

**DISENTANGLING THE EFFECTS OF CORPORATE DISCLOSURE ON THE COST OF
EQUITY CAPITAL: A STUDY OF THE ROLE OF INTELLECTUAL CAPITAL
DISCLOSURE**

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Abstract

In this paper, we investigate whether intellectual capital (IC) and financial disclosures jointly affect the firm's cost of equity capital. In contrast to prior research, we disaggregate disclosures into IC and financial disclosures and examine whether the two disclosure types are jointly related to the cost of equity capital. We also investigate whether IC and financial disclosures have an interaction effect on the cost of equity capital. Using data for a sample of 125 UK firms, we find a negative relationship between the cost of equity capital and IC disclosure. We find that the relationship between financial disclosure and the cost of equity capital is magnified when combined with IC disclosure. Additionally, we find that IC and financial disclosures interact in shaping their effects on the cost of equity capital. Further analyses suggest that the effect of financial disclosure on the cost of equity capital is augmented for firms characterised by a medium level of IC disclosure. These results provide important insights into the relationship between disclosures and cost of equity capital and have policy and practical implications.

Key words: cost of equity capital; intellectual capital disclosure; financial disclosure; disclosure interactions.

1. Introduction

This study examines the economic consequences of disclosure on a sample of UK listed firms. Specifically, we disaggregate annual report disclosures into intellectual capital (IC) and financial disclosures and investigate whether the two disclosure types are jointly related to the cost of equity capital.¹ We further analyse whether IC and financial disclosures interact in their effects on the cost of equity capital. Theoretically, disclosure reduces the cost of capital through either a reduction in estimation risk on the investor's part (see Easley and O'Hara, 2004) or transactions costs resulting from lower information asymmetry (see Lambert, Leuz and Verrecchia, 2007). Several empirical studies apply these theoretical perspectives to examine the relationship between disclosure and cost of capital. In an extensive review of such studies, Healy and Palepu (2001) and Botosan (2006) conclude that the evidence on the link is mixed.² More strikingly, Botosan's (2006) review also points to different disclosure types affecting the cost of capital in different ways. In this context, the authors call for further research to help us understand the cost of capital effects of disclosure. In this paper, we respond to these calls by examining the IC disclosure effects on the cost of equity capital.

We depend on prior literature for most of the ideas underlying our study (see section 2 for details of the literature). In summary, the prior literature points to firms' heavy investments in IC assets³ in today's knowledge-based economy, and notes the investors' growing demand for information about these IC assets in the process of valuing shares (Lev, 2001; Holland, 2003). This demand for IC information is underpinned by the notion that IC assets are an integral part of the

¹ IC is defined by CIMA (2001, p. 2) as "...the possession of knowledge and experience, professional knowledge and skill, good relationships, and technological capacities, which when applied will give organisations competitive advantage." It comprises three major categories: human capital, structural capital and relational capital (Guthrie, Petty and Ricceri, 2007; Beattie and Thomson, 2007).

²For example, some studies document a negative relationship between the cost of capital and aggregate disclosure (e.g., Hail, 2002; Botosan and Plumlee, 2002; Francis, Khurana and Pereira, 2005), timely disclosure (e.g., Gietzmann and Ireland, 2005), whilst others show a positive relationship with timely disclosures (quarterly reports) (e.g., Botosan and Plumlee, 2002) and social disclosures (e.g., Richardson and Welker, 2001), yet others show a negative relationship with financial disclosure, but only for firms with low analyst following (e.g., Botosan, 1997; Richardson and Welker, 2001).

³ Such IC assets include research and development, brand development, franchises, customer-base creation, advertising, human capital and corporate image.

firm's value-creating processes (Holland, 2003) and are important for creating and maintaining competitive advantage (Keller, 2002), and contributing to superior performance (Walsh *et al.*, 2009). The literature (e.g., Holland, 2003) also argues that IC assets combine and interact with physical and financial assets to create firm value in unique ways. In this context, there are studies demonstrating that information about IC assets helps the investor to (1) improve their interpretation of the financial results (Luft and Shields, 2001) and (2) better understand the future cash flow generating capabilities of the firm (Amir and Lev, 1996). To the extent that IC assets create value in the firm, and that the information about IC assets is important to investors, we expect greater IC disclosure to lower the cost of equity capital.

We employ a sample of firms listed on the London Stock Exchange (LSE), and estimate the firm's cost of equity capital using the modified price-earnings growth (PEG) model (Easton, 2004). Our proxy for the two disclosure measures is a coded index of IC and financial information from firms' annual reports. We find that IC disclosure is negatively related to the cost of equity capital. We also find that the relationship between financial disclosure and the cost of equity capital is magnified when combined with IC disclosure. Additionally, we observe that IC and financial disclosures interact on their effects on the cost of equity capital. An analysis of this interaction demonstrates that the effect of financial disclosure on the cost of equity capital is augmented for firms characterised by a medium level of IC disclosure. These results are robust to alternative estimates of the cost of equity capital.⁴ Our results are new, and demonstrate the importance of disaggregating disclosure into IC and financial information in understanding the disclosure-cost of capital relationship.

We contribute to the literature in a number of ways. First, we disaggregate annual report disclosure into IC and financial disclosures to understand whether they individually and jointly influence the cost of equity capital. Prior studies have examined aggregate disclosures (see Francis,

⁴ To test the robustness of our results, we also employ the abnormal earnings growth model (Ohlson and Juettner-Nauroth, 2005) to estimate the cost of capital and find similar results.

Khurana and Pereira, 2005; Espinosa and Trombetta, 2007). The focus on aggregate disclosure means that the impact of different disclosure types on the cost of capital is not well understood.⁵ Second, by examining both IC and financial disclosures in a single study, we address the problem of omitted variables suffered by studies examining a specific (single) disclosure type (e.g., Gietzmann and Ireland, 2005). As Amir and Lev (1996, p.4) argue, the focus on aggregate disclosure or a single disclosure type is “...restrictive and may lead to unwarranted conclusions”. Third, our study offers a significant development to three studies examining IC disclosure and the cost of capital (Singh and Van der Zahn, 2007; Kristandl and Bontis, 2007; Orens, Aerts and Lybaert, 2009). Unlike Singh and Van der Zahn (2007) who uses under-pricing as an indirect measure of cost of capital, we estimate the cost of equity capital by employing the modified price-earnings growth (PEG) model (Easton, 2004), which is widely used in the literature (see Botosan and Plumlee, 2005). Both Singh and Van der Zahn (2007) and Orens, Aerts and Lybaert (2009) consider IC disclosure only, hence their models are incomplete as they do not control for other disclosures. Finally, similar to Kristandl and Bontis (2007), we model both IC and financial disclosures in our analyses, and extend their study by investigating whether the disclosure measures interact to affect the cost of equity capital.

The rest of the paper is structured as follows. Section 2 presents a review of literature and formulates the hypotheses. In section 3, we specify our model, and describe how we developed the cost of equity capital and disclosure measures. In section 4, we describe the sample selection procedure and provide the descriptive statistics. Section 5 presents the empirical results of the study and reports on additional analyses. Finally, section 6 offers some concluding remarks to the study.

⁵ For example, consider two firms. Firm A discloses 60% IC and 40% financial information, and firm B discloses 40% IC and 60% financial information. Assuming equal weighting, each firm’s average aggregate disclosure score would be about 50%. Let us say firm A’s cost of capital is 10% and B’s is 15%. In this scenario, if we model with aggregate disclosure, there will be no relationship between disclosure and the cost of capital. However, modelling with individual disclosure types is likely to result in disclosure variations and a better understanding how these affect the cost of capital.

2. Literature review and hypotheses

2.1 Prior literature

The notion that disclosure affects the cost of capital is driven by two streams of theoretical literature (see Healy and Palepu, 2001 for a review). One stream argues that information asymmetry introduces adverse selection into transactions between buyers and sellers (Diamond and Verrecchia, 1991). This reduces market liquidity in the firm's shares and, therefore, firms will be forced to issue shares at a discount because investors pay less for shares with high transaction costs (Amihud and Mendelson, 1986; Welker, 1995). Firms can lower the discount at which their shares are issued by improving disclosure (Diamond and Verrecchia, 1991) because enhanced disclosure reduces the incentives by investors to acquire costly private information (Welker, 1995). The second stream posits that greater disclosure results in a reduction of the estimation risk associated with the share's return. A reduction in estimation risk lowers investors' required rate of return (Coles, Loewenstein and Suay, 1995; Lambert, Leuz and Verrecchia, 2007). Thus, from a theoretical perspective, the consensus is that there is a negative relationship between disclosure and the cost of capital.

