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**TESIS DOCTORAL**

**Segment disclosure, cost of capital**

**and**

**investment efficiency**

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# TESIS DOCTORAL

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## Introducción

Esta tesis se compone de tres ensayos empíricos sobre las consecuencias económicas de las diferencias en la calidad de la información segmentada que las empresas incluyen en sus estados financieros. En el primero, se estudia la relación entre la revelación de información segmentada y la calidad del resultado contable. En el segundo, se estudia el efecto de la relación entre la revelación de información segmentada y la calidad del resultado contable en el coste de capital. En el último ensayo se estudia el papel de la revelación de la información segmentada en el gobierno corporativo y su efecto en la eficiencia de las decisiones de inversión de la empresa. Esta tesis contribuye a la literatura sobre las consecuencias económicas derivadas de las diferencias en la calidad de la información contable. Los resultados muestran que el aumento de la calidad de la información segmentada conduce a unos resultados económicos positivos, como son un menor coste de capital y una mejora en la eficiencia de las decisiones de inversión. A continuación, se describen brevemente los principales resultados de los tres ensayos.

El primer ensayo se titula *La complementariedad entre la información segmentada y la calidad del resultado contable*. Este estudio aborda la naturaleza de la relación, complementaria o sustitutiva, entre la revelación voluntaria de información segmentada y la calidad del resultado contable. La evidencia sobre la relación entre la calidad de los números contables reportados y la revelación de información es escasa, y las dos corrientes de la literatura (calidad del resultado contable y revelación de información) se han desarrollado de forma independiente en la literatura previa. El objetivo de este estudio es la integración de ambas líneas de investigación para comprender mejor la relación entre la calidad del resultado contable y la revelación de información segmentada. Para ello, se crea un índice de cantidad de información



segmentada voluntaria, basado en los requerimientos de información segmentada de la normativa SFAS 131: a cada empresa se le suma 1 punto por cada elemento revelado de forma voluntaria en cada uno de los segmentos de negocio / geográfico obligatorios, y 1 punto por cada elemento de revelación en todos los segmentos de negocio / geográfico de carácter voluntario. Se espera que las empresas con mejor calidad del resultado contable tengan incentivos para ofrecer una información más completa de sus diferentes líneas de negocio y líneas geográficas para ayudar a los inversores a tomar decisiones de inversión adecuadas. Se espera que la complementariedad entre la revelación de información segmentada y la calidad del resultado contable aumente el valor de la empresa. Los resultados encontrados confirman que existe una relación positiva y significativa entre la revelación de información segmentada y la calidad del resultado contable. Estos resultados se sostienen también para la información revelada sobre líneas de negocio y líneas geográficas de forma separada. Los resultados también demuestran que la diversificación es un determinante crucial de los niveles de información segmentada. Es decir, las empresas que operan en un mayor número de sectores ofrecen un mayor nivel de información de líneas de negocio. Asimismo, las empresas que operan en un mayor número de países proporcionan un mayor nivel de información sobre sus líneas geográficas. Por último, encontramos que las asimetrías de información en el año anterior también determinan el nivel de revelación de información segmentada.

El segundo ensayo se titula *Información segmentada, calidad del resultado contable y coste de capital*. Este estudio analiza si las empresas que proporcionan mejor calidad del resultado contable y mejor calidad de la información segmentada obtienen un menor coste de capital. El trabajo se centra en la revelación de información segmentada, dado que este tipo de información mejora la capacidad de los inversores

