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The complementarity between segment disclosure and earnings quality, and its effect on cost of capital

We investigate the role of earnings quality in determining the levels of segment disclosure, and whether and how better quality earnings and segment disclosure influences cost of capital. Using a large US sample for the period 2001-2006, we find a positive relation between earnings quality and levels of segment disclosures. We also find that firms providing better quality segment information, contingent upon good earnings quality, enjoy lower cost of capital. We base our empirical tests on a self created index of segment disclosure. Our results contribute to a better understanding of (1) the incentives for providing segment disclosures, and (2) how accounting quality (quality of segment information and earnings quality) is related to the cost of capital.

Keywords: Segment disclosure, earnings quality, diversification, information asymmetries, forecast error, cost of capital.

JEL classification: M41, G12

1. INTRODUCTION

The objective of this paper is twofold. First, we investigate the relation between earnings quality and segment disclosure. Second, we analyze whether firms providing higher quality of segment information enjoy a lower cost of capital. For the analysis of the relation between earnings quality and segment disclosure we create an index of quantity of voluntary segment disclosure. We use the residuals of a regression of quantity of segment information on the determinants of segment disclosure as a proxy for the quality of segment disclosure. We argue that quality (and not quantity) of segment disclosure will have an impact on cost of capital.

We expect that earnings quality and segment disclosure will be related in a predictable way. The literature on information economics suggests that firms provide information to decrease information asymmetries (Grossman and Hart, 1980; Milgrom, 1981; Verrecchia, 1983). This provision of information could be achieved through several channels, including the reported accounting numbers and through additional disclosure. Verrecchia (1990) and Penno (1997) directly model the relation between earnings quality and disclosure, showing that more expansive disclosure is expected in firms with better earnings quality. However, results in the empirical literature are mixed, probably due to the use of empirical measures of disclosure that include information expected to be useful for investors (that disaggregates, explains or complements the reported numbers) and information that is difficult to verify and that might not be useful for investors.

In this study, we focus on segment disclosure. Prior literature suggests segment disclosure is useful for investors and increases firm value, as it increases the value relevance of accounting numbers (Chen and Zhang, 2003), it improves monitoring over management decisions, while diminishing agency costs (Hope and Thomas, 2008), and

helps reducing information asymmetries (Greenstein and Sami, 1994). Consequently, we expect firms providing better earnings quality will also be likely to provide comprehensive segment disclosure to additionally decrease information asymmetries and increase firm value. Thus, we expect that, holding everything else constant, firms with better earnings quality will prepare more expansive segment disclosures.

The second objective of this paper is to study the relation between cost of capital and quality of segment information. There is an ongoing debate on whether and how accounting quality decreases cost of capital. One stream of literature suggests that information asymmetries affect the cost of capital: accounting quality reduces these information asymmetries; which in turn, affects the cost of capital (Easley and O'Hara, 2004). More recently, several studies demonstrate that information differences across investors affect a firm's cost of capital through information precision, and not information asymmetry per se (Hughes, Liu and Liu, 2007; Lambert, Leuz and Verrecchia, 2007, 2008). As shown in prior research (Kinney, 1971; Collins, 1976; Baldwin, 1984; Balakrishnan, Harris and Sen, 1990), segment reporting improves the predictive ability of accounting numbers. Consequently, we expect that improved segment information will facilitate the estimation of firms' cash flows, which in the Lambert et al. (2007, 2008) setting will lead to lower cost of capital.

Using a sample of non regulated and non financial firms for the period 2001-2006, we find that firms providing high quality segment disclosure, contingent upon good earnings quality, enjoy lower costs of equity capital. This result is robust to controls for the determinants of segment disclosure, and to the use of asset-pricing based tests and implied cost of capital based tests. In addition, we provide empirical evidence that segment disclosure improves investors' ability to estimate firm's cash flows by showing that better quality segment disclosure, contingent upon good earnings

quality, reduces analysts' forecast errors. Also, we show that the provision of high segment information quality, having good earnings quality, leads to a reduction in the firm's assessed covariance with other firms' returns. This is consistent with quality of segment disclosure reducing estimation risk. Unlike Francis, Nanda and Olsson (2008), we use a proxy of disclosure quality, not a proxy of disclosure quantity. Our results show that it is the quality of disclosure, not the quantity of disclosure, which reduces the cost of capital. The quantity of segment disclosures is only a proxy of the activity of the firm (i.e., a firm provides more segment information when it is more diversified).

Our study contributes to the ongoing debate on whether accounting quality decreases cost of capital by providing empirical evidence that better quality segment disclosure, when complemented with good earnings quality, improves investors' ability to estimate firm's cash flows, which leads to a decrease in cost of capital.

The remainder of the paper is as follows. In Section 2 we present the theoretical development on the relation between segment disclosure, earnings quality and cost of capital. In Section 3 we present the research design, describing our proxies for the quantity and quality of segment information, the method to analyze the relation between earnings quality and segment information and the methods used to study the impact of segment information quality on cost of capital. In Section 4 we present the results. Finally Section 5 summarizes and concludes.

2. SEGMENT DISCLOSURE, EARNINGS QUALITY AND COST OF CAPITAL

Companies are increasingly international and increasingly diversified. The valuation of an international or a diversified firm requires information not only about overall firm activity, but also about segments of the firm because performance, risk and potential growth of different business or geographical lines vary appreciably (SFAS 131, Ernst and Young, 2005; Palepu, Healy and Bernard, 2004). Investors and analysts

need segment information as they require information to help them in predicting firm's future cash flows. Without this disaggregation in segments, predicting future cash flows of the firm becomes more difficult (AIMR, 1993). As a response to users requests, regulators require segment disclosure with the objective of providing "information about the different types of business activities in which a firm engages and the different economic environments in which it operates to help users of financial statements to a. Better understand the enterprise's performance, b. Better assess its prospects for future net cash flows and c. Make more informed judgments about the enterprise as a whole." (FAS 131, paragraph 3).

A wealth of academic research has focused on segment reporting, showing several benefits of improved segment information: (i) it is expected to help current and potential investors to improve their capital allocation decisions. Previous literature finds that segment characteristics are useful in equity valuation and that the value relevance of accounting numbers is higher in firms that provide disaggregated segment information rather than in firms that do not disaggregate such information, especially when operating segments have increasingly different profitability and growth opportunities (Foster, 1975, Tse, 1989; Basu, Kim and Lim, 1999; Wysocki, 1998; Chen and Zhang, 2003); (ii) it permits better monitoring of manager's decisions, decreasing information asymmetries between managers and debt– and equity– holders, reducing empire building decisions and improving investment efficiency. Previous literature shows that when firms provide information about the diversification of the firm and about the resource transfers across segments, they facilitate and improve the monitoring over manager decisions, and reduce information asymmetries (Greenstein and Sami,1994; Berger and Hann, 2003, 2007; Hope and Thomas, 2008); and (iii) it is useful to financial analysts, who will use the more comprehensive segment information

to improve their earnings forecasts. In this context, previous literature shows that analysts issue more accurate earnings forecasts if they have available good quality segment data (Kinney, 1971; Collins, 1976; Baldwin, 1984; Balakrishnan, Harris and Sen, 1990; Hussain, 1997).

2.1 Segment information and earnings quality

Accounting information is critical to the well functioning of the economy because decisions on the allocation of resources are based, to a large extent, on the information provided by the accounting system. Accounting information is flexible to allow managers better capture the underlying economic fundamentals of the firm. However, managers can use this discretion opportunistically to their own benefit. A way to prevent such behaviour is the provision of better quality accounting practices, which ameliorate the problems caused by information asymmetries (LaFond and Watts, 2008). However, even if reported numbers provide a true and fair view of the situation of the firm, it is likely that, given that reported numbers are too aggregated, they are not sufficient to make appropriate economic decisions. Segment disclosure helps in disaggregating the information and facilitates an efficient allocation of resources.

As segment information disaggregates accounting numbers to provide details concerning different business or geographical lines, we expect that firms with better earnings quality will have incentives to provide more comprehensive segment information to help investors in making appropriate investment decisions. Managers of firms providing better earnings quality will be keen on complementing earnings information with additional segment disclosure to additionally increase firm value. This leads to the following hypothesis:

> *Hypothesis 1: As the quality of earnings increases, the comprehensiveness of segment disclosure will increase.*

Our first hypothesis is consistent with analytical research showing that firms providing better earnings quality are expected to provide more extensive disclosure. Dye (1985) and Jung and Kwon (1988) propose a model in which information quality is the probability that the manager of the firm is privately informed. They study his/her decision of whether to disclose this private information, and show that as information quality increases, the manager has more incentives to disclose his/her private information since the market is more likely to interpret nondisclosure as bad news. Similarly, Verrecchia (1990) and Penno (1997) propose a model in which information quality is the precision of the manager's private information. They show that, since the market knows how the information quality is, disclosure is more probable in firms with better information.

Prior empirical research on the relation between reported numbers and disclosure offers conflicting results. While Lang and Lundholm (1993) and Tasker (1998) find a substitutive relation, others, like Imhoff (1978), Waymire (1985), Cox (1985) and Francis, Nanda and Olsson (2008) find a complementary relationship. These conflicting results are mainly attributable to the use of a type of disclosure that do not necessarily captures useful information to investors. Therefore, these disclosures do not lead to improvements in the firm value.

2.2 Earnings quality, segment information and cost of capital

There is an ongoing debate on whether accounting quality decreases cost of capital. Some studies suggest that information asymmetries affect the cost of capital. As accounting quality reduces information asymmetries, it affects the cost of capital (Easley and O'Hara, 2004). More recently, several studies demonstrate that information differences across investors affect a firm's cost of capital through information precision, and not information asymmetry per se, and once one controls for information precision,

information asymmetries have no effect on the cost of capital (Hughes et al., 2007; Lambert et al., 2007, 2008). In the empirical literature the results are mixed. While Bhattacharya, Daouk and Welker (2003), Francis, LaFond, Olsson and Schipper (2004, 2005) and Francis et al. (2008) find a negative relation between accounting quality and cost of capital, others like Core, Guay and Verdi (2008) or McInnis (2008) fail to find any relation between several proxies of accounting quality and cost of capital.

