Implied Cost of Capital over the Last 20 Years*

NORIO KITAGAWA[†]
Graduate School of Business Administration
KOBE UNIVERSITY

MASATOSHI GOTOH
Graduate School of Business Administration
KOBE UNIVERSITY

ABSTRACT

The purpose of this paper is to estimate an alternative implied cost of capital, as inferred from a valuation model, and to attempt to compare its validity. We compare the following major five models: 1) a model proposed by Gebhardt et al. (2001); 2) a model suggested by Ohlson and Juettner-Nauroth (2005); 3) an expected earnings to price ratio (EP ratio); 4) a PEG ratio; and 5) a modified PEG ratio (the last two being proposed by Easton (2004)). For the criteria of valuation in this study, we focused on the following two points: first, a significant correlation with the risk factors consistent with the expected signs and, second, that the coefficients have the expected sign and that the adjusted R-square is high in the multivariate models that regress the cost of capital on the risk factors. As a result, we conclude that the PEG and modified PEG ratios are superior to other models. Furthermore, we suggest that the correlation between the cost of capital and the risk factors varies, depending on the periods. Although Gode and Mohanram (2003) pointed out that the difference in the cost of capital by industry is important, this study shows that the difference in the time series of the cost of capital is more important in Japan.

JEL Classification: M; M4; M41
Key Words: Implied Cost of Capital; PEG Ratio; Modified PEG Ratio; Risk Factors

1. Introduction

The purpose of this paper is to estimate an alternative implied cost of capital as inferred from

a valuation model, and to attempt to compare its validity. The cost of capital is "the cost necessary to anchor shareholders to the company" from the company's point of view, and "expected returns on capital investment" from the shareholders' point of view. Cost of capital can be calculated by adding a risk premium to a risk-free rate, but the risk premium cannot be directly observed. Thus, some arguments have ensued about inferring the cost of capital, and thus far, the argument has focused on the following two approaches. One is the ex post approach using realized returns, which are estimated by a capital asset pricing model (CAPM) or the three-factor model of Fama and French (1992, 1993). Another is the ex ante approach using a residual income model and an abnormal earnings growth valuation model. Since the cost of capital estimated with the latter approach reflects the cost implicitly expected by market participants at the time of capital investment, it is often called an "implied cost of capital." In this study, we focus on the implied cost of capital.

In recent years, many studies using the implied cost of capital have been published, and the validity of the implied cost of capital has been suggested in many studies (e.g., Lee et al. 2009; Pastor et al. 2008).[1] However, alternative models exist for estimating the implied cost of capital, as well as various assumptions. Thus, we are interested in which of the models is the most appropriate for estimating the cost of capital. In this paper, we compare the following five major models: 1) a model proposed by Gebhardt et al. (2001); 2) one suggested by Ohlson and Juettner-Nauroth (2005); 3) an expected earnings to price ratio (EP ratio); 4) a PEG ratio; and 5) a modified PEG ratio (the last two being proposed by Easton (2004)). For the criteria of valuation in this study, we focused on the following two points: first, a significant correlation with the risk factors consistent with the expected signs and, second, that the coefficients have the expected sign and that the adjusted R-square is high in the multivariate models that regress the cost of capital on the risk factors. As a result, we conclude that the PEG ratio and modified PEG ratio are superior to other models, and that their validity varies, depending on the periods.

This paper makes several contributions as follows. First, it is the first study in which the implied cost of capital is compared in terms of a correlation with risk factors in Japan. As there have been only a few studies in Japan focusing on the implied cost of capital, it has not been fully clarified which is the best model for inferring the cost of capital. In this paper, we show that the PEG and modified PEG ratios are the most appropriate for an analysis of the cost of capital in Japan. Second, this paper presents the evidence in terms of a comparison with U. S. analysis results. While prior studies (e.g., Gode and Mohanram 2003) suggest the superiority of a cost of capital inferred from the Gebhardt et al. (2001) model, this paper indicates that the cost of capital inferred from the PEG and modified PEG models reflects risks more appropriately. Finally, in this paper, we suggest that the correlation between the cost of capital and risk factors varies, depending on the time period. Although Gode and Mohanram (2003) pointed out that the difference in the cost of capital by industry is important, it is shown that the difference in cost of capital by time series is more important in Japan. The models considering abnormal earnings growth—such as the Ohlson and Juettner-Nauroth (2005) model, PEG ratio, and modified PEG ratio—have become more weakly correlated with risk factors since the second half of the 1990s. On the contrary, the correlation between the model inferred from Gebhardt et al. (2001) and the risk factors becomes stronger. In general, the results of our analysis present beneficial evidence about the superiority of the model for inferring the implied cost of capital in a Japanese environment.

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[1] Elton (1999, p. 1199) pointed out that a risk premium estimated by using a realized return is not appropriate as a benchmark of expected return because it is often lower than the risk-free rate. However, a few studies point out that the implied cost of capital is biased.

This paper proceeds as follows. In section 2, we review prior studies that compare the alternative costs of capital. Section 3 presents the research design. In particular, we explain five models for estimating the cost of capital, and seven risk factors. Section 4 shows the sample and descriptive statistics. The analysis results are reported in section 5. Finally, in section 6 we summarize the conclusions.

2. Prior Studies

Many researchers have studied the relationship between various variables and the implied cost of capital. For example, the relationship between the cost of capital and the below-mentioned variables is analyzed: the disclosure level of the IR (investor relations) and environmental information (e.g., Botosan 1997; Botosan and Plumlee 2002; Espinosa and Tronbetta 2007; Francis et al. 2005; Francis et al. 2008; Hail 2002; Otogawa 2000; Suda et al. 2004; Chujo 2006), earnings attributes (e.g., Bhattacharya et al. 2003; Francis et al. 2004; Verdi 2006; McInnis 2010), precision of analyst forecasts (e.g., Botosan et al. 2004; Otogawa and Muramiya 2006), precision of management earnings forecast (e.g., Muramiya 2006), restatement of financial statements (e.g., Hribar and Jenkins 2004; Xu et al. 2006), the effect of the Sarbanes-Oxley Act (e.g., Ashbaugh-Skaife et al. 2009; Beneish et al. 2008; Hammersley et al. 2008; Ogneva et al. 2007), and the effect of Regulation Fair Disclosure (e.g., Chen et al. 2010).

In addition, some studies have analyzed the impacts of adopting international accounting standards (e.g., Cuijpers and Buijink 2005; Daske 2006; Christensen et al. 2007; Daske et al. 2008, 2011; Karamanou and Nishiotis 2009; Dargenidou et al. 2006; Li 2010), securities regulation for investor protection (e.g., Hail and Leuz 2006), and various tax factors (e.g., Dhaliwal et al. 2005, 2006, 2007) on the cost of capital. Several studies show evidence that some auditing factors affect the cost of capital: for example, the auditor independence (e.g., Hope et al. 2009; Khurana and Raman 2006) and the size of the auditing firms ("Big Four" and "Non-big Four") (e.g., Khurana and Raman 2004). In finance research, there are studies that examine the relationship with the structure of corporate governance (e.g., Ashbaugh-Skaife et al. 2005; Guedhami and Mishra 2010), types of shareholder rights (e.g., Cheng et al. 2006, 2008; Chen et al. 2011), cross-listings (e.g., Hail and Leuz 2009), and diversification strategy of firms (e.g., Inoue and Noma 2007), as well as those that have examined the validity of using an implied cost of capital in an investment strategy (e.g., Desrosiers et al. 2007; Esterer and Schrder 2006).

However, estimations of the implied cost of capital in these preceding studies were not carried out with identical models. There are many estimation models for the cost of capital according to assumptions regarding earnings growth and dividends, as well as forecast periods. Prior studies have generally used the following models: 1) the Gebhardt et al. (2001) model, the Claus and Thomas (2001) model, and the Gordon and Gordon (1997) model, based on a residual income model; 2) the Ohlson and Juettner-Nauroth (2005) model, called the abnormal earnings growth valuation model; and 3) the PEG ratio and modified PEG ratio, which are one form of an abnormal earnings growth valuation model, both suggested by Easton (2004). These models will be presented in section 3. Here, we are interested in which model would be the most appropriate to estimate the cost of capital. As stated above, since the true value of the cost of capital is not observable, it is not possible to compare them easily. Therefore, the preceding studies compare these models in establishing many valuation criteria. To be more specific, the cost of capital is evaluated by measuring the correlation

with observable risk factors and realized stock returns. In other words, a cost of capital that shows expected signs and a higher correlation with risk factors and realized stock returns is regarded as desirable. However, the evidence of these studies is not consistent.

For example, Gode and Mohanram (2003) compared the costs of capital derived from the models of Ohlson and Juettner-Nauroth (2005), Gebhardt et al. (2001), and Liu et al. (2002). They compared costs of capital using the following three methods. First, they examined the correlation with risk factors. Second, they examined the correlation with a risk premium computed by multiplying a realized value of risk factors and a coefficient obtained with a regression of the risk premium in the previous year on risk factors in the previous year. Third, they examined the correlation with a realized stock return. As a result, they show that all costs of capital have a positive correlation with conventional risk factors (such as earnings volatility, variability in stock returns, and leverage), and that they have a negative correlation with analysts' coverage. In particular, cost of capital as derived from the Gebhardt et al. (2001) model has a higher correlation with risk factors than that of the Ohlson and Juettner-Nauroth (2005) model. Therefore, Gode and Mohanram conclude that the Gebhardt et al. (2001) model is superior to the Ohlson and Juettner-Nauroth (2005) model.[2]

In contrast, Botosan and Plumlee (2005) compare the costs of capital by focusing on differences in assumptions of terminal value. They infer the cost of capital from five models proposed by Botosan and Plumlee (2002), Gebhardt et al. (2001), Gordon and Gordon (1997), Gode and Mohanram (2003), and Easton (2004).[3] They also measure the correlation with such risk factors as market beta, leverage, information risks, market value, book-to-market ratio, and growth in expected earnings. As a result, they suggest that the models presented in Botosan and Plumlee (2002) and in Easton (2004) show the most consistent correlation with risk factors. Meanwhile, they point out that the cost of capital as inferred from the model of Gebhardt et al. (2001) does not show a consistent correlation with risk factors.

Easton and Monahan (2005) compare the costs of capital in terms of a correlation with realized stock returns. They show that all costs of capital derived from seven types of models for analysis have a negative correlation with realized stock returns, contrary to expectation. Consequently, they conclude that an implied cost of capital is less reliable as a proxy for expected return. However, they also noted the following two points. First, if analysts' consensus regarding a long-term growth forecast is low, the reliability of the cost of capital as inferred from the model of Claus and Thomas (2001) becomes higher. Second, when ex post analysts' forecast error is low, all costs of capital have a positive correlation, as expected. In other words, their result suggests that the superiority of the cost of capital is dependent on the analysts' forecast error.

Guay et al. (2006) compare the significance of slope coefficients, obtained with a regression of future realized stock returns, to cost of capital. They use the cost of capital inferred from each model proposed by Gebhardt et al. (2001), Claus and Thomas (2001), Gordon and Gordon (1997), Ohlson and Juettner-Nauroth (2005), and Easton (2004). They measure realized stock returns from one year ahead to three years ahead. The result shows that any costs of capital have a low correlation

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[2] However, because the result varies depending on whether loss firms are included in the calculation of the industry median (Gebhardt et al. 2001) or not (Liu et al. 2002), it is necessary to interpret the superiority of the residual income model to a limited extent. On the contrary, Gode and Mohanram (2003) conclude that the cost of capital inferred from Ohlson and Juettner-Nauroth (2005) shows a more robust result.

[3] Assumptions regarding terminal value in each study are as follows: 1) Botosan and Plumlee (2002): analysts' forecast on terminal value is equal to a market forecast; 2) Gebhardt et al. (2001): ROE (return on equity) exceeding the prediction horizon converges on industry median. 3) Gordon and Gordon (1997): ROE exceeding the prediction horizon approximates a cost of capital. 4) Gode and Mohanram (2003): Corporate abnormal earnings growth converges on the economic level if exceeding the forecasts horizon; 5) Easton (2004): Corporate abnormal earnings growth is zero if exceeding the forecast horizon.

with future stock returns. However, they point out that the cost of capital inferred from the model of Gebhardt et al. (2001) shows a relatively high correlation, and it is an appropriate benchmark for forecasting future stock returns.

Chen et al. (2004) compare the costs of capital inferred from the models of Gebhardt et al. (2001) and Ohlson and Juettner-Nauroth (2005) in seven countries (U.S., U.K., Australia, Canada, Japan, Germany, and France). As a result, they show that, under a circumstance in which a clean surplus relationship is maintained in financial reporting, the cost of capital derived from the model of Gebhardt et al. (2001) is more reliable. They also show that, under a circumstance in which the clean surplus relationship is not necessarily maintained, the model of Ohlson and Juettner-Nauroth (2005) estimates a more reliable cost of capital.

As for the implied costs of capital discussed above, consistent results have not necessarily been obtained. In this study, we attempt to additional empirical evidence for these studies, using data from Japanese companies.

3. Research Design

As stated above, many alternative models are used to estimate an implied cost of capital. They are generally classified into two types—one based on the residual income model, such as that from Gebhardt et al. (2001), and the one based on abnormal earnings growth valuation, such as the Ohlson and Juettner-Nauroth (2005) model. We focus on these two models, and summarize their differences. Both are commonly based on a discounted dividend model, but there are some differences as follows.[4]

One difference is an assumption regarding the clean surplus relationship. As seen in the expression below, the model proposed by Gebhardt et al. (2001) requires information on shareholders' equity, in addition to dividends, current stock prices, and earnings forecasts. Meanwhile, the model proposed by Ohlson and Juettner-Nauroth (2005) uses only dividends, current stock prices, and expected returns, but does not need information on shareholders' equity. The Gebhardt et al. (2001) model requires assuming a clean surplus relationship so as to compute the forecasted shareholders' equity. However, the Ohlson and Juettner-Nauroth (2005) model is not necessarily based on the assumption of a clean surplus relationship.