para estimar los futuros flujos de caja de las empresas, y, en consecuencia, se espera que disminuya el coste de capital. Los resultados encontrados confirman que las empresas que proporcionan una mejor calidad de información segmentada, que complementa un resultado contable de calidad, tienen un menor coste de capital. Este resultado es robusto al uso de modelos de valoración de activos y al uso de medidas de coste implícito de capital. Además, los resultados muestran que una mejor calidad de información segmentada ayuda a los inversores a estimar los flujos de caja de la empresa, reduciendo los errores de predicción de los analistas. Esto es coherente con que la calidad de la información segmentada y del resultado contable reducen el riesgo de estimación. Los resultados también muestran que las empresas que proporcionan información segmentada de buena calidad reducen la covarianza entre los rendimientos de la empresa y los rendimientos de las empresas en el sector al que la empresa pertenece (subrogado de riesgo sistemático, no diversificable). Esta reducción, en el marco teórico proporcionado por Lambert, Leuz y Verrecchia (2007), conduce a una reducción en el coste de capital. A diferencia de Francis, Nanda y Olsson (2008), se utiliza una medida de la calidad, no de la cantidad, de la revelación de información. Los resultados muestran que es la calidad de la información, no la cantidad, lo que reduce el coste de capital. La calidad de la información segmentada se mide a través de los residuos de una regresión de la cantidad de la información segmentada sobre los determinantes de revelación de la información segmentada (calidad del resultado contable, diversificación sectorial y geográfica, y las asimetrías de información) y sobre una serie de controles.

El tercer ensayo se titula *El papel de la información segmentada en el gobierno corporativo y su efecto sobre la eficiencia de inversión de las empresas*. Este estudio analiza el papel de calidad de la información segmentada en el gobierno corporativo y

su efecto sobre la eficiencia de las decisiones de inversión de la empresa. Se espera que la calidad de la revelación de información segmentada aumente la eficiencia de las decisiones de inversión de las empresas por dos razones. En primer lugar, porque la información segmentada, como se muestra en el ensayo anterior, disminuye el coste de capital, lo que a su vez, disminuye la sensibilidad de las inversiones a los flujos de caja generados internamente, y también reduce eventuales problemas de infrainversión. En segundo lugar, porque facilita el control sobre las decisiones del gerente (Berger y Hann, 2003, 2007, Hope y Thomas, 2008), lo que reduce los problemas de sobreinversión. Los resultados encontrados muestran lo siguiente: (1) las empresas que proporcionan información segmentada de mejor calidad presentan una menor sensibilidad de sus decisiones a la existencia de flujos de caja generados internamente; (2) la calidad de la información segmentada mejora la eficiencia de las decisiones de inversión (reduciendo los problemas de infrainversión y sobreinversión), y (3) mecanismos demasiado rígidos para monitorizar las decisiones de los gerentes aumentan los problemas de infrainversión y sobreinversión. En este caso, la calidad de la información segmentada desempeña un papel crucial para evitar las ineficiencias de inversión bajo la supervisión excesiva. Es decir, la calidad de la información segmentada y los mecanismos de gobierno corporativo se complementan entre sí para mejorar la eficiencia de las decisiones de inversión de la empresa. Este estudio contribuye a la reciente corriente de literatura empírica sobre el efecto de la calidad de la información contable sobre la eficiencia de las políticas de inversión de las empresas, mostrando que la calidad de la información segmentada juega un papel crucial para evitar que los gerentes tomen decisiones de inversión ineficientes.

## **Chapter 1: Introduction.**

This thesis consists of three empirical essays on the economic consequences of differences in the quality of the information about segments that firms include in their financial statements. In the first one I study the relationship between segment disclosure and earnings quality. In the second one I study the effect of the relation between segment disclosure and earnings quality on cost of capital. In the last essay I study the role of segment disclosure in corporate governance and its effect on firms' investment efficiency. Overall, I contribute to a growing stream of literature on the economic consequences of differences in the quality of accounting information. My results are consistent with improved segment information leading to positive economic outcomes, like a reduced cost of capital and more efficient investment policies. Next, I discuss briefly the main findings of the three essays.