The provision of accurate information is the key element for predicting and estimating firm's risk, which leads to better investment decisions (Lambert et al., 2007, 2008). Given that segment information disaggregates the whole activity of the firm providing details of different business or geographical lines in which the firm is involved, this type of information is crucial for investors and analysts. However, the quantity of segment disclosure is only capturing the degree of diversification and not the quality of the disclosure itself. That is, quantity of segment disclosure is not a good indicator of investors being able to estimate firm's cash flows more accurately. Conversely, a measure of quality of segment disclosure that controls for the degree of diversification (both at the industry and geographical level) captures whether the firm provides more segmental information than expected given its degree of diversification. Such measure of quality of segment disclosure will be a good indicator of investor's capability to estimate firm's cash flows, which in turn reduce the estimation risk. However, this reduction can only happen when the quality of segment disclosure goes in hand with accounting numbers that provide a true and fair view of the situation of the firm. In this case segment information quality will really contribute to facilitate the estimation of firm's cash flows. This leads to our second hypothesis:

> *Hypothesis 2: Firms providing better segment information, contingent upon high earnings quality, are expected to be rewarded with a lower cost of capital.*

3. RESEARCH DESIGN

3.1 Creation of an index of quantity of segment disclosure (Qtt_Seg)

To elaborate our own index for the quantity of segment disclosure (*Qtt_Seg*), we analyze disclosures on both business and geographic segments. In a first step, for every mandatory reported business/geographic segment in each firm, we analyze whether they provide information on the compulsory SFAS 131 items and on additional items from the balance sheet and the income statement (See the Appendix for detailed information). Next, we collect all items provided for every voluntary business/geographic segments, and we create the business/geographic segment score by adding 1 point for every voluntary disclosed item in every business (*Qtt_Seg_Bus*)/geographic (*Qtt_Seg_Geo*) segment. Finally, we create the overall index on quantity of voluntary segment disclosure (*Qtt_Seg*) by adding the business and geographic segment scores.

3.2 Determinants of segment information and creation of an index of quality of segment disclosure (Qlt_Seg)

To explore if earnings quality is a determinant factor in explaining segment disclosure policy, we regress a fixed effect model of quantity of segment information *(Qtt_Seg)* on earnings quality, the main determinants of segment disclosures (business and geographic diversification as well as information asymmetries) and controls. The model is as follows:

$$\begin{aligned} Qtt\ Seg_{j,t} = {} & \alpha + \beta_1\, Earnings\ Quality_{j,t} + \beta_2\, Business\ Diversification_{j,t} + \\ & + \beta_3\, Geographic\ Diversification_{j,t} + \beta_4\, Information\ Asymmetries_{j,t-1} + \\ & + \beta_5\, Size_{j,t} + \beta_6\, Growth_{j,t} + \beta_7\, Leverage_{j,t} + \beta_8\, Audit\ Firm_{j,t} + \\ & + \beta_9\, Listing\ Status_{j,t} + \beta_{10}\, Proprietary\ Costs_{j,t} + \\ & + \beta_{11}\, New\ Financing_{j,t} + \beta_{12}\, Profitability_{j,t} + \beta_{13} Age_{j,t} + \\ & + \Sigma_k\, \beta_k\, Control\ year_{j,t} + \varepsilon_{j,t} \end{aligned} \quad (1)$$

We take the residuals of Model (1) as our proxy of the quality of segment reporting. We expect that when firms provide more (less) information than predicted by the model, they will contribute to improve (reduce) investors' ability to estimate their

cash flows. Our final proxy for segment disclosure quality, *Qlt_Seg* is a discrete variable defined in terms of the decile ranks in which the residuals of regression (1) are distributed. Large values of *Qlt_Seg* indicate better segment information quality.

3.2.1 Earnings Quality

Hypothesis 1 predicts earnings quality will contribute to increase disclosure levels. Given this, we expect a positive relation between proxies for earnings quality and *Qtt_Seg*. To estimate earnings quality, we use the modified Jones model as defined by Dechow, Sloan and Sweeney (1995):

$$\frac{TA_{j,t}}{Assets_{j,t-1}} = \alpha_{i,j}\left[\frac{1}{Assets_{j,t-1}}\right] + \beta_{i,j}\left[\frac{\Delta REV_{j,t}}{Assets_{j,t-1}}\right] + \gamma_{i,j}\left[\frac{PPE_{j,t}}{Assets_{j,t-1}}\right] + \varepsilon_{j,t} \qquad (2)$$

where: $TA_{j,t}$[1] is firm j's total accruals in year t, $Assets_{j,t}$ is firm's j total assets (Compustat #6) at the beginning of year t; $\Delta REV_{j,t}$ is firm's j change in revenues (Compustat #12) between year t-1 and t; $PPE_{j,t}$ is firm's j gross property, plant and equipment (Compustat #7) in year t.

We estimate equation (2) using data annually for each 2-digit SIC industry groups. Next, for each firm j, we calculate its discretionary accruals as:

$$DA_t = \frac{TA_{j,t}}{Assets_{j,t-1}} - \left(\hat{\alpha}_{i,j}\left[\frac{1}{Assets_{j,t-1}}\right] + \hat{\beta}_{i,j}\left[\frac{\Delta REV_{j,t} - \Delta AR_{j,t}}{Assets_{j,t-1}}\right] + \hat{\gamma}_{i,j}\left[\frac{PPE_{j,t}}{Assets_{j,t-1}}\right]\right) \qquad (3)$$

where: $\hat{\alpha}, \hat{\beta}, \hat{\gamma}$ = the fitted coefficients in model (2) and $\Delta AR_{j,t}$ is the change in account receivables for firm j (Compustat #2) in year t.

We use the absolute values of *DA,* multiplied by minus one, as our main proxy for earnings quality. Large values correspond to good accrual quality (*Earnings_Qlt*), that is, less discretionary accruals.

[1] Measured as $\Delta CAj,t - \Delta CLj,t - \Delta Cashj,t + \Delta STDEBTj,t - \Delta DEPNj,t$; $\Delta CAj,t$ is firm j's change in current assets (Compustat #4) between year t-1 and year t; $\Delta CLj,t$ is firm j's change in current liabilities (Compustat #5) between year t-1 and year t; $\Delta Cashj,t$ is firm j's change in cash (Compustat #1) between year t-1 and year t; $\Delta STDEBTj,t$ is firm j's change in debt in current liabilities (Compustat #34) between year t-1 and year t; $\Delta DEPNj,t$ firm j's depreciation and amortization expense (Compustat #14) in year t.

3.2.2 Business diversification

We include business diversification as a determinant of segment disclosure as more diversified/complex firms are expected to report information on a larger number of business segments than less diversified ones. To create an index of business diversification we use the primary and secondary SIC codes that Compustat assigns to each firm.[2] For every firm, we create the business diversification score by assigning 1 point for every different 2-digit SIC code assigned by Compustat to the firm as forming part of its primary or secondary activities.

3.2.3 Geographic diversification

We include geographic diversification as a determinant of segment disclosure. We define our geographic diversification index as the number of different countries where the firm has subsidiaries[3]. For example: if a given company X has four subsidiaries, one in Spain, one in Italy and two in Croatia, we assign to this company a geographic diversification score of 3, as there are three different countries in which it has subsidiaries.

3.2.4 Information asymmetries

Healy and Palepu (2001) suggest that the demand for disclosure arises from information asymmetries and agency conflicts between managers and outside investors. Managers disclose information to reduce information asymmetries. Given this, we include a proxy for information asymmetries, the bid-ask spread, as a determinant of segment disclosure. We measure the bid-ask spread as:

[2] Compustat assigns a four-digit Primary SIC code to each firm by analyzing the product line breakdown that firms provide in each 10-K. The assigned classification is reviewed each year when the company is updated.

[3] We use subsidiaries information from Osiris. We take into account subsidiaries with a minimum of 25,01% of control by the company under analysis.

$$Spread_{j,t} = \frac{|bid_{j,t} - ask_{j,t}|}{(bid_{j,t} + ask_{j,t})/2} \quad (4)$$

where: $bid_{j,t}$ is the firm's j annual mean of the monthly bid prices for year t, and $ask_{j,t}$ is the firm's j annual mean of the monthly ask prices for year t.

3.2.5 Controls

Size, Growth and Leverage

Previous literature finds that corporate size is significantly and positively associated with disclosure levels. That is, larger companies disclose more (Buzby, 1975; Diamond and Verrechia, 1991, Giner, 1997). This relation also holds for segment disclosure levels (Leuz, 2004). We measure firm size as the natural logarithm of firm's market value, measured at the beginning of the fiscal year. We also include firm's growth, measured as the logarithm of the firm's book to market ratio at the beginning of the fiscal year (Nagar, Nanda and Wysocki, 2003). With respect to leverage, prior studies analyzing its relation with disclosure levels find mixed results (Chow and Wong-Boren, 1987; Wallace, Naser and Mora, 1994; Leuz and Verrechia, 2000). Jensen and Meckling (1976) argue that leveraged firms incur in larger monitoring costs. To reduce these costs they are expected to increase disclosure. We measure leverage as the ratio of total debt to total assets.

Audit firm, Stock Exchange Status and Proprietary costs

Whether the firm is a Big Four client or a non-Big Four client has an impact in disclosure levels (Wallace et al., 1994, Hope, 2003). Large and well-known audit firms pressure their clients for better disclosure. To capture variation in pressures for additional disclosure coming from the auditing firms, we include and auditor dummy variable taking the value of 1 if the auditor is a Big Four firm, and 0 otherwise. Regarding where the firm is listed, Wallace et al. (1994) and Leuz and Verrechia (2000)

find a significant relation between disclosure and the listing status of the firm. We control for this including a dummy variable taking the value of 1 if the firm is listed in the NYSE or in NASDAQ, and 0 otherwise. Proprietary costs influence segmental disclosures (Botosan and Standford, 2005). Thus, we include the Herfindahl index as a proxy for proprietary costs. We calculate the industry concentration using the following Herfindhal index:

$$Herf_j = \sum_{i=1}^{N} \left(\frac{S_{ij}}{S_j} \right)^2 \quad (5)$$

where S_{ij} = Business i's sales (segment i's sales) in industry j, as defined by two-digit SIC code; S_j = The sum of sales for all businesses in industry; S_{ij}/S_j = Business i's market j share; N = The number of businesses in industry j.

The greater (lower) $Herf_j$, the higher the current level of industry concentration (competition) for industry j.

New financing, Profitability and Age

We expect that if the firm is looking for additional capital funds managers will be more likely to provide additional disclosure in an attempt to reduce the costs of these new financing sources (Barry and Brown, 1984, 1985, 1986; Sengupta, 1998; Healy, Hutton and Palepu, 1999, Ahmed, Billings, Morton and Stanford-Harris, 2002; Easley and O'Hara, 2004; Gietzmann and Ireland, 2005). Accordingly, we include a dummy variable taking the value of 1 if the firm raised new capital funds or increased debt in a given year, and 0 otherwise. Additionally, we include profitability, measured as return on assets (ROA), as an additional control variable. Finally, we include firm age, measured as the difference between the current year and the first year in which the firm appears in CRSP database.