Another difference is the use of long-term forecast data. Gebhardt et al. (2001) model needs forecasted ROEs over 12 years ahead and a future dividend payout ratio as information for a long-term forecast. In order to estimate forecasted ROEs over 12 terms, the Gebhardt et al. (2001) model hypothesizes that ROE will converge on the industry median in the long term.[5] Therefore, the numerical value of the industry median affects the forecasted ROE. Meanwhile, the Ohlson and Juettner-Nauroth (2005) model involves only the short-term forecasted ROE for two years ahead, and the long-term forecast depends only on γ in the expression, $EPS_{t+1} = \gamma EPS_t$. Consequently, the industry median of ROE is not required.

In this study, we are interested in how an estimated cost of capital is influenced by these differences between the two models. Based on preceding studies, such as those of Gode and Mohanram (2003) and Botosan and Plumlee (2005), we compare costs of capital using the following two methods. First, we compute risk factors considered to be generally supported, and compare the

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[4] Features of both models are further described in Ohlson and Gao (2006), Easton (2009), and other papers.

[5] The validity of said hypothesis is shown in Nissim and Penman (2001) and other papers. However, as with Fairfield et al. (2009), some studies point out that profitability converges on a median of the entire industry of companies.

correlation with the cost of capital. Second, we compare the signs of coefficients and the explanatory power of the models by estimating a multiple regression model in which the cost of capital is a dependent variable and a risk factor is an independent variable. In this study, we consider that the higher the correlation is with the risk factors, or the higher an adjusted R-square is with the expected sign of the coefficient of the multiple regression model, the more the cost of capital is presumably reflecting risks. Next, we explain the estimation model for the cost of the capital and risk factors used in this paper.

3.1 Inferring the Cost of Capital
3.1.1 The Gebhardt et al. (2001) Model

As mentioned above, the Gebhardt et al. (2001) model for inferring the cost of capital is based on the residual income model, and it can be represented by equation (1) below. Where P_0 is a stock price at 0; $BVPS_t$ is forecasted book value per share at period t; $FROE_t$ is forecasted ROE at period t; and x denotes the cost of capital. As forecasted future earnings are available to a limited extent, the forecasted earnings and the earnings growth ratio are used explicitly for three years. The values after this period are assumed to converge on an industry median. The forecast period of 12 years is adopted in this case.

$$P_0 = BVPS_0 + \frac{FROE_1 - x}{(1+x)} BVPS_0 + \frac{FROE_2 - x}{(1+x)^2} BVPS_1 + \sum_{i=3}^{11} \frac{FROE_i - x}{(1+x)^i} BVPS_{i-1}$$

$$+ \frac{FROE_{12} - x}{x(1+x)^{11}} BVPS_{11}$$

(1)

The Gebhardt et al. (2001) model requires forecasted values of ROE, book value per share, and dividend per share. The forecasted ROEs for one year and two years ahead are computed by using the forecasted earnings per share (EPS: reported by IBES). Therefore, when the forecasted EPS at the fiscal year t is defined as $FEPS_t$, the forecasted ROE for i years ahead is expressed as $FEPS_{t+i}$ / $BVPS_{t+i-1}$. The forecasted earnings for three years ahead, $FEPS_3$, are computed by multiplying the forecasted earnings for two years ahead, $FEPS_2$, and the long-term growth reported by IBES around the same time of this forecasted value. From 4 years to 12 years ahead, a constant amount is deducted every year, from the forecasted value for 3 years ahead to the median of the industry to which the company belongs. Here, the industry median is the median of the values in the industry to which the company belongs (the Nikkei industry code is used here) as experienced over the past 10 years up to the current year. To be more specific, the industry median is obtained by computing a median for each year over the past 10 years, then calculating the median of that 10-year period. It is incorporated into the model from the viewpoint of measuring how much profitability the company may have in the future by using the industry median.

The forecasted book value per share, $BVPS_1$, is obtained by using the clean surplus relationship, adding the forecasted EPS in the next year to the current book value per share, $BVPS_0$, and subtracting the forecasted dividend per share, DPS_1. In other words, the forecasted book value for the fiscal year t is expressed by the following equation: $BVPS_t = BVPS_{t-1} + FEPS_t - DPS_t$. At this time, the necessary forecasted dividend per share is computed by using a dividend payout ratio.

Specifically, on the assumption that the dividend payout ratio is invariable, the forecasted dividend is computed by multiplying the dividend payout ratio calculated in the current year and the

forecasted EPS. Consequently, the expression to calculate the forecasted dividend per share for the fiscal year t is $FEPS_t \cdot DPS_0 / EPS_0$.

The cost of capital is computed by solving the above polynomial equation for x. This polynomial equation may have multiple solutions, and we solve using the Muller method.[6]

3.1.2 The Ohlson and Juettner-Nauroth (2005) Model

The Ohlson and Juettner-Nauroth (2005) model is expressed as equation (2). The definition of variables is the same as in Gebhardt et al. (2001). Although γ plays an important role in this expression, how to decide its value is not definitively shown, even in Ohlson and Juettner-Nauroth (2005). They infer that, taking the value of EPS for example, the value is $EPS_{t+1} = \gamma EPS_t$, where $\gamma > 1$.[7] In this study, we assume that γ is 1.03.[8]

where

$$x = A + \sqrt{A^2 + \frac{FEPS_1}{P_0} \times \left(\frac{\Delta FEPS_2}{FEPS_1} - (\gamma - 1) \right)} \qquad (2)$$

$$A \equiv \frac{1}{2} \left(\gamma - 1 + \frac{DPS_1}{P_0} \right)$$

3.1.3 The Modified PEG Ratio, PEG Ratio, and EP Ratio in Easton (2004)

In this study, we also examine the modified PEG ratio and the PEG ratio proposed by Easton (2004) in order to weigh the impacts of γ and the dividends involved in Ohlson and Juettner-Nauroth (2005). The modified PEG ratio can be expressed by equation (3).[9] As seen in this expression, a modified PEG ratio is obtained by hypothesizing $\gamma = 1$ based on the condition that the abnormal earnings growth in the Ohlson and Juettner-Nauroth (2005) model is constant. Furthermore, the PEG ratio is based on the assumption of $DPS = 0$, in addition to the assumption in the modified PEG ratio. The PEG ratio can be expressed by equation (4).

$$x = \sqrt{\frac{FEPS_2 + xDPS_1 - FEPS_1}{P_0}} \qquad (3)$$

$$x = \sqrt{\frac{FEPS_2 - FEPS_1}{P_0}} \qquad (4)$$

We also examine the EP ratio, which is also regarded as a form of the abnormal earnings growth valuation model and is computed by equation (5). The EP ratio assumes that the abnormal earnings

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[6] The Muller method is described in general textbooks to explain the algorithm. Here, we refer to *Scientific and Engineering Computation* by Hayato Togawa, SAIENSU-SHA Co., Ltd., 1992. In addition to the Muller method, this equation can also be solved with the Newton method and the Traub method. The solution of a nonlinear equation can be computed, but it is not possible to limit oneself to only one solution; it is just one of many solutions. Under the Muller method, in cases where multiple solutions are obtained, the smallest one is adopted.

[7] However, if $\gamma > 1$, the future value of EPS calculated by $EPS_{t+1} = \gamma\ EPS_t$ diverges.

[8] Ohlson and Juettner-Nauroth (2005) stated that it is possible to unify γ of all firms within the range of 1.03-1.05. They explain as follows (p. 359): "Perhaps the most logical interpretation is that the limit growth should correspond to the very long-run steady state in which a firm's growth in expected earnings equals the growth in expected GNP. It follows that one can argue that γ should be the same for all firms in the range of 1.03 to 1.05."

[9] Some preceding studies modify the model by using the forecasted earnings for four and five terms ahead (e.g., Botosan and Plumlee 2005). However, since few companies announce the forecasted earnings for four and five terms ahead, this estimation model is used here.

growth = 0. In other words, the EP ratio is a model implying that, if forecasted earnings for the next year are available, a satisfactory corporate evaluation is possible.

$$x = \frac{FEPS_1}{P_0} \tag{5}$$

3.2 Measuring Risk Factors

In this study, we adopt the following seven risk factors: 1) market beta, 2) unsystematic risk, 3) earnings variability, 4) leverage, 5) firm size, 6) long-term growth in expected earnings, and 7) book-to-market ratio. These are the typical risk indicators adopted in prior studies (e.g., Gebhardt et al. 2001; Claus and Thomas 2001; Gode and Mohanram 2003; Easton 2004; Botosan and Plumlee 2005).

3.2.1 Market Beta

Prior studies use market beta as a risk factor. Their argument is based on CAPM, which predicts a positive association between a firm's market beta and the risk premium. In addition, several studies show that there is statistically significant association between market beta and the risk premium (e.g., Gordon and Gordon 1997; Harris and Marston 1992; Marston and Harris 1993; Harris et al. 2002). According to preceding studies, we estimate market beta (hereinafter referred to as Beta), using data on daily stock returns over the past year from the announcement date of analysts' forecasts by IBES.

3.2.2 Unsystematic Risk

Although some studies find no statistical relationship between unsystematic risk and expected return (see, e.g., Pratt and Grabowski 2008, p. 169), many prior studies show a positive association between unsystematic risk and future stock returns (e.g., Malkiel and Xu 1997). We extract unsystematic risk by estimating the regression model in which daily stock returns in the previous year are a dependent variable and the stock returns of market portfolios are an independent variable. We then use the variance of the residuals obtained from the regression as a proxy for unsystematic risk (hereinafter referred to as Unsyst).

3.2.3 Earnings Variability

Graham et al. (2005) provide survey evidence that corporate executives prefer smooth earnings, in part because they believe that higher earnings volatility increases the cost of capital. Francis et al. (2004) show a positive relation between earnings volatility and expected returns. We also predict a positive association between earnings variability and risk premiums. In prior studies, Gebhardt et al. (2001) and Gode and Mohanram (2003) measured earnings variability using the following procedures. First, they computed the following variables expressing earnings variability: 1) the mean absolute error of analyst forecasts over the past five years; 2) the coefficient of variation in EPS; and 3) the dispersion of analysts' forecasts. Then, using factor analysis, they identified a single variable from these three variables, and used it as a criterion in expressing earnings variability. In this study, we measure earnings variability using the standard deviation of ROA (net income divided by total assets) over the past five years (hereinafter referred to as Earnvar).

3.2.4 Leverage

Modigliani and Miller (1958) demonstrate that the risk premium can be expressed as an increasing function of leverage. Fama and French (1992) show a positive association between leverage and realized stock returns. Dhaliwal et al. (2006) also find evidence that the equity risk premium is positively related to leverage. According to preceding studies, we use leverage measured as the ratio of the book value long-term debt to the market value of equity (hereinafter referred to as Leverage) as a risk factor. We predict a positive association between the risk premium and leverage.

3.2.5 Firm Size

Numerous studies have shown the negative association between market capitalization and realized returns (e.g., Fama and French 1992; Berk 1995). In addition, market capitalization can be a risk factor as a proxy for the information environment, which is affected by many factors, including trading volume, firm size, bid-ask spreads, and institutional factor; and these factors are highly correlated with each other. Prior studies show that firms that are better connected with information intermediaries, such as analysts and institutional investors, have lower risk premiums because the easy availability of information lowers the information asymmetry between a firm and its investors, and lowers the information risk for investors (e.g., Demsetz 1968; Copeland and Galai 1983; Glosten and Milgrom 1985; Amihud and Mendelson 1986; Diamond and Verrecchia 1991; Brennan and Swaminathan 1993; Handa and Linn 1993; Coles et al. 1995; Clarkson et al. 1996; Botosan 1997; Healy and Palepu 1999).[10] Therefore, we use the firm size measured by the log of the market value of equity (hereinafter referred to as Size) as a risk factor. According to preceding studies, we expect a negative association between the size and the risk premium.

3.2.6 Long-Term Growth in Expected Earnings

Gebhardt et al. (2001) and Gode and Mohanram (2003) use the long-term growth in expected earnings from IBES 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 reasons. First, based on La Porta (1996), they argue that analysts are overoptimistic for high-growth firms and that their stock prices are too high, which results in a low risk premium. Gebhardt et al. (2001) explain the second reason for a negative association between long-term growth and the risk premium as follows. Residual income models assume that 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. Therefore, a negative association between the risk premium and long-term growth is expected. In this study, we use the forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings (hereinafter referred to as LTG).

3.2.7 Book-to-Market (BM) ratio

Gebhardt et al. (2001) and Gode and Mohanram (2003) control for the book-to-market ratio as measured by the log of the ratio of shareholders' equity to the market value of equity. This is consistent with Fama and French (1992) and Berk et al. (1999). A high book-to-market (BM) ratio could reflect lower growth opportunities and lower accounting conservatism. As argued by Gode and Mohanram (2003), it is difficult to conclude how the combination of these factors will influence

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[10] Based on these arguments, Botosan and Plumlee (2005) use both information risk and firm size as a risk factor. Information risk is measured as the width of the range between Value Line's minimum and maximum price forecasts scaled by the midpoint of range, and firm size is measured as the market value of equity.

the risk premium. According to preceding studies, however, we expect a positive correlation between the BM ratio and the risk premium. In this study, we estimate a variable of book-to-market ratio (hereinafter referred to as BM) as the log of the ratio of shareholders' equity to the market value of equity.

4. Sample and Descriptive Statistics

The sample of this study includes listed firms (excluding financial institutions) that had forecasts both one and two years ahead and a long-term growth forecast, all of which were announced simultaneously by IBES, during the period from 1987 to 2007.[11] Thus, 4,465 firm-years are extracted as a sample.[12] Earnings forecasts from IBES cover one-third of the Japanese listed firms. Earnings forecasts for different firms are announced every month. The earnings forecast seems to be irregularly announced, only when certain information is disclosed. In our analysis, we use forecast data announced in August. In a case where the earnings forecast in August is not available, we use forecast data announced in the nearest accounting month before August as a substitute.

