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Inferring the Cost of Capital Using the Ohlson–Juettner Model

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Abstract. We compare risk premia (RP) inferred using the Ohlson-Juettner (RP_{OJ}) and residual income valuation (RP_{RIV}) models in three ways: (1) correlation with risk factors; (2) correlation with RP estimated by multiplying current realizations of risk factors by coefficients obtained from regressing prior-year RP on prior-year risk factors; and (3) correlation with ex post returns. RP_{OJ} has expected correlations with risk factors, a modest correlation with RP estimated from prior-year regressions, and an economically significant association with ex post returns. RP_{RIV} has generally higher correlations, but regression coefficients are sensitive to whether the industry median ROE is computed with or without loss firms.

Keywords: implied cost of capital, ex-ante cost of capital, risk premium, equity valuation, risk

JEL Classification: M41, G12, G31, G32

Equity valuation models use a discount rate to estimate the present value of expected dividends. Following Capital Asset Pricing Model (CAPM), the discount rate is often expressed as the sum of the equity risk premium (RP) plus the risk-free rate. Because the risk premium is not directly observable, it is inferred ex post from realized returns or ex ante from the current price and expectations of future dividends. Inferring the risk premium from realized returns has been problematic because the correlation between expected returns and realized returns is weak (Elton, 1999). This has led to attempts to infer the risk premium ex ante (Harris and Marston, 1992, 2001; Marston and Harris, 1993; Claus and Thomas, 2001; Gebhardt et al., 2001).

In the ex ante approach, one infers the risk premium from the current price and future expected dividends. Yet market expectations of future dividends are not publicly observable. Instead, the closest publicly observable proxies for market expectations are earnings estimates from sell-side analysts. Moreover, analysts do not report their forecasts of the entire earnings stream. They report the forthcoming or one-year-ahead earnings per share (eps_1), two-year-ahead eps (eps_2), and, in many cases, the expected earnings growth over the next five years.

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To infer the risk premium from these data using a valuation model that explicitly relies on dividends, one would need two sets of assumptions: (1) a pattern of payout ratios, and (2) the terminal value[1] at the end of the forecast horizon or the pattern of the decay of the five-year growth rate to a perpetual growth rate. Although analysts may make such assumptions, they do not report their assumptions publicly, forcing a researcher to make ad hoc assumptions. A model that connects with the analysts' view of the world and works directly with their earnings forecasts while introducing a minimum number of additional assumptions would be appealing.

Ohlson and Juettner (2003) provide such a model (hereafter referred to as the OJ model). The OJ model relates the current price (P_0) to forthcoming earnings per share (eps_1), forthcoming dividends per share (dps_1), two-year-ahead eps (eps_2), and an assumed perpetual growth rate gamma (γ). The short-term growth $((\text{eps}_2 - \text{eps}_1)/\text{eps}_1)$ is assumed to decay asymptotically to γ, which we set to be equal to the long-term economic growth rate. The OJ model has two appealing features. First, the model works directly with earnings instead of dividends and does not require forecasts of book values or return on equity (ROE). Thus, one need not make assumptions about dividends beyond dps_1. Second, the OJ model is parsimonious; γ determines the perpetual growth rate as well as the decay rate of short-term growth. Although the technique and the parsimony of the OJ model are appealing, its usefulness in measuring the risk premium is an open empirical question.

We use the OJ model to infer the risk premium ($\text{RP} = r_e - r_f$ where r_e is the cost of equity capital and r_f is the yield on 10-year US Treasury bonds) implied by P_0, eps_1, dps_1, eps_2, and γ and then test the quality of these estimates. For comparison, we also infer the risk premium using two implementations of the residual income valuation (RIV) model that differ in their assumptions about long-term industry profitability. The first model, "RIV1," is based on the RIV implementation in Gebhardt et. al (2001). The second model, "RIV2," is based on Liu et al. (2002). We chose these models because they are representative of common RIV implementations.[2]

Both RIV1 and RIV2 construct forecasts of residual earnings ($=$ earnings $- r_e{}^*$ book value of equity at the beginning of the period) from analyst earnings forecasts (eps_1, eps_2, eps_3), an assumed constant payout ratio, and an assumed pattern of ROE beyond the third year. In particular, from the fourth year onwards, ROE is assumed to trend linearly to the industry median ROE by the 12th year and residual earnings are assumed to be constant in perpetuity thereafter. RIV1 and RIV2 differ only in the way they measure industry median ROE. RIV1 measures the industry median ROE as the moving median of the previous 10 years of ROEs excluding negative ROEs. RIV2 measures the industry median ROE as the moving median of up to the previous 10 years of all ROEs. To eliminate outliers, RIV2 winsorizes industry median ROEs at the risk-free rate and at 20%.

Following Gebhardt et al. (2001), we evaluate the risk premium estimates in three ways. First, we test how the risk premium correlates with frequently cited risk factors: systematic risk (β), earnings variability, unsystematic risk, leverage, and size while controlling for long-term growth, the book-to-market ratio, and industry membership. These associations are of interest to researchers who examine how firm characteristics, particularly β, affect the firm's cost of equity capital. The results indicate that RP_{OJ} is correlated with the independent variables in the expected direction. In the pooled sample β, unsystematic risk, earnings variability, and leverage are all positively correlated with RP_{OJ}, while firm size is negatively correlated with RP_{OJ}. RP_{RIV1} exhibits the expected associations with most of the independent variables in the pooled sample, except earnings variance, which is negatively correlated with the risk premium. RIV2 estimates are not as robust and often have the wrong sign. The wide differences between RIV1 and RIV2 highlight the sensitivity of these RIV implementations to the inclusion of loss firms in the measurement of industry median ROE.

Second, we test how well one can estimate the implicit risk premium without using the current price. This benchmark is important to equity analysts who need a discount rate to compute the stock price and obviously cannot use the price to infer the discount rate. We measure the association between the risk premium inferred from the current price and the risk premium estimated by multiplying the current values of the risk factors by coefficients obtained from a regression of the risk premia on the risk factors in the prior year. The results show that although the OJ model is useful in a predictive setting, the RIV1 model outperforms the OJ model. The correlation between estimated and actual RP_{OJ} is 27.7%, while the similar correlation for RP_{RIV1} is 52.8%. The inclusion of the industry risk premium in the prior year is an important driver of the high R^2 in the RIV1 model.

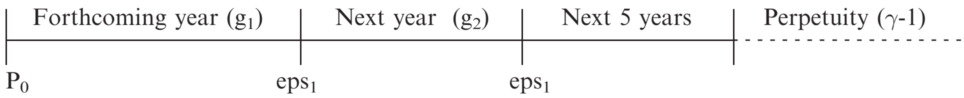
Third, we test whether the ex ante risk premium correlates with ex post realized returns. Such correlations may be used by portfolio managers for asset allocations. Prior research, however, has shown low correlations between expected and realized returns (Elton, 1999). In fact, such low correlations are the main reason for using the ex ante approach. We find economically significant associations between ex ante risk premia and future returns when we divide the firms into five portfolios grouped according to RPs. RIV1 outperforms OJ for one-year- and two-year-ahead returns, while both perform well in predicting three-year-ahead returns. RIV2 performs well only with one-year-ahead returns.

Overall, our results show that in spite of a parsimonious representation that ignores book values and industry profitability, the OJ model provides risk premium estimates that reflect the market's perception of risk. The RIV models result in higher correlations in the regressions, but the sign and significance of the coefficients depend on the computation of industry profitability. Excluding loss firms while computing the industry median ROE improves RIV estimates. Understanding this phenomenon requires further research.

The rest of the paper is organized as follows: Section 1 summarizes the OJ model, Section 2 discusses the commonly cited risk factors, Section 3 describes data and presents summary statistics, Section 4 presents the associations between RPs and risk factors, Section 5 compares the ability of the different models to predict forthcoming implied risk premiums, and Section 6 presents associations between the ex ante risk premium and ex post realized returns. Section 7 summarizes and concludes the paper.

1. The Ohlson–Juettner Model

The OJ model relates price to expected earnings and growth in expected earnings. Analysts typically provide three growth forecasts: eps_1, eps_2, and annualized five-year earnings growth. Although analysts do not provide estimates of "perpetual" growth, all valuation models assume a perpetual growth rate either explicitly or implicitly when they assume a terminal value.



To elucidate the intuition underlying the OJ model, we present it as a generalization of the Gordon growth model. The formal assumptions of the OJ model are provided after this generalization. The Gordon growth model makes the following assumptions: (1) Price equals the present value of expected dividends; (2) There is a fixed dividend payout in relation to earnings. For simplicity, we examine the case of a full payout; (3) There is a constant perpetual earnings growth rate $g_p = \gamma - 1$.

These assumptions yield the following well-known formula: $P_0 = \text{eps}_1/(r_e - g_p)$, where r_e is the cost of equity capital. Adding and subtracting eps_1/r_e to the right-hand side of the above equation yields the following:

$$P_0 = \frac{\text{eps}_1}{r_e} - \frac{\text{eps}_1}{r_e} + \frac{\text{eps}_1}{r_e - g_p} = \frac{\text{eps}_1}{r_e} + \frac{g_p \text{eps}_1}{r_e(r_e - g_p)}.$$

Because $g_p \text{eps}_1 = \text{eps}_2 - \text{eps}_1$ due to the uniform growth rate assumption of the Gordon Growth model, we get

$$P_0 = \frac{\text{eps}_1}{r_e} + \frac{\text{eps}_2 - \text{eps}_1}{r_e(r_e - g_p)}.$$

The OJ model generalizes this formula in the following ways:

i. It makes the same basic assumption that price equals present value of expected dividends (see assumption 1 of the OJ model below).

ii. It imposes NO restrictions on the payout policy. Instead, it builds in Modigliani-Miller dividend irrelevance by correcting for earnings foregone due to dividend payouts (see Assumption 2 of the OJ model below). Thus, instead of $[\text{eps}_2 - \text{eps}_1]$, the OJ model uses $[\text{eps}_2 - \text{eps}_1 - r_e(\text{eps}_1 - \text{dps}_1)]$; i.e., the abnormal change in earnings is defined to be the change in earnings in excess of the return on net reinvestment during the period $r_e(\text{eps}_1 - \text{dps}_1)$. Note that with full payout (i.e., $\text{dps}_1 = \text{eps}_1$), the abnormal change in earnings simply equals $[\text{eps}_2 - \text{eps}_1]$.

iii. Instead of a single constant perpetual growth rate $g_p(=\gamma-1)$, the OJ model allows the short-term growth $\hat{g}_2 = (\text{eps}_2 - \text{eps}_1 - r_e(\text{eps}_1 - \text{dps}_1))/\text{eps}_1$ to differ from g_p. The short-term growth is assumed to decay asymptotically to g_p. The decay rate is also determined by g_p (see Assumption 2 below).

Formally, the OJ model makes the following assumptions:

Assumption 1 $P_0 = \sum_{t=1}^{\infty} \text{dps}_t/(1+r_e)^t$, *where* $r_e > 0$ *is a fixed constant.*

Assumption 2 *Let* $z_t = (\text{eps}_{t+1} - \text{eps}_t - r_e(\text{eps}_t - \text{dps}_t))/r_e$. *The sequence* $\{z_t\}_{t=1}^{\infty}$ *satisfies* $z_{t+1} = \gamma z_t$ $t = 1, 2, \ldots$, *where* $1 \leq \gamma \leq (1 + r_e)$ *and* $z_1 > 0$.