3.3 Testing the relation between cost of capital and the quality of segment disclosure

We use four different sets of tests to analyze the relation between cost of capital and the quality of segment information. First, we study if higher segment information quality facilitates predictions about firm's future cash flows by analyzing whether such information reduces analysts' forecast errors. Second, we test if higher segment information quality reduces the firm's assessed covariance with sector firms' returns, which in Lambert et al. (2007) setting will lead to a reduction in the cost of capital. Third, we use an implied cost of capital measure to study the relation between segment information quality and cost of capital, and finally, we investigate whether market participants are pricing segment information quality.

3.3.1 Analysts' forecast errors

More comprehensive segment information is useful for analysts because it helps to predict more accurately earnings per share (Hopwood et al., 1982; Silhan, 1983; Baldwin, 1984; Swaminathan, 1991; Balakrishnan et al., 1990; Hussain, 1997). Finger (1994) and Dechow (1994) among others, find that earnings help to predict firm's cash flows. Thus, as a first initial test of Hypothesis 2, we study whether better quality segment disclosure, having good earnings quality, reduces analysts' forecast errors. To do so, we use the following model, estimated with industry fixed effects:

$$\begin{aligned} Forecast\ error_{j,t} = {} & \alpha + \beta_1 Qlt\_Seg_{j,t} + \beta_2 DummyEarningsQuality_{j,t} + \\ & + \beta_3 Qlt\_Seg_{j,t} * DummyEarningsQuality_{j,t} + \\ & + \beta_4 Number\ analysts_{j,t} + \beta_5 DesvForecast_{j,t} + \\ & + \beta_6 Size_{j,t} + \Sigma_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t} \end{aligned} \quad (6)$$

The coefficient of interest in Equation (6) is β_3. A negative coefficient would mean a reduction in forecast error when segment information quality increases and earnings quality is high (above the median for the sector and year), that is, when segment information quality and earnings quality complements each other to reduce

forecast errors. We include the number of analysts following the firm as a control as prior research shows that this variable is associated to smaller forecast errors. Consequently, we expect a negative and significant β_4 coefficient. We also include the deviation of forecasts as a control, as prior research shows this is associated to higher forecast errors. This means a positive and significant β_5 coefficient. Finally, we include firm size as prior research shows this is associated to lower forecast errors (negative β_6 coefficient).

3.3.2 Firm's assessed covariance with other firms' returns

In the Lambert et al. (2007) setting, the quality of accounting information can influence the cost of capital. They show that higher quality disclosures reduce the firm's assessed covariance with other firms' cash flows, which is non-diversifiable, and in turn, it reduces cost of capital. To test it empirically, we use actual returns as our proxy of firm's future cash flows, since returns are, by definition, the present value of expected future cash flows of the firm. We define the firm's assessed covariance with returns of firms in the same sector as an empirical proxy for the firm's assessed covariance with other firms' cash flows. We measure it as the mean of annual covariance between monthly returns of the firm and monthly returns of the sector in which firm operates. With this test, we analyze whether better quality segment disclosure, conditional to high earnings quality, reduce the firm's assessed covariance with other firms' returns in the same sector, which in turn contributes to reduce the cost of capital. Then, we use the following model, estimated with industry fixed effects:

$$\begin{aligned} Cov(r_i, r_{sector})_{j,t} = {} & \alpha + \beta_1 Qlt\_Seg_{j,t} + \beta_2 DummyEarningsQuality_{j,t} + \\ & + \beta_3 Qlt\_Seg_{j,t} * DummyEarningsQuality_{j,t} + \beta_4 Size_{j,t} + \\ & + \beta_5 Booktomarket_{j,t} + \beta_6 Herf_{j,t} + \beta_7 Leverage_{j,t} + \\ & + \beta_8 BusinessDiversification_{j,t} + \beta_9 GeographicDiversification_{j,t} + \\ & + \beta_{10} ListingStatus_{j,t} + \beta_{11} Profitability_{j,t} + \beta_{12} Age_{j,t} + \\ & + \Sigma_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t} \end{aligned} \quad (7)$$

The coefficient of interest in Equation (7) is β_3. A reduction in risk due to increases in information quality, contingent upon good earnings quality, will mean a β_3 significantly negative. That is, if segment information quality and earnings quality complements each other to reduce the assessed covariance with sector firms' returns, β_3 will be significantly negative.

Regarding the control variables in Equations (7), previous literature finds that size, industry concentration, age, listing status and diversification of the firm decrease firm's beta (Subrahmanyam and Thomadakis, 1980; Fama and French, 1992, 1993, Caves, 1982; Kim, Hwang and Burgers, 1989; Lubatkin and Rogers, 1989; Harvey, 1991 Kim Hwang and Burgers, 1993; Qian, 1996). In the same way, we include book-to-market, leverage and profitability, as previous literature finds that beta increases with these variables (i.e. Fama and French, 1992, 1993).

3.3.3 Implied cost of capital tests

The third set of tests consists of regressing a measure of implied cost of capital on quality of segment disclosure, high earnings quality, the interaction between quality of segment disclosure and high earnings quality and control variables commonly used in the cost of capital literature: size, the book-to-market ratio, beta, long term growth, leverage and diversification. To explore whether segment information quality reduces cost of capital contingent upon high earnings quality, we estimate the following model using industry fixed effects:

$$\begin{aligned} r_{PEG\,j,t} = {} & \alpha + \beta_1 Qlt\_Seg_{j,t} + \beta_2 DummyEarningsQuality_{j,t} + \\ & + \beta_3 Qlt\_Seg_{j,t} * DummyEarningsQuality_{j,t} + \beta_4 Size_{j,t} + \\ & + \beta_5 Booktomarket_{j,t} + \beta_6 Beta_{j,t} + \beta_7 Leverage_{j,t} \\ & + \beta_9 BusinessDiversification_{j,t} + \beta_{10} GeographicDiversification_{j,t} + \\ & + \Sigma_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t} \end{aligned} \tag{8}$$

The coefficient of interest in Equation (8) is β_3. A reduction in cost of capital related to increases in segment information quality, contingent upon good earnings quality, will lead to a β_3 significantly negative. That is, if segment information quality and earnings quality complements each other to reduce the cost of capital, β_3 will be significantly negative.

As a proxy for implied cost of capital we use the PEG ratio proposed by Easton (2004) as follows:

$$r_{PEG} = \sqrt{\frac{eps_5 - eps_4}{P_0}} \tag{9}$$

where: eps_t is earning per share in year t. We use five-year long-term growth rates from I/B/E/S to calculate eps_4 and eps_5. P_0 is the market price of a firm's stock. Pastor, Sinha and Swaminathan (2008) find that implied cost of capital proxies based on analysts' forecasts capture well variation in cost of capital. At the same time, Botosan and Plumlee (2005) find that the PEG ratio is positively related to risk measures, and, consequently, it is a good proxy of implied cost of capital. To calculate it, Botosan and Plumlee (2005) use earnings per share forecasts in years 4 and 5 because this proxy requires positive changes in forecasted earnings and changes between years 4 and 5 in forecasted earnings are more likely to be positive rather than changes in near-term forecasts.

Regarding the control variables in Equations (8), previous literature finds that increases in size lead to a decrease in the cost of capital (Fama and French, 1992, 1993; Hail and Leuz, 2006). We measure size as the logarithm of market value. The market perceives high-growth firms as riskier, consistent with the asset pricing theory. Consistently, we also include the log of the book-to-market ratio (Fama and Frech, 1992, 1993; Gebhardt, Lee and Swaminathan, 2001; Hail and Leuz, 2006) because it is

expected to increase the cost of capital. Also, the CAPM suggests that market beta should be associated with the cost of equity. Then, we include beta, measured as the coefficient from firm-specific CAPM regressions of firm's returns, using the 60 months preceding fiscal year t, and a value weighted NYSE/AMEX/Nasdaq as market index return. Additionally, we include leverage, as it drives cost of capital upwards (Modigliani and Miller, 1958; Fama and French, 1992, 1993). Finally, we include firm's diversification, as it is associated with lower risk (Caves, 1982; Kim et al., 1989; Lubatkin and Rogers, 1989; Harvey, 1991, Kim et al., 1993; Qian, 1996).

3.3.4 Asset pricing tests

In addition to the implied cost of capital-based tests to study whether quality of both segment information and earnings are associated to lower cost of capital, we use the Fama and French Three Factor Model (1992, 1993), which has recently been applied in the accounting literature (Core et al., 2008; Francis et al., 2008, McInnis, 2008) to study the relation between cost of capital and proxies for the quality of accounting information. If segment information quality and earnings quality are priced risk factors, then each of them should be related to average stock returns.

We group firms into portfolios, as realized returns employing cross-sectional tests are noisy at the firm level[4]. We include size (SMB) and book-to-market (HML) portfolios as in Fama and French (1992, 1993). We also include the excess market return (RMRF)[5]. Each month, from 1/1/2001 to 12/31/2006, we create a hedge portfolio based on the earnings quality measure, buying 20% of firms providing the best earnings

[4] One criticism of cross-sectional tests is that realized returns are noisy, particularly at the firm level. That is, firm-specific news may be so huge and include any pattern that exists in realized returns related to accounting quality. To deal with this concern, we perform portfolio time-series regressions in the tradition of Black, Jensen and Scholes (1972).

[5] Factors of Fama-French Three Factor Model are extracted from Kenneth R. French's webpage. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

quality and selling 20% of firms providing the worst earnings quality. Then we estimate the following time series regression for the hedge earnings quality portfolio:

$$R_{jt} - R_t^f = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_t \quad (10)$$

In this model, α represents the average excess return of the one predicted by the firm's sensitivity to the risk factors in the model. If the model is properly specified (that is, it includes all risk factors that affect the firm), the estimated α should be zero (Black, Jensen and Scholes, 1972). However, if the model omits a risk factor, then portfolios with greater exposure to that factor will have higher α, because they have greater average excess return unexplained. If earnings quality is a risk factor, and it is orthogonal to beta, size and book-to-market effects, then we should observe increasing estimates of α in equation (10) as we move from good to poor earnings quality portfolios, so we expect a negative and statistically significant α of the hedge portfolio (long on firms providing the best accounting quality and short on those with the worst accounting quality).

We perform the same analysis for the hedge segment information quality portfolio, buying 20% of firms providing good segment information and selling 20% of firms providing poor segment information.

Finally, we estimate the time series regressions in Equation (10) for the hedge accounting information quality portfolio, (Acc_Qlt) that contemplates earnings quality as well as segment information quality. To build this new variable, first, we create a dummy variable of earnings quality: we rank earnings quality according to the median, and we assign 1 if a firm provides earnings quality above the sector-year median and 0 otherwise. Second, we create a dummy variable of segment information quality: we assign 1 if the residuals of model 1 are positive and zero otherwise. Finally we sum these two dummy variables to measure overall accounting information quality

(Acc_Qlt). We create the hedge Acc_Qlt portfolio buying firms providing good segment information and good earnings quality (*Acc_Qlt*=2) and selling firms not providing neither good segment information, nor earnings quality (*Acc_Qlt*=0). As before, we expect a negative and statistically significant α of the hedge portfolio of both, segment information quality and accounting information quality.