Whilst there is theoretical consensus, the empirical literature on the relationship is mixed, and most importantly for our study, suggests that the relationship between disclosure and the cost of capital depends on the type of disclosure (see Botosan, 2006). Botosan (1997) and Richardson and Welker (2001) document a negative relationship between the cost of capital and financial disclosure, but only for firms with low (but not high) analyst following. In their study, Richardson and Welker (2001) also examine social disclosure and find a positive relationship with social disclosure. In a study similar to Botosan (1997), Hail (2002) finds a negative relationship between voluntary disclosure and the cost of capital for a sample of Swiss firms. Botosan and Plumlee (2002) document that the cost of capital decreases with increased annual report disclosures, but increases with quarterly report disclosure. In the UK, Gietzmann and Ireland (2005) document a negative

relationship between the cost of capital and strategic disclosures, but only for firms adopting aggressive (but not conservative) accounting policies. Espinosa and Trombetta (2007) find similar results for a sample of Spanish firms. Francis, Khurana and Pereira (2005) use cross-country data and document a lower cost of capital for firms with greater disclosures. Finally, Muino and Trombetta (2009) provide evidence suggesting that graph disclosure has a reducing effect on the cost of capital.

Our study is closely related to Singh and Van der Zahn (2007), Kristandl and Bontis (2007) and Orens, Aerts and Lybaert (2009). Singh and Van der Zahn (2007) provide evidence of a positive relationship between IC disclosure and the cost of capital of initial public offering (IPO) firms. However, their proxy for the cost of capital, under-pricing, is problematic, because it does not capture the cost of capital efficiently due to events arising at the time of the share issues. Further, results from using IPO firms may not be applicable to seasoned firms. By nature, IPO firms have greater uncertainty due to their higher failure rates (Fama and French, 2004). Kristandl and Bontis (2007) examine firms in four European countries and find a negative relationship between the cost of capital and forward-looking disclosures, and a positive relationship with financial disclosures. However, for their cost of capital, they use the Gebhardt, Lee and Swaminathan (2001) model which is criticised for producing estimates that fail to efficiently relate to risk factors (see Botosan, 2006). Orens, Aerts and Lybaert (2009) use web-based IC disclosures and find a negative relationship with the cost of capital, but they do not examine whether financial and IC disclosures are jointly and interactively related to the cost of equity capital.

2.2 Hypotheses

We draw from the theoretical and empirical research to develop our hypotheses. As argued in prior literature, investments in IC assets are critical for firm value creation (see Pike, Rylander and Roos, 2002; Holland, 2003; 2006) and creating and sustaining superior performance (see Holland, 2006; Walsh *et al.*, 2009; Hsu and Wang, 2012). Keller (2002) argues, for example, that advertising

expenditures promote brand equity, which creates firm value via increasing customer creation and loyalty and therefore enhanced cash flows and profitability. Consequently, information about these IC investments is an important factor in the process of valuing shares by investors. For example, Holland (2003; 2006) concludes, after interviewing fund managers and analysts, that the market demands IC information and has incentives to create and use the information on the role of IC in corporate value-creation when making investment decisions. Rajgopal, Shevlin and Venkatachalam (2003) provide evidence showing that analysts consider IC information when they make earnings forecasts. Garcia-Meca and Martinez (2007) show that information about investments in IC assets feature significantly in analyst reports. Other studies show that specific IC indicators such as research and development expenses (Amir and Lev, 1996), software development costs (Aboody and Lev, 1998) and customer satisfaction (Ittner and Larcker, 1998) have an impact on share prices.

The problem, however, is that under existing Generally Accepted Accounting Principles (GAAP), investments in IC assets are either immediately expensed in the financial statements or arbitrarily amortised and therefore are not fully reflected in the financial statements (Amir and Lev, 1996; Lev, 2001). This means that whilst investors are informed about financial assets, information asymmetry still exists because investors are not fully informed about the productivity of the investment in IC assets (Barth, Kasznik and McNichols, 2001; Holland, 2003). As Aboody and Lev (2000) argue, the information asymmetry is more acute for investments in IC than for investments in physical and financial assets because IC is unique to specific firms. The problem is compounded by the absence of regulatory requirements to disclose IC information. Chan, Lakonishok and Sougiannis (2001) argue that lack of information about IC investments complicates the task of equity valuation by investors and may affect their ability to anticipate the rewards of investments in IC assets and, therefore under-price the firm's shares. In this respect, greater disclosure of IC information improves investors' understanding of the productivity and value changes of IC assets (Beattie and Thomson, 2007; Guthrie, Petty and Ricceri, 2007) and the economic risks attached to the firm's future cash

flows (Coles, Loewenstein and Suay, 1995). This should lead to improvement in capital market efficiency, which reduces the uncertainty premium required by investors when making decisions to invest in a firm (Aboody and Lev, 2000; Easley and O'Hara, 2004). Thus, from a theoretical perspective, improving IC disclosure reduces information asymmetry (Diamond and Verrecchia, 1991), lowers estimation risk (Coles, Loewenstein and Suay, 1995) and reduces the cost of capital.

Pike, Rylander and Roos (2002), Nagar and Rajan (2001) and Holland (2006) argue that IC assets combine and interact with physical and financial assets in unique ways to create firm value. In this context, investors would also gain additional insights by integrating IC and financial information in making decisions. Indeed as Amir and Lev (1996) demonstrate, book values, earnings and cash flows are value relevant only when combined with IC related information. Chan, Lakonishok and Sougiannis (2001) and Luft and Shields (2001) find that IC information improves interpretation of financial results by market participants. Luft and Shields (2001), in particular, find that market participants felt uncertain about making good judgements on firm profits in the absence of IC information. They argue that the provision of IC information might mitigate the uncertainty by investors. In line with this literature, Gietzmann and Trombetta (2003) argue that investors condition their investment decisions on different disclosures as well as on other potential message spaces such as accounting policy choice. In this case, they argue that investors may also consider, in addition to disclosures, whether a firm adopts conservative or aggressive accounting policies. Gietzmann and Ireland (2005) and Espinosa and Trombetta (2007) provide empirical evidence demonstrating that disclosure interacts with accounting policy choice to influence the cost of equity capital. Muino and Trombetta (2009) also find that there is an interaction between graph disclosure bias and overall disclosure in their effect on the cost of capital. In this context, we argue that investors would also rationally form their view about the firm's future cash flow generating capabilities by considering both IC and financial information. Hence, we hypothesise the following (in null form):

H₁: There is no difference between the cost of equity capital of firms that provide greater IC disclosures and those firms that do not.

H₂: There is no difference between the cost of equity capital of firms that provide greater financial disclosures and those firms that do not.

H₃: There is no interaction between financial disclosures and IC disclosures in their effect on the cost of equity capital.

3. Research methods

3.1 The empirical model

Following previous work (e.g., Botosan, Plumlee and Xie, 2004; Gietzmann and Ireland, 2005; Espinosa and Trombetta, 2007), we estimate the following regression model:

$$K_{PEG} = \beta_0 + \beta_1 RFDI + \beta_2 RICDI + \beta_3 RFDI * RICDI + \beta_4 LnSIZE + \beta_5 BETA + \beta_6 LEV + \beta_7 LnB2M + \beta_8 ACCOREPUT + \varepsilon_j \quad (1)$$

Where K_{PEG} is the implied cost of equity capital for the firm, measured using the modified price earnings growth (PEG) model (see section 3.2). $RFDI$ and $RICDI$ represent the ranks of financial and IC disclosure indexes, respectively, both measured as discussed in section 3.3 below. $RFDI * RICDI$ is the interaction term computed as the product of the ranks of FDI and $ICDI$ (see also, Botosan, Plumlee and Xie, 2004; Espinosa and Trombetta, 2007; Muino and Trombetta, 2009). Although our main variables are disclosure and the cost of equity capital, consistent with prior studies, our model also controls for natural log of firm size ($LnSIZE$), market risk ($BETA$), financial leverage (LEV) and natural log of book-to-market ratio ($LnB2M$) to control for known risk factors (see Easton, 2004).⁶ Consistent with prior literature (Botosan, 1997; Francis, Khurana and Pereira, 2005), we expect firm size to be

⁶ Data for measuring all control variables, except $BETA$, are drawn from the annual reports at the financial year end as well as Thomson Research. Firms' beta values are drawn from the Risk Measurement Service, a quarterly publication by the London Business School's Institute of Finance and Accounting. The beta values obtained are for the quarter preceding the annual report publication date.

negatively related to the cost of equity capital. Our size variable (*LnSize*) is measured as the firm's natural log of market capitalisation at the financial year end. We also expect market risk (Hail, 2002; Botosan, Plumlee and Xie, 2004), financial leverage (Botosan, 1997; Easton, 2004) and book-to-market ratio (Botosan, Plumlee and Xie, 2004; Gietzmann and Ireland, 2005) to be positively associated with the cost of equity capital. We measure financial leverage as the total liabilities scaled by the market capitalisation at the year-end (see Gietzmann and Ireland, 2005; Espinosa and Trombetta, 2007). The book-to-market ratio is computed by scaling the book value of the firm's equity by the market capitalisation (Botosan, Plumlee and Xie, 2004), both measured at the financial year end. Following recent literature demonstrating a link between corporate social responsibility and the cost of capital (e.g., Guenster *et al.*, 2011; El Ghouli *et al.*, 2011; Cheah *et al.*, 2011), we also control for firm's accountability reputation (*ACCOREPUT*). We measure *ACCOREPUT* as a dummy taking the value of 1 if the firm is included in the FTSE4Good Index, 0 otherwise.⁷