We use consolidated financial statement data from Nikkei Media Marketing, Inc., *Nikkei Financial Data*, available on CD-ROM. If the data required for an estimation of the cost of capital and risk factors are unavailable, the firms are excluded from the sample. In particular, as earnings data over the past five years are required to compute the earnings variability, the sample for a forecast announced in 1987 requires ROA data since 1983. The industry median of the Gebhardt et al. (2001) model is computed by using the ROE of the same data from Nikkei Media Marketing and Nikkei industry code. We also obtain the daily stock price data from Nikkei Media Marketing, Inc., which is called the "daily Japanese stock return data." Since daily returns over the past year are required for the calculation of Beta and Unsyst, firms with a shorter period of listings than required are excluded from the sample. Given all of these requirements, the number of sample firms decreased to 3,976.

Furthermore, a firm for which the cost of capital cannot be estimated is excluded from the sample. In the Gebhardt et al. (2001) model, when the solution is negative or multiple solutions are obtained, such a firm is eliminated from the sample. In addition, when a solution cannot be specified or obtained, such a firm is also eliminated from the sample. Meanwhile, in both the Ohlson and Juettner-Nauroth (2005) and Easton (2004) models, it is required that an earnings forecast for two years ahead be higher than that for one year. A firm that does not fulfill the requirement is excluded from the sample. In the Ohlson and Juettner-Nauroth (2005) model with $\gamma = 1.03$, the costs of capital for some firms cannot be estimated.[13] As a result of considering the above-mentioned matters, the final sample consists of 3,517 firm-year observations.[14]

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[11] Industries are classified by Nikkei industry code.

[12] During the analysis period, 46,292 firm-years announce consolidated financial data. Among them, one-year-ahead forecasts of 21,005 firms and two-year-ahead forecasts of 27,873 firms are unavailable. Although some preceding studies use a three-year-ahead earnings forecast, we use instead the long-term growth forecast for computation in this study. Since the databases of companies other than IBES seldom announce long-term growth, we have to use the IBES data. However, as many preceding studies in the U.S. use forecasts from IBES, it seems safe to assume that there is no problem.

[13] We think that this is a significant problem. If the cost of capital cannot be computed just because a value to be assigned to the expression is limited, it may be argued that only preferable sample firms are selected. Also in this study, about 20% of firms are excluded from the sample due to the impossibility of calculation.

[14] The final sample varies, depending on the model adopted for estimating the cost of capital. As this study focuses on a comparison of the costs of capital as estimated by each model, we conduct analyses with the Ohlson and Juettner-Nauroth (2005) model in which the final number of samples is the least.

TABLE 1: DESCRIPTIVE STATISTICS

	GLS	OJ	EP	PEG	MPEG	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
mean	0.043	0.170	0.032	0.088	0.080	0.883	0.048	0.022	0.568	26.107	0.136	0.726
s.d.	0.033	0.359	0.059	0.050	0.058	0.362	0.035	0.059	0.876	1.402	0.165	0.437
p10	0.018	0.057	-0.002	0.041	0.027	0.422	0.015	0.002	0.025	24.271	0.001	0.298
p25	0.027	0.075	0.021	0.057	0.047	0.618	0.024	0.003	0.084	25.133	0.050	0.430
p50	0.036	0.099	0.038	0.078	0.069	0.870	0.038	0.006	0.256	26.055	0.100	0.633
p75	0.048	0.139	0.055	0.105	0.096	1.124	0.061	0.015	0.645	27.108	0.176	0.897
p90	0.066	0.219	0.076	0.143	0.139	1.367	0.093	0.041	1.420	27.973	0.306	1.262

Note: GLS: the cost of capital inferred using Gebhardt et al.(2001) model.

OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth(2005) model

EP: expected earnings to price ratio

PEG: PEG ratio proposed by Easton (2004)

MPEG: modified PEG ratio proposed by Easton (2004)

Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES

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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years

Leverage: leverage as the ratio of the book value long-term debt to the market value of equity

Size: the natural log of the market value of equity

LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings

BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

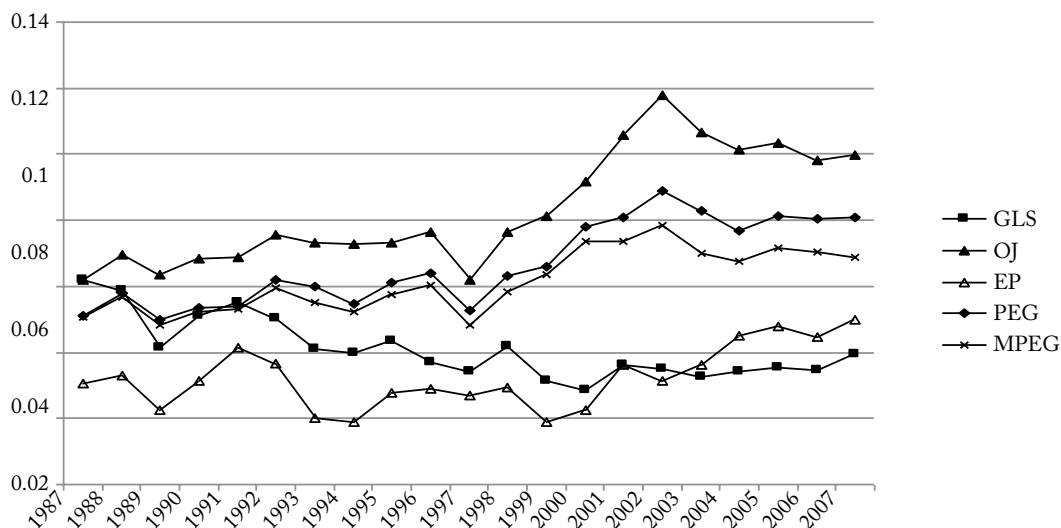FIGURE 1: TIME SERIES MEDIAN OF THE COST OF CAPITAL

TABLE 2: DESCRIPTIVE STATISTICS FOR THE COST OF CAPITAL BY YEAR AND BY INDUSTRY

Panel A: Descriptive Statistics for the Cost of Capital by Year

	GLS		OJ		EP		PEG		MPEG		
year	mean	median	mean	median	mean	median	mean	median	mean	median	N
1987	0.062	0.062	0.064	0.062	0.030	0.031	0.052	0.051	0.051	0.051	7
1988	0.065	0.059	0.073	0.070	0.041	0.033	0.063	0.058	0.060	0.057	12
1989	0.054	0.041	0.070	0.064	0.027	0.023	0.057	0.050	0.055	0.048	35
1990	0.075	0.051	0.080	0.068	0.032	0.032	0.044	0.053	0.043	0.052	13
1991	0.085	0.055	0.094	0.069	0.052	0.041	0.071	0.054	0.069	0.053	27
1992	0.072	0.050	0.080	0.076	0.040	0.036	0.062	0.062	0.058	0.060	49
1993	0.063	0.041	0.093	0.073	0.019	0.020	0.068	0.060	0.066	0.055	47
1994	0.063	0.040	0.106	0.073	0.027	0.019	0.063	0.055	0.064	0.052	47
1995	0.063	0.044	0.114	0.073	0.026	0.028	0.076	0.061	0.075	0.058	38
1996	0.058	0.037	0.089	0.076	0.029	0.029	0.074	0.064	0.068	0.060	56
1997	0.049	0.034	0.080	0.062	0.029	0.027	0.065	0.053	0.063	0.048	69
1998	0.057	0.042	0.098	0.076	0.010	0.030	0.079	0.063	0.077	0.058	54
1999	0.045	0.031	0.106	0.081	0.012	0.019	0.087	0.066	0.083	0.063	72
2000	0.030	0.029	0.113	0.092	0.016	0.023	0.091	0.078	0.094	0.074	136
2001	0.039	0.036	0.148	0.106	0.026	0.036	0.093	0.081	0.085	0.073	534
2002	0.039	0.035	0.164	0.118	0.013	0.031	0.104	0.089	0.096	0.078	522
2003	0.035	0.032	0.209	0.107	0.027	0.036	0.092	0.083	0.081	0.070	404
2004	0.034	0.034	0.205	0.101	0.042	0.045	0.080	0.077	0.070	0.068	340
2005	0.036	0.035	0.201	0.104	0.046	0.048	0.092	0.081	0.083	0.072	366
2006	0.038	0.034	0.209	0.098	0.046	0.045	0.085	0.081	0.073	0.070	335
2007	0.044	0.039	0.203	0.100	0.046	0.050	0.085	0.081	0.075	0.069	354
total	0.043	0.036	0.170	0.099	0.032	0.038	0.088	0.078	0.080	0.069	3517

(*Continued*)

Table 1 provides the descriptive statistics of the sample.[15] As for the cost of capital estimated in the Gebhardt et al. (2001) model (hereinafter referred to as GLS), the mean and the median are 4.3% and 3.6%, respectively. These points are lower than those of the Ohlson and Juettner-Nauroth (2005) model (hereinafter referred to as OJ), which shows 17.0% and 9.9%, respectively. This is because, in estimating the cost of capital, Ohlson and Juettner-Nauroth (2005) take into account the abnormal earnings growth. In the PEG and modified PEG ratios in Easton (2004) (hereinafter referred to as PEG and MPEG, respectively) which ignore abnormal earnings growth and dividends, the mean values are 8.0% and 6.9%, respectively, and the medians are 8.8% and 7.8%, respectively, which are lower than those of the OJ model. However, they are still higher than those of the GLS model.[16]

Table 2 shows a change in each cost of capital by year and by industry. Focusing on a change in the cost of capital by year in Panel A, we find that the level of OJ is high over the entire period. In particular, OJ has increased since 1997, and the difference from GLS and EP has become larger. The PEG and MPEG have also increased, but not as remarkably as OJ. The GLS and EP are relatively

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[15] Table 1 provides values after considering the effect of outliers. In this study, a value which is lower than 1 percentile (or higher than the 99th percentile) of each variable is regarded as an outlier, and it is replaced by 1 percentile (99th percentile).

[16] Preceding studies also observe such a tendency. In Gode and Mohanram (2003), the mean value of GLS is 3.2%, in comparison with the 5.1% of OJ. In Botosan and Plumlee (2005), while GLS is 1.0% and PEG is 5.0%, OJ is 6.6%. In Easton and Monahan (2005), GLS is 10.9%, PEG is 11.0%, and MPEG is 12.2%. In Guay et al. (2006), GLS is 9.9%, PEG is 13.2%, and OJ is 13.4%.

(−Continued)

Panel B: Descriptive Statistics for the Cost of Capital by Industry

Industry code	GLS mean	GLS median	OJ mean	OJ median	EP mean	EP median	PEG mean	PEG median	MPEG mean	MPEG median	N
1	0.041	0.036	0.102	0.075	0.028	0.032	0.067	0.057	0.061	0.048	197
3	0.023	0.019	0.103	0.094	0.026	0.034	0.087	0.082	0.085	0.075	61
5	0.046	0.028	0.421	0.160	0.035	0.033	0.131	0.125	0.100	0.097	28
7	0.037	0.035	0.100	0.092	0.032	0.040	0.086	0.079	0.081	0.074	244
9	0.047	0.041	0.092	0.082	0.046	0.040	0.073	0.066	0.071	0.062	159
11	0.051	0.050	0.125	0.114	0.055	0.049	0.088	0.080	0.085	0.076	11
13	0.043	0.042	0.110	0.103	0.052	0.061	0.101	0.095	0.096	0.082	29
15	0.031	0.027	0.105	0.100	0.039	0.034	0.088	0.086	0.085	0.084	50
17	0.032	0.020	0.125	0.110	0.027	0.046	0.105	0.096	0.104	0.096	55
19	0.035	0.031	0.122	0.104	0.031	0.045	0.099	0.089	0.099	0.088	92
21	0.035	0.028	0.121	0.106	0.027	0.039	0.092	0.085	0.086	0.079	260
23	0.048	0.036	0.132	0.094	0.021	0.032	0.090	0.080	0.086	0.075	575
25	0.063	0.065	0.130	0.124	0.022	0.036	0.100	0.107	0.099	0.107	5
27	0.058	0.050	0.115	0.093	0.043	0.056	0.097	0.082	0.093	0.077	167
29	0.020	0.016	0.073	0.072	0.046	0.044	0.051	0.053	0.047	0.049	4
31	0.036	0.034	0.111	0.096	0.025	0.034	0.091	0.084	0.084	0.075	87
33	0.037	0.033	0.110	0.101	0.038	0.043	0.081	0.077	0.068	0.061	74
35	0.042	0.045	0.086	0.069	0.025	0.022	0.069	0.054	0.065	0.054	8
37	0.030	0.029	0.177	0.165	0.046	0.046	0.052	0.046	0.031	0.034	4
41	0.049	0.043	0.125	0.100	0.013	0.033	0.102	0.081	0.099	0.073	102
43	0.043	0.039	0.249	0.122	0.037	0.046	0.095	0.085	0.078	0.067	201
45	0.043	0.035	0.161	0.097	0.033	0.037	0.087	0.075	0.077	0.064	270
53	0.046	0.040	0.260	0.110	0.039	0.036	0.099	0.077	0.094	0.073	86
55	0.020	0.014	0.242	0.202	0.034	0.040	0.069	0.072	0.042	0.026	43
57	0.060	0.056	0.132	0.097	0.020	0.040	0.087	0.070	0.077	0.058	55
59	0.059	0.058	0.117	0.112	0.064	0.056	0.095	0.078	0.094	0.077	16
61	0.040	0.006	0.117	0.103	0.005	0.020	0.104	0.093	0.104	0.093	10
63	0.051	0.048	0.097	0.075	0.048	0.049	0.070	0.061	0.064	0.055	29
65	0.043	0.040	0.398	0.187	0.017	0.031	0.089	0.069	0.073	0.034	73
67	0.059	0.057	0.090	0.082	0.059	0.055	0.075	0.069	0.071	0.063	50
69	0.060	0.060	0.097	0.096	0.054	0.057	0.078	0.083	0.076	0.080	15
71	0.037	0.033	0.395	0.119	0.031	0.036	0.086	0.077	0.067	0.056	378
total	0.043	0.036	0.170	0.099	0.032	0.038	0.088	0.078	0.080	0.069	3517

Note: This table shows a descriptive statistics for each cost of capital by year and by industry. Panel A shows descriptive statistics for the cost of capital by year, and Panel B shows by industry.
 N: the number of firms
GLS: the cost of capital inferred using Gebhardt et al.(2001) model.
OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth(2005) model
EP: expected earnings to price ratio
PEG: PEG ratio proposed by Easton (2004)
MPEG: modified PEG ratio proposed by Easton (2004)
The category of Industry is based on Nikkei industry code. Banks, securities firms, insurance firms, and other financial institutions are eliminated from the sample.