The first essay is entitled *The Complementarity between Segment Disclosure and Earnings Quality*. This study addresses the nature of the relation, complementary or substitutive, between voluntary segment disclosure and earnings quality. The evidence relating the quality of reported numbers and disclosure is scarce, and the two streams of literature (earnings quality and disclosure) have developed independently from each other. The objective of this study is to integrate both views to deepen our understanding of the relation between earnings quality and segment disclosure. To this purpose, I create an index of quantity of voluntary segment disclosure based on the information requirements of SFAS 131: for each firm, I assign 1 point for every voluntary item disclosed in every compulsory business/geographic segment, and 1 point for every item disclosed in every voluntary business/geographic segment. Our claim is that firms with better earnings quality will have incentives to provide more comprehensive information of their different business or geographical lines to help investors make appropriate

investment decisions. This complementarity in the provision of earnings quality and segment disclosure is expected to increase firm value. The results I find confirm that there is a significant positive association between segment disclosure and earnings quality. This result holds for both business and geographic segment information when considered separately. The results also show that diversification is a crucial determinant of segment information levels. That is, firms operating in a higher number of sectors provide higher levels of business segment information. Also, firms operating in a higher number of countries provide higher levels of geographic segment information. Finally, we find empirical evidence that also information asymmetries in the preceding year determine the level of segment disclosure.

The second essay is entitled *Segment Disclosure, Earnings Quality and Cost of Capital*. This study analyses whether firms providing better earnings quality and better segment information enjoy a lower cost of capital. I focus on segment disclosure given that it is expected to improve investors' ability to estimate firms' future cash flows, and, consequently, it is expected to decrease the cost of capital. The results I find show that firms providing better quality segment disclosure that complements good quality earnings enjoy lower costs of equity capital. This result is robust to the use of asset pricing-based tests and implied cost of capital-based tests. In addition, the results show that better segment disclosure improves investors' ability to estimate firm's cash flows, and reduces analysts' forecast errors. This is consistent with quality of segment disclosure reducing estimation risk. Our empirical evidence, as well, supports that firms providing better segment disclosure reduce the assessed covariance between firm's returns and returns of firms in the same sector. Such decrease in this assessed covariance (which is a proxy of systematic, non-diversifiable, risk) leads to a reduction in the cost of capital within the theoretical framework provided by Lambert, Leuz and

Verrecchia (2007). Unlike Francis, Nanda and Olsson (2008), we use a proxy of disclosure quality, not a proxy of disclosure quantity. Results show that it is the quality of disclosure, not the quantity of disclosure, what reduces the cost of capital. We measure the quality of segment disclosure through the residuals of a model that regresses quantity of segment disclosure on the determinants of segment disclosure (business and geographic diversification, earnings quality, information asymmetries) and controls.

The third essay is entitled *The Role of Segment Disclosure in Corporate Governance and its Effect on Firm Investment Efficiency*. This study analyses the role of segment disclosure quality in corporate governance and its effect on firm investment efficiency. Segment disclosure quality is expected to increase firms' investment efficiency because of two reasons. First, segment disclosure, as I find in the previous chapter, decreases the costs of external funds, which, in turn, reduces the sensitivity of investments to internally generated cash flows and eventual underinvestment problems. Second, it facilitates monitoring over manager decisions (Berger and Hann, 2003, 2007; Hope and Thomas, 2008), which reduces overinvestment. The results I find are as follows: (1) firms providing better segment disclosure present lower sensitivity of investments to internally generated cash flows; (2) better quality segment disclosure improves firms' investment efficiency (reducing both under and over investment); and (3) too tight mechanisms to monitor managers' decisions exacerbate under-investment and over-investment problems. In this last case, segment information quality also plays a crucial role to avoid investment inefficiencies under excessive monitoring. That is, segment information quality and corporate governance mechanisms complement each other to enhance firm's investment efficiency. This study contributes to the recent stream of empirical literature on the effect of accounting information quality on

investment efficiency by showing that segment information quality plays a crucial role in detecting and deterring managerial investment decisions that do not increase the value of the firm.