In addition, we investigate if earnings quality and segment disclosure quality, separately or together, have an influence over firms' realized returns. To do this we create a HILO*Earnings_Qlt* factor, a HILO*Qlt_Seg* factor and HILO*Acc_Qlt* factor. The HILO*Earnings_Qlt* factor is the return of the accruals quality factor-mimicking portfolio for earnings quality. We rank Earnings_Qlt into quintiles and we take a long position on the two quintiles with the best accrual quality and a short position in the two quintiles with the worst accrual quality. We perform the same analysis for the HILO*Qlt_Seg* factor, taking a long position on the two quintiles with the best segment information –larger values of residual in equation (1)– and a short position in the two quintiles with the worst segment information lower values of residual in equation (1). Finally, the HILO*Acc_Qlt* factor is the return of the accounting information quality factor-mimicking portfolio for *Acc_Qlt*, in which we take a long position on the firms with the best accounting information –firms providing good segment information and good earnings quality– and a short position in the portfolio with the worst accounting information –firms not providing neither good segment information, nor earnings quality–. We then use a two-stage cross-sectional regression approach, where excess returns are regressed on risk factor betas.

In the first stage, we estimate multivariate betas from 25 portfolios shorted on B/M and Accounting Quality[6] using a time-series regression of excess returns for a

[6] The portfolios are the intersections of 5 portfolios formed on the ratio of book equity to market equity and 5 portfolios formed on the interaction between Qlt_Seg and DummyEarningsQlt.

portfolio on the contemporaneous returns to the Fama–French factors, the earnings quality factor and the segment disclosure quality factor:

$$R_{pt} - R_t^f = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 HILOQlt\_Seg_t + \\ + \beta_5 HILOEarnings\_Qlt_t + \varepsilon_t \quad (11)$$

where $R_{p,t}$ is the return of portfolio p for month t. RMRF is the monthly excess return on the value-weighted NYSE/AMEX market index return from CRSP. SMB (Small minus Big) is the monthly return of small firms over big firms, and HML (High minus Low) is the monthly return of high BM firms over low BM firms. HILO*Qlt_Seg* is the monthly return of good quality segment disclosure firms over poor quality segment disclosure firms and HILO*Earnings_Qlt* is the monthly return of good earnings quality firms over poor earnings quality firms.

To test whether combining segment information quality and earnings quality has a larger impact in excess returns than earnings quality and segment information quality separately, we estimate multivariate betas from a single time-series regression of excess returns for a firm on the contemporaneous returns to the Fama–French factors and the factor that combines the earnings quality factor and the segment information quality factor:

$$R_{pt} - R_t^f = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 HILOAcc\_Qlt_t + \varepsilon_t \quad (12)$$

where all variables are the same as those in Equation (11) and HILO*Acc_Qlt* is the monthly return of good accounting information quality firms over poor accounting information quality firms.

In the second stage, we collect the portfolio-specific loadings from (11) and (12), respectively, and estimate the factor premium conditional on the first stage loadings with cross-sectional regression using the Fama and MacBeth (1973) procedure

to mitigate concerns about cross-sectional dependence in the data. The model for the earnings quality factor and the quality of segment information factor is as follows:

$$\overline{R_{pt} - R_t^f} = \alpha + \delta_1 \beta_{RMRF} + \delta_2 \beta_{SMB} + \delta_3 \beta_{HML} + \delta_4 \beta_{Qlt\_Seg} + \delta_5 \beta_{Earnings\_Qlt} + \varepsilon_t \qquad (13)$$

Firms providing better earnings quality and better segment information quality should enjoy lower cost of capital, so δ_4 and δ_5 are expected to be negative.

Finally, the test of whether firms providing better segment information quality complemented with better earnings quality enjoy lower cost of capital is conducted estimating the following model:

$$\overline{R_{pt} - R_t^f} = \alpha + \delta_1 \beta_{RMRF} + \delta_2 \beta_{SMB} + \delta_3 \beta_{HML} + \delta_4 \beta_{Acc\_Qlt} + \varepsilon_t \qquad (14)$$

Consistently with the individual analysis of earnings quality and segment information quality, we expect that firms providing better overall accounting information quality have smaller excess returns. Consequently, we expect a risk premium –δ_4– to be significantly negative. This means, in accordance to our implied cost of capital tests, that firms providing good segment information quality complemented with good earnings quality will enjoy a higher reduction in cost of capital.

3.4 Sample Selection

We extract a sample of non financial and non regulated firms from the Compustat annual files, for the period 2001 to 2006, with the necessary data to calculate the earnings quality measures and all variables needed for our disclosure tests. The number of subsidiaries, used to calculate our proxy for geographic diversification, is extracted from BvD Osiris[7]. Market data are extracted from CRSP and analysts data from I/B/E/S. Our final sample comprises 10,002 firm-year observations with data on

[7] We assume the number of subsidiaries does not change if the data is not available for one year. (i.e., if a firm has no data for 2004, we assume that the number of subsidiaries is equal to that of 2005) Results are robust to the use of a smaller sample in which we drop firms with no available data on the number of subsidiaries in all the years of the sample.

all variables to run all of our tests. We exclude observations with missing data from any of the variables needed. To mitigate the undesirable effect of outliers, we delete the top and bottom percentile of the distributions of all variables.

The mean (median) number of items reported by our sample firms is 42.25 (39), with a standard deviation of 20.29 (Table 1). Note that the standard deviation is high, but it is mainly due to the different number of reported segments among firms. The minimum items disclosed are 10 while the maximum are 149 (not tabulated). Data indicate substantial variation in voluntary segment disclosure levels across the sample firms. Regarding accruals quality, the mean and median values are slightly larger than those reported in previous studies (i.e., the mean and median abnormal discretionary accruals using the modified Jones model in Francis et. al (2008) are, respectively, 0.0159 and 0.0123, while is our study they are -0.0743 and -0.0349 –negative values because we multiplied them by -1–). Mean leverage is 20.19%, indicating that our sample firms are relatively low leveraged, but are issuing new debt or equity to finance their projects (mean value of Newfin=0.88). Also, most of our sample firms are audited by Big-4 firms, and are listed in NYSE or Nasdaq.

4. RESULTS

4.1 The relation between earnings quality and segment disclosure

In Table 2 we show the pairwise correlations between *Qtt_Seg*, earnings quality, and firm characteristics. Earnings quality is significantly and positively related to *Qtt_Seg* (22%). This is preliminary evidence of the complementary relation between earnings quality and quantity of voluntary disclosure, as we predict in hypothesis 1. Much as expected, business diversification and geographic diversification are very strongly correlated with *Qtt_Seg* (31 and 10% respectively). Also, information

asymmetries (the bid-ask spread) is, as expected, positively correlated with *Qtt_Seg* (2.8%).

In Table 3 we show the results of an industry fixed effect regression of Qtt_Seg, our proxy for the quantity of segment disclosure, on the determinants of segment disclosure. In the first column, we only include the controls. We find that the quantity of segment disclosure (Qtt_Seg), as expected, increases with firm size, the book to market ratio, leverage, being audited by a big-four firm, being listed in NYSE or NASDAQ, issuing new financing and firm age, and decreases with profitability and proprietary costs. All of the firm controls are significantly associated with quantity of segment information at conventional levels. These results corroborate that our index of voluntary segment information (Qtt_Seg) is a valid measure of disclosure.

In the second column of Table 3 we show the results of estimating Equation (1). Results confirm that β_1 is positive and significant (β_1=8.06 –p-value =0.000–). This confirms the complementary relation between earnings quality and segment disclosure. Results also point out that, independently of the level of earnings quality, firms operating in a higher number of sectors provide more comprehensive segment information, as well as those firms operating in a higher number of countries. Finally, we have found that firms with higher information asymmetries provide more segment information. Our results are robust to the use of other earnings quality measures[8], and to the use of geographic and business segment quantity measures separately instead of the aggregate measure *Qtt_Seg*. Concerning to the fitness of the model, the results show that determinants of disclosure explain a significant amount of the variation in *Qtt_Seg* (around 30%).

[8] Based on the absolute values of the residuals of the Jones (1991), Dechow and Dichev (2002) and McNichols (2002) models, and on the standard deviation of the residuals of the Jones, modified Jones and Dechow and Dichev models, calculated at the firm level using rolling windows of ten years as in Francis et al. (2004).

4.2 The relation between segment disclosure and cost of capital

4.2.1. Forecast errors and segment disclosure

In Table 4 we show the results on whether segment disclosure reduces analysts' forecasts errors. In the first column of the table we show the results of the regression of forecast errors on quantity of segment information, analysts' following, deviation of forecasts and size. As mentioned in the theoretical section, we do not expect quantity of segment disclosure to be a good indicator of investors being able to estimate firm's cash flows more accurately. The results show a mean estimate of β_1 = -0.0001 (p-value 0.275), so, as expected, we do not find a significant relation between quantity of segment information and forecast errors. However, when we use segment disclosure quality instead of quantity (columns two and three), the results show a negative and significant coefficient on quality of segment disclosure (β=0.0074 and p-value=0.006 when we do not control by earnings quality and β=0.0073, p-value=0.000 when we control by earnings quality). So, we find that better quality segment information reduces forecast errors. We also find that having earnings quality above the median also contributes to a decrease in forecast errors.

Finally, in the last column of Table 4 we include in the specification the interaction between segment disclosure quality and earnings quality. We expect that the coefficient of this interaction $-\beta_3$ in specification (6)– is significant and negative, indicating that the reduction in forecast errors as the quality of segment information increases, is larger when earnings quality is high. The results show a mean estimate of -0.0146 (p-value 0.023). Now, the coefficient of segment quality is not significant any more, indicating that only firms with better quality of segment information and high earnings quality facilitate earnings forecasting, and hence, only with better quality of segment information and high earnings quality, firms facilitate the predictions about

firms' future cash flows. In fact, when segment information is of high quality and earnings quality is not, the result is the opposite (positive coefficient of Qlt_Seg in column 4). Thus, superior levels of voluntary disclosure when accounting numbers are of bad quality generate more uncertainty and have damaging effects on forecasts. Another explanation could be that once we include interaction effect, as firms will not have incentives to provide high segment information quality, as given that the information that it disaggregates is not reliable, this coefficient will be only capturing firms providing poor segment quality information, which is not useful for analyst in making their forecasts.

