Implied cost of equity capital in earnings-based valuation: international evidence*

Feng Chen, Bjorn N. Jorgensen, and Yong K. Yoo*

Abstract—Assuming the clean surplus relation, the Edwards-Bell-Ohlson residual income valuation (RIV) model expresses market value of equity as the sum of the book value of equity and the expected discounted future residual incomes. Without assuming the clean surplus relation, Ohlson and Juettner-Nauroth (2000) articulate the role of forward earnings per share in valuation. We compare the implied costs of equity capital from these two approaches to earnings-based valuation within seven developed countries. We hypothesise superior performance from the RIV model in countries where the clean surplus relation holds well. First, we provide preliminary international evidence on the frequency and magnitude of the clean surplus deviations. Consistent with our hypothesis, we document superior reliability of the implied cost of equity capital derived from the RIV model when clean surplus adequately describes the firms' financial reporting. That is, the implied cost of equity capital derived from Ohlson and Juettner-Nauroth (2000) is relatively more reliable in countries where the clean surplus deviations are common. Our analyses suggest that the proper choice of earnings-based valuation model may depend on analysts' interpretation of their financial reporting environment.

1. Introduction

As is now well understood, the Edwards-Bell-Ohlson residual income valuation model (hereinafter RIV model) requires the clean surplus relation to rewrite the dividend discount model. In this paper, we provide evidence of how the assumption of the clean surplus relation applies to accounting data for firms in different countries. We proceed to investigate whether the relative performance of the RIV model varies internationally with the significance of potential clean surplus deviations within each country. We predict that in reporting environments where clean surplus relation deviations abound, the RIV model is less likely to succeed. As a benchmark for our analysis, we consider the Ohlson and Juettner-Nauroth model (hereinafter OJ model) which does *not* assume that clean surplus relation holds. We examine the relative reliability of the implied costs of equity from two earnings-based approaches, the RIV valuation model and the OJ model, within a sample of seven developed countries.

That most prior empirical analyses use data from US stock markets might raise methodological concerns. The capital markets around the world are, from the perspective of investors and analysts, either integrated or segmented. Suppose initially that capital markets are largely integrated on a global scale. First, although the capital markets are integrated on a global scale, investors and analysts in different countries likely apply different heuristics to generate earnings forecasts and to value firms. For example, the use of PEG ratios, which are a special case of the OJ model, is documented in the US starting in the early 1990s, but its use has not been documented internationally.[1] The representativeness of any single valuation model, such as PEG ratios, and the variation in investors'/analysts' choice of valuation methods might differ between stock markets and countries. Second, since the US economy has been growing consistently over a prolonged period of time, the inferred growth rates might be overstated relative to the average growth rate of the world. Alternatively, suppose that capital markets are segmented and that investors' portfolio choices exhibit home bias. In both cases, the inferences drawn from the US data might not generalise to other countries.

First, we provide evidence on the clean surplus relation in international accounting data. While accounting standard setters in many countries have pursued the reporting of the comprehensive income, the clean surplus relation need not be a descriptive assumption in financial reporting environments where the accounting standards

*The authors are, respectively, at Columbia University, Columbia University, and Singapore Management University. The address for correspondence is Bjorn Jorgensen, Graduate School of Business, Columbia University, Uris Hall 621, 3022 Broadway, New York, NY 10027, USA. Tel: 001-212-854-9220. E-mail: bnj2101@columbia.edu. The authors appreciate the helpful comments and discussions with Richard Frankel, Partha Mohanram, Jim Ohlson, Stephen Penman, Marco Trombetta (discussant), and the conference participants. Any remaining errors are their responsibility.

[1] See Bradshaw (2002, 2004) and Demirakos et al. (2003). We performed an unstructured search on the Internet and found examples of PEG ratios in France (Paris-based analyst Arnaud Joly on Mr Bricolage SA in 2002), Germany (MediClin) and the UK (Phillip Securities Limited on Barclays plc).

allow or require material deviations from the clean surplus relation. While differences in accounting methods remain across firms within any single country, this variation is likely more pronounced globally. Thus, the clean surplus relation may not be an equally effective assumption in all countries. To investigate this possibility, we proceeded to analyse the ex post deviations from the clean surplus relation in different countries. Following Lo and Lys (2001), we provide evidence on the magnitude of deviations from the clean surplus relation in percentage of the ending book value of equity. Such deviations from the clean surplus relation in prior years could, if correlated with analyst forecasts deviations from clean surplus, impact the precision of our estimated costs of capital.[2]

Second, producing a reliable empirical representation of firms' expected cost of equity is, of course, a fundamental accounting research question in its own right. Early research documents that ex post realised stock return is a natural, but noisy and potentially biased, proxy of the expected cost of equity (Elton, 1999). For example, Gebhardt et al. (2001) analyse the expected cost of equity implied in the equation between stock prices and intrinsic value estimates based on analyst earnings forecasts. In this paper, we explore what type of earnings-based valuation models, RIV or OJ, should be preferred in different countries.

Although earnings-based valuation models derive from a common underlying theory, the dividend discount model, their empirical implementation may cause differences in their assessed validity. When the empirical implementation involves simplifying assumptions about dividend payout ratios or terminal value calculations, the reliability of the implied cost of equity may vary. Therefore, identifying the preferred valuation model for deriving a reliable implied cost of equity capital is an empirical question. However, given the plethora of possible implementations, this question is difficult to resolve exhaustively. We address this concern by applying the representative implementations of alternative valuation models to different environments.

We extend prior studies of the implied cost of equity to an international setting, examining the reliability of the implied costs of equity in various environments of different countries. Diverse accounting standards and economic situations across different countries offer an empirical setting in which we can examine the robustness of the relative reliability of alternative estimates of implied costs of equity. For example, if a specific assumption about terminal values is descriptive of the underlying economic reality, the resulting implied cost of equity can approximate the true, unobservable cost of equity. Since different countries are under different economic and regulatory conditions, our international study facilitates more robust inferences about the relative reliability of the implied cost of equity. We consider the implied costs of equity derived from the representative earnings-based valuation models, such as the OJ model, the PEG model, and two different implementations of RIV models, within Australia, Canada, France, Germany, Japan, the UK and the US.[3] In particular, cross-country variation in dirty surplus accounting should affect the RIV model, but not the OJ model.[4] As already argued, the OJ model avoids the assumption of the clean surplus relation, while the RIV model requires it. This difference motivates testing the relative reliability of the implied cost of equity based on the OJ model versus the RIV model.

We examine which implied cost of equity is more closely associated with the representative risk proxies within each country and then compare the relative ranks of implied cost of equity across countries. Specifically, our metric of the reliability of the implied cost of equity is the adjusted R^2 of the regression of implied cost of equity on common risk proxies.

In terms of the association with risk proxies, we find that the RIV model reflecting industry-specific information is superior to, or equivalent with, alternative implementation of the RIV model that only reflects firm-specific information. That is, industry-specific information is incrementally helpful for enhancing the implied costs of equity for our countries. Further, the OJ model appears inferior to, or equivalent with, the PEG model (a simpler version of the OJ model), in all countries. Finally, we find that the RIV model clearly dominates the OJ model in countries where the clean surplus relation tends to hold (Australia, Canada, Japan and US) but not in the (European) countries with more pronounced dirty surplus. Overall, the clean surplus relation affects the relative performance of the RIV model as we predict.

Our study makes several contributions to the existing literature. We evaluate different measures of the implied costs of equity based on the RIV model and the OJ model in an international setting. Although prior research examines the relative reliability of alternative implied costs of equity using the US data, it remains unresolved whether these results generalise to other countries. By exploiting the diversity of economic conditions and accounting rules across seven countries, we offer more robust conclusions regarding the relative reliability

[2] The implied cost of equity capital resulting from the implementation of RIV models *without* a terminal value assumption should be unaffected by ex post deviations from clean surplus. See formal proof in the Appendix.

[3] These seven countries were chosen because they cover a substantial proportion of the world's total stock market capitalisation with data available.

[4] This is in the spirit of Walker (1997:352).

of implied costs of equity. Second, the increasing globalisation of financial markets motivates investors' and analysts' interest in which valuation model is preferred for determining the implied costs of equity capital. Third, the fact that the potential deviations from the clean surplus relation affects the relative validity of accounting-based valuation models might inspire accounting standard setters in different countries as they decide whether to pursue the reporting of the comprehensive income.

The paper proceeds as follows. Section 2 reviews the related literature. Sections 3 and 4 describe the variable measurements and our sample. We present our empirical evidence in Section 5 and summarise in Section 6.

2. Literature review

Our research relates to the intersection between the implied cost of equity and international valuation. This section briefly outlines the literatures in these areas.

2.1. Prior literature on implied cost of equity

Research in accounting and finance explored the ex ante cost of equity which is required as input for tests of asset pricing models and accounting-based valuation models. Since the ex ante cost of equity is unobservable, ex post realised stock returns are an often-used proxy. The ex post return has proven a notoriously noisy proxy for the ex ante cost of equity (for example, see Fama and French, 1997).

Gebhardt et al. (2001) present an alternative approach to estimating the ex ante cost of equity by calculating the internal rate of return that equates the stock prices with the intrinsic value estimates based on analyst earnings forecasts. They calculate the implied cost of equity from the RIV model using analyst earnings forecasts as proxies of the market's earnings expectations. Gebhardt et al. (2001) proceed to examine the relation between these implied costs of equity and ex ante firm characteristics previously suggested as risk proxies. They conclude that the implied cost of equity correlates systematically with several risk proxies, suggesting the reasonableness of their alternative approach to estimate the ex ante cost of capital.

Subsequent papers examine the reliability of the alternative implied costs of equity. For example, Botosan and Plumlee (2002) assess which valuation model produces the implied cost of equity approximating the ex ante cost of equity. They conclude that the implied cost of equity derived from the PEG model associates consistently with all of the considered risk proxies. In contrast, the associations between the implied cost of equity based on the RIV model or the OJ model and their risk proxies are unstable. Similarly, Easton and Monahan (2003) provide evidence that the reliability of the implied costs of equity derived from naïve heuristics (such as price-to-forward earnings multiple) compares to those derived from theoretical models, such as the RIV model or the OJ model. However, Gode and Mohanram (2003) report, among others, that within the US the RIV model reflecting industry-specific information outperforms the OJ model in terms of the correlations with risk proxies. Guay et al. (2003) conclude that only the implied cost of equity derived from the RIV model reflecting industry-specific information exhibits a significant correlation with two-year and three-year-ahead stock returns.