The OJ model yields the following pricing equation:

$$P_0 = \frac{\text{eps}_1}{r_e} + \frac{(\text{eps}_2 - \text{eps}_1 - r_e(\text{eps}_1 - \text{dps}_1))}{r_e(r_e - g_p)}.$$

Rearranging and substituting $g_p = \gamma - 1$, one gets the following:

$$r_e = A + \sqrt{A^2 + \frac{\text{eps}_1}{P_0}(g_2 - (\gamma - 1))}$$

$$\text{where } A \equiv \frac{1}{2}\left((\gamma - 1) + \frac{\text{dps}_1}{P_0}\right) \text{ and } g_2 = \frac{(\text{eps}_2 - \text{eps}_1)}{\text{eps}_1}$$

Note that the expression above yields the Gordon growth model if $\text{dps}_t = k^*\text{eps}_t$ and $g_2 = \gamma - 1$.

To implement the OJ model, we make the following choices: (1) Although the OJ model does not explicitly use the five-year analyst earnings forecasts, instead of discarding this information we use the average of forecast two-year growth and five-year growth as our estimate of short-term growth. (2) The OJ model does not explicitly deal with inflation. Yet analyst forecasts are in terms of nominal dollars, not real dollars. So while estimating the risk premium across time, we use estimates of the nominal long-term growth rate by setting $\gamma - 1 = r_f - 3\%$, where r_f is the yield on 10-year notes.

2. Empirical Data: Risk Proxies

Given that the risk premium is a notional concept and can only be inferred from stock prices and stated expectations of the future, one way to rationalize or justify any measure of risk premium is to study its relationship with variables that affect a firm's risk as perceived by investors. To adjust for changes in risk-free rates, we use the risk premium as the dependent variable as opposed to the cost of capital, where the risk premium equals the cost of equity capital minus the prevailing yield on the 10-year T-bond.

A key problem in relating the risk premium to risk factors is that if the CAPM holds, then β should be the only risk factor. In fact, if CAPM holds, then one should be able to infer the risk premium from realized returns. There is no theoretical model besides CAPM that tells us on exactly which risk factors we should focus. Given the paucity of theoretical models, we draw on the empirical study of Gebhardt et al. (2001) in choosing our risk factors. Since our arguments for using these risk factors are similar to those in Gebhardt et al. (2001), we summarize those arguments below rather than repeating them in full detail.

2.1. Beta (β)

CAPM predicts a positive association between a firm's β and the risk premium. Several studies have shown an association between β and the risk premium (Harris and Marston, 1992; Marston and Harris, 1993; Gordon and Gordon, 1997; Harris et al., 2002). We estimate β for each firm year by regressing 60 lagged monthly returns against the corresponding monthly returns on the CRSP value-weighted index. We winsorize β to lie between 0.2 and 4.

2.2. Unsystematic Risk

In addition to β, prior studies have also shown an association between unsystematic risk and future stock returns (Malkiel, 1997). To extract unsystematic risk from total return volatility, we regress daily returns for the preceding year against the daily CRSP value-weighted index and use the variance of the residuals from the regression as a proxy for unsystematic risk for the firm year.

2.3. Earnings Volatility

There is anecdotal as well as empirical evidence (Barth et al., 1999) that firms with stable and increasing earnings have lower risk premium. Consistent with Gebhardt et al. (2001), we develop a proxy for earnings variability from the following: the mean absolute error of analyst forecasts, the coefficient of variation in EPS, and the dispersion of analyst forecasts. Using factor analysis, we identify a single factor, EARNVAR, which measures earnings variability.[3]

2.4. Leverage

Modigliani and Miller (1958) suggest that the risk premium should be an increasing function of leverage. Fama and French (1992) demonstrate a positive association between leverage and ex post returns. We expect a positive association between the risk premium and leverage (measured as the log of the ratio of the book value long-term debt to the market value of equity).[4]

2.5. *Size*

Disclosure research has argued that firms that are better connected with information intermediaries, such as analysts and institutional investors, have lower risk premium because easy availability of information lowers the information asymmetry between a firm and its investors and lowers the informational risk for investors. Diamond and Verrecchia (1991) show theoretically that greater disclosure can lead to greater liquidity, which in turn lowers the risk premium. Brennan et al. (1993) show that firms with greater analyst coverage are quicker to react to market-wide common information. Botosan (1997) finds a negative association between the level of disclosure and the risk premium. Healy et al. (1999) show that more disclosure can lead to greater liquidity, lower bid-ask spreads, and a lower risk premium.

The information environment is affected by many factors, including trading volume, firm size, bid-ask spreads, and institutional investment. Barth and Hutton (2000) and Mohanram (2000) show that these measures are highly correlated with each other. We use the log of market capitalization of equity (hereafter referred to as the size) as our proxy for the information environment and expect a negative association between the size and the risk premium.

2.6. *Long-term (Five-year) Growth in Expected Earnings*

Gebhardt et al. (2001) use the long-term growth in expected earnings from I/B/E/S as a proxy for market mispricing and predict a negative correlation between the risk premium and long-term growth. Their argument is based on two phenomena. First, based on La Porta (1996), they argue that analysts are overoptimistic for high-growth firms and prices are too high, which results in a low risk premium. We find it difficult to predict how mispricing will affect the risk premium because it depends on price in relation to earnings forecasts. Analysts may be optimistic about earnings, but if they use the correct discount rate, their optimism will not lead to an overstated risk premium, but to an inflated price. Optimism regarding long-term growth will affect the risk premium only if they misestimate the risk for high-growth firms. Since we do not have strong priors as to the analysts' biases regarding risks inherent in high-growth firms, we examine Gebhardt et al. (2001) second explanation of how long-term growth can affect the implied risk premium.

RIV models assume that the ROE reverts to the industry median ROE. If the industry median ROE is lower than the analysts' estimate of a firm's long-run ROE, then these firms will appear to have a higher price and a lower risk premium.

Gebhardt et al. (2001) therefore hypothesize a negative association between growth and risk premium. This hypothesis does not extend to the OJ model directly because the implicit earnings growth pattern assumed in the OJ model differs from that assumed in the RIV models. In the OJ model, short-term earnings growth decays asymptotically to γ, and the rate of decay also depends on γ. Thus, the OJ model overstates future earnings and consequently the risk premium for firms whose decay in growth rate exceeds γ, and vice versa. Firms with a rapid decay in growth, as evidenced by a high ratio of short-term growth to long-term growth, should have high risk premium, and vice versa. It is difficult to predict how long-term growth alone will affect the risk premium.

We believe that the high-growth firms are generally perceived by the market to be risky because any errors in estimation of growth can have a significant impact on prices. That is, the potential of negative returns is higher with high-growth firms. Thus, we predict a positive association between growth and the risk premium. Controlling for growth also ensures that the regressions of the risk premium against the risk factors are not simply an artifact of correlation between earnings growth and risk.

2.7. *Book-to-Market (B/M) Ratio*

Gebhardt et al. (2001) control for the book-to-market ratio as measured by the log of the ratio of the book value of equity to the market value of equity. High B/M could reflect lower growth opportunities, lower accounting conservatism, or high perceived risk. Although it is difficult to argue how the combination of these factors will influence the risk premium, based on prior research we expect B/M to be positively associated with the risk premium.

2.8. *Industry Risk Premium*

Gebhardt et al. (2001) find that industry effects are important in explaining cross-sectional differences in risk premia. They find that β has no explanatory power when lagged industry mean risk premia are used, and they conclude that β merely proxies for industry differences in risk premia. We include industry controls in our tests by measuring the average of the risk premium in the prior year for all firms in the same industry as per the Fama–French (1997) classification.

3. Data and Summary Statistics

3.1. Data Sources and Sample Selection

Our sample covers the I/B/E/S data from 1984 to 1998. We select firms each year based on the following conditions: (1) at least five analyst forecasts in I/B/E/S for that year; (2) market capitalization of at least \$100 million that year; (3) returns data in CRSP daily and monthly databases; (4) accounting data in the Compustat annual database; (5) $\text{eps}_1 > 0$ and $\text{eps}_2 > 0$; and (6) availability of five-year or long-term growth estimates from I/B/E/S. We impose these criteria to ensure adequate and reliable data about analysts' expectations of earnings and earnings growth.

3.2. Computation of Risk Premia

We use the yield on a 10-year US Treasury note as a proxy for r_f. RP_{OJ} is calculated from the OJ model using the expression in Section 2. The inputs to the OJ model are P_0, eps_1, short-term growth g_2, perpetual growth γ, and dps_1, which is estimated by multiplying eps_1 by an estimated payout ratio described in the next section.

The RIV models equate price and the sum of book value and the present value of residual earnings. The inputs into the RIV models are price, eps_1, eps_2, the annualized five-year growth estimate, the industry median ROE, the current book value, and the current payout. The beginning book value for each year is computed by using the clean surplus relation with the following inputs: the prior book value, earnings forecasts, and dividends forecast by multiplying forecast earnings by the current payout. Earnings forecasts for the first and second years are simply eps_1 and eps_2 from I/B/E/S, while $\text{eps}_3 = \text{eps}_2(1 + \text{annualized five-year growth from I/B/E/S})$. Earnings forecasts for the fourth year through the 12th year are constructed by assuming that the firm's ROE reverts to its industry's median ROE on a straight-line basis, where the industry is defined using the Fama–French (1997) classification. Residual earnings are assumed to be constant in perpetuity beyond the 12th year.

3.2.1. Dividend Payout Ratios

The OJ model explicitly requires only one dividend forecast, which is the forthcoming dividend payment dps_1, while the RIV models require more forecasts. We use the same methodology used by Gebhardt et al. (2001) to forecast dividend payouts. Specifically, we assume that all future payout ratios will be equal to the current payout ratio computed as follows. If current earnings (eps_0) are positive, we divide current dividends (dps_0) by current earnings. If current earnings are negative, we divide current dividends by "normal earnings," which are assumed to be 6% of total assets. We winsorize the payout ratios to lie between 0 and 1. We ignore stock buybacks.

3.2.2. *Growth Rates Used in the OJ Model*

The OJ model requires two growth rates—a short-term growth rate that decays asymptotically to a perpetual growth rate γ. The short-term growth rate g_2 is the growth rate between eps_1 and eps_2 ($eps_2/eps_1 - 1$). Since the ratio of eps_2 to eps_1 is meaningful only if $eps_1 > 0$ and $eps_2 > 0$, we restrict our sample so that both these earnings forecasts are positive. This criterion makes our sample size smaller than the sample used in Gebhardt et al. (2001). Instead of using g_2 as the proxy for short-term growth, we use an average of g_2 and the annualized five-year growth estimate from I/B/E/S as an estimate of short-term growth in the OJ model. Our rationale for doing so is two-fold. First, we do not want to throw away an important piece of data regarding five-year growth expectations. Second, when eps_2/eps_1 is inordinately large because of artificially low eps_1, such averaging provides more reasonable estimates of short-term growth.

The OJ model also requires a forecast of perpetual growth, γ. We can think of no economic reasons why firms would have different earnings growth in perpetuity. Although firms can have different accounting policies in perpetuity, one can show that the accounting policies do not affect the perpetual growth rate in expected earnings. Thus, the only justification that we can think of for variations in γ is that γ also determines the rate of decay in earnings growth, which can differ across firms. Instead of assuming the same perpetual growth for all firms, Easton (2001) uses the OJ model at a portfolio level to simultaneously infer the risk premium and γ. Since we estimate the risk premium for each firm, we cannot use this approach.