The F-ratio test on the R^2 increment is statistically significant at p-value 0.04 (no tabulated), so we should take into account that quality of segment information and earnings quality are related when we explain their effect on the forecasts error. Given this result, we expect firms providing high segment disclosure quality will enjoy lower cost of capital only when earnings quality is high.[9] T

4.2.2. Firm's assessed covariance with other firms' returns and segment quality

In Table 5 we show the results on whether segment disclosure reduces firm's assessed covariance between firm' returns and returns of these firms operating in the same sector. In the first column of the table we show the results of the regression of covariance between firm' returns and returns of firms in the same sector, on quantity of segment information and controls. As before, we do not expect quantity of segment disclosure reduce the risk of the firm, because giving more information does not necessarily means more accurate information. The results confirm this statement as the coefficient of Qtt_seg = -0.0006 (p-value 0.184) is not significant. When we use

[9] We do the same analysis for business segment information quality and geographic segment information quality (no tabulated). The results show that firms providing good business segment information quality, complemented with good earnings quality reduce their forecast error, as well as those firms providing good geographic segment information quality, complemented with good earnings quality.

segment disclosure quality instead of quantity (columns two and three), the results show a negative and significant coefficient on quality of segment disclosure. So, we find that better quality segment information reduces assessed covariance with sector firms' returns. We also find that having earnings quality above the median also lead to a reduction in the risk of the firm.

Finally, in the last column of Table 5 we include the interaction between segment disclosure quality and earnings quality. We expect that the coefficient of this variable is significant and negative, indicating that when firms have higher earnings quality, the quality of segment information reduce the risk to a larger extend than when earnings quality is low. The results show a mean estimate of -0.0023 (p-value 0.004). However, the coefficient of segment disclosure quality is not significant at conventional levels, indicating that when segment information quality and earnings quality does not complement each other to reduce the estimation risk, segment disclosure quality does not reduce it. As before, it seems that superior levels of voluntary disclosure when accounting numbers are of bad quality does not provide useful information to investors, or it can be that firms providing poor earning quality do not provide high segment quality information. The F-ratio test on the R^2 increment is statistically significant at p-value 0.0002 (no tabulated), so we should take into account that quality of segment information and earnings quality are related when we explain their effect on the estimation risk. These findings suggest that firms with better quality of segment information provided the earnings quality is high, reduce the estimation risk of the firm. In Lambert et al. (2007) setting, these results are consistent with that firms providing high quality segment disclosure, contingent upon high earnings quality will enjoy lower cost of capital.[10]

[10] Our results are robust to the separate use of business segment information quality and geographic segment information quality (no tabulated).

4.2.3. Ex-ante cost of capital estimates and segment disclosure

In Table 6 we show the pairwise correlations between the main variables of interest for the tests where we study the relation between segment disclosure and ex-ante estimates of firms' cost of capital. Quantity of segment information *(Qtt_Seg)* is not related to the cost of capital (r_{PEG}) in a significant way (-0.33%), which is a signal that firms providing larger quantities of segment information do not reduce their cost of capital. On the other hand, we have found that quality of segment information *(Qlt_Seg)* is negatively and significantly associated with r_{PEG} (12.83%), which suggests that firms with better quality segment disclosure enjoy a lower cost of capital, as we predict in Hypothesis 2. As expected, earnings quality is negatively related with r_{PEG} (12.36%) indicating that firms with good earnings quality enjoy lower cost of capital.

In Table 7 we show results of regression of implied cost of capital on segment information quality, high earnings quality, interaction between segment information quality and high earnings quality, and controls. In the first column of this table we validate our proxy for the ex-ante cost of capital. We find that the cost of capital decreases with firm size and firm' diversification and increases with the book to market ratio, beta and leverage. These results, consistent with the evidence in Botosan and Plumlee (2005), suggest r_{PEG} is a valid proxy for cost of capital, as it has the expected relation with all of the already mentioned risk proxies.

In this table we also show the results on whether segment disclosure reduces cost of capital. In the second column of the table we show the results of the regression of ex-ante cost of capital on quantity of segment information and controls. As expected, the coefficient on *Qtt_Seg* is not significant (-0.0002, p-value 0.264), so we fail to find any significant relation between quantity of segment information and cost of capital. When we use segment disclosure quality instead of quantity (columns three and four), the

results show a negative and significant coefficient on quality of segment disclosure. So, we find that better quality segment information reduces cost of capital. In addition, we find a negative coefficient on earnings quality (-0.0139), and significant (p-value 0.000). The inclusion of earnings quality in the model does not eliminate the impact of segment disclosure quality in reducing the cost of capital (the coefficient on *Qlt_Seg* is still negative and significant at conventional levels).

Finally, in the last column of Table 7 we include in the estimation the interaction between segment disclosure quality and earnings quality. The results show that the coefficient of this interaction term is negative -0.0032 and significant (p-value 0.000). Also, consistently with the previous tests on firm's risk, the coefficient on segment disclosure quality when accounting quality is not high becomes not significant. The F-ratio test on the R^2 increment is statistically significant at p-value 0.000 (no tabulated), so we should take into account that quality of segment information and earnings quality are related when we explain their effect on the cost of capital. This result suggests that only firms with better quality segment information and high earnings quality enjoy a lower cost of capital[11].

4.2.4. Asset-pricing-based tests of the relation between segment disclosure and cost of capital

In Table 8, Panel A we show that the descriptive statistics for the variables used in the asset pricing tests. We can see that the excess market return is positive in our sample, and that smaller and high book-to-market firms have higher returns than larger and low book-to-market firms. Firms presenting better accounting quality have lower returns (cost of equity capital) than firms presenting lower accounting quality. This result is consistent with that on size given the high correlation between size and

[11] Our results are robust to the use of geographic and business segment quality measures instead of the aggregate measure *Qlt_Seg*.

accounting quality. In Panel B we show the pairwise correlations between the factors of the model. We also find a positive relation between returns of earnings quality and quality of segment information (39%).

In Table 9 we explore whether accounting quality (measured as earnings quality –*Earnings Quality*–, segment information quality –*Qlt_Seg*–, and overall accounting quality –*Acc_Qlt*–) is a risk factor and whether it decreases the cost of capital. If accounting quality is a risk factor we should observe a negative and statistically significant α of the hedge portfolio (long on firms providing good accounting quality and short on those providing poor accounting quality). In column three of this table, the results show an α= -0.00052 (p-value 0.000), then accounting quality is an omitted factor in Fama-French Three Factor Model as firms providing poor accounting quality have greater average excess returns unexplained.

In Table 10, we show the results on whether segment disclosure reduces cost of capital using asset pricing tests. We find that the sensibility of portfolios returns on segment information quality is negative. However, when we include earnings quality (in Table 10, column 9), the sensibility of portfolios' return to this factor is not significant anymore (p-value=0.120), while the sensitibity of portfolios' return to segment information quality factor remains significant (p-value=0.067). Unlike the results in Francis et al. (2008), we find that the effect of segment information quality on cost of capital is robust to the inclusion of earnings quality. Finally, in the last column of Table 10 we explore whether overall accounting quality reduces cost of capital and results show that this factor is significant (p-value=0.058). In fact, the added reduction when segment information quality and earnings quality are complementary in the mean cost of capital for 25 portfolios shorted on book-to-market and accounting quality is of -0.0007121 (no tabulated), which is consistent with those results obtained from Table 9.

Our results are robust to the use of the CAPM, and to the inclusion of excess market return, size and book to market factors (the three factor model). The use of geographic and business segment quality factors instead of the aggregate *HILOAcc_Qlt* offers qualitatively similar results (no tabulated).

In Table 11 we present the results of the two-stage regression to obtain the risk premium factors. We find that quality of segment information risk premium is negative (δ_4 =-0.0187; p-value 0.003), that is firms providing better quality segment information enjoy lower excess realized returns. However, earnings quality bears no risk premium anymore (δ_4 =-0.0150; p-value 0.180) when we include the three factors as proposed by Fama and French (1992, 1993), and the quality of segment information factor. This indicates that earnings quality, as we measure it, is not a priced factor. This is consistent with the evidence in Core et al. (2008). We show that the coefficients of market risk premium, size premium and book-to-market premium are consistent with previous empirical evidence. In the last column of this table we show the results for the accounting quality factor –estimation of Equation (14)–. We find that when earnings quality and segment quality information are complementary, this accounting quality factor is, as expected, a priced risk factor (δ_4 =-0.0148; p-value 0.014). These findings suggest that firms with better quality of segment information, when complemented with high earnings quality, enjoy a lower cost of capital. As in the first stage, these results are robust to the use of the CAPM, and to the use of the Fama and French (1992, 1993) three-factor model.

5. SUMMARY AND CONCLUSIONS

In this paper we analyze the relation between segment disclosure and earnings quality, and the effects of improved segment disclosure and earnings quality on cost of capital. We focus on segment disclosure as it is expected to improve investors' ability to

estimate firms' cash flows, and, consequently, to decrease cost of capital within the theoretical framework provided by Lambert et al. (2007, 2008). We create an index of quantity and an index of quality of segment disclosure. Using these indices we (1) find a significant positive association between segment disclosure and earnings quality: firms with better earnings quality have incentives to provide more comprehensive segment information; and (2) provide empirical evidence supporting the claim that through high segment disclosure quality, when earnings quality is high, investors are better able to estimate firm's cash flows more accurately, and, as a result, demand lower returns (lower cost of capital for a firm). Our results regarding the negative relation between segment disclosure and cost of capital are robust to the use of asset pricing based tests and implied cost of capital based tests. We also find that analysts' forecast errors are smaller for firms providing better segment disclosure. In addition, we provide empirical evidence supporting that firms providing higher segment disclosure, conditional of having good earnings quality, reduce the firm's assessed covariance with sector firms', which is non-diversifiable, and in turn, it reduces cost of capital within the theoretical framework provided by Lambert et al. (2007).

Our results contribute to the current debate (Hope and Thomas, 2008), started after the passage of SFAS 131, on whether it is advisable to reduce the amount of geographic segment information that firms are obliged to present. We show that disaggregating information by geographic segments helps estimating firms' future cash flows, and as consequence, improved geographic segment information contributes to lower cost of equity capital.

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APPENDIX: Index of quantity of voluntary segment disclosure

A.1 Distinguishing between mandatory and voluntary segment information

A.1.1. Identifying reportable business segments.

We consider as operating segment based on management reporting system all business segments available in Compustat.

To identify which segments are reportable segments to be disclosed, we begin by investigating if segments meet the quantitative thresholds, according to paragraph 18 of SFAS 131:

"a. Its reported revenue, including both sales to external customers and intersegment sales or transfers, is 10 percent or more of the combined revenue, internal and external, of all operating segments.

b. The absolute amount of its reported profit or loss is 10 percent or more of the greater, in absolute amount, of (1) the combined reported profit of all operating segments that did not report a loss or (2) the combined reported loss of all operating segments that did report a loss.

c. Its assets are 10 percent or more of the combined assets of all operating segments."