In summary, although prior research examines the reliability of implied costs of equity derived from a variety of valuation models in terms of the association with frequently cited risk proxies or realised stock returns, their analysis is generally limited to US firms. Further, their conclusions regarding the relative reliability of implied costs of equity remain mixed.

2.2. Prior literature on international valuation

Despite the popularity of the RIV model, little research explores the performance of the RIV model, or the OJ model, in an international setting. Frankel and Lee (1999) conclude that firm value estimates derived from the RIV model better explain the cross-sectional distribution of the stock prices in 20 countries than earnings or book value. They report that, in most countries, the intrinsic value estimates based on the RIV model account for more than 70% of the cross-sectional variation of stock prices. Their results predict that the implied cost of equity derived from the RIV model might be reliable within their sample countries. Hail and Leuz (2003) also explore the properties of the implied cost of equity in an international setting. They focus on the effects of a specific country legal environment on the 'level' of the cost of equity, but do not focus on the performance of alternative valuation models for the implied cost of equity.

Of particular interest for this study, Frankel and Lee (1999) point to the possibility that systematic deviations from the clean surplus relation are a source of noise in the intrinsic value estimates based on analyst earnings forecasts. This would imply that the country-specific extent of the clean surplus relation deviations might affect the relative reliability of the implied costs of equity derived from the RIV model or from the OJ model across countries. Given the limited evidence on the relative validity of different earnings-based valuation models across countries, we provide initial evidence on cross-country variation in the degree of clean surplus deviations, which will affect the relative validity of different earnings-based valuation models.

3. Research design and variable measurement

This section describes how we compare the reliability of different implied costs of equity, the assumptions we apply to different valuation models to derive the implied costs of equity, and which variables are chosen as the representative risk proxies.

3.1. Measurement of the reliability of implied cost of equity

Since the true ex ante cost of equity is unobservable, a direct assessment of the reliability of implied cost of equity is impossible. As an indirect assessment we examine the relation between the implied cost of equity and the risk proxies that are commonly believed to affect the cost of equity. We base our empirical specification of risk premia in the capital markets on the Arbitrage Pricing Theorem (APT). Ross (1976) derives firm *i*'s expected cost of equity ($E[r_i]$) as a function of the risk free rate (r_f) and the excess expected return associated with K risk factors. This leads to the following equation for the expected cost of equity:

$$E[r_i] = r_f + \sum_{k=1}^{K} \lambda_k \left(E[r_k] - r_f\right) \tag{1}$$

While the APT does not identify the risk factors, prior research identifies the risk proxies, described below, which we use in this study.

Based on equation (1), we examine which implied costs of equity are more highly associated with our risk proxies in cross-section within each country.[5] If a specific implied cost of equity is more reliable than others, this estimate should exhibit a stronger association with risk proxies. Therefore, we use the adjusted R^2 of the regression of implied cost of equity on frequently cited risk proxies as the main metric of the reliability of the implied cost of equity.[6]

3.2. Alternative measures of implied cost of equity

We derive the implied cost of equity using the OJ model and the PEG model (a specific form of the OJ model) as well as two implementations of the RIV model. We compute the implied cost of equity for each firm as the internal rate of return that equates the stock prices to intrinsic value estimates based on one-year-ahead and two-year-ahead analyst earnings forecasts.[7] The four methods compared here all derive from the same underlying valuation model, i.e., the dividend discount model:

$$P_t = E_t\left[\sum_{n=1}^{\infty} \frac{d_{t+n}}{\left(1+r_t\right)^n}\right] \tag{2}$$

where P_t is the stock price at period t, d_t are the dividends net of capital contributions during period t, and r_t is the firm's cost of equity.

However, the RIV model specifies the valuation using the 'return on equity' rather than the level of 'abnormal earnings' as in the OJ model. Furthermore, the implementations of valuation models differ in their assumptions about the forecasts horizon and the earnings growth after the forecast horizon. For example, the OJ model uses economy-wide assumptions for the terminal earnings growth, while an implementation of the RIV model incorporates industry-specific assumptions for the terminal earnings growth. These differences in implementation might affect the reliability of the implied cost of equity. The remaining part of this section describes the salient features and key assumptions underlying these four implementations.

3.2.1. The residual income valuation model

The RIV model applies the clean surplus relation to dividend discount model and expresses prices as the reported book value of equity and an infinite sum of the discounted future residual incomes, see Ohlson (1995). However, the empirical implementation of the RIV model requires additional assumptions about forecast horizon, terminal value calculation, dividend payout ratios as well as the explicit forecasts of future return on equity (ROE) before forecast horizon. We forecast future ROE explicitly for the next two years using analyst earning forecasts, and then forecast ROE beyond year t+2 implicitly by adopting different terminal value calculations used in prior representative studies using the RIV model.

Following prior research, we estimate the implied cost of equity from two implementations of the RIV model. The two implementations differ only in their assumptions about the forecasts horizon and the growth of residual income beyond the forecasts horizon. Following Frankel and Lee (1998), Lee et al. (1999), Liu et al. (2002), and Ali

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[5] This methodology is consistent with Gebhardt et al. (2001), Botosan and Plumlee (2002) and Gode and Mohanram (2003).

[6] The discussion in Chang (1998) and Gu (2001), among others, of the use and interpretation of R^2 applies less forcefully because we compare regressions using the same firms and the same independent variables within each country.

[7] Since analyst forecasts of five-year earnings growth are unavailable for many foreign firms, we use only one- and two-year-ahead earnings forecasts under a specific assumption about the longer period ahead earnings. In this study, this implementation is sensible since our implementation of the OJ model use only one- and two-year-ahead analyst earnings forecasts and so the comparison between the OJ model and the RIV model is unaffected by the different usage of analyst earnings forecasts for different horizons. Frankel and Lee (1999) also use only one- and two-year-ahead analyst earnings forecasts in their international valuation study. Furthermore, Lo and Lys (2001) indicate that to reflect long-term analyst earnings forecasts into the RIV model does not significantly improve its pricing performance.

et al. (2003), our first RIV model assumes that the residual income is constant beyond year t+2. We refer to this as the RIVC model. Formally, we denote earnings per share by eps_t and book value of equity per share by bv_t and represent current period t price per share as:

$$P_t = bv_t + \sum_{s=1}^{2}\left(\frac{E_t(eps_{t+s} - r_t \times bv_{t+s-1})}{(1+r_t)^s}\right) + \frac{E_t(eps_{t+2} - r_t \times bv_{t+1})}{r_t \times (1+r_t)^2} \quad (3)$$

Our second RIV model (RIVI) assumes that the ROE trends linearly to the industry median ROE by the 12th year and that thereafter the residual incomes remain constant in perpetuity.[8] The industry median ROE is calculated by the moving median of the previous five years' ROE of the firms within the same industry.[9] Following Gebhardt et al. (2001), we only use firms with positive ROE in the calculation. In the RIVI model, current price per share is therefore:

$$P_t = bv_t + \sum_{s=1}^{2}\left(\frac{E_t(eps_{t+s} - r_t \times bv_{t+s-1})}{(1+r_t)^s}\right) + \sum_{s=3}^{11}\frac{E_t[(ROE_{t+s} - r_t)\times bv_{t+s-1}]}{(1+r_t)^s} + \frac{E_t[(ROE_{t+12} - r_t)\times bv_{t+11}]}{r_t \times (1+r_t)^{11}} \quad (4)$$

where ROE_t is the return on equity during period t.

As stated previously, the RIVI model reflects the industry-specific information into terminal value calculation while the RIVC model does not. Therefore, if long-term industry performance is an important determinant of the valuation, the implied cost of equity derived from the RIVI model will be superior to the implied cost of equity derived from the RIVC model.

Lastly, we make the same assumptions about dividend payout ratio to both models as follows. When analyst forecasts of dividends are available, we apply those forecasts as future dividends. Otherwise, when analyst forecasts of dividends are unavailable, we estimate the future dividend payout ratio by scaling dividends in the most recent year by earnings over the same year. For the firms with negative earnings, we divide dividends in the most recent year by one-year-ahead or two-year-ahead analyst earnings forecast to derive an estimated payout ratio. If both earning forecasts are still negative, we assume the future dividend payout ratio to be zero. If the estimated dividend payout ratio is larger than 0.5, we assume the payout ratio to be 0.5. We compute future book values of equity using the dividend forecasts (if not available, dividend payout ratio) and analyst earnings forecasts based on the clean surplus relation.

Under these assumptions, we solve for r_t by searching over the range of 0 to 100% for a value of r_t that minimises the difference between the stock prices and the intrinsic value estimates based on analyst earnings forecasts.

3.2.2. *The abnormal earnings valuation model*

Ohlson and Juettner-Nauroth (2000) provide an alternative to the RIV model in order to mitigate the potential problems in the RIV model, such as the deviations from the clean surplus relation under current accounting rules. According to the OJ model, intrinsic value consists of the capitalised next-period earnings as the first value component and the present value of the capitalised expected changes in earnings, adjusted for dividends, as a second value component (i.e., abnormal earnings). In addition, the OJ model uses (γ–1) as the perpetual growth rate of these abnormal earnings as well as the rate at which the short-term growth decays asymptotically to the perpetual growth rate, (γ–1). We set (γ–1) to be equal to the country-specific risk free rate minus 3%, which is the long-term inflation rate. This assumption on (γ–1) is consistent with Gode and Mohanram (2003). Analogous to Claus and Thomas (2001), we set (γ–1) to zero when negative. In addition, we assume one-year-ahead dividend payout ratio under the same assumptions as in the RIV model. Let dps_{t+1} be the dividends during future period t+1 and denote abnormal earnings growth by $aeg_{t+2} \equiv eps_{t+2} + r_t dps_{t+1} - (1+r_t)eps_{t+1}$. The OJ model of current price per share is then:

$$P_t = \frac{eps_{t+1}}{r_t} + \frac{aeg_{t+2}}{r_t(r_t - \gamma + 1)} \quad (5)$$

Consequently the formula for the implied cost of equity is as follows:

$$r_t = A + \sqrt{A^2 + \frac{eps_{t+1}}{P_t}\left(\frac{(eps_{t+2} - eps_{t+1})}{eps_{t+1}} - (\gamma - 1)\right)} \quad (6)$$

[8] The assumption of the future convergence of ROEs toward the industry median is consistent with Lee et al. (1999), Gebhardt et al. (2001) and Liu et al. (2002). See Myers (1999) for a discussion on inter-temporal consistency.