3.2 Cost of equity capital proxy

The literature has developed valuation models to estimate the cost of capital implied by mean analyst earnings forecasts and current share prices. The main valuation models are the residual income valuation (RIV) model (Gebhardt, Lee and Swaminathan, 2001), the abnormal earnings growth (AEG) model (Ohlson and Juettner-Nauroth, 2005; Gode and Mohanram, 2003) and the modified price-earnings growth (PEG) model (Easton, 2004). We employ the PEG model for three reasons. First, Cooper (2006) argues that in studying the disclosure-cost of capital relationship, it is not the accuracy of the absolute measure of the cost of capital that matters, but the relative differences in the

⁷ With the increasing growth of the socially responsible investment agenda, large institutional investors increasingly show a preference for firms pursuing socially responsible activities (Guenster *et al.*, 2011; El Ghouli *et al.*, 2011; Cheah *et al.*, 2011), and indices such as FTSE4Good are increasingly being used by investors (Galema, Plantinga and Scholtens, 2008). The FTSE4Good Index was founded in 2001 and provides investors interested in integrating social responsibility issues into the investment decisions with a transparent and measurable benchmark. It captures firms' environmental, social and governance practices (ESG). The index only includes firms that perform well in all areas of ESG. In this context, the use of the index allows us not only to control for corporate social responsibility, but also for the quality of corporate governance, variables that prior research suggest affect the cost of equity capital (see Cheng, Collins and Huang, 2006; El Ghouli *et al.*, 2011).

cost of capital estimates. Therefore, the valuation model is not the most important issue as long as there are sufficient variations in the estimates among firms. Second, the PEG model has less onerous data requirements, and only requires share prices and analyst earnings forecasts. Finally, prior studies (Botosan and Plumlee, 2005; Espinosa and Trombetta, 2007) indicate that the cost of capital estimates obtained from the three alternative approaches (RIV, AEG and PEG) are fairly similar and positively correlated.

The PEG model (Easton, 2004) estimates the cost of equity capital as follows:⁸

$$K_{PEG} = \sqrt{\frac{eps_2 - eps_1}{P_0}} \quad (2)$$

Where: eps_2 is the two-year-ahead analysts' earnings forecast for the firm; eps_1 is the one-year-ahead analysts' earnings forecast for the firm; and P_0 is the current share price. Both eps_1 and eps_2 must be positive and eps_2 must be greater than eps_1 (Easton, 2004; Lee, Walker and Christensen, 2006). We obtain the share prices and analyst earnings forecasts data from Datastream's I/B/E/S. We collect analyst forecasts made after the release of the annual report to ensure that the analyst forecasts incorporate information from the annual reports (see Gietzmann and Ireland, 2005; Espinosa and Trombetta, 2007).

3.3 Disclosure measures

The data for measuring disclosure is drawn from annual reports published between March 2004 and February 2005. We deliberately chose a cut-off of February 2005 to ensure that we reduce possible disclosure effects of the International Financial Reporting Standards (IFRS) and Operating and Financial Review (OFR) requirements, which were to become mandatory from period beginning

⁸ In computing the cost of equity capital, the PEG model assumes no dividend pay-out and no growth in abnormal earnings beyond the forecast horizon. For details of the model, in particular, how the model is derived, we refer the reader to the paper by Easton (2004). In further analyses, we also use cost of capital measures estimated using the AEG model to test the robustness of our results and find results that are similar to those of the PEG model.

2005 (the decision to make the OFR mandatory was later repealed in 2006).⁹ Although there are other channels through which firms report information, such as the internet and analyst meetings, the use of the annual report to measure corporate disclosure is well justified in the literature. For example, it is mandatory and widely distributed by listed firms (Gray, Meek and Roberts, 1995), and is the main channel by which firms communicate with investors and other stakeholders (Bozzolan, O'Regan and Ricceri, 2005; Guthrie, Petty and Ricceri, 2007). Eng and Teo (2000) show that analysts do revise their earnings forecasts after the release of annual reports, whilst Hope (2003) documents a positive relationship between annual report disclosure and analysts' earnings forecasts accuracy.

We create two measures of disclosure for the analysis: IC disclosure and financial disclosure. Our focus is on voluntary disclosure to ensure that we differentiate firms. We develop our disclosure measures as follows. For IC disclosure, we apply the checklist developed by Li, Pike and Haniffa (2008). This comprehensive checklist comprises 61 voluntary IC items divided into human, relational and structural items (see Appendix A, Panel A). We develop the financial disclosure checklist from a review of literature (e.g., Gray, Meek and Roberts, 1995; Botosan, 1997; Mangena and Pike, 2005), regulatory requirements (i.e., accounting standards; listing rules) and this yielded 35 items (see Appendix A, Panel B). We then read the entire annual report to score the items on the checklist and develop a measure of disclosure. For both IC and financial information, we use a binary indicator value, assuming 1 (for yes) and 0 (for no) if an information item is disclosed or not disclosed in the annual report, respectively. In this case, the method we use captures the presence or absence of a disclosure item in the annual report.¹⁰ We then create a disclosure index for each firm by dividing the

⁹ Our decision was driven by the need to examine the effects of IC and financial disclosures on the cost of capital in an environment of voluntary instead of mandatory reporting and the period chosen is particularly appropriate. This is particularly important because multiple regressions work well when there are meaningful variability in the variables of interest, in this case IC and financial disclosures and the cost of equity capital (see Richardson and Welker, 2001). In a mandatory reporting environment, variability of IC and financial disclosure is likely to be very small, thus making the results less powerful. In our view, as long as there is variability in the disclosure scores, the use of most recent data should lead to findings similar to those reported in this study. We believe the results from the analyses are important, not only for firms and policy-makers, but also for understanding the relationship between disclosure and the cost of equity capital.

¹⁰ Our approach takes into account the applicability of an item to the firm, such that firms are not penalised for items that are not considered applicable. For example, where the financial statements include amounts on disposals of assets or a subsidiary, we would

sum of disclosures (all the 1s) by the total number of items scored (total count of all the 1s and 0s) (see also Botosan, 1997; Hail, 2002).¹¹

4. Sample selection and descriptive statistics

4.1 Sample description

Our sample of firms is drawn from UK firms listed on the LSE. We begin the sample selection procedure by obtaining a list of all firms listed on the LSE as at 31 March 2008. Since our focus is on UK firms, we eliminate all overseas firms because they may be subjected to additional disclosure requirements by their national regulators (Mangena and Pike, 2005). We also exclude firms that were listed after the February 2005 cut-off date and those that had not yet produced their first annual report. The resultant population size is 522 firms (see Table 1), and for a sample population of this size, Neuman (2003) suggests a sample size of 30% (approximately 157 firms). To ensure a widely representative sample across industries, we apply proportionate stratified sampling by systematically selecting one firm from every three (522 divided by 157) firms in each industry.¹² The resultant sample size is 163 firms. Given that we use I/B/E/S data, this list was submitted to Thomson's Datastream for the requisite data, following which we eliminated 38 firms due to missing or insufficient data. This yielded a final sample of 125 firms as shown in Table 1, of which 37 firms are included in the FTSE4Good Index.

expect a 'discussion of disposals and effects on the results' in the report, and the firm would be awarded a '1' score if discussed; '0' otherwise. Where no amounts on disposals or acquisitions are included in the financial statements, we assume that the item 'discussion of disposals and effects on results' is not applicable.

¹¹ We validate our disclosure measures in two ways. First, three independent experienced coders score 15 randomly selected annual reports. The correlation among the scores by the three coders was significantly high at 0.98. Second, following Botosan (1997) and Richardson and Welker (2001), we regress the disclosure scores against firm size, leverage, return on assets, multiple listing, analyst following, and listing age. These variables have been shown to be associated with disclosure (Richardson and Welker, 2001; Mangena and Pike, 2005; Li, Pike and Haniffa, 2008) and if our disclosure scores are valid, they should be related to these variables. Our results are generally consistent with these previous studies. The results of these tests conservatively assure us that our disclosure measures are valid.

¹² The use of proportionate stratified sampling was to ensure that we build a sample that is representative of the population, both in terms of the sectors and the size of the firms. We considered that as the number of firms in each industry group is not the same simple random sampling will not meet this objective. To ensure that our sample includes both large and small firms, we first ranked firms in each sector by market capitalisation and then systematically selected one firm from every three firms in each industry grouping.