If they meet these thresholds we consider directly these segments as reportable segments to be disclosed.

The next step is to sum the revenue of the segments that meet the quantitative thresholds, to know if they account for 75% of consolidated revenue, if they do not, we take additional segments until they account for 75% of consolidated revenue, and we consider these as reportable segments to be disclosed.

Another requirement is, according to the paragraphs 22 and 23 of SFAS 131, to consider reportable segments in a given year those segments considered as reportable in the previous or in the next year (we only meet this requirement if it is possible to do it with data that we have).

Finally, we take into account every year that the maximum number of reportable segments is ten, so we consider only a maximum of ten reportable segments each year (those identified in Compustat in line of business, because there is an item identifying these ten business segments (Business segments-Actual Number)), considering as prevalent paragraph 18 over 22-23 in case that the number of business segments exceeds ten.

A.1.2. Mandatory business segment information for reportable segments

Once we have identified reportable segments to be disclosed, we identify the items to be disclosed according to SFAS 131:

"a. General information as described in paragraph 26

b. Information about reported segment profit or loss, including certain revenues and expenses included in reported segment profit or loss, segment assets, and the basis of measurement, as described in paragraphs 27-31"

Taking into account the information we have available, mandatory items for each reportable segment, as SFAS 131 state in paragraph 26-31, are the following:

1. Business Segment Name (as the general information required in paragraph 26)
2. Depreciation, depletion and amortization per segment.
3. Equity in earnings per segment.
4. Operating profit per segment.
5. Sales to Principal Customer per segment.
6. Sales of Principle Product per segment.
7. Customer Name per segment.
8. Investment at equity per segment (2-8 as the requirements of paragraph 27-28).

A.1.2. Voluntary business segment information

We consider as voluntary business segment information the other items for reportable segments, and all items for non-reportable segments. We also consider as voluntary business segment information all available information for those business segments that exceed ten for each firm.

A.1.3. Mandatory geographic segment information.

We consider as geographic areas all geographic segments available in Compustat.

SFAS 131, paragraph 38 states "An enterprise shall report the following geographic information unless it is impracticable to do so:

a. Revenues from external customers (1) attributed to the enterprise's country of domicile and (2) attributed to all foreign countries in total from which the enterprise derives revenues. If revenues from external customers attributed to an individual foreign country are material, those revenues shall be disclosed separately. An enterprise shall disclose the basis for attributing revenues from external customers to individual countries.

b. Long-lived assets other than financial instruments, long-term customer relationships of a financial institution, mortgage and other servicing rights, deferred policy acquisition costs, and deferred tax assets (1) located in the enterprise's country of domicile and (2) located in all foreign countries in total in which the enterprise holds assets. If assets in an individual foreign country are material, those assets shall be disclosed separately."

Taking into account the information we have available, mandatory items for each reportable segment, as SFAS 131 state in paragraph 38, are the following:

1. Sales net per segment (as required in paragraph 38-a).
2. Identifiable assets per segment (as required in paragraph 38-b).

A.1.4. Voluntary geographic segment information

We consider as voluntary geographic segment information the other available items.

A.2. Procedure for elaborating the segment disclosure score

For every reported business segment in each firm, we analyze whether they provide information on the compulsory SFAS 131 items and on additional items from the balance sheet and the income statement. We create the business segment score by adding 1 point for every voluntary disclosed item in every segment. Then, for every reported geographic segment in each firm, we analyze whether they provide information on the compulsory SFAS 131 items, and on additional items from the balance sheet and the income statement. We create the geographic segment score by adding 1 point for every voluntary disclosed item in every segment. Finally, we create the voluntary segment disclosure score adding the business segment disclosure score and geographic segment disclosure score.

Table 1
Descriptive Statistics

Variable	N	Mean	Std. Dev.	10%	25%	Median	75%	90%
Qtt_Seg	10,002	42.2542	20.2906	20	27	39	53	69
Qlt_Seg	10,002	0.0000	15.1765	-17.5237	-10.2192	-1.8707	8.6758	19.1472
Qtt_Seg_Bus	10,002	23.3837	17.4141	8	9	18	33	47
Qlt_Seg_Bus	10,002	0.0000	13.3659	-14.0958	-9.1850	-2.5236	6.7440	17.6357
Qtt_Seg_Geo	10,002	18.8705	9.0299	11	11	17	24	31
Qlt_Seg_Geo	10,002	0.0000	7.6832	-8.8721	-5.3393	-0.7478	4.1548	10.1924
Earnings_Qlt	10,002	-0.0743	0.1118	-0.2097	-0.0970	-0.0349	-0.0000	-0.0000
BusDiversif	10,002	1.9679	1.1461	1	1	2	2	3
GeoDiversif	10,002	3.0755	4.2204	1	2	2	3	5
Spread	10,002	0.1504	0.1475	0.0225	0.0458	0.1041	0.2076	0.3416
Mve	10,002	4,771	11,669	121	317	923	3,162	11,670
Bm	10,002	0.5211	0.4632	0.162	0.262	0.419	0.635	0.943
Leverage	10,002	20.1953	18.8044	0	1.633	17.971	31.9905	45.5055
Auditor	10,002	0.9153	0.2784	1	1	1	1	1
StockExch	10,002	0.9696	0.1716	1	1	1	1	1
Herf	10,002	10.4644	9.5428	4.0059	4.9259	7.8234	11.1554	20.8409
Newfin	10,002	0.8802	0.3247	0	1	1	1	1
Roa	10,002	0.0140	0.1497	-0.1346	-0.0042	0.0444	0.0846	0.1284
Age	10,002	13.5585	10.2824	4	6	10	18	32
Forecast error	10,002	0.1270	0.8513	-0.1724	-0.0592	-0.0058	0.0833	0.4444
Dev. Forecast error	10,002	0.0690	0.1297	0.01	0.02	0.03	0.07	0.15
Number analysts	10,002	8.4469	6.2905	3	4	6	11	18
r_{peg}	10,002	0.1347	0.0443	0.1002	0.1067	0.1180	0.1665	0.1941
Beta	10,002	1.1765	0.9368	0.3599	0.9133	1.0462	1.3680	2.2228
Cov (r_i, r_{sector})	10,002	0.0161	0.1668	-0.0513	-0.0137	0.0000	0.0192	0.0739
Realized Returns	102,024	0.0161	0.2394	-0.2022	-0.0814	0.0017	0.0806	0.2145
Excess Realized Returns	102,024	0.0133	0.2394	-0.2052	-0.0841	-0.0008	0.0780	0.2117

The sample consists of 10,002 firm-year observations for the period 2001-2006. Qtt_Seg = the number of voluntary disclosure elements found in the sample firms' for segment disclosure; Qlt_Seg = the regression residuals obtained from a regression of the firm's year t Qtt_Seg on control and determinants of segment disclosure (to report this number we used JM as the proxy for earnings management). Qtt_Seg_Bus = the number of voluntary disclosure elements found in the sample firms' for business segment disclosure; Qlt_Seg_Bus = the regression residuals obtained from a regression of the firm's year t Qtt_Seg_Bus on control and determinants of segment disclosure. Qtt_Seg_Geo = the number of voluntary disclosure elements found in the sample firms' for geographic segment disclosure; Qlt_Seg_Geo = the regression residuals obtained from a regression of the firm's year t Qtt_Seg_Geo on control and determinants of segment disclosure; Earnings_Qlt = the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model); BusDiversif = number of the different sectors in which firm operates. GeoDiversif = number of the different countries in which firm operates. Spread = bid-ask spread, calculated as $\frac{|bid-ask|}{(bid+ask)/2}$ measured in t-1. MVE = the firm's market value of equity measured at the beginning of fiscal year for 2001-2006; BM = the firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006; Leverage = debt to total assets ratio in percentage. Auditor = 1 if auditor firm is a Big-Four and 0 otherwise. StockExch = 1 if firm is listed in NYSE or NASDAQ and 0 otherwise. Herf = Herfindahl index in percentage, calculated as $Herf_j = \sum_{i=1}^{N}\left(\frac{S_{ij}}{S_j}\right)^2$. NewFin= 1 if firm has issued new debt or equity and 0 otherwise. Roa = return on assets. Age = the difference between the first year when the firm appears in CRSP and the current year. Forecast error= Analysts' forecast errors. It is calculated as the value of forecasted eps for the year t – eps of the year t, scaled by market price per share in the year t. Dev. Forecast error= Deviation of analysts' forecast. It is calculated as the standard deviation of analyst forecasts of eps for the year t. Number of analysts = number of eps forecasts of the firm in the year t. r_{peg} = implied cost of equity estimate, derived from I/B/E/S eps forecasts and price target data. Beta = coefficient from firm-specific CAPM regression using the 60 months preceding fiscal year 2001-2006. Cov (r_i, r_{sector}) = mean annual covariance of the monthly return of a firm with the monthly return of the sector in which the firm belongs. Realized returns = monthly realized returns. Excess realized returns = monthly excess realized returns over risk free rate.

Table 2
Pairwise correlations between Qtt_Seg, Earnings Quality, diversification, information asymmetries and control variables (p=0.05)

Variable	Qtt_Seg	Earnings_Qlt	BusDiversif	GeoDiversif	Spread	Ln mve	Ln bm	leverage	auditor	StockExch	Herf	NewFin	Roa	Age
Qtt_Seg	1													
Eanings_Qlt	**0.2178**	1												
BusDiversif	**0.3122**	**0.1299**	1											
GeoDiversif	**0.1053**	**0.0488**	**0.0536**	1										
Spread	**0.0283**	**0.0221**	-0.0038	0.0172	1									
Ln mve	**0.3399**	**0.2932**	**0.2234**	**0.0269**	**-0.0183**	1								
Ln bm	**0.0482**	**0.0703**	**0.0625**	0.0147	**0.0212**	**-0.2792**	1							
Leverage	**0.1178**	**0.1494**	**0.1368**	**0.0419**	**0.0525**	**0.1125**	0.0082	1						
Auditor	**0.1318**	**0.0659**	**0.0708**	0.0049	0.0172	**0.1903**	-0.0170	**0.0287**	1					
StockExch	**0.1180**	**0.2703**	**0.0464**	**0.0207**	0.0195	**0.1131**	**-0.0232**	**0.0199**	**0.0382**	1				
Herf	**-0.0674**	**0.0869**	**0.0807**	0.0010	-0.0012	-0.0080	**0.0843**	**0.0993**	0.0101	**0.0403**	1			
NewFin	**0.1096**	**0.1080**	**0.0786**	**0.0221**	0.0094	**0.1918**	**-0.0861**	**0.1344**	**0.0548**	**0.0262**	**0.0453**	1		
Roa	**0.0504**	**0.1350**	**0.0232**	0.0092	-0.0184	**0.3834**	**-0.3257**	**-0.1637**	**0.0240**	**0.0569**	**0.0670**	**0.3164**	1	
Age	**0.1943**	**0.1597**	**0.1821**	0.0152	**-0.0190**	**0.2420**	0.0002	**0.0697**	**0.0521**	**-0.0228**	0.0080	**0.0785**	**0.1472**	1

Bold numbers are significant at p-value 0.05.