TABLE 3: CORRELATIONS MATRIX AMONG THE COST OF CAPITALS OR RISK FACTORS

Panel A: Correlations among the Cost of Capitals

	GLS	OJ	EP	PEG	MPEG
GLS	1.000	0.118	0.162	0.178	0.173
OJ	0.053	1.000	-0.057	0.834	0.585
EP	0.050	-0.034	1.000	-0.073	-0.135
PEG	0.200	0.164	-0.274	1.000	0.874
MPEG	0.153	0.003	-0.330	0.900	1.000

Panel B: Correlations among the Risk Factors

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Beta	1.000	0.118	0.262	0.018	0.241	0.088	-0.205
Unsyst	0.161	1.000	0.172	-0.095	-0.373	0.137	-0.044
Earnvar	0.076	0.045	1.000	0.284	-0.114	0.112	0.066
Leverage	-0.008	0.008	0.101	1.000	0.050	-0.125	0.389
Size	0.236	-0.349	-0.047	-0.028	1.000	-0.065	-0.363
LTG	0.135	0.136	0.041	-0.087	-0.066	1.000	-0.216
BM	-0.197	-0.028	0.078	0.336	-0.405	-0.109	1.000

Note: This table shows the correlations matrix. Numbers to the left below the diagonal are Pearson correlation coefficients, while numbers to the right above the diagonal are Spearman rank-order correlation coefficients. Panel A represents correlation coefficients among costs of capital. On the other hand, Panel B represents correlation coefficients among risk factors.
GLS: the cost of capital inferred using Gebhardt et al.(2001) model.
OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth(2005) model
EP: expected earnings to price ratio
PEG: PEG ratio proposed by Easton (2004)
MPEG: modified PEG ratio proposed by Easton (2004)
Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES
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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years
Leverage: leverage as the ratio of the book value long-term debt to the market value of equity
Size: the natural log of the market value of equity
LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings
BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

stable at a low level. On the other hand, Panel B provides the cost of capital by industry.[17] There is not as large a difference in magnitude relationally among the costs of capital in any industries. However, the industry that has a high (or low) cost of capital varies, depending on which cost of capital is the focus.

Table 3 provides correlation coefficients. Numbers to the left below the diagonal are Pearson correlation coefficients, while numbers to the right above the diagonal are Spearman rank-order correlation coefficients. Panel A represents correlation coefficients among costs of capital. Although the costs of capital have a positive correlation with each other in general, some costs of capital have a negative correlation only with EP. While a correlation between PEG and MPEG is as high as

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[17] Classification of industries is based on the Nikkei industry code.

TABLE 4: CORRELATION MATRIX BETWEEN COST OF CAPITAL AND RISK FACTORS

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
GLS	-0.056***	-0.105***	-0.004	0.273***	-0.007	-0.022	0.372***
	(0.001)	(0.000)	(0.800)	(0.000)	(0.663)	(0.163)	(0.000)
OJ	0.023	0.218***	0.001	0.008	-0.198***	0.109***	-0.035**
	(0.180)	(0.000)	(0.951)	(0.640)	(0.000)	(0.000)	(0.038)
EP	-0.113***	-0.229***	-0.148***	-0.114***	0.014	-0.039**	-0.015
	(0.000)	(0.000)	(0.000)	(0.000)	(0.362)	(0.013)	(0.332)
PEG	0.093***	0.152***	0.139***	0.276***	-0.109***	0.060***	0.245***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MPEG	0.058***	0.192***	0.126***	0.279***	-0.238***	0.095***	0.276***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: This table shows the correlations matrix between each cost of capital and risk factors. There are 3,517 observations in the sample from 1987-2007. P-values are in parentheses.
 *** Statistically significant at the 0.01 level of significance using a two-tailed t-test.
 ** Statistically significant at the 0.05 level of significance using a two-tailed t-test.
GLS: the cost of capital inferred using Gebhardt et al.(2001) model.
OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth(2005) model
EP: expected earnings to price ratio
PEG: PEG ratio proposed by Easton (2004)
MPEG: modified PEG ratio proposed by Easton (2004)
Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES
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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years
Leverage: leverage as the ratio of the book value long-term debt to the market value of equity
Size: the natural log of the market value of equity
LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings
BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

90%, OJ has a slightly lower correlation with them. The correlation between OJ and GLS is just 5.3%.[18] Panel B represents correlation coefficients among risk factors. While the coefficients have the expected signs in general, the correlation with LTG tends to be different from the expectation. Since the maximum coefficient is -0.405 for SIZE and BM, the problem of multicollinearity seems to be trivial.[19]

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[18] In preceding studies, the correlation between GLS and OJ is quite high. For example, Gode and Mohanram (2003) and Botosan and Plumlee (2005) observed the correlation to be as high as 36%. In the analysis of this study, the correlation between GLS and OJ is almost 40% in the first half of the sampling period. For this reason, it has been found that the correlation is significantly dependent on the adopted sampling period.

[19] To test the possible multi-correlation problem statistically, we calculated the VIF (variance inflation factor) statistics, and we find that the VIF values of the multi-regression model in the next section are all less than 10 for the multicollinearity detection point. Therefore, we believe that our result is robust under multi-correlation problems.

<div align="center">TABLE 5: CORRELATIONS MATRIX DIVIDING INTO TWO PERIODS</div>

Panel A: The First Half of Ten Years (1987–1996)

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
GLS	0.009	-0.103**	-0.007	0.414***	0.035	-0.086*	0.548***
	(0.867)	(0.047)	(0.886)	(0.000)	(0.501)	(0.095)	(0.000)
OJ	0.031	-0.032	0.093*	0.460***	-0.244***	0.027	0.419***
	(0.571)	(0.567)	(0.090)	(0.000)	(0.000)	(0.620)	(0.000)
EP	-0.245***	-0.025	-0.290***	0.347***	-0.287***	0.182***	0.628***
	(0.000)	(0.630)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PEG	0.004	-0.080	0.185***	0.562***	-0.264***	0.026	0.602***
	(0.944)	(0.136)	(0.001)	(0.000)	(0.000)	(0.633)	(0.000)
MPEG	0.019	-0.080	0.184***	0.525***	-0.214***	0.012	0.522***
	(0.732)	(0.138)	(0.001)	(0.000)	(0.000)	(0.822)	(0.000)

Panel B: The Latter Half of Eleven Years (1997–2007)

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
GLS	-0.079***	-0.075***	0.012	0.257***	-0.059***	0.013	0.368***
	(0.000)	(0.000)	(0.478)	(0.000)	(0.000)	(0.425)	(0.000)
OJ	0.025	0.212***	-0.005	-0.005	-0.192***	0.103***	-0.053***
	(0.171)	(0.000)	(0.795)	(0.796)	(0.000)	(0.000)	(0.003)
EP	-0.107***	-0.240***	-0.143***	-0.149***	0.033**	-0.047***	-0.064***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.049)	(0.005)	(0.000)
PEG	0.067***	0.184***	0.116***	0.252***	-0.216***	0.081***	0.236***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MPEG	0.101***	0.147***	0.132***	0.255***	-0.086***	0.050***	0.215***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)

Note: This table shows the result of correlations matrix dividing into two periods. Panel A shows the result of first half of ten years, and Panel B shows the result of last half of eleven years. P-values are in parentheses.

*** Statistically significant at the 0.01 level of significance using a two-tailed t-test.
** Statistically significant at the 0.05 level of significance using a two-tailed t-test.
* Statistically significant at the 0.10 level of significance using a two-tailed t-test.
GLS: the cost of capital inferred using Gebhardt et al.(2001) model.
OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth(2005) model
EP: expected earnings to price ratio
PEG: PEG ratio proposed by Easton (2004)
MPEG: modified PEG ratio proposed by Easton (2004)
Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES
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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years
Leverage: leverage as the ratio of the book value long-term debt to the market value of equity
Size: the natural log of the market value of equity
LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings
BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

5. Results

5.1 Univariate Analysis

Table 4 indicates a correlation matrix between each cost of capital and risk factor. Both GLS and OJ have two variables that are statistically significant and have expected signs. Leverage and BM in GLS, as well as Unsyst and Size in OJ, have the expected signs.[20] In EP, only LTG has the expected sign.[21] Meanwhile, PEG and MPEG have the most consistent correlation because six risk factors other than LTG are statistically significant and have the expected signs. Therefore, PEG and MPEG are considered to have the most preferable correlation with risk factors in the entire sample.

Next, we compare the sample, dividing the period into the first half of 10 years and the latter half of 11 years in order to observe the tendencies in each period.[22] The result is presented in Table 5. In the first half, OJ, PEG, and MPEG have a more consistent correlation with risk factors than with GLS and EP. In other words, four risk factors—including Earnvar, Leverage, Size, and BM—have the expected signs. In the latter half, however, while the number of variables with the expected signs increases in PEG and MPEG, only Unsyst and Size have a consistent correlation with OJ. Moreover, in EP, the number of such variables decreases, but in GLS, three variables have expected signs, as many as in the first half. Consequently, it is suggested that the abnormal earnings growth valuation model has a lower correlation with risks in the latter half of the analysis period.

Furthermore, Table 6 summarizes the results by year of correlation between the cost of capital and risk factors.[23] Leverage and BM in GLS have the expected sign and a significant correlation over almost the entire period. The correlation with Earnvar and Size is significant in more years in the latter half. On the other hand, in OJ, Unsyst, Leverage, Size, and BM have the expected signs in many years. However, as with Earnvar, the correlation with leverage has tended to be insignificant since 2000. In contrast to expectations, the correlation with BM since 2003 has tended to be significantly negative in the latter half. Meanwhile, in PEG and MPEG, several variables are found to have the expected signs and significant correlations over the entire year. These tendencies imply that the results of Tables 5 and 6 are not caused by effects in specific years.

As a summary of the results above, we can argue as follows. According to the result of the entire sample, the correlation of PEG and MPEG with risk factors is the most consistent with the expected signs. Only in the first half of the analysis period, OJ is comparable to PEG and MPEG. However, in the latter half, the number of risk factors with expected signs decreases. While GLS is stable without a significant variation over the entire period, fewer risk factors show expected correlations in general, compared with PEG and MPEG. Consequently, in the correlation analysis, the PEG and modified PEG ratios are considered advantageous.

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[20] Beta and Unsyst in GLS, as well as BM in OJ, show a significant correlation with an unexpected sign. In EP, Beta, Unsyst, Earnvars, and Leverage have unexpected signs. As an additional analysis, we estimate Beta and Unsyst using different time period. We adopted an estimation period of both 180 days and three months prior to forecast data announcement by IBES. However, the remarkable differences in the main results are not found.

[21] LTG in EP is contrary to the expectation that LTG and the cost of capital mostly have a significant and positive correlation. Although the LTG sign forecast is based on Gode and Mohanram(2003), even in their analysis, the same tendency is observed. Therefore, our result is consistent with preceding studies.

[22] In dividing the sample, it is possible to examine a structural change. However, as confirmed in Table 2, the increasing variation in levels of cost of capital was observed around 1997, and so the way to divide the sample adopted here is deemed valid to some extent. We conducted a similar verification after dividing the sample into two around 2000. While the difference in adjusted R-squares among subsamples became smaller slightly, there were not the remarkable difference in analysis results.

[23] Although we conducted an analysis of correlation by industry, notable tendencies could not be found.