INSERT TABLE 1 ABOUT HERE

4.2 Descriptive statistics

In Table 2, we present summary descriptive statistics for the sample. Panel A provides the statistics for the cost of equity capital, IC and financial disclosures and control variables, and Panel B presents the cost of equity capital and disclosure statistics by industry. The mean (median) value of the cost of equity capital (K_{PEG}) is 9.95% (9.02%), which, although marginally lower, is consistent with the 10.4% reported by Lee, Walker and Christensen (2006) and the 10.7% reported by Gietzmann and Ireland (2005) also for listed UK firms. The mean (median) disclosure scores are 70.0% (72.1%) and 46.3% (46.7%) for IC disclosure (ICDI) and financial disclosure (FDI), respectively. In terms of industries (Panel B), firms in the telecommunications service, IT, aerospace, utility, media and publishing, business service providers and banks and insurance sectors have higher cost of capital than other firms. These sectors, with the exception of utility, appear to provide greater levels of IC disclosure, but their financial disclosures are similar to other sectors.

For the control variables, the mean market capitalisation (SIZE) of £6,047.1 million and the median market value of £655.2 million, indicate that our sample is characterised by both large and small firms. From the mean (median) BETA values of 0.998 (1.020), it is clear that the level of the sample market risk is close to that of the market portfolio. In terms of financial leverage, the mean (median) leverage of 19.6% (14.9%) is consistent with the notion that UK firms generally do not rely heavily on debt financing (see Lee, Walker and Christensen, 2006). The book-to-market ratio (B2M) mean (median) value of 0.474 (0.397) suggest that the market values are substantially different from the book values.

INSERT TABLE 2 ABOUT HERE

5. Empirical results

In this section, we present the empirical results of our study. We first report the univariate analysis in section 5.1 and then in section 5.2, we present our multiple regression results.

5.1 Univariate analysis

Table 3 reports the correlations between the independent variables and dependent variable as well as among the independent variables. The table shows that the cost of equity capital is significantly and negatively related to each measure of disclosure: the ranks of IC disclosure index (RICDI) and financial disclosure index (RFDI). We also note that although the correlations among the independent variables are significant, multicollinearity is not a problem because they are below the 0.7 benchmark (Gujarati, 2003).¹³

INSERT TABLE 3 ABOUT HERE

5.2 Multiple regression results

We first rank both IC and financial disclosure scores to alleviate the effects of extreme observations consistent with prior studies (see Botosan, 1997; Hail, 2002; Francis, Khurana and Pereira, 2005; Espinosa and Trombetta, 2007). Similarly, to reduce the impact of outliers, we winsorise the cost of equity capital data at the top and bottom 1% of the distribution (as in Lee, Walker and Christensen, 2006; Muino and Trombetta, 2009).¹⁴ Section 5.2.1 presents the main results, and in section 5.2.2, we provide the results of robustness tests.

¹³ Additional checks included an examination of the variance inflation factors (VIFs) in our model to further test for multicollinearity. All VIFs are well below the threshold value of 10 indicating that multicollinearity does not pose a problem (Gujarati, 2003). We also compute condition index using eigenvalues of the independent variables correlation matrix. As a rule of thumb, a condition index below 30 suggests no cause for concern and, a condition index of over 30 indicates the presence of collinearity (Gujarati, 2003). The largest condition index is 15.8, which is well below the threshold.

¹⁴ We also run the regressions with raw disclosure measures and the cost of equity capital as in Francis, Khurana and Pereira (2005) and find that the results are similar.

5.2.1 IC disclosure, financial disclosure and cost of equity capital

The results of the relationship between the cost of equity capital and IC and financial disclosures are presented in Table 4.

INSERT TABLE 4 ABOUT HERE

We first run the regression including the control variables only (Model 1) to establish whether our cost of equity capital estimates are related to the traditional risk factors in the predicted fashion, thus also validating the cost of equity capital measure. Overall, our results are in line with prior predictions (see Fama and French, 1992; Easton, 2004). The coefficients of LnSIZE and BETA are significantly negative and positive, respectively, whilst the coefficients of LEV and LnB2M are both positive, but not significant¹⁵. These results offer us assurance that our estimates for the cost of equity capital are valid. Finally, although not significant, the coefficient of ACCOREPUT is negative in line with prior studies (e.g. Guenster *et al.*, 2011; El Ghouli *et al.*, 2011).

In Model 2, we introduce RFDI only into the modelling to allow comparison of our results with previous studies that examine the effects of financial disclosure on the cost of equity capital. Our results show that the relationship between financial disclosure and the cost of capital is negative and significant only at the 10% level or better. This is consistent with prior studies (e.g., Amir and Lev, 1996; Botosan, 1997; Richardson and Welker, 2001; Espinosa and Trombetta, 2007). As noted earlier, prior literature (Amir and Lev, 1996; Nagar and Rajan, 2001; Pike, Rylander and Roos, 2002; Holland, 2006) suggests that IC combines with physical and financial assets to create value. Consistent with this, we introduce RICDI into the analyses (as in Model 3). In this case we are testing

¹⁵ The insignificant results for LEV and LnB2M are consistent with other previous studies (see Richardson and Welker, 2001; Botosan, Plumlee and Xie, 2004; Gietzmann and Ireland, 2005).

whether IC disclosure and financial disclosure are individually and jointly related to the cost of equity capital, thus addressing hypothesis 1 (H_1) and hypothesis 2 (H_2). The results indicate that the coefficient of RICDI is negative and significant at the 5% level or better, supporting hypothesis 1 (H_1). The coefficient of RFDI is also negative and significant at the 5% level or better, thus hypothesis 2 (H_2) is supported. We observe that when we introduce RICDI to Model 2, the coefficient of RFDI changes from a significance of 10% level to significant at the 5% level or better (in Model 3). These results suggest that the effect of financial disclosure in reducing the cost of equity capital is magnified by the presence of IC information. This confirms that when combined with IC disclosure, financial information has better incremental effect on the cost of equity capital (Amir and Lev, 1996; Pike, Rylander and Roos, 2002; Orens, Aerts and Lybaert, 2009).

With regard to the notion that IC and financial assets interact to create value (e.g., Nagar and Rajan, 2001 Pike, Rylander and Roos, 2002; Holland, 2006), we introduce an interaction term ($RFDI*RICDI$) into the analyses. The results are reported in Table 5.

INSERT TABLE 5 ABOUT HERE

As indicated in Model 4, we find that the coefficient of RICDI is still negative and significant at the 5% level or better, but RFDI is no longer significant. The coefficient of $RFDI*RICDI$ is positive and significant at the 5% level or better, thus our hypothesis 3 (H_3) is supported. This implies that the interaction between IC and financial disclosure has an incremental effect on the cost of equity capital beyond that of the individual disclosure types. The fact that RICDI remains significant whilst RFDI is not suggests that the interaction between the disclosure types is such that the relationship between financial disclosure and the cost of equity capital depends on the level of IC disclosure (see Aiken and West, 1991). In this context, the positive interaction term implies that the impact of financial disclosure on the cost of equity capital is greater for high IC disclosure firms than for low IC

disclosure firms. To gain better insights into the interaction effects of the two disclosure types, we perform further analyses in which we partition our sample into three levels of IC disclosure to create low, medium and high IC disclosure categories and re-run the analyses. This approach is similar to Cheng, Collins and Huang (2006) and Muino and Trombetta (2009). Using the percentiles as reported in Table 2 (the descriptive statistics), we define low IC disclosure (LICDI) as 1 if $ICDI \leq 0.623$ (25th Quartile), 0 otherwise; medium IC disclosure (MICDI) as 1 if $0.623 < ICDI < 0.787$ (50th Quartile), 0 otherwise and high IC disclosure (HICDI) as 1 if $ICDI \geq 0.787$ (75th Quartile), 0 otherwise. Using this partitioning, we run the following regression model which takes LICDI as the base case:

$$\begin{aligned}
 K_{PEG} = & \beta_0 + \beta_1 RFDI + \beta_2 MICDI + \beta_3 HICDI + \beta_4 RFDI * MICDI + \beta_5 RFDI * HICDI \\
 & + \beta_6 LnSIZE + \beta_7 BETA + \beta_8 LEV + \beta_9 LnB2M + \beta_{10} ACCOREPUT + \varepsilon_j, \quad (3)
 \end{aligned}$$

The results are reported in Table 5 (Models 5 and 6). In Model 5, we include RFDI, MICDI and HICDI and find that the coefficient of MICDI is negative and significant at the 5% level or better, whilst both the coefficients of FDI and HICDI are only significant at the 10% level or better. When we interact both MICDI and HICDI with RFDI (Model 6), MICDI drops to a significance of only 10% level or better, whilst RFDI and HICDI are no longer significant. With regard to the interaction term, we find that the coefficient of RFDI*MICDI is negative and significant at the 5% level or better, and RFDI*HICDI is also negative, but not significant. These results suggest that the effect of financial disclosure on the cost of equity capital is augmented for firms characterised by a medium level of intellectual capital disclosure.

5.2.2 Robustness checks

To enhance the robustness of our results, we perform further analyses (1) using alternative measures of the cost of equity capital, (2) testing for endogeneity, and (3) including additional control variables. These are performed for the main models only (i.e. Model 3 in Table 4 and Model 4 in Table 5) and demonstrate that the results still hold, suggesting that our results are robust.