We set the real perpetual growth rate to be equal to a very long-term economic growth rate of 3%. Because we use the same perpetual growth rate for all firms, the assumed rate does not affect the relative risk premia of different firms, but merely affects the overall level of risk premium. Because our focus is on the cross-sectional variation and not the absolute magnitude of the risk premium, our choice of γ is not central to our results. Since analyst forecasts are in nominal, not real, dollars, we set $\gamma - 1$ to be equal to $r_f - 3\%$ to account for the effects of inflation, where r_f is the yield on the 10-year US Treasury note.

3.2.3. *ROE Assumptions Used in the RIV Models*

RIV1 measures the industry median ROE as the moving median of up to the previous 10 years of ROE, excluding negative ROE firms. RIV2 measures the industry median ROE as the moving median of the previous 10 years of ROE of all firms in the industry. To eliminate outliers, RIV2 winsorizes industry median ROEs at the risk-free rate and at 20%.

3.2.4. Measurement Dates and Updated Book Values

As in Gebhardt et al. (2001), we infer the risk premium on June 30 of each year. We also use their procedure of matching book values to I/B/E/S forecasts as outlined below. A problem arises because I/B/E/S updates its references to forecasting periods when firms announce earnings, but the new book value enters into the Compustat database with a lag when the 10 K is filed. Thus, between the earnings announcement date and the 10 K filing date, the earnings forecasts refer to the forthcoming year but the book value refers to the beginning of the prior year, when it should refer to the beginning of the current year. To avoid stale book values, we update the book value using the equation $b_t = b_{t-1} + \text{eps}_t - \text{dps}_t$ during the period between the month of the earnings announcement and month $+4$ after the fiscal year end. From the fourth month to the next year's earnings announcement, we use the book value as reported by Compustat.

3.3. Summary Statistics: Tables 1–3

Table 1 provides descriptive statistics for the sample by year. The number of firms increases from 711 in 1984 to 1352 in 1998. There is an increase in the typical firm size, whether it is measured by assets, sales, or market value of equity, but the median number of analysts per firm whose forecasts are in I/B/E/S has decreased over the years. As is typical, the distribution of firm sizes is skewed, as demonstrated by the difference between mean and median statistics for firm size.

Figure 1 plots the time series of risk premia. Note that the absolute differences in levels between OJ and RIV are not meaningful, as the OJ levels can be shifted by changing the assumed perpetual growth rate. Because our focus is not on the absolute levels of market risk premia, we do not address the issue of determining a reasonable level of the perpetual growth rate. Overall, RP_{OJ} appears to be more stable than both RIV measures. RP_{RIV1} exceeds RP_{RIV2} because RIV1 assumes reversion to the industry median ROE without loss-making firms, which is higher than the industry median ROE with loss-making firms, as assumed by RIV2.

Table 2 and Figure 2 plot the time series of the components of RP_{OJ}. Although there are changes in the individual components, such as the steady decline in dividend yields, overall the level of RP_{OJ} remains reasonably stable.

Table 3 presents Spearman and Pearson correlations between the variables. Because these two correlations are similar, we discuss only the Pearson correlations shown in the first three columns of Table 3. There is considerable divergence between the three risk premium measures. The correlation between OJ and RIV1 is 36%, while the correlation between OJ and RIV2 is only 17%. The correlation between the two RIV measures—RIV1 and RIV2—is 63%. The univariate correlations between the risk premium measures and risk factors reveal interesting patterns. RP_{OJ} is positively correlated with our proxy for risk measures, such as earnings variability (EARNVAR), systematic risk (β), unsystematic risk (UNSYST), leverage, long-term growth, and the book-to-market ratio. RP_{OJ} is also negatively correlated with size.

Table 1. Summary statistics.

		RP_{OJ}		RP_{RIV1}		RP_{RIV2}		Sales ($ Billions)		Assets ($ Billions)		MV_{EQUITY} ($ Billions)		Number of Analysts	
Year	*N*	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean	Median	Mean	Median	Mean	Median	Mean	Median
84	711	5.5	4.7	0.2	−0.1	−0.2	−0.4	3.55	0.73	2.16	0.66	1.04	0.38	11.7	10
85	794	5.4	4.7	1.9	1.7	0.8	0.6	3.70	0.88	2.14	0.70	1.25	0.48	12.8	11
86	807	5.6	4.9	2.8	2.6	1.5	1.2	4.38	0.96	2.33	0.70	1.69	0.64	13.2	11
87	857	5.0	4.6	1.9	1.7	0.5	0.1	4.23	0.89	2.29	0.65	2.00	0.64	13.0	11
88	839	4.6	4.2	2.6	2.3s	1.1	0.8	4.88	1.01	2.62	0.71	1.93	0.60	13.3	11
89	876	4.4	4.3	2.9	2.8	1.3	1.0	5.26	1.09	2.56	0.76	2.03	0.66	13.7	11
90	941	5.4	4.7	3.0	2.6	1.1	0.5	5.75	1.04	2.87	0.71	2.27	0.61	13.0	11
91	1044	5.6	4.8	2.8	2.4	0.9	0.3	5.29	0.96	2.77	0.66	2.17	0.55	12.3	9
92	1092	6.2	5.6	3.5	3.3	1.3	0.8	5.36	1.01	2.74	0.68	2.36	0.60	11.7	9
93	1086	6.5	6.1	4.4	4.2	2.0	1.5	5.54	1.04	2.70	0.72	2.37	0.68	11.9	10
94	1200	5.8	5.3	3.3	3.2	1.1	0.5	5.81	1.02	2.71	0.67	2.56	0.69	11.5	9
95	1219	6.3	5.8	4.3	4.3	2.0	1.6	6.88	1.07	3.10	0.73	2.91	0.79	11.0	9
96	1344	5.2	4.8	3.5	3.3	1.2	0.9	6.49	1.01	3.11	0.71	3.32	0.80	10.5	8
97	1423	5.2	4.8	3.7	3.5	1.4	1.3	6.97	1.03	3.16	0.71	3.87	0.89	10.0	8
98	1352	6.1	5.5	4.7	4.6	2.6	2.5	6.48	0.98	2.62	0.72	3.62	0.83	9.0	7
All	15585	5.6	5.1	3.2	3.0	1.3	1.0	5.58	0.99	2.71	0.70	2.52	0.66	11.7	9

The table above shows yearly average implied risk premia (the cost of capital minus the risk-free rate) for the following three definitions of risk premia:
RP_{OJ}: The risk premium inferred using the Ohlson–Juettner (2003) model based on the I/B/E/S earnings estimates of one-year- and two-year-ahead EPS and long-term growth.
RP_{RIV1}: The risk premium inferred using an RIV framework with the assumption that a firm's third-year ROE reverts to the median ROE of profitable firms in the industry by the 12th year.
RP_{RIV2}: Based on a methodology similar to RP_{RIV1} except that industry median ROEs are calculated for all firms, including loss-making firms.

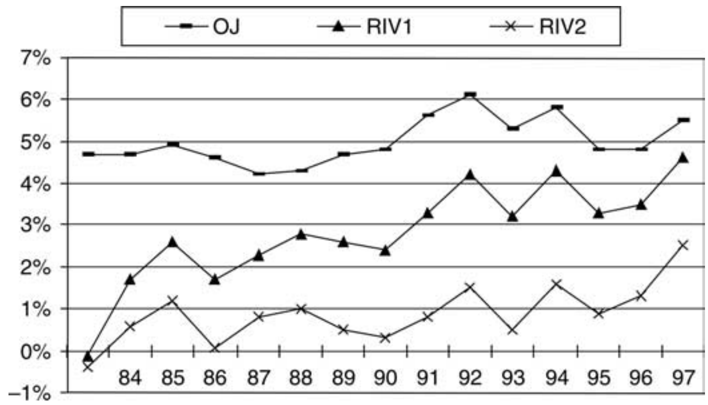


Figure 1. Time series of median risk premia.

Table 2. Descriptive statistics for components of RP_{OJ}.

Year	N	RP_{OJ} (%)	STG (%)	LTG (%)	(STG + LTG)/2 (%)	$(\gamma - 1) = r_f - 3\%$ (%)	dps_1/P_0 (%)	eps_1/P_0 (%)	$A = 0.5$ $(\gamma - 1 + dps_1/P_0)$ (%)
1984	711	5.46	33.8	14.3	24.0	10.6	4.3	11.4	7.4
1985	794	5.35	29.7	13.7	21.7	7.2	3.3	9.3	5.2
1986	807	5.57	29.8	12.9	21.3	4.8	2.7	7.3	3.8
1987	857	5.05	33.2	13.3	23.3	5.4	2.4	6.9	3.9
1988	839	4.58	22.0	12.9	17.4	5.9	3.0	8.7	4.4
1989	876	4.38	19.1	12.6	15.9	5.3	2.7	8.6	4.0
1990	941	5.35	28.6	12.9	20.8	5.5	2.7	8.3	4.1
1991	1,044	5.63	36.9	13.0	25.0	5.3	2.5	7.4	3.9
1992	1,092	6.20	33.9	13.0	23.4	4.3	2.5	7.3	3.4
1993	1,086	6.46	31.0	13.2	22.1	3.0	2.2	6.9	2.6
1994	1,200	5.79	29.4	13.5	21.5	4.1	2.2	7.1	3.1
1995	1,219	6.27	24.8	13.6	19.2	3.2	2.2	7.5	2.7
1996	1,344	5.24	28.2	14.2	21.2	3.9	1.9	6.7	2.9
1997	1,423	5.17	28.2	15.2	21.7	3.5	1.5	6.1	2.5
1998	1,352	6.06	28.6	15.7	22.1	2.5	1.3	6.1	1.9

N: The number of firms
RP_{OJ}: The risk premium inferred using the Ohlson–Juettner (2003) model based on the I/B/E/S earnings estimates of one-year- and two-year-ahead EPS and long-term growth.
STG: The I/B/E/S estimate of short-term growth derived by computing (eps2 − eps1)/eps1.
LTG: The I/B/E/S estimate of long-term growth.
r_f: The yield on the 10-year US Treasury note.
γ: The perpetual growth rate assumed in the Ohlson–Juettner (2003) model.
dps_1: Estimated forthcoming dividends computed by multiplying estimated forthcoming eps_1 by the payout ratio.
P_0: The current price.
A: The expression as defined in the Ohlson–Juettner formula.

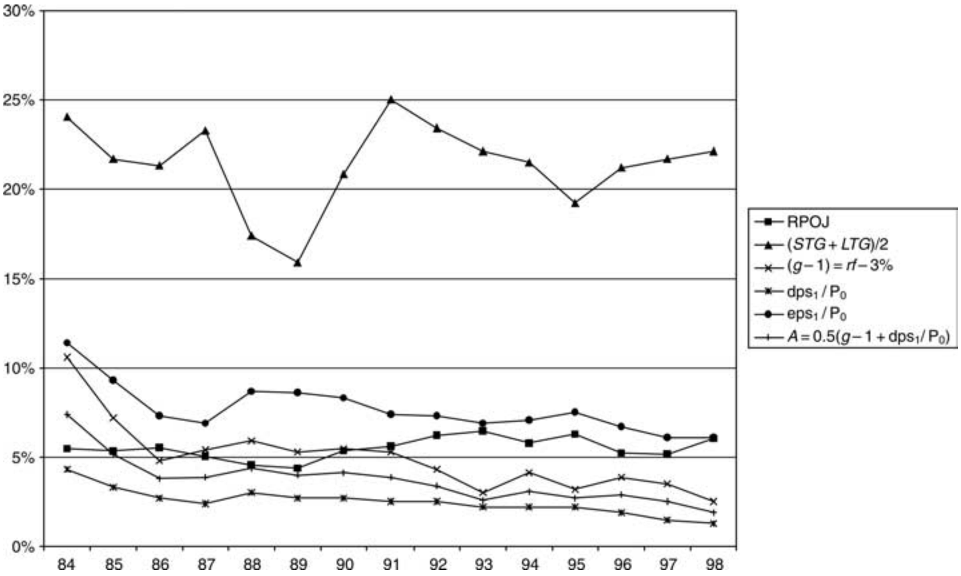


Figure 2. Time series of components of RP_{OJ}.