TABLE 6: CORRELATIONS MATRIX BY YEAR

Panel A: GLS Model

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
1987	-0.356	0.667	-0.395	0.408	-0.287	0.721*	0.284
	(0.433)	(0.102)	(0.381)	(0.364)	(0.532)	(0.067)	(0.537)
1988	0.299	0.404	0.225	0.288	-0.325	0.085	0.869***
	(0.321)	(0.171)	(0.461)	(0.341)	(0.279)	(0.782)	(0.000)
1989	0.218	-0.114	0.260	0.435***	-0.003	0.284*	0.611***
	(0.176)	(0.486)	(0.105)	(0.005)	(0.987)	(0.076)	(0.000)
1990	-0.053	-0.324	-0.127	0.059	0.387	-0.073	0.357
	(0.833)	(0.189)	(0.616)	(0.817)	(0.112)	(0.774)	(0.146)
1991	-0.262	-0.233	-0.120	0.443**	0.042	-0.158	0.512***
	(0.178)	(0.233)	(0.542)	(0.018)	(0.831)	(0.423)	(0.005)
1992	-0.196	-0.332***	-0.100	0.544***	0.234*	-0.149	0.623***
	(0.134)	(0.010)	(0.448)	(0.000)	(0.072)	(0.256)	(0.000)
1993	0.218	-0.156	0.441***	0.333**	0.234*	-0.016	0.436***
	(0.117)	(0.264)	(0.001)	(0.015)	(0.092)	(0.911)	(0.001)
1994	0.029	-0.191	-0.103	0.586***	-0.131	-0.020	0.520***
	(0.838)	(0.179)	(0.472)	(0.000)	(0.359)	(0.887)	(0.000)
1995	-0.010	-0.100	-0.137	0.528***	-0.051	-0.034	0.515***
	(0.952)	(0.535)	(0.394)	(0.000)	(0.754)	(0.835)	(0.001)
1996	0.016	-0.058	0.048	0.331***	-0.138	-0.270**	0.722***
	(0.900)	(0.649)	(0.704)	(0.007)	(0.275)	(0.028)	(0.000)
1997	0.040	-0.111	-0.155	0.397***	0.054	-0.206*	0.502***
	(0.735)	(0.346)	(0.187)	(0.001)	(0.649)	(0.078)	(0.000)
1998	-0.059	-0.092	-0.102	0.110	-0.046	-0.214*	0.526***
	(0.630)	(0.450)	(0.403)	(0.368)	(0.709)	(0.078)	(0.000)
1999	-0.048	0.001	-0.082	0.520***	-0.264**	-0.041	0.671***
	(0.662)	(0.993)	(0.452)	(0.000)	(0.014)	(0.708)	(0.000)
2000	-0.522***	-0.251***	0.036	0.437***	-0.347***	-0.104	0.702***
	(0.000)	(0.002)	(0.672)	(0.000)	(0.000)	(0.214)	(0.000)
2001	-0.216***	-0.112***	0.031	0.195***	-0.246***	-0.037	0.462***
	(0.000)	(0.005)	(0.446)	(0.000)	(0.000)	(0.359)	(0.000)
2002	-0.088**	-0.017	0.016	0.219***	-0.167***	0.020	0.403***
	(0.038)	(0.683)	(0.696)	(0.000)	(0.000)	(0.637)	(0.000)
2003	-0.072	-0.131***	0.085*	0.321***	0.005	-0.103**	0.364***
	(0.139)	(0.007)	(0.076)	(0.000)	(0.917)	(0.031)	(0.000)
2004	0.001	-0.119**	0.102**	0.336***	0.136***	0.057	0.240***
	(0.982)	(0.016)	(0.038)	(0.000)	(0.006)	(0.247)	(0.000)
2005	0.058	-0.083*	-0.008	0.352***	0.140***	0.074	0.264***
	(0.239)	(0.089)	(0.867)	(0.000)	(0.004)	(0.125)	(0.000)
2006	-0.096*	-0.047	-0.043	0.305***	0.141***	0.149***	0.235***
	(0.071)	(0.377)	(0.411)	(0.000)	(0.007)	(0.004)	(0.000)
2007	-0.021	0.026	0.004	0.169***	-0.080	0.149***	0.209***
	(0.684)	(0.606)	(0.934)	(0.001)	(0.109)	(0.003)	(0.000)

(*Continued*)

(*−Continued*)

Panel B: OJ Model

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
1987	-0.182	0.731*	-0.484	0.357	-0.299	0.805**	0.268
	(0.696)	(0.062)	(0.271)	(0.431)	(0.514)	(0.029)	(0.561)
1988	0.048	0.488	0.120	0.432	-0.660**	0.272	0.869***
	(0.881)	(0.108)	(0.710)	(0.161)	(0.020)	(0.393)	(0.000)
1989	0.206	0.000	0.627***	0.516***	-0.365**	0.651***	0.551***
	(0.235)	(1.000)	(0.000)	(0.002)	(0.031)	(0.000)	(0.001)
1990	0.025	-0.507*	-0.274	0.010	0.218	0.035	-0.164
	(0.935)	(0.077)	(0.365)	(0.975)	(0.475)	(0.911)	(0.593)
1991	-0.185	-0.132	0.149	0.135	-0.136	0.024	0.323
	(0.356)	(0.513)	(0.459)	(0.502)	(0.498)	(0.905)	(0.100)
1992	-0.221	-0.274*	-0.149	0.608***	-0.187	-0.076	0.632***
	(0.127)	(0.057)	(0.307)	(0.000)	(0.197)	(0.606)	(0.000)
1993	0.245	0.033	0.415***	0.379***	0.035	-0.017	0.245*
	(0.101)	(0.829)	(0.004)	(0.009)	(0.816)	(0.909)	(0.097)
1994	-0.160	0.046	-0.005	0.860***	-0.377***	0.155	0.474***
	(0.288)	(0.761)	(0.971)	(0.000)	(0.009)	(0.299)	(0.001)
1995	0.082	0.159	-0.033	0.627***	-0.346**	0.025	0.428***
	(0.623)	(0.341)	(0.844)	(0.000)	(0.033)	(0.882)	(0.007)
1996	0.035	0.210	0.416***	0.644***	-0.319**	-0.085	0.657***
	(0.799)	(0.125)	(0.001)	(0.000)	(0.016)	(0.532)	(0.000)
1997	-0.046	0.518***	0.213*	0.116	-0.295**	-0.019	0.354***
	(0.710)	(0.000)	(0.079)	(0.344)	(0.014)	(0.875)	(0.003)
1998	0.103	0.170	0.024	0.447***	-0.354***	-0.034	0.610***
	(0.461)	(0.218)	(0.864)	(0.001)	(0.009)	(0.809)	(0.000)
1999	0.278**	0.481***	0.024	0.539***	-0.248**	-0.120	0.341***
	(0.018)	(0.000)	(0.839)	(0.000)	(0.035)	(0.315)	(0.003)
2000	-0.293***	-0.009	0.025	0.347***	-0.219***	-0.006	0.392***
	(0.001)	(0.917)	(0.774)	(0.000)	(0.010)	(0.944)	(0.000)
2001	0.044	0.226***	0.009	0.044	-0.141***	0.209***	0.028
	(0.315)	(0.000)	(0.830)	(0.309)	(0.001)	(0.000)	(0.519)
2002	-0.016	0.215***	0.003	0.036	-0.138***	0.113***	0.019
	(0.721)	(0.000)	(0.945)	(0.416)	(0.002)	(0.010)	(0.664)
2003	-0.068	0.304***	-0.009	-0.047	-0.223***	0.035	-0.132***
	(0.182)	(0.000)	(0.855)	(0.349)	(0.000)	(0.488)	(0.008)
2004	0.165***	0.448***	0.010	-0.048	-0.196***	0.072	-0.164***
	(0.003)	(0.000)	(0.853)	(0.373)	(0.000)	(0.184)	(0.002)
2005	0.038	0.298***	-0.040	-0.001	-0.184***	0.108**	-0.108**
	(0.474)	(0.000)	(0.447)	(0.982)	(0.000)	(0.040)	(0.039)
2006	0.057	0.345***	-0.033	-0.008	-0.284***	0.108**	-0.105*
	(0.305)	(0.000)	(0.543)	(0.885)	(0.000)	(0.048)	(0.056)
2007	-0.076	0.331***	0.011	0.021	-0.280***	0.127**	-0.024
	(0.161)	(0.000)	(0.832)	(0.697)	(0.000)	(0.017)	(0.658)

(*Continued*)

(−*Continued*)

Panel C: EP Ratio

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
1987	-0.447	0.335	-0.659	-0.581	-0.339	0.358	0.785**
	(0.314)	(0.463)	(0.108)	(0.171)	(0.458)	(0.431)	(0.037)
1988	0.013	0.284	-0.010	0.292	-0.665**	0.113	0.971***
	(0.965)	(0.346)	(0.974)	(0.333)	(0.013)	(0.714)	(0.000)
1989	0.088	-0.011	-0.162	0.780***	-0.399**	0.075	0.904***
	(0.588)	(0.949)	(0.317)	(0.000)	(0.011)	(0.647)	(0.000)
1990	-0.128	-0.398	0.002	0.266	0.348	0.473**	0.664***
	(0.612)	(0.102)	(0.995)	(0.286)	(0.158)	(0.047)	(0.003)
1991	-0.364*	-0.238	-0.272	0.667***	-0.276	-0.122	0.925***
	(0.057)	(0.224)	(0.161)	(0.000)	(0.156)	(0.535)	(0.000)
1992	-0.373***	-0.148	-0.186	0.771***	-0.386***	0.310**	0.864***
	(0.003)	(0.259)	(0.154)	(0.000)	(0.002)	(0.016)	(0.000)
1993	-0.468***	-0.142	-0.541***	-0.440***	-0.206	0.325**	0.254*
	(0.000)	(0.312)	(0.000)	(0.001)	(0.136)	(0.017)	(0.064)
1994	-0.513***	-0.228	-0.219	0.549***	-0.572***	0.346**	0.847***
	(0.000)	(0.108)	(0.119)	(0.000)	(0.000)	(0.012)	(0.000)
1995	-0.303*	-0.018	-0.547***	0.509***	-0.279*	0.171	0.557***
	(0.054)	(0.910)	(0.000)	(0.001)	(0.077)	(0.286)	(0.000)
1996	-0.248**	0.095	-0.300**	-0.309**	-0.083	0.200	0.233*
	(0.049)	(0.455)	(0.015)	(0.012)	(0.512)	(0.111)	(0.062)
1997	-0.139	-0.233**	-0.318***	0.195*	-0.040	-0.086	0.390***
	(0.237)	(0.046)	(0.006)	(0.095)	(0.735)	(0.468)	(0.001)
1998	-0.299**	-0.349***	-0.133	-0.556***	0.071	0.051	0.193
	(0.013)	(0.003)	(0.277)	(0.000)	(0.563)	(0.675)	(0.113)
1999	-0.265**	-0.437***	-0.173	-0.103	-0.083	-0.008	0.239**
	(0.013)	(0.000)	(0.109)	(0.343)	(0.445)	(0.940)	(0.026)
2000	-0.030	-0.054	-0.268***	-0.074	-0.081	-0.095	0.144*
	(0.717)	(0.520)	(0.001)	(0.374)	(0.326)	(0.249)	(0.081)
2001	0.020	-0.101**	-0.104***	-0.170***	0.060	-0.055	-0.092**
	(0.629)	(0.012)	(0.010)	(0.000)	(0.133)	(0.170)	(0.022)
2002	-0.340***	-0.217***	-0.212***	-0.129***	-0.042	-0.068	-0.076*
	(0.000)	(0.000)	(0.000)	(0.002)	(0.309)	(0.102)	(0.066)
2003	-0.395***	-0.275***	-0.209***	0.021	0.008	-0.139***	-0.051
	(0.000)	(0.000)	(0.000)	(0.655)	(0.868)	(0.003)	(0.284)
2004	-0.234***	-0.142***	-0.112**	-0.049	-0.037	-0.160***	0.102**
	(0.000)	(0.004)	(0.022)	(0.315)	(0.455)	(0.001)	(0.036)
2005	-0.059	-0.226***	-0.034	-0.017	0.046	-0.122**	0.164***
	(0.225)	(0.000)	(0.476)	(0.722)	(0.333)	(0.011)	(0.001)
2006	0.056	-0.113**	-0.055	0.131**	-0.031	-0.053	0.140***
	(0.289)	(0.032)	(0.290)	(0.012)	(0.557)	(0.313)	(0.007)
2007	0.142***	-0.337***	-0.159***	-0.194***	0.047	0.032	-0.077
	(0.005)	(0.000)	(0.001)	(0.000)	(0.344)	(0.525)	(0.123)

(*Continued*)

(−Continued)

Panel D: PEG Ratio

	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
1987	-0.231	0.739*	-0.548	0.261	-0.346	0.844**	0.348
	(0.618)	(0.058)	(0.203)	(0.572)	(0.448)	(0.017)	(0.444)
1988	0.071	0.465	0.107	0.436	-0.640**	0.265	0.901***
	(0.828)	(0.128)	(0.741)	(0.156)	(0.025)	(0.405)	(0.000)
1989	0.231	0.016	0.610***	0.508***	-0.281*	0.676***	0.529***
	(0.175)	(0.927)	(0.000)	(0.002)	(0.098)	(0.000)	(0.001)
1990	-0.785***	-0.331	0.392	-0.216	0.616***	0.465*	0.008
	(0.000)	(0.194)	(0.120)	(0.406)	(0.009)	(0.060)	(0.976)
1991	-0.234	-0.150	-0.059	0.485***	-0.371*	0.100	0.841***
	(0.241)	(0.456)	(0.770)	(0.010)	(0.057)	(0.620)	(0.000)
1992	-0.235*	-0.376***	-0.096	0.445***	-0.119	-0.058	0.531***
	(0.084)	(0.005)	(0.484)	(0.001)	(0.388)	(0.677)	(0.000)
1993	0.299**	0.086	0.536***	0.504***	-0.013	-0.226	0.345**
	(0.035)	(0.551)	(0.000)	(0.000)	(0.928)	(0.111)	(0.013)
1994	-0.155	0.132	0.052	0.884***	-0.364***	0.013	0.588***
	(0.288)	(0.364)	(0.718)	(0.000)	(0.009)	(0.930)	(0.000)
1995	-0.114	0.206	0.019	0.875***	-0.561***	0.059	0.848***
	(0.495)	(0.215)	(0.911)	(0.000)	(0.000)	(0.724)	(0.000)
1996	0.007	0.097	0.433***	0.616***	-0.234*	-0.067	0.620***
	(0.960)	(0.476)	(0.001)	(0.000)	(0.081)	(0.621)	(0.000)
1997	-0.096	0.339***	0.309***	0.245**	-0.225*	0.010	0.325***
	(0.417)	(0.003)	(0.008)	(0.037)	(0.056)	(0.935)	(0.005)
1998	0.119	0.179	0.028	0.453***	-0.372***	-0.063	0.572***
	(0.376)	(0.178)	(0.837)	(0.000)	(0.004)	(0.637)	(0.000)
1999	0.278**	0.445***	0.028	0.620***	-0.261**	-0.134	0.390***
	(0.014)	(0.000)	(0.811)	(0.000)	(0.022)	(0.244)	(0.001)
2000	-0.307***	-0.065	0.043	0.216***	-0.215***	-0.050	0.321***
	(0.000)	(0.447)	(0.607)	(0.010)	(0.010)	(0.550)	(0.000)
2001	0.066	0.125***	0.081*	0.219***	-0.160***	0.056	0.170***
	(0.124)	(0.003)	(0.057)	(0.000)	(0.000)	(0.192)	(0.000)
2002	0.264***	0.245***	0.175***	0.312***	-0.184***	0.133***	0.297***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
2003	0.166***	0.165***	0.158***	0.177***	-0.121**	0.093*	0.147**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.014)	(0.058)	(0.003)
2004	0.043	-0.041	0.109**	0.183***	-0.054	0.174***	0.070
	(0.425)	(0.450)	(0.038)	(0.001)	(0.304)	(0.001)	(0.183)
2005	0.036	0.134***	0.045	0.105**	-0.189***	0.125**	0.142***
	(0.486)	(0.010)	(0.374)	(0.040)	(0.000)	(0.014)	(0.005)
2006	0.142***	0.471***	0.190***	0.126**	-0.316***	0.106**	-0.044
	(0.009)	(0.000)	(0.000)	(0.019)	(0.000)	(0.050)	(0.414)
2007	-0.043	0.395***	0.170***	0.207***	-0.358***	0.103**	0.272***
	(0.417)	(0.000)	(0.001)	(0.000)	(0.000)	(0.049)	(0.000)