[9] Since the data is limited for international firms, we use the median of the prior five years. We use the most general I/B/E/S industry classification, 'Sector', when calculating the industry median of ROE.

where

$$A \equiv \frac{1}{2}\left(\gamma - 1 + \frac{dps_{t+1}}{P_t}\right).$$

When $eps_{t+1} > eps_{t+2}$, we assign the short-term earnings growth (eps_{t+2}–eps_{t+1}), to zero. When the value inside the root is negative, we assume that the implied cost of equity is A.

Following Easton (2004), we derive the implied cost of equity from the PEG model, which is a special case of the OJ model. Specifically, if we assume that both γ=1 and dps_{t+1}=0 in the OJ model, i.e., assuming no changes in abnormal earnings beyond the forecast horizon and no dividend payments, we can obtain the PEG model as follows:

$$P_t = \frac{eps_{t+2} - eps_{t+1}}{r_t^2}.$$

Therefore we classify the PEG model as a specific form of the OJ model when we compare the validity of the OJ model with that of the RIV model in Section 5. The implied cost of equity can be obtained as the solution to the above quadratic equation. When $eps_{t+1} > eps_{t+2}$, the implied cost of equity is set as the implied cost of equity derived from the OJ model.[10]

3.3. Measurement of risk proxies

Since no generally accepted theory guides a priori selection of risk factors, we choose the following five risk proxies used in prior research.

Market Beta (BETA): The Capital Asset Pricing Model predicts a positive association between a firm's beta and its cost of equity. We estimate beta by regressing at least 30 prior monthly returns up to 60 prior monthly returns against the corresponding market index in each country. We generally use the country indexes compiled by Morgan Stanley, but the CRSP value-weighted market index for US firms.

Market Value of Equity (MV): Penman (2004) indicates the importance of liquidity in explaining the cost of equity. Amihud and Mendelson (1986) argue that firm size does proxy for the liquidity of the stock. We therefore choose the natural log of market value of equity as the risk proxy regarding to liquidity and expect a negative association between the cost of equity and market value of equity.

Debt-to-Market Ratio (D/M): We use the financial leverage, defined as the book value of debt divided by the market value of equity, to proxy for financing risk. Modigliani and Miller (1958) show that cost of equity should be an increasing function of the financial leverage. Thus we expect a positive association between implied cost of equity and the D/M.

Dispersion of Analyst Earnings Forecasts (EPSDISP): Following Botosan and Plumlee (2002), we consider information risks using the dispersion in analyst earnings forecasts as a risk proxy. We measure the dispersion of analyst earnings forecasts as the standard deviation of the one-year-ahead earnings forecasts scaled by the absolute mean of these forecasts. We expect a positive association between the implied cost of equity and the dispersion of analyst earnings forecasts.

Idiosyncratic Risk (IDRISK): While beta indicates a systematic risk, Lehmann (1990) and Malkiel and Xu (1997), among others, present comprehensive evidence of the importance of idiosyncratic risks. Therefore, we include idiosyncratic risk as the risk factors in the regression test. Our measure of idiosyncratic risk is the variance of residuals from the regressions of beta estimation. We expect a positive association between implied cost of equity and idiosyncratic risk.

4. Sample and descriptive statistics

4.1. Sample selection

Our empirical analysis is based on a sample of firms from seven developed countries from 1993 to 2001. We extract accounting data from COMPUSTAT (US firms) and Global Vantage, stock price, analyst earning forecasts and industry identification code from I/B/E/S (all firms), and stock returns from CRSP (US firms). In addition, we use the 10-year government bond rate from Global Insight as a proxy for the risk free rate.

In September of each year,[11] we select firm-years that satisfy the following criteria: (1) non-financial firm, (2) financial statement data for main variables, such as book value of equity, number of shares, are available in COMPUSTAT or Global Vantage,[12] (3) stock price, consensus of one-year-ahead and two-year-ahead analyst earning forecasts, industry identification code and number of shares data are available from I/B/E/S, (4) the currency codes are consistent between Global Vantage and I/B/E/S, and between adjacent years, (5) stock return data are available from CRSP or can be calculated from the Global Vantage, (6) all of the risk proxies, such as beta, are available, (7) book value of equity and stock price are positive,

[10] We choose this assumption in order to keep the firm-years whose one-year-ahead analyst earnings forecasts is larger than two-year-ahead earnings forecasts, since deleting these firms might cause a selection bias toward growth firms.

[11] Frankel and Lee (1999) note that regulatory filings are not publicly available until seven months after the fiscal year-end in many countries. We choose the end of September for our analysis to ensure that financial statements of December year-end firms are publicly available.

[12] Following Liu et al. (2002), we set missing dividends to zero.

and (8) the means of one-year-ahead and two-year-ahead analyst earnings forecasts are positive.[13] This process yields a final sample of 31,199 firm-year observations, consisting of 7,292 firms between 1993 and 2001. Our sample for the main analysis contains 1112, 1393, 760, 594, 6543, 3894 and 16903 firm-year observations for Australia, Canada, France, Germany, Japan, UK and US, respectively.[14] For our analysis of deviation from clean surplus, we use a larger sample only based on Global Vantage because we do not require analyst forecasts data. Our sample does not concentrate in any specific sector within each country.

4.2. Descriptive statistics

Table 1 reports the descriptive statistics of our variables. The pooled mean of one-year-ahead (two-year-ahead) analyst earnings forecasts scaled by stock prices is 0.06 (0.08). The country average two-year-ahead earnings forecasts scaled by stock prices vary from 0.05 (in Japan) to 0.10 (in the UK). This cross-country variation might be due to the definitional difference of earnings or the differences of expected earnings growth and risks across countries. The cross-country variation of the actual earnings scaled by stock prices can be explained by similar reasoning. The mean of the dividend yield varies from 0.01 (in Japan and the US) to 0.04 (in Australia and the UK). This cross-country variation might be due to the difference of dividend payout tendency and tax treatment of dividends across countries.

On the other hand, the cross-country variations of the mean return on equity (from 0.03 of Japan to 0.15 of the UK), of the mean risk-free rate (from 0.02 of Japan to 0.07 of Australia and Canada) and of the mean stock returns (from –0.16 of France to 0.14 of Canada) reflect the varying economic conditions across countries. The cross-country variation in risk proxies indicates the differences of the ex ante firm characteristics related to risk factors across countries. Note that the average beta is below one for some countries. This might reflect a potential selection bias within our sample toward firms with lower systematic risks. Since the pooled median analyst following is six, using consensus of analyst earnings forecasts may cancel out extreme errors in individual analysts' earnings forecasts. In sum, the descriptive statistics of main variables indicate variation in economic conditions as well as of the accounting standards across countries. Such cross-country variation will tend to increase the power of our test.

Table 2 presents the descriptive statistics of the risk premium estimates for each country. Investigating the aggregate market level cost of equity, Claus and Thomas (2001) conclude that the average implied risk premium derived from the RIV model is around 3% in six developed countries, below the historically average ex post risk premium of 7% to 9%. Consistent with their findings, our implied risk premium derived from the RIVC model is slightly below 3%. Although the RIVI model yields higher implied risk premium than the RIVC model, the level of implied risk premium remains below the historical average ex post risk premium. However, the OJ model and the PEG model produce consistently higher implied risk premium than the RIV model. This result might arise from more optimistic assumptions about future earnings growth by the OJ and PEG models.

Further note that the ex post returns remain more volatile than the implied risk premium: The standard deviation of the ex post returns (RET12) is lowest for Germany at 38.5%, whereas the standard deviations of our implied costs of equity always remain below 8%. This supports the observation in Fama and French (1997), among others, that estimating the cost of equity based on realised stock returns introduces additional noise.

4.3. Descriptive statistics of the deviations from clean surplus

This section reports descriptive evidence on the cross-country variation in the extent to which the clean surplus relation (hereafter CSR) holds. As noted before, the CSR deviations might affect the validity of the RIV model, but not of the OJ model, and so the cross-country variation in the extent of the CSR deviation might lead to the differential relative reliability of the implied cost of equity derived from the RIV model or the OJ model across countries.

As noted by Frankel and Lee (1999), accounting standards often allow some (potentially value-relevant) accounting items to be charged directly to the book value of equity without running through the income statement. That is, these 'dirty surplus adjustments' go against the CSR. For example, under the US GAAP, unrealised gains and losses on marketable securities, foreign currency transla-

[13] As noted by Gode and Mohanram (2003), empirical implementation of the OJ model requires this condition.

[14] We calculate cum-dividend stock returns for non-US firms from the data of stock prices and dividends extracted from Global Vantage. We adjust all per share numbers for stock splits and stock dividends using I/B/E/S adjustment factors. Also, when I/B/E/S indicates that the consensus forecast for that firm-year is on a fully diluted basis, we use I/B/E/S dilution factors to convert those numbers to a primary basis. Furthermore, to mitigate the effects of outliers, we winsorise all of the risk proxies except market value of equity at the 5% and 95% of the pooled distribution within each country. In addition, we winsorise the industry median of ROE at the risk free rate and 20%. To maintain consistency between calculations of implied costs of equity, we winsorise the cost of equity implied from equation (6), and implied from the PEG model, at 0 and 100%.

Table 1
Descriptive statistics of variables for the pooled sample and by country

This table presents the mean, median and the standard deviations of variables used in this paper for the pooled sample and by country. EPS1/P is the one-year-ahead consensus analyst earnings forecast scaled by stock price. EPS2/P is two-year-ahead consensus analyst earning forecast scaled by stock price. AEPS/P is the actual earnings per share scaled by stock price. ADIV/P is the actual dividend per share scaled by stock price. NUMEST is the number of earnings forecasts. All forecasts are from the September statistical period from I/B/E/S. ROE is the return on book value of equity. BETA is the systematic risk estimated by regressing at least 30 prior monthly returns up to 60 prior monthly returns against the corresponding market index in each country. D/M is the book value of debt divided by market value of equity for each firm. EPSDISP is the dispersion of analyst earnings forecasts, which is measured as the standard deviation of the one-year-ahead earnings forecasts scaled by the absolute mean of these forecasts. IDRISK is the idiosyncratic risk, which is measured as the variance of residuals from the regressions of beta estimation. RF is the risk-free rate, as proxied by the 10-year long-term government bond rate in each country. RET12 is the realised annual stock return.

