3.17
Historical Risk Premium	-0.83%	-0.13	-5.39%	-1.35	-1.46%	-0.46	-3.02%	-1.29	-4.38%	-1.21
Dispersion of Analyst Forecasts										
Mean Ex-ante Risk Premium	-0.67%	-0.82	0.80%	2.19	1.27%	3.23	1.33%	4.04	2.17%	6.65
Median Ex-ante Risk Premium	-0.29%	-0.97	0.56%	4.44	1.14%	4.31	1.10%	4.31	1.76%	6.54
Historical Risk Premium	-2.64%	-0.37	-5.42%	-1.09	-6.93%	-2.23	-2.80%	-0.84	-3.45%	-0.75
Book/Price										
Mean Ex-ante Risk Premium	14.29%	9.86	8.33%	12.81	8.22%	14.85	6.33%	20.53	5.39%	21.31
Median Ex-ante Risk Premium	6.53%	16.36	5.36%	28.08	5.42%	25.29	4.89%	26.32	4.36%	15.89
Historical Risk Premium	6.14%	1.37	4.71%	1.39	2.71%	0.83	1.56%	0.41	-2.93%	-1.08
Momentum										
Mean Ex-ante Risk Premium	-2.67%	-2.63	-2.00%	-5.70	-2.11%	-6.41	-1.70%	-5.25	-2.66%	-9.36
Median Ex-ante Risk Premium	-1.66%	-4.92	-1.65%	-7.87	-1.93%	-5.32	-1.52%	-4.65	-2.22%	-11.23
Historical Risk Premium	-0.96%	-0.19	4.55%	1.69	6.21%	1.87	8.56%	3.13	20.19%	3.98
Turnover (x1000)										
Mean Ex-ante Risk Premium	1.57%	1.02	2.27%	3.20	1.42%	2.24	1.16%	2.91	1.21%	3.92
Median Ex-ante Risk Premium	0.56%	0.88	0.86%	2.93	0.45%	2.21	1.07%	4.54	0.98%	4.11
Historical Risk Premium	-1.18%	-0.33	-3.64%	-1.57	-3.90%	-2.30	-4.97%	-1.88	-4.97%	-1.74