## **Chapter 2: The Complementarity between Segment Disclosure and Earnings Quality.**

### **2.1. INTRODUCTION**

The objective of this paper is to investigate the relation between earnings quality and segment disclosure. 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. The empirical literature relating accounting numbers and disclosure provides mixed results, 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 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, 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; however, below a given level of earnings quality, we expect the relation between segment



disclosure and earnings quality to be independent, as for firms providing poor quality earnings the incentives for additional disclosure disappear.

Using a sample of non regulated and non financial firms for the period 2001-2006, we find that firms providing better earnings quality disaggregate more segment information, and this result is robust to controls for the determinants of segment disclosure. Our study contributes to the literature relating the quality of reported numbers and disclosure. These two streams of literature (earnings quality and disclosure) have developed mostly independently from each other. We contribute to understand the link between the two by providing empirical evidence that segment disclosure and earnings quality show a complementary relation. We also find that this complementary relation only holds if the earnings quality is sufficiently good.

The remainder of the paper is as follows. In Section 2.2 we present the theoretical development on the relation between segment disclosure and earnings quality. In Section 2.3 we present the research design, describing our proxies for the quantity and quality of segment information and the method to analyze the relation between earnings quality and segment information. In Section 2.4 we present the results. Finally Section 2.5 summarizes and concludes.

## **2.2. SEGMENT DISCLOSURE AND EARNINGS QUALITY**

### ***2.2.1 The importance of segment disclosure***

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; Wysocki, 1998; Basu, Kim and Lim, 1999; Chen and Zhang, 2003; Hope, Kang, Thomas and Vasvari, 2009); (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, Kang, Thomas and Vasvari, 2008; 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).

### ***2.2.2 The relation between segment information and earnings quality***

Prior literature shows that in the absence of disclosure related costs, individuals disclose information to obtain certain benefits (Spence, 1973). In particular, firms will have incentives to voluntarily disclose relevant information to the market to reduce information asymmetry and agency costs (Jensen and Meckling, 1976; Grossman, 1981; Milgrom, 1981; Hughes, 1986; Morris, 1987). Managers can obtain these economic benefits related to the provision of information through improvements in the quality of their firms' reported numbers. 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 is expected to help in disaggregating the information and to facilitate an efficient allocation of resources. Consistent with this expectation, prior empirical research shows that segment reporting decreases information asymmetries (Greenstein and Sami, 1994) and agency costs (Berger and Hann, 2003, 2007; Hope and Thomas, 2008). Consequently, we predict 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 decrease information asymmetries and increase firm value.

However, the provision of this information might bear some costs, as it could compromise the firms' competitive position by providing strategic information to potential competitors (Harris, 1998; Hayes and Lundholm, 1996). Thus, incentives to voluntarily provide segment information will be limited by the existence of proprietary costs (Verrecchia, 1983; Dye, 1986; Darrough and Stoughton, 1990; Wagenhofer, 1990). However, when information quality increases, the manager has more incentives to disclose private information, since the market is more likely to interpret nondisclosure as bad news (Dye, 1985; Jung and Kwon, 1988). This is also consistent with our prediction of a positive relation between the quality of reported earnings and the quantity of segment disclosures.

Moreover, we expect this complementary relation to hold until earnings quality becomes very poor. In this case the relation disappears: companies will not have incentives to provide comprehensive segment information because they do not want that other parties may infer that they have manipulated information and the way in which they have conducted such manipulation. This leads to the following hypothesis:

*Hypothesis 1: As the quality of earnings increases, the comprehensiveness of segment disclosure will increase once the quality of earnings becomes sufficiently good.*

## **2.3. RESEARCH DESIGN**

### ***2.3.1 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 reported business/geographic segment in each firm, we analyze whether the segment is reported on a compulsory or voluntary basis. For the compulsory segments, we distinguish between the items reported compulsorily as they are required by SFAS 131, and the items reported on a voluntary basis. (See the Appendix for detailed information

on how we identify the mandatory vs. voluntary segments, and on which items firms should compulsorily report for the mandatory segments under SFAS 131). Next, we create the business/geographic segment score ( $Qtt\_Seg\_Bus$ )/( $Qtt\_Seg\_Geo$ ) by adding 1 point for every voluntarily disclosed item in every mandatory segment, and 1 point for every item in every voluntary segment. Finally, we create the overall index of quantity of voluntary segment disclosure ( $Qtt\_Seg$ ) by adding the business and geographic segment scores.