	Pooled Sample			*Australia*			*Canada*			*France*		
	Mean	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*
EPS1/P	0.06	0.06	0.12	0.08	0.07	0.05	0.07	0.06	0.04	0.06	0.06	0.03
EPS2/P	0.08	0.07	0.19	0.09	0.08	0.06	0.09	0.08	0.05	0.08	0.07	0.04
AEPS/P	0.05	0.05	0.33	0.04	0.06	0.45	0.05	0.05	0.08	0.05	0.05	0.07
ADIV/P	0.02	0.01	0.06	0.04	0.04	0.07	0.02	0.00	0.15	0.03	0.02	0.03
NUMEST	8.46	6.00	6.83	8.82	9.00	4.22	7.31	6.00	4.35	13.65	13.00	7.97
ROE	0.11	0.10	0.13	0.10	0.10	0.12	0.09	0.09	0.11	0.10	0.11	0.09
BETA	0.95	0.90	0.51	0.75	0.75	0.39	0.72	0.67	0.45	0.69	0.68	0.37
D/M	0.46	0.23	0.62	0.34	0.25	0.33	0.50	0.29	0.58	0.49	0.29	0.51
EPSDISP	0.10	0.05	0.14	0.13	0.08	0.14	0.17	0.10	0.21	0.13	0.08	0.14
IDRISK	0.013	0.009	0.012	0.009	0.006	0.008	0.014	0.009	0.013	0.015	0.010	0.012
RF	0.05	0.06	0.02	0.07	0.06	0.01	0.07	0.06	0.01	0.05	0.06	0.01
RET12	0.07	–0.01	0.68	0.12	0.00	1.50	0.14	0.07	0.62	–0.16	–0.11	0.52
	Germany			*Japan*			*U.K.*			*U.S.*		
	Mean	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*	*Mean*	*Median*	*Std. Dev.*
EPS1/P	0.06	0.06	0.05	0.04	0.04	0.04	0.08	0.07	0.05	0.07	0.06	0.16
EPS2/P	0.08	0.07	0.05	0.05	0.04	0.04	0.10	0.08	0.06	0.08	0.07	0.26
AEPS/P	0.03	0.05	0.17	0.02	0.03	0.18	0.07	0.07	0.08	0.06	0.05	0.41
ADIV/P	0.03	0.03	0.03	0.01	0.01	0.01	0.04	0.04	0.03	0.01	0.00	0.07
NUMEST	19.22	17.50	13.15	6.21	5.00	4.54	8.19	6.00	5.85	8.85	6.00	7.15
ROE	0.08	0.08	0.10	0.03	0.04	0.06	0.15	0.14	0.17	0.14	0.14	0.12
BETA	0.62	0.60	0.46	0.97	0.97	0.37	0.73	0.72	0.41	1.04	0.97	0.56
D/M	0.49	0.33	0.53	0.75	0.40	0.89	0.26	0.16	0.27	0.39	0.18	0.53
EPSDISP	0.14	0.05	0.20	0.18	0.10	0.20	0.08	0.04	0.09	0.07	0.03	0.10
IDRISK	0.032	0.017	0.039	0.009	0.007	0.007	0.010	0.007	0.007	0.015	0.012	0.012
RF	0.05	0.05	0.01	0.02	0.02	0.01	0.06	0.06	0.01	0.06	0.06	0.01
RET12	–0.10	–0.10	0.39	–0.02	–0.11	0.58	0.03	–0.01	0.47	0.12	0.04	0.68

Table 2
Descriptive statistics of risk premium estimates

The table presents the means, medians and standard deviations for risk premium estimates in percent for seven major developed countries from 1993 to 2001. RF is the risk-free rate, as proxied by the 10-year long-term government bond rate. RET12 is the ex post realised annual stock return. OJ is the cost of equity estimate from the OJ model. PEG is the cost of equity estimate from the PEG model. RIVC and RIVI are cost of equity estimates from the RIV model. RIVC assumes a constant residual income after two periods, and RIVI incorporates industry-specific information.

Country	*Statistics*	*RF* (%)	*RET12* (%)	*OJ* (%)	*PEG* (%)	*RIVC* (%)	*RIVI* (%)
Australia	Mean	6.5	11.9	7.2	4.0	1.9	2.2
	Median	6.2	0.1	6.4	3.0	1.2	1.7
	Std. Dev.	1.5	150.4	7.1	6.6	5.0	3.7
Canada	Mean	6.5	13.9	7.8	6.3	1.6	2.5
	Median	5.9	6.9	6.7	5.0	1.0	2.1
	Std. Dev.	1.2	61.9	7.2	7.0	4.3	3.6
France	Mean	5.5	–16.3	7.6	5.8	1.9	2.6
	Median	5.5	–11.0	6.5	4.7	1.2	2.0
	Std. Dev.	1.2	52.3	5.5	5.3	3.6	3.5
Germany	Mean	5.1	–9.9	7.3	5.5	1.9	1.9
	Median	5.1	–9.7	6.6	4.7	1.4	1.3
	Std. Dev.	0.9	38.5	5.7	5.4	4.3	3.8
Japan	Mean	2.0	–2.5	6.1	5.6	2.7	2.1
	Median	1.9	–11.1	5.2	4.7	2.3	2.0
	Std. Dev.	0.9	57.6	5.7	5.5	3.6	2.6
UK	Mean	6.4	2.6	7.2	4.5	2.6	4.5
	Median	5.5	–0.8	6.2	3.5	1.7	3.8
	Std. Dev.	1.4	46.8	5.8	5.2	4.9	4.9
US	Mean	5.8	12.4	7.2	5.9	1.6	5.0
	Median	5.9	4.4	6.2	5.0	1.0	4.6
	Std. Dev.	1.0	68.3	5.9	5.8	4.2	3.8

tion gains and losses, and gains and losses on derivative instruments, among others, are charged directly to the book value of equity and not through the income statement. Similarly, in countries such as the UK, Australia and France, fixed assets may be revalued to reflect their market value, with a corresponding adjustment directly to the book value of equity. Another example is the goodwill written off directly against the book value of equity under the UK GAAP during the first half of our sample period. Occasionally, this direct write-off is used by German firms. In countries such as France and Australia, foreign currency translation tends to be an important source of the dirty surplus adjustments.

In local GAAP, the existence of the dirty surplus adjustments does not necessarily lead to the noise in the intrinsic value estimates based on the RIV model. As indicated by Claus and Thomas (2001), if future earnings expectations, proxied by analyst earnings forecasts in our study, satisfy the CSR, the validity of the RIV model should remain unaffected. The effect of analyst forecasts' deviations from the CSR on the validity of the RIV model implementation can be described as follows. Based on the assumption of the CSR, we start from the prior year's actual book value of equity, and add earnings forecast, then subtract forecasted dividend. This yields a predicted book value of equity. If analysts' expectations on the future book value of equity deviate from the predicted book value of equity, our intrinsic value estimates might differ from the firm values in analysts' or investors' minds. This difference will also bias the implied cost of equity, which is derived from the assumed equation between stock prices and analysts' valuations.

We initially intended to provide descriptive evidence of ex ante deviations from the CSR from three sets of consensus analyst forecasts from I/B/E/S. Specifically we required that three sets of consensus forecasts on book value of equity, earnings, and dividends are available for each firm-year. However, since the resulting sample is quite small, we cannot reliably compare the extent of the ex ante CSR deviations across countries. Furthermore, the extent of ex ante CSR deviations is also affected by variation in the composition of analysts used to calculate the consensus forecasts.

Given this limitation in data, we report the ex post deviations from the CSR as indirect descriptive evidence. Our implicit assumption is that analyst earnings forecasts' potential deviations from the CSR may be proportional to the magnitude of the ex post deviations from the CSR in our sample. Under this assumption, the effect of the potential CSR deviations from analyst earnings forecasts on the validity of the RIV model can be tested indirectly by examining whether the cross-country variation of the relative reliability of the implied cost of equity derived from the RIV model or the OJ model relate to this ex post deviations from the CSR.

We measure the magnitude of the ex post CSR deviation by the difference between the comprehensive income[15] and the net income[16] scaled by the book value of equity (hereinafter DSPB), following Lo and Lys (2001). To describe the general magnitude of the CSR deviation within a country, we include all of the firm-years for which the required data for the CSR analysis are available. Figure 1 represents for each country the cumulative distributions of DSPB with the familiar S-shape arising from a bell-curved histogram. Visual inspection suggests that the UK data appears to be second order stochastically dominated by US, Japan, Australia and Canada, but comparable to France and Germany. Recall that second order stochastic dominance implies that CSR deviations contain additional noise in the European countries. It is therefore not surprising when we also find that the variance of deviations from CSR is higher among the European countries.

Panel A of Table 3 reports the distribution of the DSPB within each of the seven countries. Following Liu et al. (2002), we compare the magnitude of the CSR deviation across countries in several different ways. First, the interquartile range of the DSPB distributes from 1% (Australia) to 6% (France).[17] This measure implies that for half of the firms, the CSR deviations from Australian firm-years exceed 0.05% of the book value of equity while half of French CSR deviations exceed 3%. Panel C of Table 3 reports the t-statistics based on bootstrap-type analysis,[18] indicating that the differences of interquartile ranges across countries are statistically significant in most cases. Second, as a supplementary metric, Panel B of Table 3 reports the mean of the absolute DSPB and the percentage of sample whose absolute DSPB is below 3% or 10%.[19] The mean of the absolute DSPB distributes from 3% (Japan) to 13% (the UK). Panel C of Table 3 indicates that the cross-country differences on the mean of the absolute DSPB are statistically significant. Moreover, Panel B of Table 3 shows that 44% (83%) of French (Japanese) firm-years has the ex post CSR deviation smaller than 3% of the book value of equity. Bootstrap t-statistics (untabulated) indicate that the cross-country differences of the percentage with absolute DSPB is below 3% or 10% are statistically significant.