These correlations are in line with our expectations. RP_{RIV1} has similar correlations with β, unsystematic risk, and size; somewhat lower correlations with earnings variance, leverage, and growth; and a significantly higher correlation with the book-to-market ratio. RP_{RIV2} exhibits a dramatically different pattern. It is negatively correlated with β, unsystematic risk, earnings variability, and long-term growth, which is contrary to what one would expect. It does, however, show a strong correlation with leverage and book-to-market ratio.

4. Association of Risk Premia with Risk Factors

Tables 4–6 show the association of risk premia with major risk factors. Table 4 provides results of pooled regressions, Table 5 provides results of year-by-year regressions, and Table 6 highlights the differences between RP_{OJ} and RP_{RIV1}.

4.1. Pooled Regressions: Table 4

Table 4 presents the results of pooled regression of the risk premium measures on the risk factors. Each observation represents a firm year, and the regression is carried out for the entire panel of data from 1984 to 1998. Panels A, B, C, and D show the regressions for E/P ratio, OJ, RIV1, and RIV2 models, respectively.

Table 4, Panel A provides a benchmark where we simply use the E/P ratio as a measure of the risk premium. Our reason for doing so is as follows. A single-stage

Table 3. Correlations among independent variables and risk premium variables.

	RP_{OJ}	RP_{RIV1}	RP_{RIV2}	β	UNSYST	EARNVAR	$\ln(D/M)$	$\ln(M)$	LTG	$\ln(B/M)$
RP_{OJ}		37	23	21	31	41	15	−24	23	21
RP_{RIV1}	36		75	15	29	16	15	−22	7	36
RP_{RIV2}	17	63		−10	−4	0	27	−9	−23	47
β	23	17	−16		36	27	−5	−9	40	−12
Unsyst	33	31	−10	36		43	−5	−50	46	−4
Earnvar	42	18	−4	29	46		20	−33	19	25
$\ln(D/M)$	10	4	27	−12	−17	16		−5	−27	36
$\ln(M)$	−24	−22	−6	−7	−52	−34	2		−18	−31
LTG	26	8	−31	40	49	19	−37	−20		−39
$\ln(B/M)$	20	33	46	−11	−5	29	42	−31	−40	

The table shows the correlation (in percent) among the three measures of risk premia and firm risk characteristics for the entire pooled sample of 15,585 observations. Numbers above the diagonal are Pearson correlation coefficients, while numbers below the diagonal are Spearman rank-order correlations.

RP_{OJ}: The risk premium inferred using the Ohlson–Juettner (2003) model based on the I/B/E/S earnings estimates of one-year and two-year-ahead EPS and long-term growth.

RP_{RIV1}: The risk premium inferred using an RIV framework with the assumption that a firm's third-year ROE reverts to the median ROE of profitable firms in the industry by the 12th year.

RP_{RIV2}: Based on a methodology similar to RP_{RIV1} except that industry median ROEs are calculated for all firms, including loss-making firms.

β: Beta computed using a five-year rolling window before the date of measurement.

UNSYST: Unsystematic risk as measured by the residual from the regression over the previous year of a firm's daily return on the daily market return.

EARNVAR: Earnings variance from a factor analysis of the mean absolute error in analyst forecasts in the previous five years, dispersion of analysts' forecasts, and the coefficient of variation of earnings.

$\ln(D/M)$: Leverage as measured by the log of the ratio of the book value of long-term debt to the market value of equity.

$\ln(M)$: Size as measured by the log of the total market value of equity.

LTG: The I/B/E/S estimate of long-term growth.

$\ln(B/M)$: The log of the ratio of the book value of equity to the market value of equity.

Table 4. Cross-sectional pooled regression of the implied risk premium.

Intercept	β	UNSYST	EARNVAR	$\ln(D/M)$	$\ln(M)$	LTG	$\ln(B/M)$	RP_{IND}	Adj-R^2 (%)
Panel A: Dependent variable E/P									
1.06	−0.13	−10.74	−0.35	2.36	−0.23				10.49
(6.27)	(−2.50)	(−3.24)	(−28.55)	(31.38)	(−12.47)				
1.89	0.32	24.02	−0.34	1.68	−0.22	−13.9			15.83
(11.85)	(6.14)	(7.06)	(−28.50)	(22.16)	(−12.25)	(−31.44)			
0.49	0.31	38.00	−0.43	1.11	0.02	−7.90	1.57		21.93
(3.08)	(6.19)	(11.52)	(−36.91)	(14.81)	(1.16)	(−17.14)	(34.90)		
0.54	0.36	30.71	−0.34	0.68	−0.00	−5.39	1.39	0.50	30.72
(3.59)	(7.66)	(9.87)	(−30.58)	(9.53)	(−0.01)	(−12.32)	(32.78)	(44.48)	
Panel B: Dependent variable RP_{OJ}									
4.80	0.53	44.81	0.40	0.93	−0.14				21.3
(31.39)	(10.91)	(14.32)	(35.03)	(13.17)	(−8.06)				
4.35	0.30	27.17	0.40	1.28	−0.14	7.07			22.6
(28.29)	(6.05)	(8.28)	(34.83)	(17.42)	(−8.45)	(16.54)			
3.40	0.30	36.62	0.33	0.89	0.02	11.16	1.06		25.4
(21.8)	(6.03)	(11.28)	(28.89)	(12.05)	(0.93)	(24.62)	(24.00)		
1.23	0.10	28.92	0.31	1.14	0.02	10.43	0.95	0.44	28.6
(7.09)	(2.01)	(9.07)	(27.28)	(15.62)	(0.87)	(23.46)	(21.82)	(26.37)	
Panel C: Dependent variable RP_{RIV1}									
2.06	0.39	70.97	−0.02	1.32	−0.15				12.3
(14.96)	(8.87)	(25.23)	(−2.43)	(20.75)	(−9.88)				
2.20	0.46	76.72	−0.02	1.21	−0.15	−2.31			12.5
(15.79)	(10.17)	(25.82)	(−2.25)	(18.25)	(−9.77)	(−5.95)			
0.44	0.45	94.33	−0.14	0.49	0.15	5.31	1.98		25.6
(3.28)	(10.75)	(34.19)	(−14.62)	(7.82)	(9.7)	(13.77)	(52.56)		
0.10	0.20	45.50	−0.03	0.58	0.02	4.43	1.89	0.79	48.0
(0.94)	(5.67)	(19.1)	(−3.83)	(10.97)	(1.77)	(13.74)	(59.99)	(81.96)	

Table 4. Continued.

Intercept	β	UNSYST	EARNVAR	$\ln(D/M)$	$\ln(M)$	LTG	$\ln(B/M)$	RP_{IND}	Adj-R^2 (%)
Panel D: Dependent variable RP_{RIV2}									
2.55	− 0.38	− 9.01	− 0.05	2.12	− 0.19				9.3
(19.16)	(− 8.86)	(− 3.31)	(− 5.52)	(34.41)	(− 12.74)				
3.03	− 0.13	9.98	− 0.05	1.76	− 0.19	− 7.62			11.7
(22.7)	(− 3)	(3.51)	(− 4.98)	(27.65)	(− 12.51)	(− 20.55)			
1.29	− 0.14	27.31	− 0.17	1.05	0.11	− 0.12	1.95		25.8
(10.21)	(− 3.57)	(10.41)	(− 17.95)	(17.52)	(7.55)	(− 0.34)	(54.39)		
0.08	0.04	27.09	− 0.04	0.62	0.05	2.47	1.59	0.81	53.8
(0.75)	(1.31)	(13.08)	(− 5.38)	(13.1)	(3.93)	(8.49)	(55.95)	(97.18)	

Results of pooled regressions of the risk premium on firm-specific risk characteristics. There were 15,872 observations in the sample from 1984 to 1998. *T*-statistics are in parentheses. Three sets of regressions are run for each risk premium measure. The first set includes β, UNSYST, $\ln(D/M)$ and $\ln(M)$. The second set adds LTG and $\ln(B/M)$ to control for growth and the book-to-market ratio. The final set also controls for the industry mean risk premium (RP_{IND}) during the prior year for firms in the same industry per the Fama-French (1997) classification.

RP_{OJ}: The risk premium inferred using the Ohlson–Juettner model from the I/B/E/S estimates of one-year and two-year-ahead EPS and long-term growth.

RP_{RIV1}: The risk premium inferred using an RIV framework with the assumption that a firm's third-year ROE reverts to the median ROE of profitable firms in the industry by the 12th year.

RP_{RIV2}: Based on a methodology similar to RP_{RIV1} except that industry median ROEs are calculated for all firms, including loss-making firms.

β: Beta computed using a five-year rolling window before the date of measurement.

UNSYST: Unsystematic risk as measured by the residual from the regression over the previous year of a firm's daily return on the daily market return.

EARNVAR: Earnings variance from a factor analysis of the mean absolute error in analyst forecasts in the previous five years, dispersion of analysts' forecasts, and the coefficient of variation of earnings.

$\ln(D/M)$: Leverage as measured by the log of the ratio of the book value of long-term debt to the market value of equity.

$\ln(M)$: Size as measured by the log of the total market value of equity.

LTG: The I/B/E/S estimate of long-term growth.

$\ln(B/M)$: The log of the ratio of the book value of equity to the market value of equity.

Table 5. Cross-sectional year-by-year regression of the implied risk premium.

Intercept	β	UNSYST	EARNVAR	$\ln(D/M)$	$\ln(M)$	LTG	$\ln(B/M)$	RP_{IND}	Adj-R^2(%)
Panel A: Dependent variable RP_{OJ}									
5.27	0.73	17.18	0.46	0.86	− 0.18				23.6
(14.59)	(5.18)	(1.81)	(5.38)	(6.73)	(− 5.3)				
4.74	0.39	− 0.86	0.45	1.21	− 0.17	8.08			25.4
(10.92)	(3.79)	(− 0.08)	(5.43)	(12.7)	(− 3.85)	(4.32)			
3.80	0.35	13.46	0.38	0.76	− 0.02	12.92	1.19		28.5
(6.43)	(3.05)	(1.95)	(5.51)	(7.43)	(− 0.44)	(4.62)	(6.35)		
1.62	0.15	12.93	0.35	1.00	− 0.01	12.05	1.07	0.41	30.8
(3.42)	(1.6)	(2.27)	(5.58)	(10.21)	(− 0.21)	(4.67)	(7.36)	(15.42)	
Panel B: Dependent variable RP_{RIV1}									
3.91	0.65	4.14	0.07	1.29	− 0.32				16.4
(5.32)	(13.93)	(0.3)	(2.9)	(4.23)	(− 5.68)				
4.09	0.81	9.48	0.07	1.16	− 0.32	− 3.04			16.8
(6.44)	(8.84)	(0.73)	(2.81)	(4.69)	(− 6.09)	(− 2.74)			
2.08	0.73	39.13	− 0.09	0.23	− 0.01	7.05	2.49		40.0
(2.3)	(5.62)	(10.87)	(− 1.79)	(2.13)	(− 0.12)	(11.17)	(6.35)		
0.57	0.43	28.21	− 0.04	0.44	− 0.03	4.83	2.21	0.74	55.5
(1.74)	(3.73)	(7.72)	(− 0.67)	(5.29)	(− 0.72)	(4.81)	(6.41)	(10.41)	
Panel C: Dependent variable RP_{RIV2}									
3.96	− 0.34	− 54.99	0.02	2.08	− 0.30				13.6
(13.2)	(− 1.28)	(− 4.57)	(0.69)	(12.76)	(− 10.76)				
4.43	0.02	− 37.73	0.02	1.72	− 0.30	− 8.17			16.5
(16.55)	(0.13)	(− 2.54)	(0.85)	(9.49)	(− 13.45)	(− 5.54)			
2.52	− 0.05	− 8.66	− 0.13	0.83	− 0.01	1.47	2.37		36.6
(4.74)	(− 0.41)	(− 1.31)	(− 5.6)	(6.7)	(− 0.11)	(1.02)	(5.71)		
0.58	0.17	11.53	− 0.04	0.50	− 0.01	2.84	1.89	0.79	65.2
(2.42)	(2.23)	(5.16)	(− 0.91)	(5.64)	(− 0.48)	(3.04)	(4.45)	(9.98)	

Results of year-by-year regressions of the risk premium on firm-specific risk characteristics. The number of observations ranged from a low of 711 in 1984 to a high of 1,423 in 1997. The coefficients presented are the means from 15 annual regressions. Numbers in parentheses are *t*-statistics adjusted for auto-correlation as in Bernard (1995). The last column shows the average adjusted R^2 for the regressions.