(Continued)

(–*Continued*)

Panel E: Modified PEG Ratio							
	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM
Expected sign	(+)	(+)	(+)	(+)	(−)	(−)	(+)
1987	-0.184	0.746*	-0.550	0.325	-0.262	0.808**	0.291
	(0.694)	(0.054)	(0.201)	(0.477)	(0.571)	(0.028)	(0.527)
1988	0.097	0.463	0.123	0.403	-0.599**	0.273	0.886***
	(0.765)	(0.130)	(0.705)	(0.194)	(0.040)	(0.391)	(0.000)
1989	0.252	0.007	0.664***	0.457***	-0.252	0.702***	0.470***
	(0.139)	(0.968)	(0.000)	(0.005)	(0.138)	(0.000)	(0.004)
1990	-0.766***	-0.342	0.387	-0.203	0.631***	0.463*	0.001
	(0.000)	(0.180)	(0.125)	(0.435)	(0.007)	(0.061)	(0.997)
1991	-0.221	-0.173	-0.047	0.394**	-0.311	0.086	0.783***
	(0.268)	(0.389)	(0.817)	(0.042)	(0.115)	(0.669)	(0.000)
1992	-0.220	-0.406***	-0.087	0.390***	-0.053	-0.096	0.486***
	(0.106)	(0.002)	(0.527)	(0.003)	(0.700)	(0.486)	(0.000)
1993	0.326**	0.079	0.528***	0.488***	0.046	-0.230	0.299**
	(0.021)	(0.587)	(0.000)	(0.000)	(0.750)	(0.105)	(0.033)
1994	-0.107	0.209	0.028	0.843***	-0.396***	0.027	0.512***
	(0.466)	(0.150)	(0.848)	(0.000)	(0.004)	(0.854)	(0.000)
1995	-0.097	0.222	0.015	0.916***	-0.528***	0.052	0.826***
	(0.564)	(0.181)	(0.927)	(0.000)	(0.001)	(0.758)	(0.000)
1996	0.037	0.029	0.507***	0.545***	-0.062	-0.087	0.392***
	(0.785)	(0.832)	(0.000)	(0.000)	(0.647)	(0.520)	(0.003)
1997	-0.058	0.396***	0.293**	0.173	-0.188	0.004	0.249**
	(0.627)	(0.001)	(0.012)	(0.144)	(0.111)	(0.974)	(0.034)
1998	0.106	0.162	0.040	0.474***	-0.308**	-0.064	0.520***
	(0.427)	(0.225)	(0.767)	(0.000)	(0.019)	(0.635)	(0.000)
1999	0.327***	0.468***	0.025	0.534***	-0.171	-0.134	0.237**
	(0.004)	(0.000)	(0.827)	(0.000)	(0.137)	(0.244)	(0.038)
2000	-0.250***	-0.044	0.259***	0.204**	-0.219***	-0.097	0.306***
	(0.003)	(0.608)	(0.002)	(0.014)	(0.009)	(0.248)	(0.000)
2001	0.106**	0.075*	0.083*	0.246***	-0.066	0.039	0.158***
	(0.013)	(0.081)	(0.052)	(0.000)	(0.124)	(0.364)	(0.000)
2002	0.294***	0.248***	0.183***	0.302***	-0.093**	0.084*	0.280***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.031)	(0.052)	(0.000)
2003	0.220***	0.063	0.177***	0.190***	0.051	0.047	0.142***
	(0.000)	(0.210)	(0.000)	(0.000)	(0.299)	(0.343)	(0.004)
2004	0.052	-0.146***	0.101*	0.211***	0.172***	0.130**	0.070
	(0.333)	(0.006)	(0.055)	(0.000)	(0.001)	(0.013)	(0.188)
2005	0.070	0.067	0.051	0.116**	-0.081	0.087*	0.144***
	(0.174)	(0.192)	(0.315)	(0.023)	(0.113)	(0.088)	(0.005)
2006	0.165***	0.253***	0.210***	0.128**	-0.045	0.036	-0.047
	(0.002)	(0.000)	(0.000)	(0.017)	(0.406)	(0.500)	(0.380)
2007	0.088*	0.292***	0.160***	0.235***	-0.157***	0.134***	0.203***
	(0.095)	(0.000)	(0.002)	(0.000)	(0.003)	(0.010)	(0.000)

Note: This table shows the correlations matrix by year. Panel A shows the correlation between GLS and

risk factors. From Panel B to E shows the result of OJ, EP, PEG, and MPEG, respectively. P-values are in parentheses.
*** Statistically significant at the 0.01 level of significance using a two-tailed t-test.
** Statistically significant at the 0.05 level of significance using a two-tailed t-test.
* Statistically significant at the 0.10 level of significance using a two-tailed t-test.
Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES
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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years
Leverage: leverage as the ratio of the book value long-term debt to the market value of equity
Size: the natural log of the market value of equity
LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings
BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

Table 7: The Result of Pooled Regression

	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R^2
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
GLS	-0.064***	-0.004***	0.050	0.011	0.007***	0.003***	0.000***	0.032***	0.319
	(0.000)	(0.005)	(0.483)	(0.152)	(0.000)	(0.000)	(0.000)	(0.000)	
OJ	1.110***	-0.030	2.224***	-0.095	0.024***	-0.032***	0.100***	-0.029	0.124
	(0.000)	(0.142)	(0.000)	(0.336)	(0.005)	(0.000)	(0.001)	(0.102)	
EP	0.157***	-0.005	-0.405***	-0.111***	-0.011***	-0.003***	0.000	0.003	0.133
	(0.000)	(0.110)	(0.000)	(0.000)	(0.000)	(0.000)	(0.181)	(0.205)	
PEG	0.142***	0.001	0.250***	0.051***	0.017***	-0.004***	0.000***	0.019***	0.227
	(0.000)	(0.602)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
MPEG	0.009	0.005*	0.276***	0.077***	0.019***	0.001	0.000***	0.023***	0.188
	(0.708)	(0.095)	(0.000)	(0.000)	(0.000)	(0.454)	(0.003)	(0.000)	

Note: This table shows the result of pooled regression. There are 3,517 observations in the sample from 1987-2007. Indicator for the year and the industry are included but not reported. P-values are in parentheses.
*** Statistically significant at the 0.01 level of significance using a two-tailed t-test.
* Statistically significant at the 0.10 level of significance using a two-tailed t-test.
GLS: the cost of capital inferred using Gebhardt et al. (2001) model.
OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth (2005) model
EP: expected earnings to price ratio
PEG: PEG ratio proposed by Easton (2004)
MPEG: modified PEG ratio proposed by Easton (2004)
Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES
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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years
Leverage: leverage as the ratio of the book value long-term debt to the market value of equity
Size: the natural log of the market value of equity
LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings
BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

TABLE 8: THE RESULT OF REGRESSION DIVIDING INTO TWO PERIODS

Panel A: The First Half of Ten Years (1987–1996)

	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R²
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
GLS	-0.516***	0.008	0.189	-0.077	0.009***	0.019***	0.000	0.070***	0.420
	(0.000)	(0.331)	(0.189)	(0.176)	(0.002)	(0.000)	(0.239)	(0.000)	
OJ	0.136	0.024	-0.368	0.199*	0.027***	-0.004	0.000	0.036***	0.241
	(0.258)	(0.134)	(0.229)	(0.061)	(0.000)	(0.377)	(0.403)	(0.003)	
EP	-0.019	-0.016***	-0.002	-0.213***	-0.005**	0.001	0.001***	0.056***	0.519
	(0.632)	(0.002)	(0.979)	(0.000)	(0.019)	(0.448)	(0.000)	(0.000)	
PEG	0.001	0.012*	-0.223*	0.231***	0.012***	0.001	0.000	0.041***	0.447
	(0.984)	(0.089)	(0.072)	(0.000)	(0.000)	(0.654)	(0.173)	(0.000)	
MPEG	-0.012	0.012*	-0.217	0.225***	0.013***	0.001	0.000	0.036***	0.387
	(0.832)	(0.087)	(0.103)	(0.000)	(0.000)	(0.504)	(0.397)	(0.000)	

Panel B: The Latter Half of Eeleven Years (1997–2007)

	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R²
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
GLS	-0.033***	-0.001	-0.034***	-0.012*	0.005***	0.002***	0.000***	0.025***	0.191
	(0.002)	(0.265)	(0.010)	(0.090)	(0.000)	(0.000)	(0.000)	(0.000)	
OJ	1.468***	0.016	1.353***	-0.100	0.018**	-0.051***	0.001***	-0.104***	0.076
	(0.000)	(0.380)	(0.000)	(0.350)	(0.026)	(0.000)	(0.000)	(0.000)	
EP	0.165***	-0.008***	-0.417***	-0.112***	-0.007***	-0.003***	0.000**	-0.012***	0.099
	(0.000)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)	
PEG	0.170***	0.013***	0.153***	0.053***	0.012***	-0.005***	0.000***	0.018***	0.146
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
MPEG	0.019	0.016***	0.194***	0.083***	0.012***	0.000	0.000***	0.026***	0.122
	(0.404)	(0.000)	(0.000)	(0.000)	(0.000)	(0.714)	(0.001)	(0.000)	

Note: This table shows the result of regression dividing into two periods. Panel A shows the result of first half of ten years, and Panel B shows the result of last half of eleven years. Indicator for the year and the industry are included but not reported. P-values are in parentheses.

 *** Statistically significant at the 0.01 level of significance using a two-tailed t-test.

 * Statistically significant at the 0.10 level of significance using a two-tailed t-test.

GLS: the cost of capital inferred using Gebhardt et al. (2001) model.

OJ: the cost of capital inferred using Ohlson and Juettner-Nauroth (2005) model

EP: expected earnings to price ratio

PEG: PEG ratio proposed by Easton (2004)

MPEG: modified PEG ratio proposed by Easton (2004)

Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts' forecasts by IBES

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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years

Leverage: leverage as the ratio of the book value long-term debt to the market value of equity

Size: the natural log of the market value of equity

LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings

BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

TABLE 9: THE RESULT OF REGRESSION BY YEAR

Panel A: GLS Model								
	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R^2
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)
1988	-0.339*	-0.024	-0.274	3.675*	0.006*	0.014*	-0.023	0.064***	0.871
	(0.082)	(0.522)	(0.437)	(0.095)	(0.087)	(0.072)	(0.882)	(0.002)	
1989	-0.786***	0.016	0.897	2.469***	0.002	0.028***	-0.011	0.109***	0.656
	(0.000)	(0.397)	(0.136)	(0.006)	(0.737)	(0.000)	(0.896)	(0.000)	
1990	-0.666	-0.028	-0.449	-5.310	0.004	0.029	-0.555	0.118	-0.111
	(0.431)	(0.878)	(0.823)	(0.555)	(0.895)	(0.286)	(0.357)	(0.418)	
1991	-0.908**	-0.097	0.766	6.462	0.030*	0.037**	-0.195	0.053	0.352
	(0.050)	(0.239)	(0.462)	(0.265)	(0.082)	(0.020)	(0.347)	(0.126)	
1992	-0.609***	-0.008	-0.094	-0.005	0.019*	0.024***	-0.003	0.045*	0.532
	(0.001)	(0.748)	(0.822)	(0.991)	(0.073)	(0.001)	(0.970)	(0.071)	
1993	-0.619***	0.050	0.043	1.655	-0.001	0.022***	0.137	0.075***	0.377
	(0.002)	(0.125)	(0.938)	(0.140)	(0.921)	(0.004)	(0.197)	(0.000)	
1994	-0.303	0.065**	-0.693	-0.008	0.035***	0.010	0.037	0.040**	0.429
	(0.109)	(0.044)	(0.360)	(0.978)	(0.001)	(0.118)	(0.763)	(0.021)	
1995	-0.471	0.047	-0.471	-0.168	0.031*	0.017	-0.033	0.047	0.330
	(0.121)	(0.164)	(0.625)	(0.132)	(0.058)	(0.102)	(0.826)	(0.120)	
1996	-0.270*	0.017	-0.776	0.022	-0.012*	0.010**	-0.108***	0.107***	0.577
	(0.054)	(0.246)	(0.252)	(0.738)	(0.035)	(0.048)	(0.004)	(0.000)	
1997	-0.370***	0.009	-0.337	-0.102*	0.009**	0.014***	-0.022	0.077***	0.455
	(0.001)	(0.485)	(0.267)	(0.081)	(0.049)	(0.001)	(0.584)	(0.000)	
1998	-0.348**	-0.004	0.007	-0.047	0.002	0.013**	-0.023	0.065***	0.329
	(0.035)	(0.848)	(0.979)	(0.685)	(0.633)	(0.021)	(0.467)	(0.000)	
1999	-0.383***	-0.018	-0.024	-0.013	0.009**	0.014***	0.010	0.078***	0.515
	(0.003)	(0.198)	(0.881)	(0.868)	(0.045)	(0.002)	(0.594)	(0.000)	
2000	-0.019	-0.010***	-0.006	-0.009	0.002**	0.002	0.010	0.021***	0.545
	(0.546)	(0.001)	(0.854)	(0.567)	(0.027)	(0.141)	(0.143)	(0.000)	
2001	0.027	-0.008***	-0.021	-0.011	0.003***	0.000	0.015**	0.023***	0.233
	(0.299)	(0.006)	(0.509)	(0.446)	(0.005)	(0.920)	(0.041)	(0.000)	
2002	-0.019	-0.009**	0.065	-0.003	0.004***	0.001	0.016*	0.024***	0.195
	(0.557)	(0.014)	(0.145)	(0.862)	(0.001)	(0.227)	(0.066)	(0.000)	
2003	-0.010	-0.003	0.017	0.016	0.008***	0.001	-0.006	0.021***	0.216
	(0.722)	(0.284)	(0.678)	(0.291)	(0.000)	(0.277)	(0.327)	(0.000)	
2004	-0.056**	-0.001	0.031	0.013	0.008***	0.003***	0.016***	0.019***	0.167
	(0.029)	(0.684)	(0.453)	(0.294)	(0.000)	(0.002)	(0.002)	(0.000)	
2005	-0.077***	0.001	0.138**	-0.017	0.011***	0.003***	0.012**	0.023***	0.205
	(0.002)	(0.763)	(0.024)	(0.290)	(0.000)	(0.000)	(0.015)	(0.000)	
2006	-0.096***	-0.009**	0.126**	-0.003	0.010***	0.004***	0.030***	0.023***	0.190
	(0.001)	(0.027)	(0.012)	(0.889)	(0.000)	(0.000)	(0.000)	(0.000)	
2007	-0.053	0.001	0.128	-0.073	0.007**	0.002*	0.031***	0.035***	0.126
	(0.191)	(0.786)	(0.169)	(0.111)	(0.027)	(0.092)	(0.000)	(0.000)	