Although we measure the magnitude of the CSR deviation in several different ways, all measures uniformly indicate that there are significant ex post deviations from the CSR within all of the countries. Further, the cross-country differences of the magnitude of the CSR deviation are significant. On the basis of these measures, we classify Australia, Canada, Japan, and the US as the countries where the CSR deviation is relatively small and classify France, Germany and the UK as the countries where the CSR deviation is relatively large.

In sum, we observe significant deviations from the ex post CSR within all of our countries, and the

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[15] In Global Vantage (abbreviated GV), retained earnings do not include all dirty surplus items. We therefore measure the comprehensive income by the annual change of the sum of a firm's retained earnings (GV #131), revaluation reserve (GV #130), unappropriated net profit (GV #132), other equity reserves (GV #133), and cumulative translation adjustment (GV #134), adding in common dividends (GV #36). To ensure the robustness of our comprehensive income measure, we perform additional analyses on US firms: following Dhaliwal et al. (1999) we measure the comprehensive income of US firms by the annual change in a firm's retained earnings (Compustat item #36), which includes the dirty surplus items, and add common dividends (Compustat item #21). These untabulated results for US firms are very similar to those using the Global Vantage dataset.

[16] Net income is measured by Global Vantage item #32.

[17] We calculate the interquartile range of DSPB as the main metric to assess the magnitude of the CSR deviation since the DSPB cannot perfectly measure the CSR deviations from the firm-years in the tail. For example, a merging firm's retained earnings will increase by the merged firm's retained earnings under the pooling of interest method. Although this is not the deviations from the CSR, our DSPB measure will count this increase in the deviation from the CSR. It is conceivable that the firm-years in the tail will be affected by these non-dirty surplus items to a relatively larger extent. However, the interquartile range can mitigate this concern since the statistic is not affected by the firm-years in the tail. In addition, this statistic is sensible only when the middle of the distribution is zero. As indicated by Panel A of Table 3, the median of the distribution is around zero within all countries.

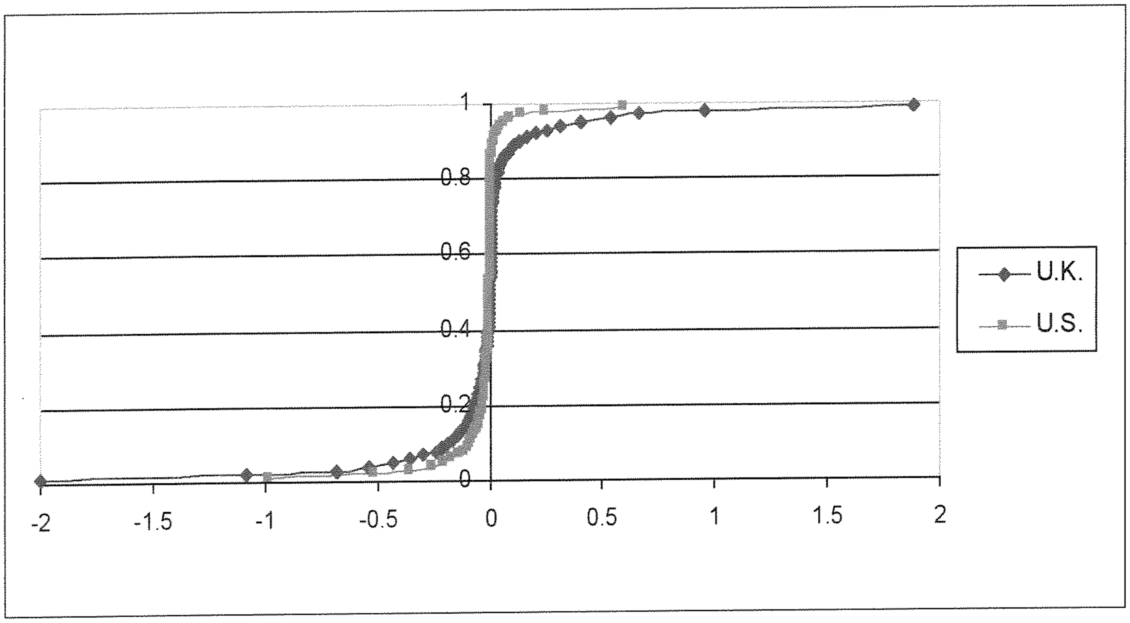
[18] The bootstrap-type analysis results in 58,943 firm-years by drawing observations randomly from the constructed sample with replacement. For each trial, we compute the interquartile range of the DSPB for each country and then compute the difference of interquartile range across countries. This process is repeated 100 times and a distribution for the difference of interquartile range across countries is obtained. A t-statistic is computed as the mean divided by the standard deviation of this distribution. This analysis follows Liu et al. (2002).

[19] Unlike the interquartile range, this measure is unaffected by cross-country variation in skewness and by the firm-years in the tails.

Figure 1
The cumulative distributions of ex post deviations from the clean surplus relation

Figure 1 presents the cumulative distributions of ex post deviations from the clean surplus relation for each sample country. The ex post CSR deviation is calculated by the difference between the comprehensive income and the net income scaled by the book value of equity. In each figure, the horizontal axis represents the extent of deviation from clean surplus relation, where zero indicates no deviation; the vertical axis represents the cumulative distribution of ex post deviation, which is bounded by 0 and 1.

Panel A. United Kingdom and United States



Panel B. Australia, Canada and United Kingdom

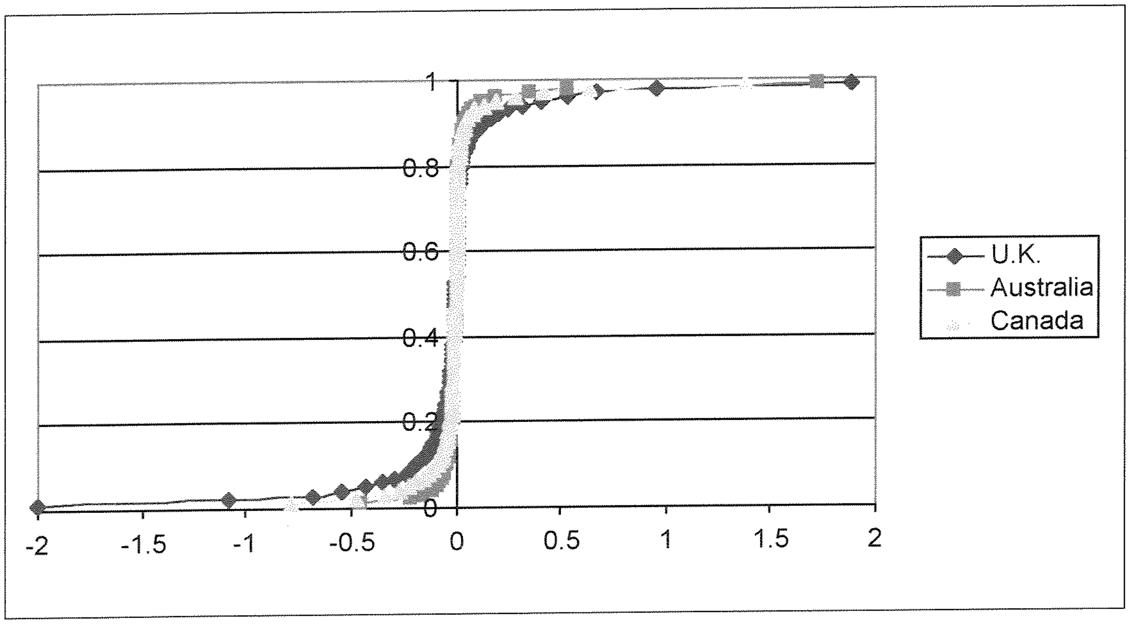
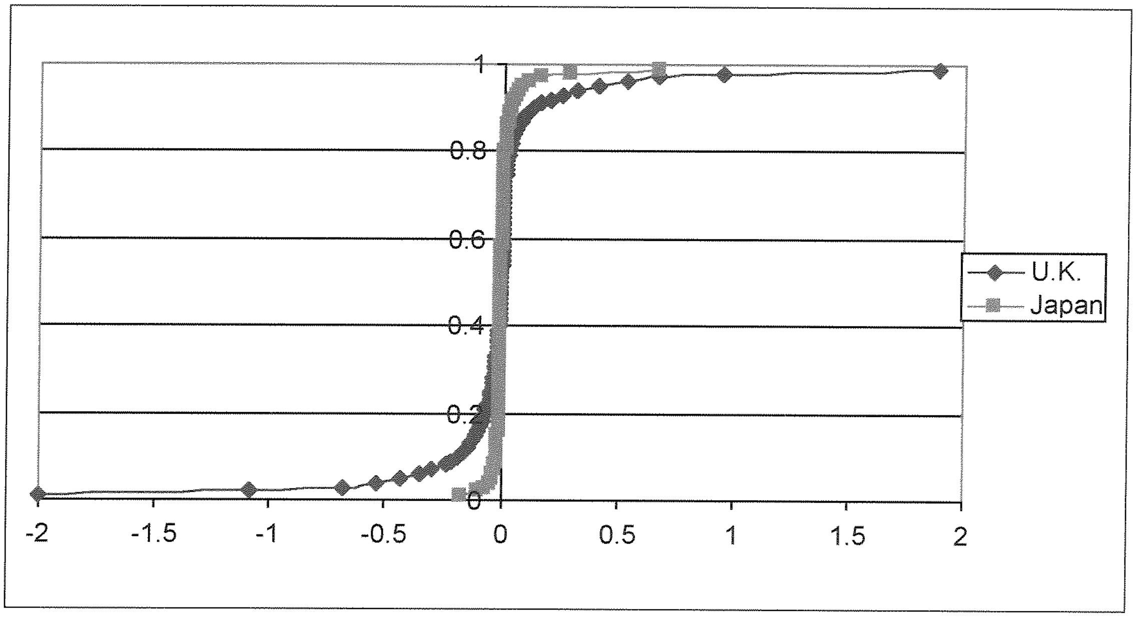


Figure 1
The cumulative distributions of ex post deviations from the clean surplus relation *(continued)*