Three sets of regressions are run for each risk premium measure. The first set includes β, UNSYST, $\ln(D/M)$ and $\ln(M)$. The second set adds LTG and $\ln(B/M)$ to control for growth and the book-to-market ratio. The final set also controls for the industry mean risk premium (RP_{IND}) during the prior year for firms in the same industry per the Fama-French (1997) classification.

RP_{OJ}: The risk premium inferred using the Ohlson–Juettner model from the I/B/E/S estimates of one-year and two-year-ahead EPS and long-term growth.

RP_{RIV1}: The risk premium inferred using an RIV framework with the assumption that a firm's third-year ROE reverts to the median ROE of profitable firms in the industry by the 12th year.

RP_{RIV2}: Based on a methodology similar to RP_{RIV1} except that industry median ROEs are calculated for all firms, including loss-making firms.

β: Beta computed using a five-year rolling window before the date of measurement.

UNSYST: Unsystematic risk as measured by the residual from the regression over the previous year of a firm's daily return on the daily market return.

EARNVAR: Earnings variance from a factor analysis of the mean absolute error in analyst forecasts in the previous five years, dispersion of analysts' forecasts, and the coefficient of variation of earnings.

$\ln(D/M)$: Leverage as measured by the log of the ratio of the book value of long-term debt to the market value of equity.

$\ln(M)$: Size as measured by the log of the total market value of equity.

LTG: The I/B/E/S estimate of long-term growth.

$\ln(B/M)$: The log of the ratio of the book value of equity to the market value of equity.

Gordon growth model with a full payout assumption shows the following:

$$P_0 = \frac{\text{eps}_1}{r_e - g} \quad \text{and therefore} \quad r_e = \frac{\text{eps}_1}{P_0} + g.$$

As discussed earlier, the OJ formula generalizes the Gordon formula by allowing the short-term growth to differ from the perpetual growth. It is therefore useful to know how far one can get if one simply ignores growth, assumes full payout, and uses the E/P ratio as a measure of the risk premium. Table 4, Panel A shows that although the simple model has a high R^2, it yields a risk premium that has a negative association with earnings variability and long-term growth. Although the negative association with earnings variability is somewhat unexpected, the negative association with growth is expected. Rearranging terms in the Gordon growth formula, one can see that the E/P ratio equals the risk premium minus the growth rate. Unless an increase in the growth rate is more than offset by an increase in the risk premium, one should expect a lower E/P for a higher growth rate.

The first row of Table 4, Panel B shows that RP_{OJ} correlates with systematic risk, unsystematic risk, earnings variability, leverage, and size in ways we expect. Row 2 shows that controlling for long-term growth does not affect the result and reinforces the belief that high-growth firms are also perceived to be high-risk firms. Controlling for the book-to-market effect does not alter the results, except that size is no longer significant. Controlling for the industry risk premium from the prior year reduces the significance of systematic risk but does not change the results otherwise. Addition of each of these controls raises the R^2 marginally, with the final R^2 being 28.6%.

Panel C has RP_{RIV1} as the dependent variable. The results in the first row are similar to RP_{OJ} in Panel A, except that the earnings variability has a significant negative coefficient. Controlling for growth in Row 2 has little incremental impact, but in contrast to RP_{OJ}, growth has a negative coefficient in this case. Once we control for the book-to-market ratio, the growth is once again positively associated with the risk premium. Controls for the industry risk premium boost the R^2 from 25.6% to 48.0% and yield the expected signs for all risk factors except earnings variability. Thus, the overall R^2 for RIV1 with all controls in place (48%) is much higher than the corresponding R^2 for OJ (28.6%).

Panel D has RP_{RIV2} as the dependent variable, and the results are dramatically different. The coefficients behave erratically as controls are added. Moreover, many coefficients have the wrong signs. When all controls are added, however, RP_{RIV2} regression does yield expected signs for all risk factors except earnings variability and a high R^2 of 53.8%. The increase in R^2 is largely attributable to the industry control and to a lesser extent to the book-to-market ratio.

The only difference between our implementation of RIV1 and RIV2 is in the computation of the industry median ROE. RIV1 computes the industry median ROE after excluding negative ROE firms, while RIV2 includes all firms but winsorizes the median ROE to lie within 20% and r_f. Since the median ROE assumption determines the terminal value in RIV models, it is not surprising that the computation of ROE is crucial to the results.

4.2. *Year-by-Year Regressions: Table 5*

We also run year-by-year regressions to test the stability of the relationships observed in the pooled sample. Table 5 presents the average coefficients and *t*-statistics for these regressions using a methodology similar to Fama and MacBeth (1973). Because auto-correlation among the coefficients in the annual regressions can bias the true standard errors downward and bias the *t*-statistics upward, we correct the *t*-statistics for auto-correlation as in Bernard (1995).[5]

For brevity, we do not run the E/P ratio as the benchmark. The average R^2 for the annual regressions is higher because the coefficients are allowed to vary across years, leading to a slightly better fit. The regressions exhibit patterns similar to those in the pooled cross-sectional results presented in Table 4, with some differences. Unsystematic risk loses its significance when only growth is added for the OJ models but is significant again with the addition of B/M and industry controls. The coefficient on earnings variability is no longer consistently negative for RIV1 and RIV2 and depends on the specification.

4.3. *Examining the Divergence between RP_{OJ} and RP_{RIV1}: Table 6*

To uncover the potential causes of the divergence between the OJ and RIV1 models, we examine the characteristics of firms where this divergence is magnified. We consider the subsets that lie in the top quartile of one metric and the bottom quartile of the other metric.

Table 6, Panel A examines firm years that are in the top quartile of RP_{OJ} (mean $RP_{OJ} = 8.7\%$) but are in the bottom quartile of RP_{RIV1} (mean RP_{RIV1} 0.58%).[6] The key characteristics of these firms are the following: (1) high short-term growth relative to the entire sample (61% vs. 29%) but similar long-term growth (13.9% vs. 13.7%); (2) a lower ROE (6.7% vs. 15.4%); and (3) a lower book-to-market ratio (0.484, vs. 0.598 for the entire sample).

The short-term growth rate for firms in Table 6, Panel A is high because the current earnings are abnormally low, as demonstrated by their low current ROE. The market does not expect the short-term growth to last, as indicated by the average long-term growth and an E/P ratio that is only modestly lower. Yet the OJ model overstates the expected earnings pattern, resulting in a high RP_{OJ}, because it does not assume that the short-term growth will decay rapidly, since the decay factor is only γ.[7] As short-term growth estimates fall in the subsequent year, RP_{OJ} is revised downward.

In contrast, firms in Panel A of Table 6 have low RP_{RIV1} because these firms have low ROEs and a relatively lower book-to-market ratio. Because the book value does not account for much of the market value for this sub-sample, the discounted abnormal earnings must pick up a greater share. Yet because the current ROE is low, the near-term expected abnormal earnings are low (even negative), while the longer-term expected abnormal earnings should be higher as the ROE reverts to industry median. A low risk premium boosts the discounted abnormal earnings in two ways.

Table 6. Extreme divergence between RP_{OJ} and RP_{RIV1}.

	High RP_{OJ} Low RP_{RIV1}	Entire Sample	*T* Statistic
Panel A: Firm years with High RP_{OJ} and Low RP_{RIV1}			
RP_{OJ}	8.70%	5.55%	40.33
RP_{RIV1}	0.58%	3.20%	– 43.15
Earnings-to-price ratio (EPS_1/P_0)	0.056	0.075	– 19.73
Book-to-market ratio (B/M)	0.484	0.598	– 12.26
ROE	6.7%	15.4%	– 9.56
Short-term growth ($STG = (EPS_2 - EPS_1)/P_0$))	61.1%	29.4%	9.99
Long-term growth (LTG estimate from *I*/B/E/S)	13.9%	13.7%	0.87
STG/LTG	4.98	2.52	7.53
β	1.02	1.09	– 3.52
UNSYST	0.019	0.019	– 1.02
EARNVAR*	1.296	– 0.059	12.90
Debt-to-equity ratio (D/M)	0.382	0.433	– 2.62
Change in RP_{OJ} during the following year	– 1.81%	0.05%	– 12.78
Change in RP_{RIV1} during the following year	1.24%	0.27%	10.85
Stock return during the following year	4.58%	9.42%	– 2.68
Panel B: Firm years with Low RP_{OJ} and High RP_{RIV1}			
RP_{OJ}	1.80%	5.55%	– 46.86
RP_{RIV1}	5.74%	3.20%	25.23
Earnings to price ratio (EPS_1/P_0)	0.106	0.075	15.85
Book-to-Market Ratio (B/M)	0.988	0.598	11.50
ROE	16.0%	15.4%	0.42
Short-term growth ($STG = (EPS_2 - EPS_1)/P_0$))	14.9%	29.4%	– 5.98
Long-term growth (LTG estimate from I/B/E/S)	10.6%	13.7%	– 15.85
STG/LTG	1.21	2.52	– 5.91
β	1.12	1.09	1.43
UNSYST	0.019	0.019	– 0.09
EARNVAR*	0.453	– 0.059	4.92
Debt-to-equity ratio (D/M)	0.575	0.433	2.84
Change in RP_{OJ} during the following year	2.23%	0.05%	12.45
Change in RP_{RIV1} during the following year	– 0.17%	0.27%	– 4.04
Stock return during the following year	10.41%	9.42%	0.53

This table compares subsamples with extreme observations of two risk premium measures with the entire sample. There were 519 observations where RP_{OJ} was in the top quartile while RP_{RIV1} was in the bottom quartile. There were 520 observations where RP_{OJ} was in the bottom quartile while RP_{RIV1} was in the top quartile.

RP_{OJ}: The risk premium inferred using the Ohlson–Juettner model from the I/B/E/S estimates of one-year and two-year-ahead EPS and long-term growth.

RP_{RIV1}: The risk premium inferred using an RIV framework with the assumption that a firm's third-year ROE reverts to the median ROE of profitable firms in the industry by the 12th year.