### ***2.3.2 Determinants of segment information and creation of an index of quality of segment disclosure ( $Qtt\_Seg$ )***

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:

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

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 test whether below a given level of earnings quality the relationship is independent, we divide firms into high earnings quality and poor earnings quality, to analyze if there is any difference in segment disclosure behavior between these two groups of firms. We create two median clusters according to the Euclidean distance in earnings quality to the group of firms. In addition, we also estimate the model

distinguishing between voluntary business segment information and voluntary geographic segment information. The residuals of this model can be interpreted as a proxy for the quality of segment information. We will use this proxy in Chapters 3 and 4 to analyze the relation between segment disclosure quality and cost of capital (in Chapter 3) and firm investment efficiency (in Chapter 4).

We measure the variables used in Equation (1) as follows:

#### *A/ Earnings quality measures*

We use four different measures of earnings quality, broadly used in the literature. These four measures are based on the studies by Dechow and Dichev (2002), McNichols (2002), Jones (1991), and Dechow, Sloan and Sweeney (1995). We estimate them as follows:

##### *The Dechow and Dichev (2002) measure*

Our first proxy is based on Dechow and Dichev (2002). They propose a model that explains current working capital accruals with lagged, current and future cash flow from operations. The unexplained portion of the variation in cash flows (the residuals of the model) is an inverse measure of accruals quality. The intuition behind this measure is that working capital accruals should shift or adjust the recognition of operating cash flows over a short period of time (t-1, t and t+1).<sup>1</sup> We denote these residuals as *DD*. We estimate Equation (2) using data from 2000 to 2007.

$$\frac{TCA_{j,t}}{Assets_{j,t}} = \varphi_{0,j} + \varphi_{1,j} \frac{CFO_{j,t-1}}{Assets_{j,t}} + \varphi_{2,j} \frac{CFO_{j,t}}{Assets_{j,t}} + \varphi_{3,j} \frac{CFO_{j,t+1}}{Assets_{j,t}} + v_{j,t} \quad (2)$$

where:  $TCA_{j,t}$  = firm's j total current working capital accruals in year t =  $\Delta CA_{j,t} - \Delta CL_{j,t} - \Delta Cash_{j,t} + \Delta STDEBT_{j,t}$ ;  $Assets_{j,t}$  = firm's j average total assets (Compustat #6) in

<sup>1</sup> Dechow and Dichev (2002) assume that any working capital accrual that is not explained by CFO in t-1, t or t+1 is not responding to economic fundamentals. Thus, higher abnormal accruals (higher residuals) are indicative of lower accruals quality.

year  $t$  and  $t-1$ ;  $CFO_{j,t}$  = cash flow from operations in year  $t$  =  $NIBE_{j,t} - TA_{j,t}$ ;  $TA_{j,t}$  = firm  $j$ 's total accruals in year  $t$ , measured as  $\Delta CA_{j,t} - \Delta CL_{j,t} - \Delta Cash_{j,t} + \Delta STDEBT_{j,t} - DEPN_{j,t}$ ;  $\Delta CA_{j,t}$  = firm  $j$ 's change in current assets (Compustat #4) between year  $t-1$  and year  $t$ ;  $\Delta CL_{j,t}$  = firm  $j$ 's change in current liabilities (Compustat #5) between year  $t-1$  and year  $t$ ;  $\Delta Cash_{j,t}$  = firm  $j$ 's change in cash (Compustat #1) between year  $t-1$  and year  $t$ ;  $\Delta STDEBT_{j,t}$  = firm  $j$ 's change in debt in current liabilities (Compustat #34) between year  $t-1$  and year  $t$ ;  $DEPN_{j,t}$  = firm  $j$ 's depreciation and amortization expense (Compustat #14) in year  $t$ ;  $NIBE_{j,t}$  = firm  $j$ 's net income before extraordinary items (Compustat #18) in year  $t$ .