Panel C. Japan and United Kingdom



Panel D. France, Germany, and United Kingdom

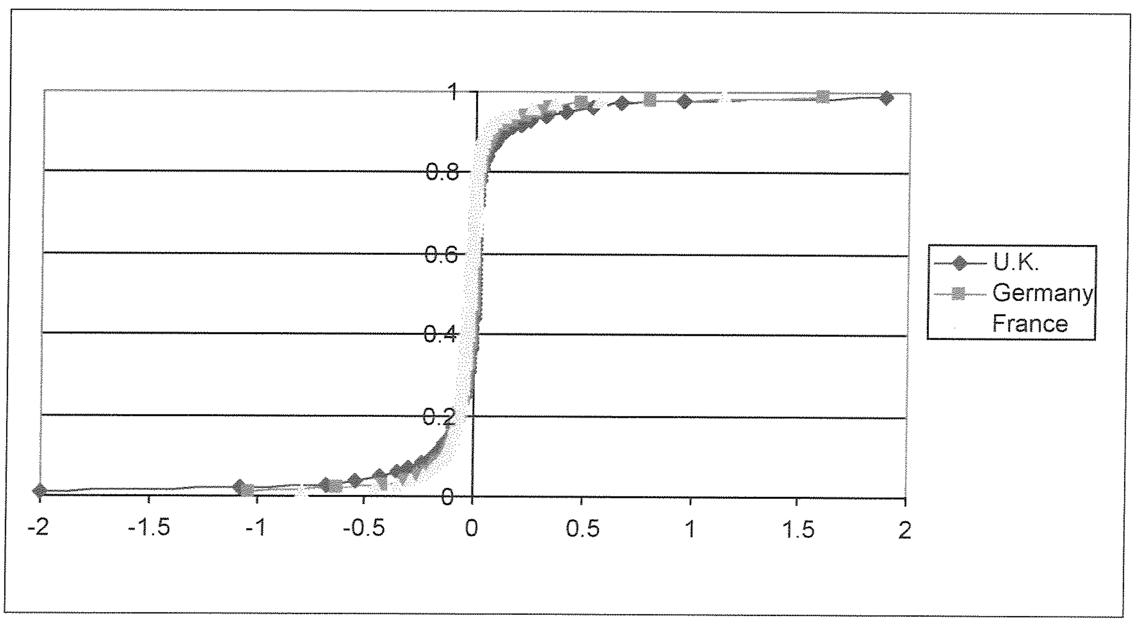


Table 3
Ex post deviations from the clean surplus relation

This table presents the descriptive statistics of ex post deviations from the clean surplus relation (CSR) for each sample country. The ex post CSR deviation is calculated by the difference between the comprehensive income and the net income scaled by the book value of equity. Panel A presents the mean, median, the standard deviation, and the interquartile range. We winsorise the ex post CSR deviations at –1 and 1. Panel B presents the ex post CSR deviations in absolute values, which are winsorised at 1. Similar statistics are presented in Panel B. In addition, ADS3% (ADS10%) is the percentage of firm-years with CSR deviation smaller than 3% (10%) of book value of equity. Panel C presents the t-statistics for the difference of CSR deviation. The upper triangle is t-statistics for the differences of mean absolute CSR deviation presented in Panel B. The lower triangle is the bootstrap t-statistics for the differences of interquartile range statistics presented in Panel A. The critical value for the pair-wise t-test is 1.96.

Panel A. The distribution of ex post CSR deviation per book value of equity

Country	*No. of firm-years*	*Mean*	*Median*	*Std. Dev.*	*Interquartile Range*
Australia	2,087	0.011	0.000	0.170	0.009
Canada	3,311	–0.006	0.000	0.208	0.021
France	3,082	–0.027	–0.024	0.196	0.058
Germany	3,264	–0.008	–0.001	0.227	0.054
Japan	16,582	0.012	–0.001	0.121	0.010
UK	7,425	–0.014	–0.001	0.274	0.053
US	23,192	–0.044	0.000	0.225	0.022

Panel B. The distribution of ex post CSR deviation in absolute values per book value of equity

Country	*Mean*	*Median*	*Std. Dev.*	*ADS3%*	*ADS10%*
Australia	0.053	0.005	0.156	0.750	0.899
Canada	0.077	0.010	0.187	0.689	0.841
France	0.091	0.036	0.174	0.440	0.801
Germany	0.099	0.026	0.202	0.526	0.789
Japan	0.034	0.005	0.117	0.831	0.939
UK	0.129	0.026	0.242	0.520	0.730
US	0.060	0.007	0.164	0.730	0.875

Panel C. t-statistics for the pair-wise differences of CSR deviation

	Australia	*Canada*	*France*	*Germany*	*Japan*	*U.K.*	*U.S.*
Australia		–4.79	–8.03	–8.89	6.83	–13.60	–1.91
Canada	7.09		–3.21	–4.74	17.14	–11.12	5.26
France	24.51	18.31		–1.74	22.89	–7.93	9.74
Germany	17.84	13.30	–1.69		25.40	–6.16	12.36
Japan	0.04	–9.29	–29.22	–20.33		–41.16	–17.82
UK	19.73	14.22	–2.13	–0.16	21.93		27.80
US	11.02	1.41	–21.61	–14.12	20.44	–14.97	

cross-country variation of the ex post CSR deviation is significant. Assuming that the ex post CSR deviation is positively related to the ex ante CSR deviation, the cross-country variation of the CSR deviation will provide a good empirical setting in which we can examine the effects of the CSR deviation on the validity of the RIV model.

5. Empirical results

5.1. Univariate analysis

In this section, we report the pair-wise correlations of key variables. Panel A of Table 4 presents Pearson correlations between implied costs of equity. First, as expected, the implied costs of equity derived from the OJ model are very highly correlated with the implied costs of equity derived from the PEG model within all of the countries. Second, the implied costs of equity derived from the RIVC and RIVI model are more highly correlated with each other than with costs of equity derived from the OJ or PEG model within all of the countries. That the correlations among the implied costs of equity emerging from different valuation models remain below one unit supports the argument that the implied costs of equity exhibit different degrees of reliability.

Panel B of Table 4 reports the Pearson correlations between the risk proxies. Many of these correlations are significantly different from zero. This suggests that multicollinearity may prevent the detection of statistical significance of the coefficients on risk proxies. Panel C of Table 4 presents the Pearson correlation between our risk proxies and the implied costs of equity. Within all countries, the implied costs of equity are significantly correlated with the risk proxies in a manner consistent with our expectations. The correlations between the implied costs of equity and realised stock returns are typically insignificant, with Japan and the US as notable exceptions. Overall, the implied cost of equity appears to be a reasonable proxy for the ex ante cost of equity in all of the countries, and the ex ante cost of equity inferred from the implied cost of equity can differ significantly from the ex ante cost of equity proxied by the realised stock returns.

Since most of the implied costs of equity are significantly correlated with most of risk proxies, it is difficult to evaluate the relative reliability of the implied costs of equity exclusively on the basis of pair-wise correlations. Therefore, we report multivariate regressions which compare the overall associations between the implied costs of equity and the risk proxies.

5.2. Multivariate analysis

This section discusses the results of our multivariate regression tests. We regress the alternative implied costs of equity on the individual risk proxies as the independent variables.[20] We then assess which valuation model produces a more reliable implied cost of equity by identifying the implied cost of equity that produces a higher adjusted R^2 within each country.[21] Since the coefficients of risk proxies can be biased due to the multicollinearity problem, we focus on the analysis of R^2s rather than on the coefficients of the risk proxies.

Specifically, to remove the effects of cross-sectional correlation in error terms inherent in panel data and to allow the coefficient of risk proxies to change in each year, we follow the Fama and MacBeth (1973) approach to regression analyses. This procedure involves two steps. First, we estimate the regression model separately for each year of data in the sample. Next, the coefficients and adjusted R^2 from each of these regressions are averaged across all years. We report the means of the estimated coefficients and the adjusted R^2 along with t-statistics based on the time-series standard errors of the individual estimated coefficients with correction for serial correlation.[22]

Panel A of Table 5 reports the results of this regression. Consider the polar cases of Australia and France. In Australia, the RIVI model produces the highest adjusted R^2 of 0.47. The RIVC model produces a relatively high adjusted R^2 of 0.35. In contrast, the OJ (PEG) model generates low adjusted R^2 of 0.16 (0.18). Consider next the pattern observed for France: The OJ and PEG models result in high R^2s of 0.43 while the RIVC (RIVI) model generates lower R^2 of 0.32 (0.30). As indicated in Panel B of Table 5, the differences between the two RIV-based models and the two OJ-based models are statistically significant but ordered reversely.[23] Canada, Japan, and US offer evidence similar to Australia. This is as we would expect since the deviations from the clean surplus relation are lowest in these countries. While for Germany and the UK, the differences between valuation models based on RIV and OJ are statistically insignificant, the results are qualitatively more similar to France

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[20] To control for the effect of the risk-free rate, we use the implied risk premium as the dependent variable.

[21] Consider Australia as an example. The pair-wise correlation analysis (in Panel C of Table 4) indicates that all of the implied costs of equity have significant correlations with four out of five risk proxies. However, Panel A of Table 5 indicates that two risk proxies impact all of the implied costs of equity.

[22] Following Bernard (1987), we adjust the t-statistics for serial correlation, assuming the annual coefficients follow a first-order auto-regressive process. The correction factor is

$$\sqrt{[(1+\phi)/(1-\phi)] - [2\phi(1-\phi^n)/n(1-\phi)^2]}$$

where ϕ is the serial correlation in the coefficient and n is the number of years.

[23] This bootstrap-type analysis results in 31,199 firm-years. For each trial, we compute the adjusted R^2 from four valuation models within each country and then compute the difference of adjusted R^2 across four valuation models. Proceeding as described in footnote 18, we generate t-statistics.

Table 4
Correlations of implied costs of equity and risk proxies

This table presents the Pearson correlations of implied costs of equity and risk proxies for the pooled sample and for each country. OJ is the cost of equity estimate from the OJ model. PEG is the cost of equity estimate from the PEG model. RIVC is the cost of equity estimate from the RIV model assuming a constant residual income after two periods. RIVI is the cost of equity estimate from the RIV model but incorporating industry-specific information. BETA is the systematic risk estimated by regressing at least 30 prior monthly returns up to 60 prior monthly returns against the corresponding market index in each country. MV is the market value of equity for each firm-year. D/M is the book value of debt divided by market value of equity for each firm. EPSDISP is the dispersion of analyst earnings forecasts, which is measured as the standard deviation of the one-year-ahead analyst earnings forecasts scaled by the absolute mean of these forecasts. IDRISK is the idiosyncratic risk, which is measured as the variance of residuals from the regressions of beta estimation. RET12 is the realised annual stock return. ***, **, * indicate, respectively, the significance level at the 1%, 5% and 10% level or better.