RP_{RIV2}: Based on a methodology similar to RP_{RIV1} except that industry median ROEs are calculated for all firms, including loss-making firms.

β: Beta computed using a five-year rolling window before the date of measurement.

UNSYST: Unsystematic risk as measured by the residual from the regression over the previous year of a firm's daily return on the daily market return.

EARNVAR: Earnings variance from a factor analysis of the mean absolute error in analyst forecasts in the previous five years, dispersion of analysts' forecasts, and the coefficient of variation of earnings.

D/M: Leverage as measured by the ratio of the book value of long-term debt to the market value of equity. We do not take logs here.

LTG: The I/B/E/S estimate of long-term growth.

B/M: The ratio of the book value of equity to the market value of equity. We do not take logs here.

First, it boosts the abnormal earnings for a given level of earnings because the charge for the use of capital is lower. Second, it boosts present values via a lower discount rate. Thus, for this sub-sample, one gets a low implied RP_{RIV1}.

Table 6, Panel B examines firm years in the bottom quartile of RP_{OJ} (mean RP_{OJ} 1.80%) that are in the top quartile of RP_{RIV1} (mean RP_{RIV1} 5.74%). The key characteristics of these firms are the following: (1) a much lower short-term growth rate (14.9% vs. 29.4%) and lower long-term growth rate (10.6% vs. 13.7%); (2) a higher book-to-market ratio of 0.988, vs. 0.598 for the entire sample; and (3) a slightly higher ROE of 16.0%, vs. 15.4%. These firms have low RP_{OJ} because they have low growth in expected earnings. They have a high RP_{RIV1} because they have a high book-to-market ratio and also a normal ROE. A high book-to-market ratio implies that the present value of expected abnormal earnings must be low. This can happen if the ROE is low or if the discount rate is high. Since the ROE is normal, a high discount rate is needed to lower the abnormal earnings as well as increase the discount factor in the denominator.

The firms in Panel A seem to underperform the market, while the firms in Panel B seem to outperform the market. This is most likely driven by the well-documented effect of the book-to-market ratio on returns. The book-to-market effect is better captured by the RIV1 model.

5. Predicting the Implied Risk Premium Using Risk Factors

Another way to evaluate models of risk premia is to assess how well one can estimate the actual risk premium inferred from the stock price based on observable risk factors. Models with a high predictive ability can then be used to compute a price from earnings forecasts rather than simply to infer the risk premium from the price and earnings forecasts. We use an instrumental variables approach to test whether the estimated risk premium predicts the implied risk premium. First, we regress the implied risk premium in the prior year on our independent variables in the prior year. Second, we multiply the coefficients from the prior year regressions by the current realizations of independent variables to obtain an estimate of the current risk premium—RP_{EST}. Third, for each firm year we regress the actual implicit risk premium on RP_{EST} for that firm year. The results are presented in Table 7A for the OJ model and Table 7B for RIV1.

As the first set of tests in Tables 7A and 7B indicate, the mean R^2 of OJ is only 27.7%, while that for RIV1 is 52.8%. Thus, RIV1 outperforms OJ by a wide margin. If we drop the industry risk premium as an explanatory variable, then the average R^2 for the RP_{OJ} regression drops slightly, from 27.7% to 25.4%, while the average R^2 for RP_{RIV1} regressions drops from 52.8% to 36.5%. This demonstrates the strong influence of the industry controls on RIV1. The OJ coefficients are slightly more stable because they differ from 1 at the 10% significance level in three years, while RIV1 coefficients do so in five years.

To understand why the OJ and RIV1 models differ in predictive ability, we conduct two additional tests. First, we neutralize the impact of year-to-year variation

Table 7. Panel A: Measuring RP_{OJ} without using the current price. This table presents the regression $RP_{EST} = a_0 + a_1 RP_{ACT}$, where RP_{ACT} is the risk premium inferred from the current price and earnings forecasts using the OJ model, while RP_{EST} is the risk premium computed without using the current price but instead by multiplying the realizations of hypothesized risk factors with the coefficients obtained from prior-period regressions of RP_{ACT} on the risk factors. We use all of the independent variables in Table 5 (β, UNSYST, EARNVAR, $\ln(D/M)$, $LN(M)$, LTG, $\ln(B/M)$ and RP_{IND}) as risk factors. In the first regression below, we compute RP_{EST} as follows. We regress RP_{ACT} in the previous year on the risk factors in the previous year and then multiply the coefficients so obtained by the realizations of risk factors in the current year. For the second regression below, instead of using coefficients from only the previous year, we use the average of coefficients from three previous years. In the third set, we average RP_{ACT} and RP_{EST} over three years ($t-2$, $t-1$, and t). To avoid overlap between estimation and prediction periods, we use coefficients from year $t-3$. The number of observations ranges from a low of 796 in 1985 to a high of 1,421 in 1997. The sample is slightly smaller for the second and third sets of regressions because of the data required for three years. T-statistics are in parentheses. The t-statistics for the average a_0 and a_1 across time have been corrected for auto-correlation as in Bernard (1995).

	Estimation from the Previous Year				Using the Average Coefficients from the Three Previous Years				Using the Average RP_{OJ} from Three Years			
Year	a_0	a_1	(a_1-1)	Adj R^2 (%)	a_0	a_1	(a_1-1)	Adj R^2 (%)	a_0	a_1	(a_1-1)	Adj R^2 (%)
1985	2.5	0.59	−0.41	28.9								
	(13.00)	(9.07)	(−6.33)									
1986	0.68	0.99	−0.01	29.3								
	(2.41)	(9.25)	(−0.07)									
1987	0.33	0.86	−0.14	31.6	1.29	0.74	−0.26	30.8				
	(1.32)	(10.07)	(−1.55)		(6.23)	(19.75)	(−6.81)					
1988	0.62	0.79	−0.21	16.1	0.79	0.73	−0.27	16.0				
	(1.92)	(6.41)	(−1.60)		(2.55)	(12.79)	(−4.72)					
1989	0.29	0.94	−0.06	17.1	0.76	0.76	−0.24	15.7	1.51	0.64	−0.36	25.3
	(0.95)	(6.84)	(−0.43)		(2.61)	(12.99)	(−4.16)		(6.66)	(14.21)	(−7.85)	
1990	0.71	1.08	0.08	18.7	−0.58	1.32	0.32	27.8	0.9	0.83	−0.17	32.8
	(2.18)	(7.46)	(0.55)		(−1.8)	(19.28)	(4.7)		(4.01)	(17.64)	(−3.74)	
1991	0.22	0.93	−0.07	32.3	−0.19	1.12	0.12	29.3	0.6	0.85	−0.15	35.9
	(0.84)	(11.31)	(−0.8)		(−0.66)	(21.08)	(2.3)		(2.6)	(19.41)	(−3.35)	
1992	0.97	0.95	−0.05	32.0	0.32	1.07	0.07	33.4	−0.4	1.12	0.12	42.3
	(4)	(11.43)	(−0.6)		(1.23)	(23.59)	(1.47)		(−1.52)	(23.26)	(2.45)	
1993	0.99	0.86	−0.14	35.1	1.43	0.85	−0.15	35.4	0.05	1.07	0.07	42.5
	(4.24)	(12.17)	(−1.94)		(6.64)	(24.52)	(−4.32)		(0.21)	(24.69)	(1.69)	

Table 7. Continued.

Year	Estimation from the Previous Year				Using the Average Coefficients from the Three Previous Years				Using the Average RP_{OJ} from Three Years			
	a_0	a_1	$(a_1 - 1)$	Adj R^2 (%)	a_0	a_1	$(a_1 - 1)$	Adj R^2 (%)	a_0	a_1	$(a_1 - 1)$	Adj R^2 (%)
1994	− 0.65	0.98	− 0.02	29.7	0.29	0.88	− 0.12	29.2	0.79	0.99	− 0.01	37.4
	(− 2.23)	(11.35)	(− 0.25)		(1.13)	(22.45)	(− 2.93)		(3.29)	(22.41)	(− 0.31)	
1995	1.3	0.92	− 0.08	26.8	1.16	0.87	− 0.13	27.0	1.37	0.87	− 0.13	39.7
	(5.35)	(10.64)	(− 0.92)		(4.7)	(21.41)	(− 3.17)		(6.63)	(23.33)	(− 3.48)	
1996	− 0.28	0.86	− 0.14	21.4	− 0.1	0.88	− 0.12	24.0	0.94	0.82	− 0.18	37.8
	(− 0.96)	(9.66)	(− 1.62)		(− 0.39)	(20.79)	(− 2.83)		(4.53)	(23.18)	(− 5.1)	
1997	0.19	1.01	0.01	29.9	− 0.12	1.01	0.01	29.4	0.97	0.89	− 0.11	39.3
	(0.9)	(12.45)	(0.15)		(− 0.54)	(24.59)	(0.28)		(5.16)	(24.02)	(− 3.12)	
1998	− 0.02	1.17	0.17	38.3	− 0.55	1.26	0.26	39.4	0.5	0.88	− 0.12	41.1
	(− 0.1)	(14.61)	(2.17)		(− 2.38)	(29.87)	(6.15)		(2.51)	(24.21)	(− 3.33)	
Average	0.56	0.92	− 0.08	27.7	0.38	0.96	− 0.04	28.1	0.72	0.9	− 0.1	37.4
	(3.51)	(25.01)	(− 2.04)		(1.52)	(11.89)	(− 0.52)		(2.5)	(12.83)	(− 1.5)	

Table 7. Continued.

Panel B: Measuring RP_{RIV1} without using the current price. This table presents the regression $RP_{EST} = a_0 + a_1 RP_{ACT}$, where RP_{ACT} is the risk premium inferred from the current price and earnings forecasts using the RIV1 model, while RP_{EST} is the risk premium computed without using the current price but instead by multiplying the realizations of observed risk factors that are hypothesized to affect RP with the coefficients obtained from prior-period regressions of RP_{ACT} on the risk factors. We use all of the independent variables in Table 5 (β, UNSYST, EARNVAR, $\ln(D/M)$, $\mathrm{LN}(M)$, LTG, $\ln(B/M)$ and RP_{IND}) as risk factors. In the first regression below, we compute RP_{EST} as follows. We regress RP_{ACT} in the previous year on the risk factors in the previous year and then multiply the coefficients so obtained by the realizations of risk factors in the current year. For the second regression below, instead of using coefficients from only the previous year, we use the average of coefficients from three previous years. In the third set, we average RP_{ACT} and RP_{EST} over three years ($t-2$, $t-1$, and t). To avoid overlap between estimation and prediction periods, we use coefficients from year $t-3$. The number of observations ranges from a low of 796 in 1985 to a high of 1421 in 1997. The sample is slightly smaller for the second and third sets of regressions because of the data required for three years. *T*-statistics are in parentheses. The *t*-statistics for the average a_0 and a_1 across time have been corrected for auto-correlation as in Bernard (1995).