Regarding the alternative measure of cost of equity capital, we use the Abnormal Earnings Growth (AEG) model, which is derived in Ohlson and Juettner-Nauroth (2005) and is specified as follows:

$$Ke = A + \sqrt{A^2 + \left(\frac{eps_1}{P_0}\right) * \left(\frac{eps_2 - eps_1}{eps_1}\right) - (y - 1)} \quad (4)$$

Where: $A = \frac{1}{2}[y - 1 + dps_1/P_0]$; eps_2 is the two-year-ahead analysts' earnings forecast for the firm; eps_1 is the one-year-ahead analysts' earnings forecast for the firm; P_0 is the current share price; $y - 1$ is the rate of perpetual growth in abnormal earnings beyond the forecast horizon, which is represented by the economy-wide growth (Ohlson and Juettner-Nauroth, 2005; Botosan and Plumlee, 2005)¹⁶; and dps_1 is the one-year-ahead dividend per share forecast. The results are reported in Table 6 (Models 7 to 9) and the results are largely similar to those in Tables 4 and 5.¹⁷

INSERT TABLE 6 ABOUT HERE

Second, prior studies (e.g., Nikolaev and van Lent, 2005; Orens, Aerts and Lybaert, 2009) argue that a major concern in using the ordinary least squares (OLS) regression approach is that of

¹⁶ In our estimations, we assume an economy-wide growth rate of 3% as represented by the gross domestic product growth rate (see HM Treasury, 2008)

¹⁷ The cost of equity capital estimated by the AEG model is 10.46% and is highly correlated with the PEG estimates (correlation is 0.992).

endogeneity. In this respect, it is possible that, on the one hand, disclosure lead to a reduction in the cost of equity capital, whilst on the other hand, the cost of equity capital may influence a firm's disclosure policy. This potential endogeneity problem may affect the interpretation of the results on the relationship between disclosure and the cost of equity capital. We test for this problem by applying a two-stage least squares (2SLS) approach. In the first stage, we estimate the regressions of RFDI and RICDI based on exogenous variables of the cost of capital together with instrumental variables. For the instrument variables, we include analyst following, listing age, sector, return on assets and multiple listing status (Models 10 and 11). Previous studies suggest that these variables are associated with disclosure (see for example, Botosan, 1997; Richardson and Welker, 2001; Li, Pike and Haniffa, 2008; Orens, Aerts and Lybaert, 2009). In the second stage, we re-run the cost of capital regressions by replacing RFDI and RICDI in our original models (see Models 3 and 4 in Tables 4 and 5 respectively) with their predicted values (PREFDI and PREICDI) from the first-stage 2SLS estimations (Models 10 and 11). The results as reported in Table 7 (Models 12 and 13) remain similar to our original results. As in Model 3 (Table 4), Model 12 results (Table 7) show that both financial and IC disclosures are negatively related to the cost of equity capital. Similarly, as in Model 4 (Table 5), Model 13 results indicate that IC disclosure is still negative and significant, whilst financial disclosure is not significant. Additionally, the interaction term is significant and positive. This analysis suggests that endogeneity might not significantly influence our results.

INSERT TABLE 7 ABOUT HERE

Finally, to our original model specification in Tables 4 and 5, we also add separately additional variables as a test of robustness (the results of these tests are not tabulated here). First, Lee, Walker and Christensen (2006) find that firms in knowledge-intensive sectors have higher equity premiums than other sectors due to greater uncertainty resulting from high growth, intense competition and shorter product life cycles. We therefore introduce, SECTOR, as an additional variable, which assumes a value

of 1 if the firm is classified as in knowledge-intensive sectors and 0 otherwise.¹⁸ Second, following Gietzmann and Ireland (2005) and Muino and Trombetta (2009), we include long-term growth (GROWTH) as an additional variable. We obtain long-term growth forecasts from I/B/E/S. Third, prior literature (e.g., Botosan, 1997; Richardson and Welker, 2001) shows that firms with low analyst following enjoy greater cost of capital benefits from enhanced disclosure. In this context, we partition our sample into low and high analyst following using a dummy variable (ANALYST) assuming 1 if number of analysts is below the median, and 0 otherwise. In all the three analyses above, we find that our results are similar to our original analyses.

6. Concluding remarks

In this paper, we investigate whether IC and financial disclosures are jointly related to the cost of equity capital. We also analyse whether IC and financial disclosures interact to affect the cost of equity capital. The cost of equity capital is estimated using the PEG model (Easton, 2004) and both IC and financial disclosures are measured using a disclosure index approach. We find that IC disclosure is negatively related to the cost of equity capital, and the relationship between financial disclosure and the cost of equity capital is magnified when combined with IC disclosure. We also document evidence indicating that IC and financial disclosures interact in their effects on the cost of equity capital. The interaction term is positive implying that for firms with greater IC disclosures, the impact of financial disclosures on the cost of capital is greater than for firms with low IC disclosures. Further analyses partitioning IC disclosure into low, medium and high indicate that the effects of financial disclosure on the cost of equity capital are augmented for firms with a medium level of IC disclosure. These results are robust to alternative measures of the cost of equity capital, endogeneity and to the

¹⁸ The industry sectors that we classify as knowledge intensive are biotechnology and pharmaceuticals, IT, business service providers, telecommunications, banks and insurance, media and publishing, aerospace and defence, chemicals, and electronic and electrical equipment. We classify the remaining industries (real estate, mining, retailing, engineering, food and beverages and utility) as traditional sectors (see Bozzolan, O'Regan and Ricceri, 2005; Unerman, Guthrie and Striukova, 2007). We find that IC disclosure is higher for knowledge based sector firms (at 71.7%) than for traditional sector firms (at 66.4%) and using t-tests, we find the differences are significant at the 5% level.

inclusion of additional control variables.

Our study makes important contributions to the literature. First, we contribute to the limited literature on the relationship between the cost of equity capital and IC disclosure. Second, we document empirically, for the first time, that there is an interaction effect between IC and financial disclosure on the cost of equity capital. In this respect, our decision to disaggregate corporate disclosure into IC and financial disclosure provides additional insights into the disclosure-cost of capital relationship not examined in prior studies. Finally, our results have implications for policy and practice. An understanding of whether IC disclosure is associated with the firm's cost of capital provides policy-makers and regulators with a basis upon which to evaluate the costs and benefits of disclosure. The results are also important to managers of firms. They suggest that enhancing IC disclosure makes financial disclosures more meaningful for investors and also benefit the firm in terms of a reduction in the cost of equity capital. In this context, firms with low IC disclosure might consider improving the extent of IC disclosures to lower their cost of equity capital.

Our findings must be interpreted in the context of at least two limitations. First, both cost of equity capital and levels of disclosure are difficult to measure. While this limitation must be noted, the reliability tests we conducted, based on similar prior studies, suggest that our results may be robust despite potential measurement errors in our main variables of interest. Second, the study uses only equity capital and not debt, so that the cost of capital used does not reflect the firm's total financing costs. A potential area of future research is to examine whether IC disclosures also affect the cost of debt financing as well.

References

Abodiy, D. and B. Lev (1998). 'The value-relevance of intangibles: The case of software capitalization', *Journal of Accounting Research*, **36**, pp. 161-191.

- Aboody, D. and B. Lev (2000). 'Information asymmetry, R&D and insider gains', *Journal of Finance*, **55**, pp. 47-66.
- Aiken, L.S. and S.G. West (1991). *Multiple Regression: Testing and Interpreting Interactions*. London: Sage
- Amihud, Y. and H. Mendelson (1986). 'Asset pricing and the bid-ask spread', *Journal of Financial Economics*, **17**, pp. 223-249.
- Amir, E. and B. Lev (1996). 'Value relevance of non-financial information: The wireless communications industry', *Journal of Accounting and Economics*, **22**, pp. 3-30.
- Barth, M. E., R. Kasznik and M. McNichols (2001). 'Analyst coverage and intangible assets', *Journal of Accounting Research*, **39**, pp. 1-34.
- Beattie, V. and S. J. Thomson (2007). 'Lifting the lid on the use of content analysis to investigate intellectual capital disclosures', *Accounting Forum*, **31**, pp. 129-163.
- Botosan, C. A. (1997). 'Disclosure level and the cost of equity capital', *Accounting Review*, **72**, pp. 323-349.
- Botosan, C. A. (2006). 'Disclosure and the cost of equity capital: what do we know?', *Accounting and Business Research, International Accounting Policy Forum*, pp. 31-40.
- Botosan, C. A. and M. A. Plumlee (2002). 'A re-examination of disclosure level and the expected cost of equity capital', *Journal of Accounting Research*, **40**, pp. 21-40.
- Botosan, C. A. and M. A. Plumlee (2005). 'Assessing alternative proxies for the expected risk premium', *Accounting Review*, **80**, pp. 21-53.
- Botosan, C. A., M. A. Plumlee and Y. Xie (2004). 'The role of information precision in determining the cost of equity capital', *Review of Accounting Studies*, **9**, pp. 233-259.
- Bozzolan, S., R. O'Regan and F. Riccerri (2005). 'Intellectual capital disclosure across Europe: A comparison between Italy, Ireland and the UK', *Journal of Human Resource Costing and Accounting*, **10**, pp. 92-113.