(*Continued*)

(*–Continued*)

Panel B: OJ Model								
	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R^2
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
1988	-0.002	-0.022	0.186	0.731	0.003	0.002	0.207	0.033	0.545
	(0.994)	(0.741)	(0.738)	(0.821)	(0.545)	(0.891)	(0.580)	(0.147)	
1989	-0.047	-0.005	0.274	3.177***	0.007*	0.002	0.144**	0.044***	0.821
	(0.698)	(0.681)	(0.548)	(0.000)	(0.094)	(0.619)	(0.025)	(0.001)	
1990	0.348	-0.137	-4.585	-4.104	0.075	0.005	-0.558	-0.194	-0.223
	(0.860)	(0.566)	(0.274)	(0.758)	(0.802)	(0.946)	(0.634)	(0.329)	
1991	0.778	-0.074	-3.579*	21.182**	-0.019	-0.023	0.216	0.040	0.113
	(0.331)	(0.611)	(0.064)	(0.037)	(0.494)	(0.380)	(0.536)	(0.503)	
1992	0.363**	0.006	-0.923*	-0.158	0.009	-0.011	-0.086	0.030	0.404
	(0.041)	(0.816)	(0.065)	(0.682)	(0.398)	(0.105)	(0.272)	(0.228)	
1993	-0.205	0.067	-0.012	3.755**	0.012	0.007	0.125	0.030	0.200
	(0.444)	(0.170)	(0.989)	(0.017)	(0.418)	(0.469)	(0.382)	(0.221)	
1994	0.359	0.130**	-0.965	-0.271	0.182***	-0.016	0.421**	-0.051*	0.785
	(0.259)	(0.036)	(0.472)	(0.585)	(0.000)	(0.156)	(0.048)	(0.090)	
1995	0.467	0.078	-1.405	-0.147	0.108***	-0.016	0.057	-0.038	0.302
	(0.512)	(0.303)	(0.519)	(0.540)	(0.004)	(0.518)	(0.879)	(0.573)	
1996	0.066	0.028*	-0.239	0.454***	0.012**	-0.003	0.014	0.083***	0.745
	(0.654)	(0.074)	(0.741)	(0.000)	(0.041)	(0.598)	(0.740	(0.000)	
1997	-0.158	-0.066*	2.894***	0.294**	0.011	0.006	-0.019	0.044	0.341
	(0.472)	(0.025)	(0.000)	(0.015)	(0.298)	(0.415)	(0.821)	(0.133)	
1998	-0.148	-0.011	-0.233	0.106	0.027***	0.006	0.098	0.103***	0.480
	(0.590)	(0.757)	(0.603)	(0.577)	(0.000)	(0.552)	(0.116)	(0.000)	
1999	0.038	0.027	0.700**	-0.176	0.018*	-0.001	-0.019	0.021	0.311
	(0.877)	(0.326)	(0.031)	(0.354)	(0.052	(0.922)	(0.598)	(0.483)	
2000	-0.150	-0.034*	0.403**	-0.049	0.018**	0.007	0.056	0.050***	0.187
	(0.414)	(0.037)	(0.036)	(0.672)	(0.018)	(0.247)	(0.179)	(0.009)	
2001	1.851*	-0.135	1.052	0.156	0.008	-0.061	0.433	-0.173*	0.007
	(0.072)	(0.257)	(0.425)	(0.801)	(0.867)	(0.109)	(0.165)	(0.091)	
2002	2.058*	-0.065	1.386	-0.049	0.015	-0.070	0.278	-0.178	0.004
	(0.094)	(0.645)	(0.423)	(0.950)	(0.736)	(0.129)	(0.394)	(0.102)	
2003	6.932**	-0.362	6.567*	0.495	0.046	-0.237*	0.091	-0.711*	0.054
	(0.015)	(0.226)	(0.092)	(0.731)	(0.749)	(0.025)	(0.876)	(0.024)	
2004	0.925	-0.050	8.645***	-0.172	0.073	-0.037	-0.190	-0.063	0.129
	(0.384)	(0.702)	(0.000)	(0.735)	(0.259)	(0.340)	(0.401)	(0.716)	
2005	2.938*	-0.062	9.519**	-0.862	0.114	-0.106*	0.079	-0.200	0.037
	(0.067)	(0.794)	(0.017)	(0.425)	(0.353)	(0.075)	(0.808)	(0.376)	
2006	6.346**	-0.254	7.355*	-1.818	-0.013	-0.218*	-0.074	-0.463	0.047
	(0.012)	(0.452)	(0.085)	(0.422)	(0.947)	(0.015)	(0.891)	(0.278)	
2007	5.390	-0.771*	21.322**	-0.379	-0.026	-0.174	0.594	-0.819	0.047
	(0.154)	(0.087)	(0.014)	(0.935)	(0.938)	(0.190)	(0.430)	(0.159)	

(*Continued*)

(*–Continued*)

Panel C: EP Ratio

	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R²
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
1988	-0.087	-0.045	-0.535	1.395	0.002	0.005	-0.014	0.080***	0.927
	(0.621)	(0.273)	(0.179)	(0.492)	(0.511)	(0.448)	(0.931)	(0.001)	
1989	-0.141*	0.017**	-0.041	-0.353	0.006***	0.005*	0.001	0.055***	0.854
	(0.056)	(0.037)	(0.868)	(0.311)	(0.010)	(0.054)	(0.967)	(0.000)	
1990	-0.008	-0.001	-0.284	0.971	0.000	0.000	0.199**	0.063***	0.564
	(0.947)	(0.976)	(0.334)	(0.452)	(0.940)	(0.996)	(0.036)	(0.010)	
1991	-0.270**	-0.033	0.658**	-1.342	0.001	0.011***	-0.107**	0.074***	0.904
	(0.021)	(0.114)	(0.017)	(0.346)	(0.842)	(0.007)	(0.045)	(0.000)	
1992	0.116*	-0.006	-0.156	-0.341**	-0.005	-0.004*	0.150***	0.073***	0.851
	(0.088)	(0.509)	(0.319)	(0.041)	(0.176)	(0.079)	(0.000)	(0.000)	
1993	0.111	-0.022*	-0.236	-1.378***	-0.032***	-0.003	0.037	0.042***	0.745
	(0.125)	(0.065)	(0.251)	(0.001)	(0.000)	(0.300)	(0.342)	(0.000)	
1994	0.221**	-0.028*	-0.799**	-0.200	0.000	-0.007**	0.112**	0.046***	0.812
	(0.012)	(0.057)	(0.023)	(0.142)	(0.977)	(0.022)	(0.049)	(0.000)	
1995	-0.016	-0.013	-0.421	-0.325***	0.024**	0.001	0.147	0.017	0.579
	(0.932)	(0.518)	(0.475)	(0.000)	(0.019)	(0.831)	(0.118)	(0.365)	
1996	-0.105	-0.021	0.379	-0.079	-0.032***	0.005	0.021	0.070***	0.488
	(0.422)	(0.137)	(0.554)	(0.208)	(0.000)	(0.334)	(0.541)	(0.000)	
1997	-0.094	0.002	-0.651**	-0.154***	0.002	0.004	0.021	0.044***	0.308
	(0.302)	(0.829)	(0.014)	(0.003)	(0.598)	(0.206)	(0.541)	(0.000)	
1998	-0.259	0.014	-0.463	0.002	-0.041***	0.010	0.027	0.076***	0.369
	(0.436)	(0.710)	(0.402)	(0.992)	(0.000)	(0.408)	(0.670)	(0.003)	
1999	0.112	0.000	-0.903***	-0.116	-0.008	-0.002	-0.005	0.046**	0.247
	(0.589)	(0.998)	(0.001)	(0.351)	(0.262)	(0.735)	(0.859)	(0.038)	
2000	0.061	0.010	-0.034	-0.230***	-0.006	-0.002	-0.035	0.023*	0.086
	(0.631)	(0.383)	(0.800)	(0.001)	(0.161)	(0.672)	(0.200)	(0.071)	
2001	0.146*	0.016*	-0.311***	-0.099**	-0.011***	-0.003	-0.046**	-0.014**	0.055
	(0.052)	(0.074)	(0.001)	(0.018)	(0.000)	(0.245)	(0.033)	(0.039)	
2002	0.196**	-0.060***	-0.419***	-0.222***	-0.006*	-0.003	-0.036	-0.017*	0.175
	(0.022)	(0.000)	(0.001)	(0.000)	(0.062)	(0.339)	(0.116)	(0.018)	
2003	0.190***	-0.046***	-0.306***	-0.133***	0.006*	-0.003	-0.037**	-0.028***	0.235
	(0.006)	(0.000)	(0.002)	(0.000)	(0.070)	(0.226)	(0.012)	(0.000)	
2004	0.094**	-0.016***	-0.069	-0.040*	-0.003	-0.001	-0.018*	0.001	0.059
	(0.047)	(0.005)	(0.368)	(0.090)	(0.357)	(0.503)	(0.063)	(0.927)	
2005	0.054	-0.002	-0.474***	-0.011	-0.006	0.000	-0.012	0.016**	0.056
	(0.323)	(0.846)	(0.001)	(0.757)	(0.132)	(0.985)	(0.288)	(0.045)	
2006	0.135**	0.026***	-0.290***	-0.054	0.010**	-0.004**	-0.005	0.018*	0.054
	(0.025)	(0.001)	(0.004)	(0.257)	(0.034)	(0.045)	(0.710)	(0.083)	
2007	0.286***	0.033***	-1.117***	-0.133**	-0.011***	-0.008***	0.006	-0.013	0.217
	(0.000)	(0.000)	(0.000)	(0.037)	(0.010)	(0.000)	(0.592)	(0.135)	

(*Continued*)

(*−Continued*)