Panel A. Pearson correlations between implied costs of equity

Australia	*OJ*	*PEG*	*RIVC*
PEG	0.97***		
RIVC	0.57***	0.57***	
RIVI	0.47***	0.48***	0.79***

Canada	*OJ*	*PEG*	*RIVC*
PEG	0.99***		
RIVC	0.49***	0.52***	
RIVI	0.35***	0.40***	0.72***

France	*OJ*	*PEG*	*RIVC*
PEG	0.99***		
RIVC	0.54***	0.55***	
RIVI	0.49***	0.51***	0.83***

Germany	*OJ*	*PEG*	*RIVC*
PEG	0.98***		
RIVC	0.40***	0.40***	
RIVI	0.31***	0.30***	0.59***

Japan	*OJ*	*PEG*	*RIVC*
PEG	1.00***		
RIVC	0.54***	0.53***	
RIVI	0.42***	0.40***	0.72***

U.K.	*OJ*	*PEG*	*RIVC*
PEG	0.97***		
RIVC	0.58***	0.55***	
RIVI	0.44***	0.43***	0.74***

U.S.	*OJ*	*PEG*	*RIVC*
PEG	0.99***		
RIVC	0.48***	0.51***	
RIVI	0.44***	0.49***	0.73***

Pooled	*OJ*	*PEG*	*RIVC*
PEG	0.98***		
RIVC	0.56***	0.55***	
RIVI	0.51***	0.51***	0.71***

Table 4
Correlations of implied costs of equity and risk proxies *(continued)*

Panel B. Pearson correlations between risk proxies and realised annual stock returns

Australia	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	0.12***				
D/M	0.08**	–0.02			
EPSDISP	0.20***	–0.15***	0.28***		
IDRISK	0.18***	–0.10***	0.00	0.31***	
Ret12	–0.03	0.00	0.03	–0.02	–0.03

Canada	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	0.02				
D/M	0.00	–0.09***			
EPSDISP	0.19***	–0.04	0.17***		
IDRISK	0.26***	–0.17***	–0.06*	0.17***	
Ret12	–0.08***	–0.05	0.03	0.02	0.05

France	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	0.13***				
D/M	0.01	–0.12***			
EPSDISP	0.03	–0.14***	0.37***		
IDRISK	–0.03	–0.11***	0.04	0.06*	
Ret12	–0.04	–0.02	0.09**	–0.05	0.07*

Germany	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	0.23***				
D/M	0.05	–0.12***			
EPSDISP	0.06	–0.07*	0.25***		
IDRISK	0.10**	–0.04	–0.03	–0.16***	
Ret12	–0.08	0.05	–0.04	–0.15***	0.15***

Japan	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	–0.06***				
D/M	0.08***	–0.04***			
EPSDISP	0.18***	–0.06***	0.28***		
IDRISK	0.42***	–0.15***	0.02*	0.12***	
Ret12	–0.03**	–0.01	0.05***	0.03**	0.02*

UK	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	0.02				
D/M	0.02	–0.07***			
EPSDISP	0.07***	–0.05***	0.35***		
IDRISK	0.09***	–0.09***	0.07***	0.25***	
Ret12	0.04**	–0.02	–0.04**	–0.04**	–0.01

US	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	–0.04***				
D/M	–0.17***	–0.07***			
EPSDISP	0.09***	–0.07***	0.24***		
IDRISK	0.45***	–0.15***	–0.12***	0.20***	
Ret12	0.04***	–0.03***	–0.01	–0.03***	–0.02***

Pooled	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*
MV	–0.03***				
D/M	–0.06***	–0.02***			
EPSDISP	0.07***	0.02***	0.31***		
IDRISK	0.33***	–0.10***	–0.08***	0.07***	
Ret12	0.03***	–0.03***	–0.01	–0.03***	0.01

Table 4
Correlations of implied costs of equity and risk Proxies *(continued)*

Panel C. Pearson correlations between implied costs of equity and risk proxies

Australia	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.03	0.07**	–0.02	0.04
MV	–0.13***	–0.11***	–0.19***	–0.20***
D/M	0.20***	0.19***	0.40***	0.57***
EPSDISP	0.28***	0.34***	0.21***	0.35***
IDRISK	0.10***	0.20***	0.17***	0.21***
Ret12	0.01	0.01	0.00	0.01

Canada	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.18***	0.20***	0.06*	0.10***
MV	–0.13***	–0.15***	–0.19***	–0.21***
D/M	0.16***	0.16***	0.29***	0.36***
EPSDISP	0.27***	0.28***	–0.08***	0.12***
IDRISK	0.16***	0.21***	0.16***	0.22***
Ret12	0.04	0.04	0.05	0.08**

France	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.07*	0.08*	–0.05	–0.05
MV	–0.17***	–0.17***	–0.23***	–0.25***
D/M	0.55***	0.54***	0.45***	0.41***
EPSDISP	0.47***	0.48***	0.17***	0.29***
IDRISK	0.14***	0.14***	0.15***	0.25***
Ret12	0.12***	0.07*	–0.01	–0.07*

Germany	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.22***	0.24***	0.14***	0.09*
MV	–0.14***	–0.14***	–0.15***	–0.17***
D/M	0.36***	0.33***	0.27	0.48***
EPSDISP	0.36***	0.38***	0.08*	0.19***
IDRISK	–0.03	–0.04	–0.05	–0.07*
Ret12	0.04	0.02	0.01	–0.01

Japan	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.11***	0.13***	0.01	–0.02
MV	–0.08***	–0.07***	–0.15***	0.21***
D/M	0.17***	0.16***	0.17***	0.25***
EPSDISP	0.24***	0.24***	–0.07***	0.12***
IDRISK	0.33***	0.35***	0.37***	0.29***
Ret12	0.12***	0.12***	0.21***	0.23***

UK	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.05***	0.04***	–0.07***	–0.09***
MV	–0.14***	–0.14***	–0.15***	–0.13***
D/M	0.35***	0.33***	0.43***	0.45***
EPSDISP	0.35***	0.37***	0.15***	0.25***
IDRISK	0.18***	0.24***	0.07***	0.18***
Ret12	0.01	0.01	0.05***	0.05***

US	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.14***	0.17***	–0.07***	0.07***
MV	–0.13***	–0.15***	–0.14***	–0.20***
D/M	0.22***	0.22***	0.42***	0.40***
EPSDISP	0.35***	0.35***	0.04***	0.19***
IDRISK	0.23***	0.30***	0.02**	0.223***
Ret12	0.03***	0.03***	0.04***	0.03***

Pooled	*OJ*	*PEG*	*RIVC*	*RIVI*
BETA	0.09***	0.14***	–0.08***	0.04***
MV	–0.13***	–0.12***	–0.13***	–0.20***
D/M	0.10***	0.12***	0.20***	0.09***
EPSDISP	0.18***	0.20***	–0.05***	–0.07***
IDRISK	0.22***	0.27***	0.08***	0.22***
Ret12	0.07***	0.07***	0.08***	0.10***

Table 5
Cross-sectional year-by-year regressions of implied risk premia

This table presents the cross-sectional year-by-year regressions of implied risk premia for each country. The regression equation is as follows.

$$RISKPREMUIM_{it} = (Intercept) + \alpha_1 BETA_{it} + \alpha_2 MV_{it} + \alpha_3 D/M_{it} + \alpha_4 EPSDISP_{it} + \alpha_5 IDRISK_{it} + \varepsilon_{it}$$

RISKPREMIUM is defined as the cost of equity estimate minus the country-specific risk free rate. OJ is the cost of equity estimate from the OJ model. PEG is the cost of equity estimate from the PEG model. RIVC is the cost of equity estimate from the RIV model assuming a constant residual income after two periods. RIVI is the cost of equity estimate from the RIV model but incorporating industry-specific information. BETA is the systematic risk estimated by regressing at least 30 prior monthly returns up to 60 prior monthly returns against the corresponding market index in each country. MV is the market value of equity for each firm-year. D/M is the debt divided by market value of equity for each firm. EPSDISP is the dispersion of analyst earnings forecasts, which is measured as the standard deviation of the one-year-ahead earnings forecasts scaled by the absolute mean of these forecasts. IDRISK is the idiosyncratic risk, which is measured as the variance of residuals from the regressions of beta estimation. The coefficients presented are the means from annual regressions. The number below each coefficient is the t-statistic, adjusted for auto-correlation as in Bernard (1987). Adj-R^2 is the average adjusted R^2 for the regressions. Average sample size is the average number of samples per year for each sample country. Panel B shows the bootstrap t-statistics for the differences of adjusted R^2s. The null hypothesis is no difference between any pair of adjusted R^2s in the cross-sectional regressions. ***, **, * indicate, respectively, the significance level at the 1%, 5% and 10% level or better.