The sample consists of 10,002 firm-year observations for the period 2001-2006. Qtt_Seg = the number of voluntary disclosure elements found in the sample firms' for segment disclosure; Earnings_Qlt = the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model); BusDiversif = number of the different sectors in which firm operates. GeoDiversif = number of the different countries in which firm operates. Spread = bid-ask spread, calculated as $\frac{|bid-ask|}{(bid+ask)/2}$ measured in t-1. Ln mve = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006; Ln bm = the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006; Leverage = debt to total assets ratio in percentage. Auditor = 1 if auditor firm is a Big-Four and 0 otherwise. StockExch = 1 if firm is listed in NYSE or NASDAQ and 0 otherwise. Herf = Herfindahl index in percentage, calculated as $Herf_j = \sum_{i=1}^{N}\left(\frac{S_{ij}}{S_j}\right)^2$. NewFin= 1 if firm has issued new debt or equity and 0 otherwise. Roa = percentile rank of return on assets. Age = the difference between the first year when the firm appears in CRSP and the current year.

Table 3
Fixed Effect Regression of Qtt_Seg on earnings quality, diversification, information asymmetries and control variables

Variable	Expected sign	Coef. (p-value)	Coef. (p-value)
Earnings_Qlt	+		8.0612 (0.000)
BusDiversif	+		5.2727 (0.000)
GeoDiversif	+		0.2532 (0.000)
Spread	+		2.9581 (0.013)
Ln mve	+	4.5303 (0.000)	3.9419 (0.000)
Ln bm	+	4.3421 (0.000)	3.9496 (0.000)
Leverage	+	0.1006 (0.000)	0.0844 (0.000)
Auditor	+	2.7050 (0.000)	2.3874 (0.000)
StockExch	+	8.4118 (0.000)	6.4297 (0.000)
Herf	-	-0.6394 (0.000)	-0.4776 (0.000)
Newfin	+	2.1688 (0.000)	1.6418 (0.000)
Roa	+/-	-0.0373 (0.000)	-0.0301 (0.000)
Age	+	0.1941 (0.000)	0.1173 (0.000)
Cons		7.2229 (0.000)	2.4034 (0.173)
R^2		0.1700	0.2958

The sample consists of 10,002 firm-year observations for the period 2001-2006. Qtt_Seg = the number of voluntary disclosure elements found in the sample firms' for segment disclosure; Earnings_Qlt = the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model); BusDiversif = number of the different sectors in which firm operates. GeoDiversif = number of the different

countries in which firm operates. Spread = bid-ask spread, calculated as $\frac{|bid-ask|}{(bid+ask)/2}$ measured in t-1. Ln mve = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006; Ln bm = the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006; Leverage = debt to total assets ratio in percentage. Auditor = 1 if auditor firm is a Big-Four and 0 otherwise. StockExch = 1 if firm is listed in NYSE or NASDAQ and 0 otherwise. Herf = Herfindahl index in percentage, calculated as $Herf_j = \sum_{i=1}^{N}\left(\frac{S_{ij}}{S_j}\right)^2$. NewFin= 1 if firm has issued new debt or equity and 0 otherwise. Roa = percentile rank of return on assets. Age = the difference between the first year when the firm appears in CRSP and the current year.

Table 4
Fixed Effect Regressions of analysts' forecast errors on Quantity and Quality of segment disclosure and number of analysts following the firm

	Expected sign	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
Qtt_Seg	?	-0.0001 (0.275)			
Qlt_Seg	-		-0.0074 (0.006)	-0.0073 (0.000)	0.0111 (0.019)
Dummy_Earnings_Qlt	-			-0.0507 (0.003)	0.0023 (0.953)
Qlt_Seg*Dummy_Earnings_Qlt	-				-0.0146 (0.023)
Number analysts	-	-0.0021 (0.118)	-0.0017 (0.285)	-0.0017 (0.293)	-0.0015 (0.440)
Dev. Forecast error	+	0.4816 (0.000)	0.5968 (0.000)	0.5945 (0.000)	0.5613 (0.000)
Ln_mve	-	-0.0637 (0.000)	-0.0687 (0.000)	-0.0637 (0.000)	-0.0784 (0.000)
Cons		0.6957 (0.000)	0.7549 (0.000)	0.7468 (0.000)	0.7948 (0.000)
R^2		0.0342	0.0368	0.0381	0.0385

The sample consists of 10,002 firm-year observations for the period 2001-2006. Forecast error= Analysts' forecast errors. It is calculated as the absolute value of forecasted eps for the year t – eps of the year t, scaled by eps in the year t. Qtt_Seg = the number of voluntary disclosure elements (out of 34) found in the sample firms' for segment disclosure; Qlt_Seg = the regression residuals obtained from a regression of the firm's year t Qtt_Seg on control and determinants of segment disclosure. We then rank the residuals from this model into deciles. Dummy_Earnings_Qlt = it is dummy variable which takes value of 1 if Earnings_Qlt is above median, and zero otherwise, where Earnings_Qlt is equal to the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model). Acc_Qlt = 0 if the firm does not provide good accounting quality, 1 if firm provides earnings quality above the median of earnings quality of the sample or if it provides good segment information (the regression residuals obtained from a regression of the firm's year t Qtt_Seg on control and determinants of segment disclosure are positive), and 2 if a firm provides good earnings quality (above median of earnings quality) and good segment information (positive residuals). Number of analysts = number of eps forecasts of the firm in the year t. Dev. Forecast error= Deviation of analysts' forecast. It is calculated as the standard deviation of analyst forecasts of eps for the year t. Ln mve = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006.

Table 5

Fixed Effect Regressions of assessed covariance with sector firms' return on Quantity and Quality of segment disclosure and controls

	Expected sign	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
Qtt_Seg	?	-0.0006 (0.184)			
Qlt_Seg	-		-0.0010 (0.000)	-0.0010 (0.007)	0.0002 (0.719)
Dummy_Earnings_Qlt	-			-0.0061 (0.016)	0.0066 (0.194)
Qlt_Seg*Dummy_Earnings_Qlt	-				-0.0023 (0.004)
Ln mve	-	-0.0024 (0.008)	-0.0032 (0.000)	-0.0026 (0.003)	-0.0024 (0.006)
Ln bm	+	0.0148 (0.000)	0.0140 (0.000)	0.0146 (0.000)	0.0148 (0.000)
Herf	-	-0.0940 (0.055)	-0.0825 (0.091)	-0.0821 (0.093)	-0.0839 (0.086)
Leverage	+	0.0001 (0.028)	0.0001 (0.048)	0.0001 (0.026)	0.0001 (0.024)
BusDiversif	-	-0.0006 (0.587)	-0.0016 (0.160)	-0.0016 (0.159)	-0.0016 (0.168)
GeoDiversif	-	-0.0001 (0.579)	-0.0002 (0.474)	-0.0001 (0.480)	-0.0001 (0.489)
StockExch	-	-0.0133 (0.005)	-0.0152 (0.027)	-0.0142 (0.039)	-0.0139 (0.043)
Roa	+	0.0001 (0.006)	0.0001 (0.005)	0.0001 (0.004)	0.0001 (0.005)
Age	-	-0.0002 (0.089)	-0.0002 (0.067)	-0.0002 (0.089)	-0.0002 (0.067)
Cons		0.1067 (0.000)	0.1133 (0.000)	0.1110 (0.000)	0.1034 (0.000)
R^2		0.0271	0.0272	0.0280	0.0294

The sample consists of 10,002 firm-year observations for the period 2001-2006. Cov (r_i, r_{sector}) = mean annual covariance of the monthly return of a firm with the monthly return of the sector in which the firm belongs, expressed in percentage and in absolute values. Qtt_Seg = the number of voluntary disclosure elements (out of 34) found in the sample firms' for segment disclosure; Qlt_Seg = the regression residuals obtained from a regression of the firm's year t Qtt_Seg on control and determinants of segment disclosure. We then rank the residuals from this model into deciles. Dummy_Earnings_Qlt = it is dummy variable which takes value of 1 if Earnings_Qlt is above median, and zero otherwise, where Earnings_Qlt is equal to the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model). Ln mve = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006; Ln bm = the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006. Herf = Herfindahl index in percentage, calculated as $Herf_j = \sum_{i=1}^{N} \left(\frac{S_{ij}}{S_j} \right)^2$. Leverage = debt to total assets ratio in percentage. BusDiversif = number of the different sectors in which firm operates. GeoDiversif = number of the different countries in which firm operates. Roa = percentile rank of return on assets. Age = the difference between the first year when the firm appears in CRSP and the current year.

Table 6
Pairwise correlations between r_{PEG}, Qtt_Seg and Qlt_Seg, Earnings Quality and control variables (p=0.05)

Variable	r_{PEG}	Qtt_Seg	Qlt_Seg	DumEarQlt	Ln mve	Ln bm	Beta	Leverage	BusDiversif	GeoDiversif
r_{PEG}	1									
Qtt_Seg	-0.0033	1								
Qlt_Seg	**-0.1283**	**0.7087**	1							
Dummy_Earnings_Qlt	**-0.1236**	**0.2207**	-0.0039	1						
Ln mve	**-0.1888**	**0.3399**	-0.0032	**0.2936**	1					
Ln bm	**0.1813**	**0.0482**	0.0047	**0.0218**	**-0.2792**	1				
Beta	**0.0921**	0.0090	0.0004	0.0095	**-0.0413**	**0.0320**	1			
Leverage	**0.1222**	**0.1178**	-0.0071	**0.0995**	**0.1125**	0.0082	0.0149	1		
BusDiversif	**-0.0852**	**0.3122**	-0.0094	**0.1231**	**0.2234**	**0.0625**	**-0.0137**	**0.1368**	1	
GeoDiversif	**-0.0600**	**0.1053**	0.0002	**0.0413**	**0.0269**	0.0147	0.0342	**0.0419**	**0.0536**	1

Bold numbers are significant at p-value 0.05

The sample consists of 10,002 firm-year observations for the period 2001-2006. r_{peg} = implied cost of equity estimate, derived from I/B/E/S eps forecasts and price target data; Qtt_Seg = the number of voluntary disclosure elements found in the sample firms' for segment disclosure; Dummy_Earnings_Qlt = it is dummy variable which takes value of 1 if Earnings_Qlt is above median, and zero otherwise, where Earnings_Qlt is equal to the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model). Ln mve = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006; Ln bm = the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006. Beta = coefficient from firm-specific CAPM regression using the 60 months preceding fiscal year 2001-2006. Leverage = debt to total assets ratio in percentage. BusDiversif = number of the different sectors in which firm operates. GeoDiversif = number of the different countries in which firm operates.