- Chan, L. K. C., K. Lakonishok and T. Sougiannis (2001). 'The stock market valuation of research and development expenditures', *Journal of Finance*, **56**, pp. 2431-2456.
- Chartered Institute of Management Accountants (CIMA) (2001). *Managing the IC within Today's Knowledge-based Organisations*. Technical Briefings, London: CIMA.
- Cheah, E., D. Jamali, J. E. V. Johnson and M. Sung (2011). 'Drivers of corporate social responsibility attitudes: The demography of socially responsible investors', *British Journal of Management*, **22**, pp. 305-323.
- Cheng, C. S. A., D. Collins and H. H. Huang (2006). 'Shareholder rights, financial disclosure and the cost of equity capital', *Review of Quantitative Finance and Accounting*, **27**, pp. 175-204.
- Coles, J., U. Loewenstein and J. Suay (1995). 'On equilibrium pricing under parameter uncertainty', *Journal of Financial and Quantitative Analysis*, **30**, pp. 347-364.
- Cooper, S. (2006). 'Discussion of disclosure and the cost of capital: what do we know?', *Accounting and Business Research*, **International Accounting Policy Forum**, pp. 41-42.
- Diamond, D. and R. Verrecchia (1991). 'Disclosure, liquidity and the cost of capital', *Journal of Finance*, **46**, pp. 1325-1359.
- Easley, D. and M. O'Hara (2004). 'Information and the cost of capital', *Journal of Finance*, **LIX**, pp. 1553-1583.
- Easton, P. D. (2004). 'PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital', *Accounting Review*, **79**, pp. 73-79.
- El Ghouli, S., O. Guedhami, C. C. Kwok and D. R. Mishra (2011). 'Does corporate social responsibility affect the cost of capital?', *Journal of Banking and Finance*, **35**, pp. 2388-2406.
- Eng, L. L. and H. K. Teo (2000). 'The relationship between annual report disclosures, analysts' earnings forecasts and analyst following: Evidence from Singapore', *Pacific Accounting Review*, **11**, pp. 219-239.

- Espinosa, M. and M. Trombetta (2007). 'Disclosure interactions and the cost of equity capital: Evidence from the Spanish Continuous Market', *Journal of Business Finance and Accounting*, **34**, pp. 1371-1392.
- Fama, E. and K. French (1992). 'The cross-section of expected stock returns', *Journal of Finance*, **47**, pp. 427-465.
- Fama, E. and K. French (2004). 'New lists: fundamentals and survival rates', *Journal of Financial Economics*, **73**, pp. 229-269.
- Francis, J. R., I. K. Khurana and R. Pereira (2005). 'Disclosure incentives and effects on cost of capital around the world', *Accounting Review*, **80**, pp. 1125-1162.
- Galema, R., A. Plantinga and B. Scholtens (2008). 'The stocks at stake: return and risk in socially responsible investment', *Journal of Banking and Finance*, **32**, pp. 2646-2654.
- Garcia-Meca, E. and I. Martinez (2007). 'The use of intellectual capital information in investment decisions - an empirical study using analyst reports', *Journal of International Accounting*, **42**, pp. 57-82.
- Gebhardt, W., C. Lee and B. Swaminathan (2001). 'Towards an implied cost of capital', *Journal of Accounting Research*, **39**, pp. 135-176.
- Gietzmann, M. B. and M. Trombetta (2003). 'Disclosure interactions: accounting policy choice and voluntary disclosure effects on the cost of raising outside capital', *Accounting and Business Research*, **33**, pp. 187-203.
- Gietzmann, M. and J. Ireland (2005). 'Cost of capital, strategic disclosures and accounting choice', *Journal of Business Finance and Accounting*, **32**, pp. 599-634.
- Gode, D. and P. Mohanram (2003). 'Inferring the cost of capital using the Ohlson-Juettner model', *Review of Accounting Studies*, **8**, pp. 399-431.

- Gray, S. J., G. K. Meek and C. B. Roberts (1995). 'International capital market pressure and voluntary annual reports disclosure by US and U.K. multinationals', *Journal of International Financial Management and Accounting*, **6**, pp. 43-67.
- Guenster, N., R. Bauer, J. Derwall and K. Koedijk (2011). 'The economic value of corporate eco-efficiency', *European Financial Management*, **17**, pp. 679-704.
- Gujarati, D. N. (2003). *Basic Econometrics*. Boston: McGraw-Hill.
- Guthrie, J., R. Petty and F. Ricceri (2007). *Intellectual Capital Reporting Investigations into Australia and Hong Kong*. Edinburgh: The Institute of Chartered Accountants of Scotland (ICAS).
- Hail, L. (2002). 'The impact of voluntary corporate disclosures on the ex-ante cost of capital for Swiss firms', *European Accounting Review*, **11**, 741-773.
- Healy, P. M. and K. G. Palepu (2001). 'Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature', *Journal of Accounting and Economics*, **31**, pp. 405-440.
- HM Treasury (2008). 'The UK economy: An analysis of long-term performance and strategic challenges'. HM Treasury, March, Available at <http://www.hm-treasury.gov.uk> [Accessed 23 October 2012].
- Holland, J. (2003). 'Intellectual capital and the capital market - Organisation and competence', *Accounting, Auditing and Accountability Journal*, **16**, pp. 39-48.
- Holland, J. (2006). 'Fund management, intellectual capital, intangibles and private disclosure', *Managerial Finance*, **32**, pp. 277-316.
- Hope, O-K. (2003). 'Accounting policy disclosure and analysts' forecasts', *Contemporary Accounting Research*, **20**, pp. 295-321.
- Hsu, L. and C. Wang (2012). 'Clarifying the effect of intellectual capital on performance: The mediating role of dynamic capability', *British Journal of Management*, **23**, pp. 179-205.

- Ittner, C. and D. Larcker (1998). 'Are non-financial measures leading indicators of financial performance? An analysis of customer satisfaction', *Journal of Accounting Research*, **36**, pp. 1-35.
- Keller, K. L. (2002). *Strategic Brand Management: Building, Measuring, and Managing Brand Equity*. N.J.: Prentice Hall.
- Kristandl, G. and N. Bontis (2007). 'The impact of voluntary disclosure on cost of equity capital estimates in a temporal setting', *Journal of Intellectual Capital*, **8**, pp. 577-594.
- Lambert, R. C., C. Leuz and R. Verrecchia (2007). 'Accounting information, disclosure, and the cost of capital', *Journal of Accounting Research*, **45**, pp. 385-420.
- Lee, E., M. Walker and H. B. Christensen (2006). *The Cost of Capital in Europe: An Empirical Analysis and the Preliminary Impact of International Accounting Harmonization*, London: The Association of Chartered Certified Accountants.
- Lev, B. (2001). *Intangibles: Management, Measurement and Reporting*. Washington, D.C.: The Brookings Institution.
- Li, J., R. Pike and R. Haniffa (2008). 'Intellectual capital disclosure and corporate governance structure in UK firms', *Accounting and Business Research*, **38**, pp. 137-159.
- Luft, J. L. and M. D. Shields (2001). 'Why does fixation persist? Experimental evidence on the judgement performance effects of expensing intangibles', *Accounting Review*, **76**, pp. 561-587.
- Mangena, M. and R. Pike (2005). 'The effect of audit committee characteristics on interim financial disclosures', *Accounting and Business Research*, **35**, pp. 327-349.
- Muino, F. and M. Trombetta (2009). 'Does graph disclosure bias reduce the cost of equity capital?', *Accounting and Business Research*, **39**, pp. 83-102.
- Nagar, V. and M. V. Rajan (2001). 'The revenue implications of financial and operational measures of product quality', *Accounting Review*, **76**, pp. 495-513.

- Neuman, W. L. (2003). *Social Research Methods: Quantitative and Qualitative Approaches*. 5th Edition, London: Allyn & Bacon.
- Nikolaev, V. and L. van Lent (2005). 'The endogeneity bias in the relation between cost of debt capital and corporate disclosure policy', *European Accounting Review*, **14**, pp. 677-724.
- Ohlson, J. and B. Juettner-Nauroth (2005). 'Expected EPS and EPS growth as determinants of value', *Review of Accounting Studies*, **10**, pp. 349-365.
- Orens, R., W. Aerts and N. Lybaert (2009). 'Intellectual capital disclosure, cost of finance and firm value', *Management Decision*, **47**, pp. 1536-1554.
- Pike, S., A. Rylander and G. Roos (2002). 'Intellectual capital management and disclosure', in: N. Bontis and C. W. Choo (eds), *The Strategic Management of Intellectual Capital and Organisational Knowledge* (Oxford University Press).
- Rajgopal, S., T. Shevlin and M. Venkatachalam (2003). 'Does the stock market fully appreciate the implications of leading indicators for future earnings? Evidence from order backlog', *Review of Accounting Studies*, **8**, pp. 461-492.
- Richardson, A. J. and M. Welker (2001). 'Social disclosure, financial disclosure and the cost of equity capital', *Accounting, Organisations and Society*, **26**, pp. 597-616.
- Singh, I. and J. L. M. Van der Zahn (2007). 'Does intellectual capital disclosure reduce an IPO's cost of capital: The case of underpricing', *Journal of Intellectual Capital*, **8**, pp. 494-516.
- Unerman, J., J. Guthrie and L. Striukova (2007). *UK Reporting of Intellectual Capital*. London: Institute of Chartered Accountants of England and Wales (ICAEW).
- Walsh, G., V. Mitchell, P. R. Jackson and S. E. Beatty (2009). 'Examining the antecedents and consequences of corporate reputation: A customer perspective', *British Journal of Management*, **20**, pp.187-203.
- Welker, M. (1995). 'Disclosure policy, information asymmetry and liquidity in equity markets', *Contemporary Accounting Review*, **11**, pp. 153-174.