Panel A. Regressions of implied risk premia with risk proxies

Country	*Model*	*Intercept*	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*	*Adj-R²*	*No. of years*	*Average sample size*
Expected signs		?	+	–	+	+	+			
Australia	OJ	0.12	0.00	–0.01	0.03	0.10	–0.31	0.16	9	124
	t-stat	12.61	0.32	–15.18	4.23	4.88	–0.53			
	PEG	0.06	0.00	–0.01	0.02	0.11	0.33	0.18	9	124
	t-stat	6.73	0.55	–12.09	2.48	6.87	0.65			
	RIVC	0.08	0.00	–0.01	0.04	–0.02	–0.02	0.35	9	124
	t-stat	3.69	0.12	–5.97	2.91	–0.79	–0.04			
	RIVI	0.05	0.00	–0.01	0.04	0.01	0.02	0.47	9	124
	t-stat	2.53	1.17	–5.53	6.21	3.91	0.06			
Canada	OJ	0.09	0.02	–0.01	0.01	0.07	0.31	0.14	9	155
	t-stat	2.47	2.82	–1.72	8.94	5.48	0.91			
	PEG	0.08	0.02	–0.01	0.01	0.06	0.44	0.17	9	155
	t-stat	2.36	2.77	–2.42	7.94	5.18	1.39			
	RIVC	0.05	0.01	–0.01	0.02	–0.04	0.31	0.21	9	155
	t-stat	2.01	2.07	–3.61	12.45	–4.88	3.32			
	RIVI	0.05	0.01	–0.01	0.02	0.00	0.22	0.30	9	155
	t-stat	1.93	2.41	–4.46	7.79	–0.82	3.98			

Table 5
Cross-sectional year-by-year regressions of implied risk premia *(continued) (Panel A continues)*

Country	*Model*	*Intercept*	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*	*Adj-R^2*	*No. of years*	*Average sample size*
Expected signs		?	+	–	+	+	+			
France	OJ	0.08	0.01	–0.01	0.04	0.11	0.40	0.43	8	95
	t-stat	8.06	3.18	–8.00	10.75	11.85	1.03			
	PEG	0.06	0.01	–0.01	0.04	0.10	0.40	0.43	8	95
	t-stat	7.49	4.27	–10.63	10.48	11.37	1.08			
	RIVC	0.07	0.01	–0.01	0.03	–0.02	–0.28	0.32	8	95
	t-stat	3.21	0.89	–4.44	3.13	–1.12	–2.13			
	RIVI	0.06	0.01	–0.01	0.02	0.01	–0.11	0.30	8	95
	t-stat	3.69	0.97	–9.91	4.33	0.49	–0.92			
Germany	OJ	0.08	0.03	–0.01	0.03	0.06	–0.17	0.25	7	85
	t-stat	1.51	4.33	–1.28	8.03	3.25	–2.95			
	PEG	0.05	0.03	0.00	0.02	0.06	–0.13	0.25	7	85
	t-stat	0.93	4.19	–0.90	4.05	4.21	–2.39			
	RIVC	0.07	0.01	–0.01	0.01	–0.02	–0.24	0.26	7	85
	t-stat	1.40	5.22	–1.89	5.43	–0.97	–1.11			
	RIVI	0.04	0.01	–0.01	0.02	0.00	–0.13	0.32	7	85
	t-stat	1.25	1.32	–3.80	24.83	–0.88	–1.21			
Japan	OJ	0.09	0.00	0.00	0.00	0.04	0.65	0.11	9	727
	t-stat	1.72	1.81	–1.42	1.69	8.73	2.85			
	PEG	0.08	0.00	0.00	0.00	0.04	0.78	0.12	9	727
	t-stat	1.70	2.23	–1.50	1.50	8.52	3.59			
	RIVC	0.10	0.00	–0.01	0.00	–0.03	0.17	0.29	9	727
	t-stat	1.66	–1.40	–1.65	0.72	–7.57	1.49			
	RIVI	0.09	0.00	–0.01	0.00	0.00	–0.38	0.33	9	727
	t-stat	1.97	–1.23	–2.24	1.34	0.30	–3.85			
UK	OJ	0.15	0.01	–0.01	0.04	0.14	0.37	0.31	9	433
	t-stat	4.79	5.61	–5.62	7.35	5.50	3.30			
	PEG	0.11	0.01	–0.01	0.03	0.13	0.73	0.32	9	433
	t-stat	3.35	4.56	–5.29	7.18	6.15	10.21			
	RIVC	0.11	0.01	–0.01	0.05	–0.02	–0.16	0.30	9	433
	t-stat	1.87	3.25	–2.56	5.11	–1.73	–0.78			
	RIVI	0.12	0.01	–0.01	0.05	0.02	0.20	0.31	9	433
	t-stat	1.96	1.48	–2.50	5.73	4.19	1.41			

Table 5
Cross-sectional year-by-year regressions of implied risk premia *(continued) (Panel A continues)*

Country	*Model*	*Intercept*	*BETA*	*MV*	*D/M*	*EPSDISP*	*IDRISK*	*Adj-R^2*	*No. of years*	*Average sample size*
Expected signs		?	+	–	+	+	+			
US	OJ	0.09	0.01	–0.01	0.02	0.14	0.41	0.26	9	1,878
	t-stat	4.29	9.71	–4.97	4.49	7.49	1.42			
	PEG	0.08	0.01	–0.01	0.01	0.13	0.57	0.30	9	1,878
	t-stat	3.38	10.08	–5.58	4.61	6.85	1.87			
	RIVC	0.06	0.00	–0.01	0.03	–0.04	–0.21	0.27	9	1,878
	t-stat	2.63	0.70	–3.25	10.49	–10.11	–1.65			
	RIVI	0.09	0.01	–0.01	0.02	0.00	0.03	0.35	9	1,878
	t-stat	2.96	6.31	–3.88	12.55	–0.27	0.14			

Panel B. t-statistics for the differences of Adjusted R^2

Country		*OJ*	*PEG*	*RIVC*
Australia	PEG	2.10**		
	RIVC	5.23***	4.45***	
	RIVI	8.52***	7.64***	3.77***
France	PEG	0.69		
	RIVC	–1.40	–1.52	
	RIVI	–1.69*	–1.83*	–0.42
Japan	PEG	3.39***		
	RIVC	14.80***	14.41***	
	RIVI	12.76***	12.48***	2.76***
US	PEG	32.38***		
	RIVC	1.67*	–3.01***	
	RIVI	7.29***	3.73***	6.18***

Country		*OJ*	*PEG*	*RIVC*
Canada	PEG	7.25***		
	RIVC	2.69***	1.60	
	RIVI	4.92***	3.81***	3.14***
Germany	PEG	0.40		
	RIVC	0.45	0.37	
	RIVI	1.32	1.28	1.37
UK	PEG	1.97**		
	RIVC	0.03	–0.49	
	RIVI	0.64	0.16	0.77

than to Australia. Again, this evidence is consistent with our argument that the OJ and PEG models should perform relatively better in countries with large deviations from clean surplus, which we documented in Section 4.3.

As a supplementary test, not reported, we include the logarithm of the book-to-market ratio in our regression in Table 5. Prior studies view the book-to-market ratio as a proxy for risk (Griffin and Lemmon, 2002; Berk, 1995) or mispricing (Daniel and Titman, 1997). If the book-to-market ratio reflects mispricing of stocks rather than risks, as suggested by several studies, our analysis based on adjusted R^2 would be mechanically biased toward a more favorable evaluation of the RIV model. This is because the book-to-market ratio being used to impute the RIV-based costs of equity could mechanically affect its association with the implied costs of equity and generate higher adjusted R^2s. Our untabulated results confirm this, but the relative orderings remain qualitatively robust.

In summary, the RIV model clearly outperforms the OJ model (including the PEG model) within all non-European countries that we consider in terms of the adjusted R^2. Furthermore, despite its theoretical foundation, the OJ model appears to offer little advantage at the implementation stage in comparison to the PEG model, a naïve heuristic for valuation. In addition, the deviations from the CSR seem to affect the relative performance of the RIV and OJ models.

6. Conclusion

We examine the relative reliability of the implied costs of equity within seven developed countries. We conclude that the implied costs of equity derived from the RIV models are more reliable than those implied from the OJ model in non-European countries. In Europe the OJ model performs better – or as well as – the RIV model. Further, we document that the deviations from the clean surplus relation within a country affects which accounting-based valuation model produces the more reliable implied costs of equity.

Our analyses and findings invariably suffer from limitations. First, we only examine representative implementations of valuation models, applied by prior research. Heterogeneity in analysts' information processing and valuation heuristics may induce measurement error in the relative reliability of implied cost of equity. Second, our ex post CSR deviation is an imperfect measure for the ex ante CSR deviation that will directly distort the firm valuation. Third, our approach uses the association between the implied cost of equity and risk proxies as the metric for the reliability of the implied cost of equity. An implicit assumption is that considered risk proxies represent the full list of the 'true' risk factors. Omitted, correlated risk proxies may affect our results. Finally, due to data limitations, we consider only seven developed countries. Therefore, our findings need not generalise to a larger cross-section of countries. Despite these caveats, we believe that our findings offer insights into the derivation of the implied cost of equity closer to the true, unobservable expected cost of equity. We leave for future research whether other accounting attributes, including accounting conservatism, affect the implied cost of equity and its estimation.

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Appendix

In this Appendix we prove the claim in footnote 2 that ex post clean surplus deviations should not affect the infinite horizon empirical implementation of the RIV model.

Denote the most recently observed historical book value by bv_t and analyst earnings forecasts by $eps_{t+1}, eps_{t+2}, \ldots$ The book value includes retained earnings which are the accumulation of earnings (or comprehensive income) from all prior years less the accumulated dividends. Consider what would happen if analysts, for the purpose of forecasting future earnings, apply a different definition or standard of earnings than that applied by the firm in prior years. Let bv_t^a denote the accounting book value that would have been reported in the initial year t if the firm had applied the analysts' definition of earnings. This creates an initial discrepancy, $\Delta bv = bv_t - bv_t^a$, in the application by empirical researchers of historical book value, bv_t, and analyst earnings forecasts. Since empirically, future book values are created by rolling forward through the clean surplus relation, all future book values will be misstated by the exact same amount, that is, $\Delta bv = bv_{t+n} - bv_{t+n}^a$. However, this potential measurement error rinses out in the valuation of the firm since:

$$bv_t + \frac{(eps_{t+1} - r \cdot bv_t)}{(1+r)} + \frac{(eps_{t+2} - r \cdot bv_{t+1})}{(1+r)^2} + \frac{(eps_{t+3} - r \cdot bv_{t+2})}{(1+r)^3} + \ldots$$

$$= (bv_t^a + \Delta bv) + \frac{(eps_{t+1} - r(bv_t^a + \Delta bv))}{(1+r)} + \frac{(eps_{t+2} - r(bv_{t+1}^a + \Delta bv))}{(1+r)^2} + \frac{(eps_{t+3} - r(bv_{t+2}^a + \Delta bv))}{(1+r)^3} + \ldots$$

$$= bv_t^a + \frac{(eps_{t+1} - r \cdot bv_t^a)}{(1+r)} + \frac{(eps_{t+2} - r \cdot bv_{t+1}^a)}{(1+r)^2} + \frac{(eps_{t+3} - r \cdot bv_{t+2}^a)}{(1+r)^3} + \ldots$$

where the last equality follows from the identity that

$$0 = \Delta bv - r\left\{\frac{\Delta bv}{(1+r)} + \frac{\Delta bv}{(1+r)^2} + \frac{\Delta bv}{(1+r)^3} + \ldots\right\}.$$

This completes our proof. Note that this does not rule out that ex ante clean surplus deviations may affect the empirical implementation of the RIV model.