Panel D: PEG Ratio								
	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R²
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
1988	-0.105	-0.037	0.040	0.575	0.004	0.005	0.248	0.039*	0.684
	(0.650)	(0.508)	(0.929)	(0.827)	(0.344)	(0.564)	(0.426)	(0.056)	
1989	-0.197*	-0.002	0.523	2.916***	0.008**	0.007*	0.184***	0.045***	0.820
	(0.093)	(0.847)	(0.245)	(0.000)	(0.047)	(0.096)	(0.003)	(0.001)	
1990	-0.079	-0.082*	-0.375	3.806	-0.016	0.007	0.103	-0.021	0.626
	(0.686)	(0.092)	(0.426)	(0.133)	(0.730)	(0.255)	(0.444)	(0.549)	
1991	0.064	0.041	-0.513	2.153	-0.021***	-0.003	0.116	0.086***	0.774
	(0.735)	(0.239)	(0.250)	(0.347)	(0.004)	(0.581)	(0.170)	(0.000)	
1992	0.381**	0.046*	-1.401***	-0.126	-0.005	-0.013*	-0.009	0.052**	0.355
	(0.036)	(0.084)	(0.002)	(0.769)	(0.624)	(0.056)	(0.923)	(0.041)	
1993	-0.100	0.038	0.263	2.911***	0.010	0.003	-0.053	0.029**	0.429
	(0.507)	(0.144)	(0.589)	(0.001)	(0.225)	(0.530)	(0.517)	(0.041)	
1994	-0.116	0.012	0.768*	0.008	0.049***	0.004	-0.006	0.014	0.781
	(0.225)	(0.455)	(0.059)	(0.959)	(0.000)	(0.183)	(0.920)	(0.122)	
1995	0.125	0.014	0.088	0.037	0.029***	-0.005	0.066	0.050***	0.835
	(0.387)	(0.349)	(0.843)	(0.452)	(0.000)	(0.354)	(0.388)	(0.001)	
1996	0.008	0.017	-0.681	0.420***	0.011*	0.000	0.021	0.075***	0.706
	(0.953)	(0.243)	(0.321)	(0.000)	(0.056)	(0.965)	(0.595)	(0.000)	
1997	-0.139	-0.044**	1.469***	0.254***	0.009	0.006	0.001	0.030*	0.299
	(0.330)	(0.014)	(0.000)	(0.001)	(0.136)	(0.216)	(0.989)	(0.084)	
1998	0.037	-0.002	-0.215	0.083	0.020***	-0.001	0.053	0.059***	0.409
	(0.861)	(0.951)	(0.555)	(0.595)	(0.001)	(0.921)	(0.288)	(0.000)	
1999	-0.014	0.022	0.503*	-0.122	0.020***	0.001	-0.020	0.018	0.390
	(0.945)	(0.311)	(0.054)	(0.429)	(0.004)	(0.898)	(0.485)	(0.412)	
2000	0.065	-0.028**	0.080	0.014	0.004	0.001	0.016	0.023	0.092
	(0.667)	(0.042)	(0.613)	(0.886)	(0.369)	(0.904)	(0.633)	(0.118)	
2001	0.133**	0.010	0.157**	0.036	0.010***	-0.003	0.023	0.011*	0.067
	(0.029)	(0.149)	(0.040)	(0.309)	(0.000)	(0.170)	(0.222)	(0.078)	
2002	0.156**	0.040***	0.268***	0.112***	0.014***	-0.005**	0.057***	0.021***	0.276
	(0.011)	(0.000)	(0.002)	(0.004)	(0.000)	(0.016)	(0.001)	(0.000)	
2003	0.143**	0.018***	0.106	0.075**	0.007**	-0.004	0.019	0.017**	0.104
	(0.021)	(0.006)	(0.216)	(0.019)	(0.019)	(0.113)	(0.138)	(0.012)	
2004	0.148***	0.004	-0.115	0.027	0.009***	-0.003*	0.037***	0.004	0.068
	(0.003)	(0.499)	(0.133)	(0.252)	(0.002)	(0.082)	(0.000)	(0.604)	
2005	0.190***	0.012	0.374**	0.008	0.015***	-0.006**	0.024*	0.029***	0.078
	(0.006)	(0.260)	(0.030)	(0.873)	(0.006)	(0.031)	(0.097)	(0.005)	
2006	0.143***	-0.006	0.522***	0.203***	0.012***	-0.003**	0.001	0.002	0.285
	(0.001)	(0.283)	(0.000)	(0.000)	(0.001)	(0.045)	(0.916)	(0.814)	
2007	0.128***	-0.001	0.645***	0.107*	0.015***	-0.003**	0.019*	0.033***	0.291
	(0.007)	(0.830)	(0.000)	(0.074)	(0.000)	(0.038)	(0.054)	(0.000)	

(*Continued*)

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Panel E: Modified PEG Ratio

	Intercept	Beta	Unsyst	Earnvar	Leverage	Size	LTG	BM	adj.R²
Expected sign	(?)	(+)	(+)	(+)	(+)	(−)	(−)	(+)	
1988	-0.113	-0.035	0.053	0.475	0.003	0.006	0.231	0.035*	0.608
	(0.613)	(0.517)	(0.902)	(0.850)	(0.418)	(0.527)	(0.438)	(0.068)	
1989	-0.159	-0.001	0.437	2.754***	0.007*	0.006	0.163***	0.035***	0.825
	(0.117)	(0.897)	(0.261)	(0.000)	(0.055)	(0.109)	(0.002)	(0.002)	
1990	-0.116	-0.078	-0.397	3.944	-0.013	0.008	0.106	-0.026	0.611
	(0.575)	(0.121)	(0.425)	(0.139)	(0.790)	(0.209)	(0.452)	(0.480)	
1991	0.058	0.047	-0.625	2.818	-0.024***	-0.003	0.125	0.085***	0.737
	(0.765)	(0.194)	(0.179)	(0.238)	(0.002)	(0.594)	(0.154)	(0.000)	
1992	0.333*	0.049*	-1.432***	-0.081	-0.006	-0.011*	-0.013	0.050**	0.330
	(0.062)	(0.064)	(0.001)	(0.848)	(0.551)	(0.092)	(0.879)	(0.046)	
1993	-0.145	0.040	0.273	2.894***	0.012	0.005	-0.050	0.026*	0.414
	(0.348)	(0.140)	(0.584)	(0.002)	(0.186)	(0.368)	(0.547)	(0.078)	
1994	-0.053	0.025	1.184**	-0.139	0.061***	0.001	0.038	0.004	0.719
	(0.691)	(0.274)	(0.038)	(0.510)	(0.000)	(0.776)	(0.664)	(0.780)	
1995	0.042	0.016	0.201	0.015	0.044***	-0.002	0.052	0.043***	0.866
	(0.773)	(0.305)	(0.656)	(0.755)	(0.000)	(0.732)	(0.501)	(0.004)	
1996	-0.040	0.014	-0.670	0.400***	0.013**	0.002	0.008	0.058***	0.686
	(0.758)	(0.314)	(0.290)	(0.000)	(0.016)	(0.670)	(0.816)	(0.000)	
1997	-0.174	-0.046**	1.872***	0.268***	0.007	0.007	-0.010	0.022	0.278
	(0.273)	(0.019)	(0.000)	(0.002)	(0.252)	(0.190)	(0.873)	(0.237)	
1998	-0.053	-0.009	-0.187	0.102	0.025***	0.002	0.059	0.065***	0.375
	(0.830)	(0.794)	(0.661)	(0.577)	(0.000)	(0.776)	(0.315)	(0.001)	
1999	0.005	0.027	0.580**	-0.131	0.019***	0.000	-0.022	-0.003	0.326
	(0.982)	(0.233)	(0.032)	(0.410)	(0.010)	(0.963)	(0.455)	(0.901)	
2000	0.107	-0.018	-0.002	0.261***	0.003	-0.001	0.004	0.028	0.113
	(0.555)	(0.268)	(0.993)	(0.007)	(0.585)	(0.874)	(0.913)	(0.114)	
2001	0.013	0.017**	0.121	0.046	0.012***	0.001	0.018	0.015**	0.064
	(0.848)	(0.031)	(0.149)	(0.236)	(0.000)	(0.689)	(0.371)	(0.020)	
2002	-0.004	0.044***	0.430***	0.137***	0.014***	0.000	0.043**	0.032***	0.269
	(0.959)	(0.000)	(0.000)	(0.003)	(0.000)	(0.868)	(0.023)	(0.000)	
2003	-0.041	0.023***	0.093	0.103***	0.005	0.003	0.011	0.025***	0.100
	(0.555)	(0.002)	(0.334)	(0.004)	(0.113)	(0.289)	(0.442)	(0.001)	
2004	-0.044	0.005	-0.161*	0.031	0.009**	0.004*	0.042***	0.011	0.086
	(0.448)	(0.475)	(0.075)	(0.256)	(0.015)	(0.072)	(0.001)	(0.231)	
2005	0.095	0.018	0.335	0.028	0.015**	-0.003	0.017	0.033***	0.042
	(0.250)	(0.133)	(0.101)	(0.631)	(0.020)	(0.407)	(0.316)	(0.006)	
2006	-0.010	0.003	0.394***	0.245***	0.010**	0.002	-0.009	0.002	0.116
	(0.858)	(0.684)	(0.000)	(0.000)	(0.018)	(0.290)	(0.479)	(0.837)	
2007	-0.009	0.015*	0.710***	0.152*	0.021***	0.000	0.037***	0.043***	0.186
	(0.901)	(0.088)	(0.000)	(0.091)	(0.001)	(0.922)	(0.009)	(0.000)	

Note: This table shows the result of the regression by year. Panel A shows the result of the regression on GLS. From Panel B to E shows the result of OJ, EP, PEG, and MPEG, respectively. P-values are in parentheses.
*** Statistically significant at the 0.01 level of significance using a two-tailed t-test.
** Statistically significant at the 0.05 level of significance using a two-tailed t-test.
* Statistically significant at the 0.10 level of significance using a two-tailed t-test.
Beta: market beta using daily stock returns over the past 1 year from the announcement date of analysts'

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forecasts by IBES
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: earning variability using the standard deviation of ROA (net income divided by total assets) over the past five years
Leverage: leverage as the ratio of the book value long-term debt to the market value of equity
Size: the natural log of the market value of equity
LTG: forecasted long-term growth reported by IBES to define variables regarding the long-term growth in expected earnings
BM: book-to-market ratio as the ratio of shareholders' equity to the market value of equity

5.2 Multivariate Analysis

Table 7 shows the estimation result of a multiple regression model in which costs of capital estimated by each model are dependent variables and seven risk factors are independent variables. In order to control the effects of year and industry, we regress the model including year dummies and industry dummies. According to the result of Table 7, the adjusted R-square of GLS is the highest, 31.9%. However, among risk factors included in independent variables, only the coefficients of Leverage and BM have the expected signs, and this result should be interpreted carefully. On the other hand, as for OJ, three risk factors—including Unsyst, Leverage, and Size—have the expected signs and significant values, but the adjusted R-square is about 12%, lower than that of other models. According to the results of PEG and MPEG, five risk factors, including Unsysts, Earnvar, Leverage, Size, and BM, have the expected signs and significant values. The R-squares are, respectively, 22.7% and 18.8%, higher than the one for the OJ model. As with the result of the correlation matrix, from the viewpoint of the correlation with individual risk factors, the PEG and modified PEG ratios appear to be advantageous.

Gode and Mohanram (2003) compared GLS and OJ, obtaining a result that showed hardly any differences between them. However, our result is different from theirs, in terms of the considerable variation in the signs of estimated coefficients and their levels of significance.

In order to analyze this tendency in detail, as with the correlation analysis, we regress the model by dividing the period into 10 years in the first half and 11 years in the latter half. The result is shown in Table 8. As for any costs of capital, the adjusted R-square in the first half is higher than in the latter half. It is also found that the values of the cost of capital reflect more risks in the first half. In particular, the R-squares of EP and PEG are, respectively, 51.9% and 44.7%, higher than 42.0% of GLS. Briefly, the reason why the R-square of GLS is high in the analysis with the entire sample is a relatively higher power of explanation for the model in the latter half.

Table 9 shows the result of a year-by-year regression.[24] In the comparison of R-squares, we found that OJ, PEG, and MPEG are high in the first half, and GLS is high in the second half. The result in Table 8 is not affected by a specific year. Focusing on signs of coefficients and levels of significance, the following tendency can be pointed out. Specifically, as GLS has a positive and significant correlation with leverage in 15 years out of 20, and with BM in 17 years, its result is stable. On the other hand, OJ has a positive and significant correlation with Unsyst in 8 years, relatively more years than in other models. In PEG and MPEG, more variables have the expected signs and significant values over the entire period, whereas in EP, few variables have the expected signs and significant values over the entire period. These results are consistent with the correlation analysis.

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[24] For 1987, because the low number of samples made a reliable estimation impossible, the result of 1987 is not presented. Although we conducted the regression analysis by industry, we could not find notable tendencies, like the correlation analysis. The presentation of said analysis is omitted, due in part to limitations of space.

The results in this section are summarized as follows. We find that GLS is the indicator that has the highest R-square and reflects risks the best in the entire sample. This tendency shows especially in the latter half. However, in the first half, the R-squares of EP and PEG are higher. Furthermore, in GLS analysis using entire sample, the fact that several coefficients have unexpected signs is still controversial. Costs of capital that show preferable results in terms of R-square, the sign, and significance over the entire period are PEG and MPEG. For this reason, the PEG and modified PEG ratios appear to be advantageous.

6. Conclusion

In this study, we estimate an alternative implied cost of capital as inferred from a valuation model, and attempt to compare its validity.

Many valuation models have been proposed to estimate the implied cost of capital, and their results vary, depending on assumptions for earnings growth, dividends, and the forecast period. Among them, we compare the following models: 1) the model proposed by Gebhardt et al. (2001), 2) the model proposed by Ohlson and Juettner-Nauroth (2005), 3) the EP ratio, 4) the PEG ratio, and 5) the modified PEG ratio, both PEG ratios being proposed by Easton (2004). As criteria to evaluate their validity, we focus on the following two points. One is a significant correlation with risk factors in consistency with the expected sign. Another is that variables have the expected signs, and the adjusted R-square is high in the multiple regression model, in which the cost of capital is a dependent variable and the risk factors are independent variables. We use seven risk factors as follows: 1) Beta, 2) Unsystematic risk, 3) Earnings variability, 4) Leverage, 5) Size, 6) Long-term growth in expected earnings, and 7) Book-to-market ratio.

As the result of the univariate analysis, we found the PEG and modified PEG ratios to show a significant correlation in consistency with the expected sign. Although the cost of capital inferred by the Ohlson and Juettner-Nauroth (2005) model also shows a preferable correlation in just the first half of the analysis period, the one in the latter half is not as correlative as expected. The cost of capital estimated by the Gebhardt et al. (2001) model has the expected correlations with just a few risk factors over the entire period.

In the multiple regression analysis, the Gebhardt et al. (2001) model shows the highest R-square. However, in this model, few of the coefficients of independent variables are consistent with the expected sign. In the first half of the analysis period, the R-squares in the EP and PEG ratios are rather higher. Furthermore, in the PEG and modified PEG ratios, the most coefficients have the expected signs.

We conclude that the PEG and modified PEG ratios reflect the risk factors most appropriately and that they are superior to other models. The estimated value of the cost of capital can be used for the valuation and forecast of risks associated with capital investment. The result suggests that more appropriate risk valuation and forecast will be enabled if the PEG and modified PEG ratios are used as a form of the abnormal earnings growth valuation model.

However, some problems remain in this study. The result obtained here implies that the cost of capital can be appropriately estimated in Japan by assuming that the abnormal earnings growth is zero in the abnormal earnings growth valuation model. In preceding studies, however, it has been argued that the PEG and modified PEG ratios cause a downward bias in general due to the assumption that the abnormal earnings growth and dividends are zero. This argument is inconsistent

with our results; therefore, we must examine this inconsistent result in detail. Furthermore, some recent studies have argued that the correlation with risk factors should be analyzed not at the firm level, but at the portfolio level. Though we analyze at the firm level in order to ensure comparability with many preceding studies, analysis must occur at the portfolio level in the future.

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