APPENDIX A: DISCLOSURE CHECKLIST

Panel A: Intellectual capital information disclosure items			
I.	Structural capital		
1.	Intellectual property	32.	Relationship with suppliers
2.	Process	33.	Business collaborations
3.	Management philosophy	34.	Business agreements
4.	Corporate or organisational culture	35.	Favourable contracts
5.	Organisational flexibility/adaptability	36.	Research collaborations
6.	Organisational structure	37.	Marketing
7.	Organisational learning	38.	Relationship with stakeholders
8.	Research and development	39.	Market leadership
9.	Innovation		
10.	Technology	III.	Human capital
11.	Financial relationships	40.	Number of employees
12.	Customer support function	41.	Employee age
13.	Knowledge-based infrastructure	42.	Employee diversity
14.	Quality management and improvement	43.	Employee equality
15.	Accreditations	44.	Employee relationship
16.	Overall infrastructure/capability	45.	Employee education
17.	Networking	46.	Skills/know-how/expertise/knowledge
18.	Distribution network	47.	Employee work-related competences
		48.	Employee work-related knowledge
II.	Relational capital	49.	Employee attitudes/behaviour
19.	Customers	50.	Employee commitments
20.	Market presence	51.	Employee motivation
21.	Customer relationship	52.	Employee productivity
22.	Customer acquisition	53.	Employee training
23.	Customer retention	54.	Vocational qualification
24.	Customer training and education	55.	Employee development
25.	Customer involvement	56.	Employee flexibility
26.	Company image/reputation	57.	Entrepreneurial spirit
27.	Company awards	58.	Employee capabilities
28.	Public relationships	59.	Employee teamwork
29.	Diffusion and networking	60.	Employee involvement with community
30.	Brands	61.	Other employee features
31.	Distribution channels		

Panel B: Financial information disclosure items			
I.	Financial analysis	19.	Discussion of disposals and effects on results
1.	Profitability ratios	20.	Commentary on the effects of inflation on operations
2.	Cash flow ratios	21.	Commentary on effects of interest rates on operations
3.	Liquidity ratios	22.	Effects of foreign currency fluctuations on operations
4.	Gearing ratios	23.	Effects of commodity prices on results
5.	Dividend cover ratio	24.	Disclosure of capital expenditure in general
6.	Graphical presentation of key data	25.	Quantitative geographical capital expenditure
7.	Analysis of free cash flows	26.	Quantitative line of business capital expenditure
8.	Financial history summary	27.	Creditor payment policy
9.	Comments on change in sales		
10.	Comments on change in operating profit	II.	Forecast information
11.	Comments on change in cost of goods sold	28.	Forecast of sales
12.	Comments on change in selling and administration expenses	29.	Forecast of profits
13.	Comments on change in interest expense or interest income	30.	Forecast of cash flows
14.	Comments on change in working capital	31.	Order book or backlog information
15.	Discussion of capital structure		
16.	Discussion of cash flow position	III.	Capital market data
17.	Commentary on level of borrowings	32.	Share trading information
18.	Discussion of acquisitions and effects on results	33.	Share price information
		34.	Domestic and foreign shareholdings
		35.	Distribution of shareholdings by type of shareholders

Table 1: Sample composition by industry				
Industry	Population size	Initial sample size	Final sample size	
			Number	%
Biotechnology and Pharmaceuticals	40	13	10	7.9
Information Technology	60	19	13	10.3
Media and Publishing	45	14	12	9.5
Business Service Providers	83	26	21	17.4
Telecommunications Services	18	6	6	4.8
Banks and Insurance	51	15	14	11.1
Food and Beverages	22	7	7	5.6
Electronic and Electrical Equipment	45	14	5	4.0
Retailing	20	6	6	4.8
Utility	36	11	10	7.9
Engineering	10	3	3	2.4
Aerospace and Defence	11	3	3	2.4
Chemicals	29	9	3	2.4
Real Estate	40	13	8	6.3
Mining	12	4	4	3.2
Total number of firms	522	163	125	100

Table 2: Descriptive statistics**Panel A: Cost of equity capital, disclosure measures and control variables**

Variable	Variable definitions	Mean	Percentiles			Standard deviation
			25%	Median	75%	
K_{PEG}	Implied cost of capital	9.95%	7.24%	9.02%	11.32%	6.29%
ICDI	IC disclosure index	.700	.623	.721	.787	.1158
FDI	Financial disclosure index	.463	.388	.467	.539	.0943
SIZE	Market capitalisation (£m)	6,047.1	164.5	655.2	3,158.8	15,291.8
BETA	Market beta	.998	.775	1.020	1.235	.307
LEV	Financial leverage	.196	.063	.149	.286	.1928
B2M	Book-to-market ratio	.474	.251	.397	.663	.328

Panel B: Cost of equity capital and disclosure measures by industry (means)

Industry	Cost of equity capital	IC disclosure	Financial Disclosure
	%	%	%
Telecommunications services	13.59	72.7	45.6
IT	12.02	71.8	41.5
Aerospace and defence	11.50	70.5	54.9
Utility	11.29	64.6	45.1
Media and publishing	10.46	72.7	47.2
Business service providers	10.11	70.1	43.4
Banks and insurance	10.05	75.3	45.6
Retailing	9.95	62.1	46.1
Biotech and pharmaceuticals	9.80	71.8	48.5
Electronic and electrical equipment	9.74	67.9	44.7
Engineering	9.30	69.9	48.9
Food and beverages	9.17	70.0	49.2
Chemicals	7.03	68.8	41.9
Real estate	6.70	62.1	46.1

Table 3: Pearson correlations among all variables

Variable ^a	K_{PEG}	RICDI	RFDI	SIZE	BETA	LEV	B2M	ACCOREPUT
K_{PEG}	1.000							
RICDI	-.344***	1.000						
RFDI	-.250***	.559***	1.000					
LnSIZE	-.392***	.406***	.322***	1.000				
BETA	.203**	.103	-.196**	-.189**	1.000			
LEV	.094	.222**	.315***	.338***	-.110	1.000		
LnB2M	-.005	-.063	-.062	.010	-.172*	.207**	1.000	
ACCOREPUT	-.257***	.433***	.369***	.530***	.059	.244***	-.131	1.000

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

^a Variable Definitions:

K_{PEG} is the cost of equity measure imputed from the Easton (2004) model. *RICDI* denotes the rank of IC disclosure index; *RFDI* is the rank of financial disclosure index. *LnSIZE* is the natural log of market capitalisation at the end of the financial year of the firm. *BETA* is the firm's market risk which is drawn from the Risk Measurement Service, which is a quarterly publication by the London Business School's Institute of Finance and Accounting. *LEV* is the financial leverage of the firm calculated as total liabilities of the firm scaled by the firm's market capitalisation at the financial year end. *LnB2M* is the natural log of the book-to-market ratio of the firm computed by scaling the book value of equity by the market capitalisation at the year end. *ACCOREPUT* denotes the accountability reputation of the firm, measured as a dummy variable taking the value of 1 if the firm is included in FTSE4GOOD index of socially responsible firms. The FTSE4GOOD index includes firms that perform well in the areas of environment, social and governance and we base our measure on the list published prior to the financial year end of the firms in our sample.