Table 7

Fixed Effect Regression of implied cost of capital (r_{PEG}) on earnings quality, quality of segment disclosure (Qlt_Seg) and control variables

Variable	Expected sign	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
Qtt_Seg	?		-0.0002 (0.264)			
Qlt_Seg	-			-0.0021 (0.000)	-0.0021 (0.000)	-0.0003 (0.115)
Dummy_Earnings_Qlt	-				-0.0139 (0.000)	0.0035 (0.100)
Qlt_Seg*Dummy_Earnings_Qlt	-					-0.0032 (0.000)
Ln mve	-	-0.0035 (0.000)	-0.0032 (0.000)	-0.0036 (0.000)	-0.0021 (0.000)	-0.0019 (0.000)
Ln bm	+	0.0080 (0.000)	0.0078 (0.000)	0.0080 (0.000)	0.0093 (0.000)	0.0096 (0.000)
Beta	+/-	0.0052 (0.000)	0.0055 (0.000)	0.0053 (0.000)	0.0051 (0.000)	0.0051 (0.000)
Leverage	+	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)	0.0001 (0.000)
BusDiversif	-	-0.0015 (0.000)	-0.0010 (0.197)	-0.0015 (0.003)	-0.0015 (0.003)	-0.0014 (0.005)
GeoDiversif	-	-0.0007 (0.000)	-0.0007 (0.000)	-.0007 (0.000)	-0.0007 (0.000)	-0.0007 (0.000)
Cons		0.1699 (0.000)	0.1752 (0.000)	0.1826 (0.000)	0.1796 (0.000)	0.1693 (0.000)
R^2		0.0716	0.0720	0.0895	0.1046	0.1134

The sample consists of 10,002 firm-year observations for the period 2001-2006. r_{peg} = implied cost of equity estimate, derived from I/B/E/S eps forecasts and price target data; Qtt_Seg = the number of voluntary disclosure elements found in the sample firms' for segment disclosure; Dummy_Earnings_Qlt = it is dummy variable which takes value of 1 if Earnings_Qlt is above median, and zero otherwise, where Earnings_Qlt is equal to the regression absolute residuals, and multiplied by –1, obtained from a regression of the firm's year t change in revenues minus receivables and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000–2006 (It is the Jones Modified model). Ln mve = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006; Ln bm = the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006. Beta = coefficient from firm-specific CAPM regression using the 60 months preceding fiscal year 2001-2006. Leverage = debt to total assets ratio in percentage. BusDiversif = number of the different sectors in which firm operates. GeoDiversif = number of the different countries in which firm operates.

Table 8
Tests of the Relation between Realized Cost of Capital and Voluntary Segment Disclosure: Descriptive data

Panel A: Descriptive statistics

Variable	Mean	Std.Dev.	Annualized return
RMRF	0.0026	0.0411	3.1650%
SMB	0.0068	0.0292	8.4722%
HML	0.0082	0.0291	10.2961%
HILOQlt_Seg	-0.0051	0.0218	6.2946%
HILOEarnings_Qlt	-0.0025	0.0421	3.0415%
HILOAcc_Qlt	-0.0071	0.0610	8.7310%

Panel B: Correlation Matrix

Variable	RMRF	SMB	HML	HILOQlt_Seg	HILOAQ	HILOAcc_Qlt
RMRF	1					
SMB	**0.3308**	1				
HML	**-0.4618**	**-0.2407**	1			
HILOQlt_Seg	**0.0324**	**-0.2163**	**0.4018**	1		
HILOEarnings_Qlt	**0.0624**	**-0.2421**	**0.5009**	**0.3925**	1	
HILOAcc_Qlt	**0.0435**	**-0.3651**	**0.3069**	**0.4009**	**0.6927**	1

Bold numbers are significant at p-value 0.05

The sample consists of 102,024 firm-month observations for the period 2001-2006. RMRF is the excess return on the market portfolio. SMB is the return to size factor-mimicking portfolio. HML is the return to book-to-market factor-mimicking portfolio. HILOEarnings_Qlt is the portfolio that results on hedge earnings quality portfolio, buying 20% of firms providing good earnings quality and selling 20% of firms providing poor earnings quality. HEDGE Qlt_Seg is the portfolio that results on hedge segment information quality portfolio, buying 20% of firms providing good segment quality information and selling 20% of firms providing poor segment quality information. HEDGE Acc_Qlt is the portfolio that results on hedge accounting information quality portfolio, buying firms providing good segment quality information and selling firms providing poor segment quality information.

Table 9
Firm-specific time-series regressions of contemporaneous excess returns on the Fama –French 3 factors

	HEDGE Earnings_Qlt	HEDGE Qlt_Seg	HEDGE Acc_Qlt
Variable	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
RMRF	0.00043 (0.000)	0.00017 (0.000)	0.00108 (0.000)
SMB	-0.00032 (0.000)	-0.00015 (0.000)	-0.00011 (0.000)
HML	0.00090 (0.000)	0.00037 (0.000)	0.00131 (0.000)
cons	-0.00006 (0.000)	-0.00030 (0.000)	-0.00052 (0.000)
R^2	0.4076	0.2588	0.5201

The sample consists of 102,024 firm-month observations for the period 2001-2006. RMRF is the excess return on the market portfolio. SMB is the return to size factor-mimicking portfolio. HML is the return to book-to-market factor-mimicking portfolio. HEDGE Earnings_Qlt is the portfolio that results on hedge earnings quality portfolio, buying 20% of firms providing good earnings quality and selling 20% of firms providing poor earnings quality. HEDGE Qlt_Seg is the portfolio that results on hedge segment information quality portfolio, buying 20% of firms providing good segment quality information and selling 20% of firms providing poor segment quality information. HEDGE Acc_Qlt is the portfolio that results on hedge accounting information quality portfolio, buying firms providing good segment quality information and selling firms providing poor segment quality information.

Table 10
Average factor loadings across 25 portfolios sorted on B/M and Accounting Quality

Variable			CAPM Coef. (p-value)				FF 3 FACTOR MODEL Coef. (p-value)			
SMB							0.8552 (0.000)	0.8583 (0.000)	0.7951 (0.000)	0.8532 (0.000)
HML							0.0993 (0.064)	0.0765 (0.097)	0.2126 (0.037)	0.1225 (0.098)
RMRF			1.3811 (0.000)	1.3811 (0.000)	1.2640 (0.000)	1.4032 (0.000)	1.2127 (0.000)	1.2062 (0.000)	1.2035 (0.000)	1.2318 (0.000)
HILOQlt_Seg	-0.8118 (0.000)	-0.6590 (0.000)		-0.7269 (0.031)	-0.4287 (0.009)			-0.4761 (0.087)	-0.2098 (0.067)	
HILOEarnings_Qlt		-0.3894 (0.000)			-0.0131 (0.096)				-0.0683 (0.120)	
HILOAcc_Qlt						-0.3538 (0.049)				-0.3764 (0.058)
cons	0.1679 (0.055)	0.1786 (0.036)	0.1330 (0.003)	0.1330 (0.002)	0.1362 (0.003)	0.1351 (0.006)	0.0761 (0.001)	0.0763 (0.005)	0.0727 (0.001)	0.0754 (0.002)
R^2	0.0055	0.2630	0.7539	0.7579	0.7924	0.7648	0.8903	0.8946	0.9065	0.8958
GRS test cons = 0	5.71	5.75	13.37	13.70	13.70	13.55	13.02	12.54	12.15	12.66
p-value GRS test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GRS test on all factors = 0	9.36	32.64	54.36	31.41	39.84	32.91	50.81	39.65	42.03	39.86
p-value GRS test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The sample consists of 102,024 firm-month observations for the period 2001-2006. We form 25 portfolios sorting stocks into quintiles based on B/M and Acc_Qlt each month. RMRF is the excess return on the market portfolio. SMB is the return to size factor-mimicking portfolio. HML is the return to book-to-market factor-mimicking portfolio. HILOQlt_Seg factor is the return to the segment quality factor-mimicking portfolio for Qlt_Seg. HILOEarnings_Qlt factor is the return to the earnings quality factor-mimicking portfolio for Earnings_Qlt. HILAcc_Qlt factor is the return to the accounting quality factor-mimicking portfolio for Acc_Qlt.

Table 11
Two-stage regressions, based on realized returns of 25 portfolios sorted on B/M and Accounting Quality

Variable	CAPM Coef. (p-value)						FF 3 FACTOR MODEL Coef. (p-value)			
SMB							-0.1481 (0.006)	-0.0680 (0.179)	-0.1027 (0.057)	-0.1517 (0.003)
HML							-0.0300 (0.624)	-0.0938 (0.065)	-0.1112 (0.007)	-0.0533 (0.288)
RMRF			0.2061 (0.028)	0.1922 (0.014)	0.1883 (0.000)	0.1316 (0.203)	0.2393 (0.004)	0.2767 (0.000)	0.1552 (0.138)	0.1387 (0.121)
HILOQlt_Seg	-0.0198 (0.000)	-0.0179 (0.000)		-0.0187 (0.002)	-0.0186 (0.003)			-0.0187 (0.003)	-0.0163 (0.006)	
HILOEarnings_Qlt		-0.0127 (0.074)			-0.0004 (0.968)				-0.0150 (0.180)	
HILOAcc_Qlt						-0.0091 (0.416)				-0.0148 (0.014)
cons	1.9404 (0.000)	1.8493 (0.000)	-0.5824 (0.577)	-0.3754 (0.665)	-0.0005 (0.000)	0.2978 (0.808)	0.2603 (0.772)	-0.6522 (0.395)	1.0148 (0.464)	1.5227 (0.139)
R^2	0.2473	0.3552	0.2004	0.4207	0.5201	0.2231	0.4076	0.5620	0.6065	0.4624

The sample consists of 102,024 firm-month observations for the period 2001-2006. We form 25 portfolios sorting stocks into quintiles based on B/M and Acc_Qlt each month. RMRF is the excess return on the market portfolio. SMB is the return to size factor-mimicking portfolio. HML is the return to book-to-market factor-mimicking portfolio. HILOQlt_Seg factor is the return to the segment quality factor-mimicking portfolio for Qlt_Seg. HILOEarnings_Qlt factor is the return to the earnings quality factor-mimicking portfolio for Earnings_Qlt. HILAcc_Qlt factor is the return to the accounting quality factor-mimicking portfolio for Acc_Qlt.

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