	Estimation from the Previous Year				Using the Average Coefficients from the Three Previous Years				Using the Average RP_{RIV1} from Three Years			
Year	a_0	a_1	(a_1-1)	Adj R^2 (%)	a_0	a_1	(a_1-1)	Adj R^2 (%)	a_0	a_1	(a_1-1)	Adj R^2 (%)
1985	2.42	0.6	−0.4	34.1								
	(33.14)	(10.24)	(−6.87)									
1986	0.96	0.86	−0.14	41.3								
	(10.19)	(12.04)	(−2.00)									
1987	−1.58	1.11	0.11	52.2	0.79	0.84	−0.16	57.1				
	(−12.9)	(15.47)	(1.52)		(12.32)	(28.34)	(−5.55)					
1988	1.18	0.91	−0.09	59.4	0.08	1.04	0.04	66.6				
	(18.76)	(17.67)	(−1.69)		(1)	(36.07)	(1.33)					
1989	0.35	0.87	−0.13	56.1	0.39	0.92	−0.08	68.5	0.15	1.06	0.06	63.5
	(3.92)	(16.96)	(−2.43)		(4.49)	(34.25)	(−2.88)		(1.89)	(32.09)	(1.94)	
1990	−1.24	1.29	0.29	62.6	−0.75	1.22	0.22	70.4	−0.03	1.11	0.11	71.4
	(−10.45)	(20.07)	(4.5)		(−7.02)	(40.97)	(7.39)		(−0.37)	(39.79)	(3.9)	
1991	0.42	0.82	−0.18	44.7	−0.21	0.94	−0.06	66.0	−0.03	0.91	−0.09	66.0
	(3.78)	(14.69)	(−3.2)		(−1.63)	(29.32)	(−1.72)		(−0.37)	(36.11)	(−3.77)	
1992	0.5	1.09	0.09	60.2	0.29	1.07	0.07	61.4	−0.42	1.23	0.23	61.4
	(5.63)	(20.48)	(1.65)		(3.16)	(41.57)	(2.61)		(−3.69)	(34.27)	(6.42)	
1993	1.29	0.85	−0.15	64.5	1.54	0.89	−0.11	52.9	0.43	1	0	56.5
	(15.97)	(22.32)	(−3.87)		(21.04)	(46.55)	(−5.81)		(4.03)	(32.75)	(−0.14)	

Table 7. Continued.

Year	Estimation from the Previous Year				Using the Average Coefficients from the Three Previous Years				Using the Average RP_{RIV1} from Three Years			
	a_0	a_1	$(a_1 - 1)$	Adj R^2 (%)	a_0	a_1	$(a_1 - 1)$	Adj R^2 (%)	a_0	a_1	$(a_1 - 1)$	Adj R^2 (%)
1994	− 1.53	0.92	− 0.08	63.3	− 0.53	0.89	− 0.11	62.6	− 0.31	1.15	0.15	62.7
	(− 13.77)	(22.94)	(− 1.91)		(− 5.52)	(43.33)	(− 5.54)		(− 2.81)	(37.51)	(4.82)	
1995	2.38	0.88	− 0.12	48.1	1.81	0.79	− 0.21	59.6	1.58	0.78	− 0.22	57.2
	(33.5)	(16.9)	(− 2.23)		(20.62)	(32.74)	(− 8.85)		(20.34)	(33.21)	(− 9.62)	
1996	− 2.85	1.25	0.25	34.2	− 1.42	1.14	0.14	64.0	0.03	0.89	− 0.11	59.5
	(− 11.58)	(13.32)	(2.7)		(− 7.4)	(27.16)	(3.41)		(0.33)	(35.97)	(− 4.61)	
1997	1.58	0.81	− 0.19	54.2	0.86	0.94	− 0.06	51.0	1.49	0.92	− 0.08	49.5
	(25.57)	(20.72)	(− 4.77)		(11.75)	(43.18)	(− 2.81)		(17.22)	(29.59)	(− 2.69)	
1998	0.32	1.13	0.13	64.6	0.61	1.11	0.11	66.4	0.12	0.92	− 0.08	65.6
	(3.4)	(25.04)	(2.87)		(6.87)	(51.3)	(5.22)		(1.24)	(40.03)	(− 3.42)	
Average	0.3	0.96	− 0.04	52.8	0.29	0.98	− 0.02	62.2	0.3	1.00	0.00	61.3
	(1.35)	(28.8)	(− 1.28)		(1.97)	(35.98)	(− 0.65)		(1.85)	(24.92)	(− 0.12)	

in the regression coefficients by averaging them from the three previous years. Second, we isolate the impact of variation in the risk premium by averaging it over three years.

The second set of columns in Tables 7A and 7B shows the effect of estimating RP_{EST} using the average of coefficients from the three previous years. For example, the mean coefficients from 1984, 1985, and 1986 are used to estimate the risk premium in 1987. The average R^2 increases slightly for the OJ model to 28.1%, and to a greater extent for the RIV1 model to 62.2%. The marginal increase in R^2 for OJ indicates that dampening the variability in coefficients does not improve OJ estimates.

The third set of columns shows the effect of averaging the risk premium over three years. For example, we define the risk premium in 1996 as the average of the risk premia in 1994, 1995, and 1996. To ensure that the estimation and prediction periods do not overlap, we use coefficients lagged by three years; e.g., to estimate the risk premium in 1996, we use coefficients from 1993. For the OJ model, the mean R^2 increases from 27.7% to 37.4%; for the RIV1 model, it increases from 52.8% to 61.3%. The results of these tests indicate that the RIV1 model outperforms the OJ model in a predictive setting.

6. Predicting Future Realized Returns

We now turn to another yardstick for evaluating these models—the correlation between the ex ante risk premium and the ex post returns. An important caveat is, however, in order. Had the relationship between expected returns and realized returns been strong, we would have used the ex post returns as an unbiased estimate of the expected returns. We infer the risk premium from analysts' earnings forecasts because prior research (see Elton, 1999) suggests that the relationship between expected returns and realized returns is, at best, weak. Elton (1999) argues that significant surprises make realized returns different from expected returns even over relatively long periods of time for a large portfolio of stocks. For example, although the realized return in the Japanese stock market in the last 10 years has been negative, it is difficult to argue that the expected return in the Japanese stock market over these years was negative as well.

It is still an important question whether expected returns correlate with realized returns. Any mechanism for predicting realized returns is of great interest to those who study mispricing or those who wish to allocate assets based on ex ante risk. To test this relationship, we form quintiles each year sorted on RP, as the realized returns at the firm level are too noisy. For each of these quintiles, we compute one-year-ahead, two-year-ahead, and three-year-ahead mean realized returns.

Table 8 and Figure 3 present the results. As shown by the *t*-statistics for the difference in realized returns between the top and bottom quintiles, the OJ model performs marginally when predicting one-year-ahead returns, while it performs well in predicting two-year or three-year-ahead returns. The RIV1 model performs well across the board, while the RIV2 model does well only with one-year-ahead returns.

Table 8. Returns on quintiles of the risk premium. Panel A: Using annual measures of the risk premium.

	*Q*1	*Q*2	*Q*3	*Q*4	*Q*5	(*Q*5-*Q*1)	*T* Statistic
Quintiles based on RP_{OJ}							
RP_{OJ}	2.06%	3.92%	5.05%	6.51%	10.21%		
Year +1 Return	8.62%	8.96%	9.36%	10.39%	10.10%	1.48%	1.21
Year +2 Return	8.90%	7.34%	9.70%	11.60%	14.13%	5.23%	3.55
Year +3 Return	7.22%	7.96%	9.45%	10.30%	12.69%	5.47%	3.95
Quintiles based on RP_{RIV1}							
RP_{RIV1}	0.47%	1.97%	3.02%	4.12%	6.51%		
Year +1 Return	6.16%	7.91%	10.50%	9.73%	13.12%	6.97%	5.69
Year +2 Return	5.94%	8.35%	11.08%	12.80%	13.49%	7.56%	5.88
Year +3 Return	6.78%	8.68%	8.84%	11.35%	12.02%	5.24%	3.98
Quintiles based on RP_{RIV2}							
RP_{RIV2}	−1.26%	−0.08%	0.97%	2.21%	4.73%		
Year +1 Return	7.58%	9.20%	8.93%	8.97%	12.75%	5.18%	4.47
Year +2 Return	10.11%	11.66%	9.84%	9.01%	10.99%	0.88%	0.71
Year +3 Return	7.87%	12.42%	9.28%	7.93%	10.07%	2.20%	1.85

Quintiles are created at the end of year t by sorting the sample by the ex ante risk premium at the end of year t. For each quintile, the mean ex post returns for years $t+1$, $t+2$, and $t+3$ are reported. To ensure comparability with the risk premium measures, the risk-free rate is subtracted from the ex post returns. The quintile sizes were 3,116, 3,002, and 2,886 respectively for the one-year-, two-year- and three-year-ahead returns.

Overall, the ability of the OJ and RIV1 models to predict future returns is economically significant, as shown by the magnitude of differences in realized returns between the top and bottom quintiles.

7. Summary and Conclusions

Understanding how stock prices relate to earnings forecasts is crucial to equity analysis. The risk premium (RP = the cost of equity minus the risk-free rate) is a summary measure of risk as perceived by equity investors and is the critical link between stock prices and earnings forecasts. It is also a key measure in project evaluation and in asset allocation. Accordingly, measuring the risk premium and identifying the causes of its variation have received considerable attention. Because inferring the risk premium from realized returns is problematic (Elton, 1999), researchers have started to infer the risk premium from earnings forecasts.

We use a new valuation model proposed by Ohlson and Juettner (2003) to infer the risk premium and compare RP_{OJ} with the risk premium inferred from two implementations of the RIV model. The OJ model generalizes the Gordon growth model to allow short-term growth rates to exceed RP. The OJ model does not rely on book values or return on equity and does not require explicit assumptions about the payout policy or clean surplus.

Table 8. Returns on quintiles of the risk premium. Panel B: Using three-year averages of the risk premium.

	$Q1$	$Q2$	$Q3$	$Q4$	$Q5$	$(Q5\text{-}Q1)$	T Statistic
Quintiles based on RP_{OJ}							
RP_{OJ}	2.65%	4.11%	5.00%	6.15%	8.80%		
Year +1 Return	6.50%	8.25%	7.03%	10.11%	13.12%	6.62%	4.20
Year +2 Return	5.53%	6.59%	7.61%	9.53%	12.97%	7.43%	4.68
Year +3 Return	7.32%	8.84%	9.65%	11.39%	12.59%	5.27%	3.42
Quintiles based on RP_{RIV1}							
RP_{RIV1}	0.63%	1.94%	2.85%	3.85%	5.82%		
Year +1 Return	5.37%	6.85%	8.79%	10.61%	13.39%	8.02%	5.47
Year +2 Return	5.62%	4.32%	8.43%	11.53%	12.32%	6.70%	4.64
Year +3 Return	8.01%	6.75%	9.93%	12.42%	12.78%	4.78%	3.24
Quintiles based on RP_{RIV2}							
RP_{RIV2}	−1.12%	−0.03%	0.97%	2.16%	4.46%		
Year +1 Return	7.24%	9.69%	8.40%	8.44%	11.25%	4.02%	3.17
Year +2 Return	7.12%	9.37%	9.17%	6.55%	9.97%	2.85%	2.11
Year +3 Return	8.44%	12.00%	9.70%	8.01%	11.61%	3.17%	2.20

Quintiles are created at the end of year t by sorting the sample by the average of the ex ante risk premium at the end of years $t-2$, $t-1$, and t. For each quintile, the mean ex post returns for years $t+1$, $t+2$, and $t+3$ are reported. To ensure comparability with the risk premium measures, the risk-free rate is subtracted from the ex post returns. This averaging mitigates the errors in risk premium measures. The quintile sizes were 1,861, 1,813, and 1,729 respectively for the one-year-, two-year- and three-year-ahead returns.