Table 4: Regression results for the relationship between disclosure and the cost of equity capital

Variable ^a	Model 1	Model 2 (RFDI)	Model 3 (RICDI & RFDI)
Constant	.120 (6.231***)	.120 (6.150***)	.117 (6.011***)
LnSIZE	-.008 (-3.345***)	-.008 (-3.132***)	-.007 (-2.386**)
BETA	.022 (2.108**)	.022 (2.063**)	.022 (1.995**)
LEV	.021 (1.080)	.021 (1.041)	.023 (1.151)
LnB2M	.005 (1.034)	.005 (1.018)	.006 (1.208)
ACCOREPUT	-.001 (-.924)	-.001 (-.797)	-.00003 (-.833)
RFDI	-	-.0001 (-1.777*)	-.0001 (-2.006**)
RICDI	-	-	-.0001 (-2.273**)
Adjusted R ²	.161	.181	.239
F-value	6.747***	5.855***	5.431***
Number	125	125	125

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

^a Variable Definitions:

LnSIZE is the natural log of market capitalisation at the end of the financial year of the firm. *BETA* is the firm's market risk which is drawn from the Risk Measurement Service, which is a quarterly publication by the London Business School's Institute of Finance and Accounting. *LEV* is the financial leverage of the firm calculated as total liabilities of the firm scaled by the firm's market capitalisation at the financial year end. *LnB2M* is the natural log of the book-to-market ratio of the firm computed by scaling the book value of equity by the market capitalisation at the year end. *ACCOREPUT* denotes the accountability reputation of the firm, measured as a dummy variable taking the value of 1 if the firm is included in FTSE4GOOD index of socially responsible firms. The FTSE4GOOD index includes firms that perform well in the areas of environment, social and governance and we base our measure on the list published prior to the financial year end of the firms in our sample. *RFDI* and *RICDI* denote the ranks of financial disclosure index and IC disclosure index, respectively.

Table 5: Regressions of the cost of equity capital and disclosure interactions

Variable ^a	Model 4	Model 5	Model 6
Constant	.132 (6.557***)	.113 (5.967***)	.108 (4.798***)
LnSIZE	-.006 (-2.085**)	-.005 (-2.034**)	-.005 (-2.029**)
BETA	.025 (2.193**)	.025 (2.255**)	.027 (2.332**)
LEV	.027 (1.387)	.019 (.970)	.020 (.999)
LnB2M	.005 (1.021)	.005 (1.153)	.005 (1.118)
ACCOREPUT	-.008 (-.721)	-.008 (-.747)	-.010 (-.583)
RFDI	-.0001 (-1.637)	-.0001 (-1.889*)	-.0001 (-1.325)
RICDI	-.001 (-2.117**)	-	-
RFDI*RICDI	.00006 (2.353**)	-	-
MICDI	-	-.030 (-2.281**)	-.022 (-1.925*)
HICDI	-	-.024 (-1.806*)	-.033 (-1.417)
RFDI*MICDI	-	-	-.0001 (-2.209**)
RFDI*HICDI	-	-	-.00005 (-.562)
Adjusted R ²	.251	.242	.244
F-value	4.719***	5.090***	4.296***
Number	125	125	125

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

^a Variable Definitions:

LnSIZE is the natural log of market capitalisation at the end of the financial year of the firm. *BETA* is the firm's market risk which is drawn from the Risk Measurement Service, which is a quarterly publication by the London Business School's Institute of Finance and Accounting. *LEV* is the financial leverage of the firm calculated as total liabilities of the firm scaled by the firm's market capitalisation at the financial year end. *LnB2M* is the natural log of the book-to-market ratio of the firm computed by scaling the book value of equity by the market capitalisation at the year end. *ACCOREPUT* denotes the accountability reputation of the firm, measured as a dummy variable taking the value of 1 if the firm is included in FTSE4Good index of socially responsible firms. The FTSE4Good index includes firms that perform well in the areas of environment, social and governance and we base our measure on the list published prior to the financial year end of the firms in our sample. *RFDI* and *RICDI* denote the ranks of financial disclosure index and IC disclosure index, respectively. *RFDI*RICDI* denotes the interaction term of the ranks of FDI and ICDI. *MICDI* denotes medium level IC disclosure measured as a dummy taking the value of 1 if $0.623 < \text{ICDI} < 0.787$, 0 otherwise; and *HICDI* denotes high level IC disclosure and is measured as a dummy variable taking 1 if $\text{ICDI} \geq 0.787$, 0 otherwise. Finally, *RFDI*MICDI* and *RFDI*HICDI* are the interaction terms for financial disclosure (rank) and medium IC disclosure, and financial disclosure (rank) and high IC disclosure respectively.

Table 6: Regressions of the cost of equity capital and disclosure: Alternative measure of cost of equity capital using the Abnormal Earnings Growth (AEG) model

Variable ^a	Model 7	Model 8	Model 9
Constant	.123 (5.864***)	.119 (5.655***)	.137 (6.272***)
LnSIZE	-.008 (-2.992***)	-.006 (-2.046**)	-.005 (-2.382**)
BETA	.027 (2.216**)	.027 (2.199**)	.030 (2.381**)
LEV	.005 (.225)	.007 (.338)	.012 (.575)
LnB2M	.004 (.904)	.006 (1.119)	.005 (.921)
ACCOREPUT	-.004 (-.351)	-.003 (-.223)	-.012 (-.976)
RFDI	-	-.00006 (-1.815*)	-.0001 (-1.544)
RICDI	-	-.0001 (-2.011**)	-.001 (-2.240**)
RFDI*RICDI	-	-	.0001 (2.488**)
Adjusted R ²	.171	.198	.223
F-value	6.122***	4.827***	5.185***
Number	125	125	125

*** Significant at the 1% level
 ** Significant at the 5% level
 * Significant at the 10% level

^a Variable Definitions:

LnSIZE is the natural log of market capitalisation at the end of the financial year of the firm. *BETA* is the firm's market risk which is drawn from the Risk Measurement Service, which is a quarterly publication by the London Business School's Institute of Finance and Accounting. *LEV* is the financial leverage of the firm calculated as total liabilities of the firm scaled by the firm's market capitalisation at the financial year end. *LnB2M* is the natural log of the book-to-market ratio of the firm computed by scaling the book value of equity by the market capitalisation at the year end. *ACCOREPUT* denotes the accountability reputation of the firm, measured as a dummy variable taking the value of 1 if the firm is included in FTSE4Good index of socially responsible firms. The FTSE4Good index includes firms that perform well in the areas of environment, social and governance and we base our measure on the list published prior to the financial year end of the firms in our sample. *RFDI* and *RICDI* denote the ranks of financial disclosure index and IC disclosure index, respectively. *RFDI*RICDI* is the interaction term of the ranks of FDI and IC DI.

Table 7: Tests for Endogeneity: A two-stage least square (2 SLS) approach

Variable ^a	First Stage 2SLS		Second Stage 2SLS	
	Model 10 RFDI	Model 11 RICDI	Model 12	Model 13
Constant	.245 (8.142***)	.437 (12.561***)	.230 (3.818***)	.681 (3.347***)
LnSIZE	.017 (2.835***)	.023 (3.275***)	-.001 (-2.124**)	-.0001 (-2.297**)
BETA	--	--	.014 (2.147**)	.019 (2.057**)
LEV	.038 (.960)	.034 (.743)	.038 (1.122)	.026 (1.247)
LnB2M	--	-.005 (-.407)	.006 (1.263)	.006 (1.370)
ACCOREPUT	--	--	-.004 (-.958)	-.005 (-.815)
PRERFDI	--	--	-.086 (-1.947**)	-.033 (-1.537)
PRERICDI	--	--	-.043 (-2.320**)	-.251 (-2.314**)
PRERFDI*PRERICDI	--	--	--	.463 (2.882***)
ANALYST	.020 (2.171**)	.035 (2.448**)	--	--
LISTAGE	.026 (4.112***)	.001 (.179)	--	--
SECTOR	.007 (.454)	.054 (3.034***)	--	--
ROA	-.049 (-.500)	-.082 (-.596)	--	--
MULTLIST	.009 (1.983*)	--	--	--
Adjusted R ²	.459	.512	.188	.218
F-value	15.924***	19.604***	5.078***	5.279***
Number	125	125	125	125

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level

^a Variable Definitions:

LnSIZE is the natural log of market capitalisation at the end of the financial year of the firm. *BETA* is the firm's market risk which is drawn from the Risk Measurement Service, which is a quarterly publication by the London Business School's Institute of Finance and Accounting. *LEV* is the financial leverage of the firm calculated as total liabilities of the firm scaled by the firm's market capitalisation at the financial year end. *LnB2M* is the natural log of the book-to-market ratio of the firm computed by scaling the book value of equity by the market capitalisation at the year end. *ACCOREPUT* denotes the accountability reputation of the firm, measured as a dummy variable taking the value of 1 if the firm is included in FTSE4Good index of socially responsible firms. The FTSE4Good index includes firms that perform well in the areas of environment, social and governance and we base our measure on the list published prior to the financial year end of the firms in our sample. *PRERFDI* and *PRERICDI* denote the predicted values of the ranks of FDI (RFDI) and ICDI (RICDI), respectively, from the first stage 2SLS, whilst *PRERFDI*PRERICDI* is the interaction term for the two. *ANALYST* is the number of analyst following the firm; *LISTAGE* is the company age measured as the number of years the firm has been listed on the stock exchange; *SECTOR* denotes sector classification, taking the value of 1 if the firm is classified as in the knowledge-intensive sector, and 0 otherwise; *ROA* the return on assets of the firm; and *MULTLIST* is multiple listing, measured as a dummy taking the value of 1 if the firm is listed on another stock exchange, and 0 otherwise.