We compare RP_{OJ} with the risk premium inferred using two implementations of the residual income valuation model (RIV1 and RIV2) that are motivated by, but not identical to, Gebhardt et al. (2001) and Liu et al. (2002), respectively. Both RIV1 and RIV2 assume that a firm's ROE reverts to the median ROE of its industry over time. The key difference between them is that RIV1 computes the median after excluding negative ROE firms, while RIV2 computes the median with all firms and winsorizes the median to lie between r_f and 20%. The ROE assumption is crucial, as it determines the terminal value, which is the most important component of total value.

The three risk premia exhibit quite different time series patterns (Table 1) and are not highly correlated with each other (Table 3). The OJ-RIV1 rank correlation is only 0.36, while the OJ-RIV2 rank correlation is even lower at 0.17. Even the RIV1-RIV2 correlation is only 0.63. To understand the differences between these measures, we report three sets of comparisons: (1) correlation with frequently cited risk factors, such as β, unsystematic risk, earnings variability, size, and leverage, while controlling for long-term growth, the book-to-market ratio, and the lagged industry risk premium; (2) correlation with the risk premium estimated by multiplying current realizations of risk factors by coefficients obtained from regressing the implied risk premium in the previous year on risk factors in the previous year; and (3) correlation between ex ante risk premium and ex post returns.

RP_{OJ} correlates with the risk factors in ways we expect in a pooled cross-sectional regression (Table 4), and the results are generally robust when we run annual

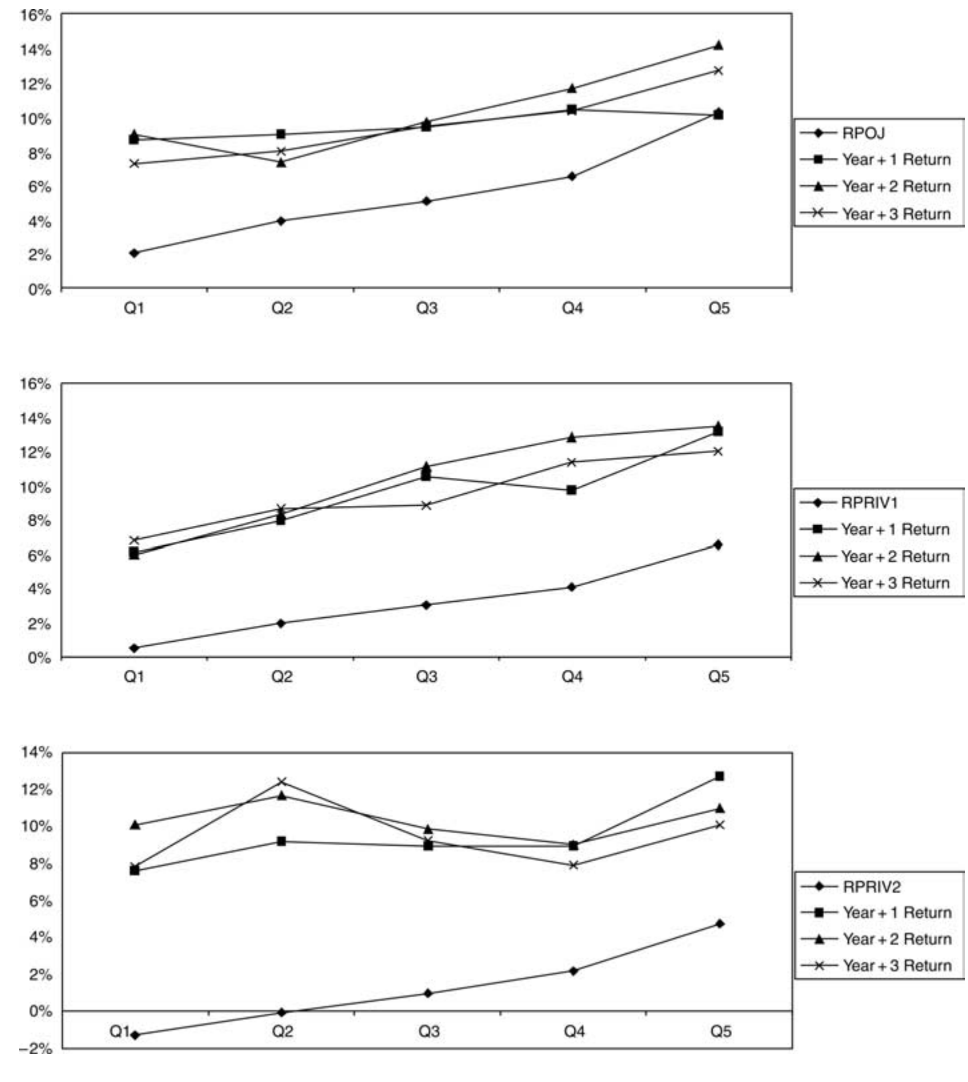


Figure 3a. Returns on quintiles of the risk premium. Using annual measures of the risk premium. Quintiles are created at the end of year t by sorting the sample by the ex ante risk premium at the end of year t. For each quintile, the mean ex post returns for years $t+1$, $t+2$, and $t+3$ are reported. To ensure comparability with the risk premium measures, the risk-free rate is subtracted from the ex post returns. The quintile sizes were 3,116, 3,002, and 2,886 respectively for the one-year-, two-year- and three-year-ahead returns.

regressions (Table 5). RP_{RIV1} also correlates with risk factors in ways we expect, with the exception of earnings variability. The overall R^2 for RIV1 is higher than for OJ when we control for industry effects. Most RIV1 results are robust when we run annual regressions. The RIV1 model outperforms the OJ model in predicting one-year-ahead implied risk premia (Table 7) and realized returns (Table 8). The RIV2

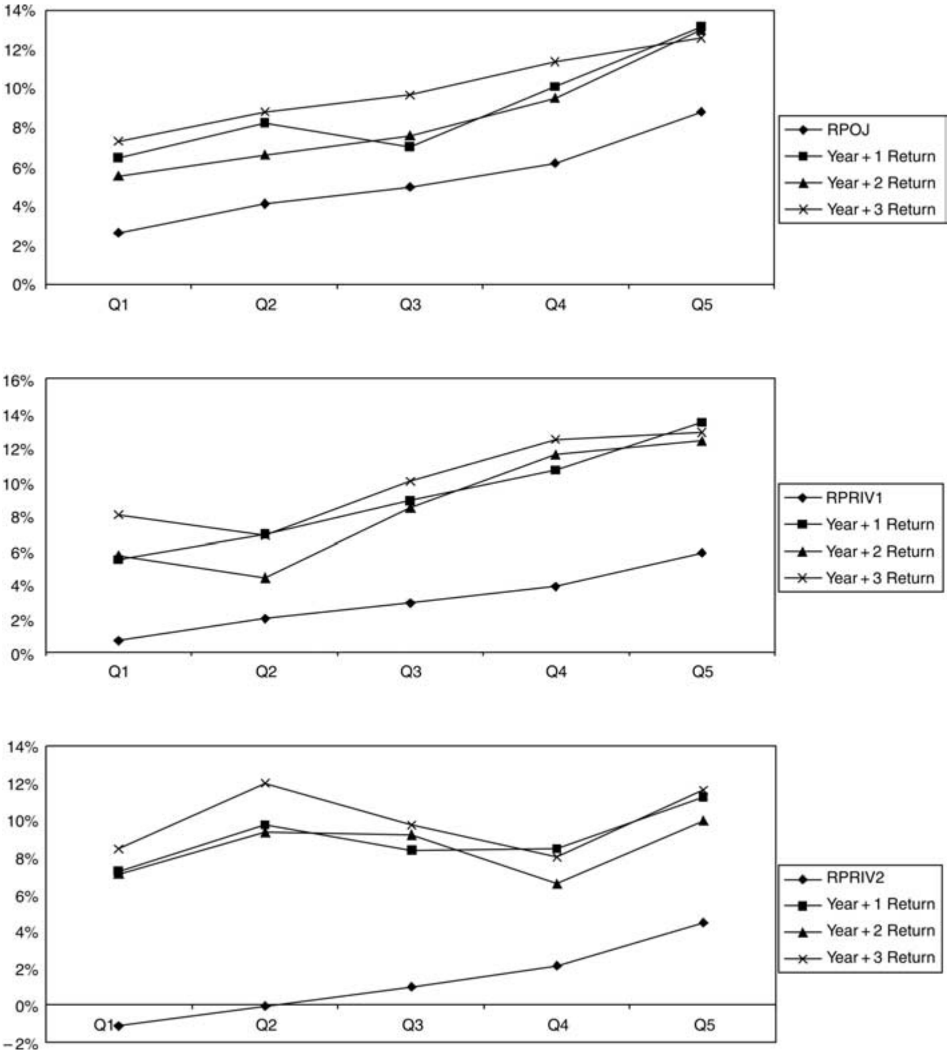


Figure 3b. Returns on quintiles of the risk premium. Using three-year averages of the risk premium. Quintiles are created at the end of year t by sorting the sample by the average of the ex ante risk premium at the end of years $t-2$, $t-1$, and t. For each quintile, the mean ex post returns for years $t+1$, $t+2$, and $t+3$ are reported. To ensure comparability with the risk premium measures, the risk-free rate is subtracted from the ex post returns. This averaging mitigates the errors in risk premium measures. The quintile sizes were 1,861, 1,813, and 1,729 respectively for the one-year-, two-year- and three-year-ahead returns.

measures do not exhibit the expected association with risk factors and are the least associated with the realized returns. We do not test the ability of the RIV2 model to predict forthcoming implied risk premia.

Overall, the RIV1 model generally outperforms the OJ model, potentially because it incorporates additional information, particularly the industry median ROE. The

RIV2 model, which also uses the industry median ROE but includes loss firms in the median ROE computation, generally underperforms both the OJ and the RIV1 models. Thus, the OJ results are robust because of the model's parsimony, while the RIV results are sensitive to how one exploits the flexibility of using additional information.

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Notes

1. See Plumlee and Botosan (2002) for the use of terminal value estimates from Valueline.
2. Liu et al. (2002) do not focus on the measurement of RPs, while Gebhardt et al. (2001) do. The bulk of our paper therefore uses RIV1 as an example of a typical RIV implementation used to measure RPs.
3. The three variables we consider are: MAE, the mean absolute error in annual analysts forecasts over the previous five years scaled by the mean absolute realized EPS over the period; EPSVAR, the coefficient of variation in EPS over the previous five years; and DISP, the dispersion in analyst forecasts. We take logs of these variables to reduce the effects of outliers and then run a factor analysis. A single factor accounts for more than 65% of the variance. The loadings on the three measures are 0.95, 0.90, and 0.80, respectively, on the logs of MAE, EPSVAR, and DISP.
4. Botosan and Plumlee (2002) argue that if one uses leverage as a risk factor, then one should use unlevered β and leverage because equity β already picks up the effect of leverage. For a fixed level of unlevered β, increasing leverage indeed increases equity β. In a cross section of firms that choose their leverage depending on their business risks, however, it is unclear whether one can treat unlevered β and leverage as unrelated independent variables. For instance, stable firms (low unlevered β) may have higher leverage. We control for leverage while using the equity β as a risk factor because we wish to find out whether leverage matters beyond its effect on β.
5. Another alternative is to calculate Z statistics from the distribution of the *t*-statistics using information on the actual number of observations in each year-by-year regression. We find similar levels of significance if we use such an approach. We prefer to present the results using our approach because we can better control for the effects of substantial auto-correlation in the coefficients.
6. Note that EARNVAR is a factor that measures earnings variability and can be negative because all factor components are normalized to have zero mean and unit standard deviation.
7. We use the average of STG and LTG as a proxy for g_2 in the OJ model. Had we used STG alone, the implied RP_{OJ} would have been even higher.

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