We use the absolute values of  $DD$ , multiplied by minus one, so that larger values of  $DD$  correspond to better accrual quality.

#### *The McNichols (2002) measure*

Our second measure of accrual quality is the one proposed by McNichols (2002). She uses as a proxy for accrual quality the residuals from a model relating current accruals to lagged, current and future cash flow from operations, change in net sales in year  $t$  and gross property, plant and equipment in year  $t$ . The unexplained portion of the variation in working capital accruals is an inverse measure of accruals quality. The intuition behind this measure is the same as in Dechow and Dichev (2002), but McNichols (2002) also takes into account that working capital accruals are also a function of changes in revenues and PPE (Jones, 1991). We denote these residuals as  $McN$ . We estimate Equation (3) using data from 2000 to 2007.

$$\begin{aligned} \frac{TCA_{j,t}}{Assets_{j,t}} = & \varphi_{0,j} + \varphi_{1,j} \frac{CFO_{j,t-1}}{Assets_{j,t}} + \varphi_{2,j} \frac{CFO_{j,t}}{Assets_{j,t}} + \varphi_{3,j} \frac{CFO_{j,t+1}}{Assets_{j,t}} + \\ & + \varphi_{4,j} \frac{\Delta Rev_{j,t}}{Assets_{j,t}} + \varphi_{5,j} \frac{PPE_{j,t}}{Assets_{j,t}} + v_{j,t} \end{aligned} \quad (3)$$

where:  $TCA_{j,t}$  and  $CFO_{j,t}$  are defined as in the Dechow Dichev Measure;  $\Delta REV_{j,t}$  = firm's j change in revenues (Compustat #12) between year t-1 and t;  $PPE_{j,t}$  = firm's j gross property, plant and equipment (Compustat #7) in year t.

We use the absolute values of  $McN$ , multiplied by minus one, so that large values of  $McN$  correspond to good accrual quality.

#### *Jones and Jones Modified Measures*

Our last measures are based on the Jones (1991) model, and its modified version as defined by Dechow, Sloan and Sweeney (1995). We denote them as  $J$  and  $JM$ , respectively. The intuition behind these models is that accruals are explained with changes in revenues (both changes in receivables and payables, and changes in inventory, are a function of change in revenues) and the level of PPE in the firm (depreciation is a function of PPE). One implicit assumption of the Jones (1991) model is that revenues are nondiscretionary. Dechow et al. (1995) relax this assuming that discretion could be exercised over revenues. Both models assume that the accrual generating process is similar within each industry. We estimate Equation (4) using data from 2000 to 2006 for each 2-digit SIC industry groups.

$$\frac{TA_{j,t}}{Assets_{j,t-1}} = \alpha_{i,j} \left[ \frac{1}{Assets_{j,t-1}} \right] + \beta_{i,j} \left[ \frac{\Delta REV_{j,t}}{Assets_{j,t-1}} \right] + \gamma_{i,j} \left[ \frac{PPE_{j,t}}{Assets_{j,t-1}} \right] + \varepsilon_{j,t} \quad (4)$$

where:  $TA_{j,t}$  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.

Next, for each firm j, we calculate its discretionary accruals as:

$$J_t = \frac{TA_{j,t}}{Assets_{j,t-1}} - \left( \hat{\alpha}_{i,j} \left[ \frac{1}{Assets_{j,t-1}} \right] + \hat{\beta}_{i,j} \left[ \frac{\Delta REV_{j,t}}{Assets_{j,t-1}} \right] + \hat{\gamma}_{i,j} \left[ \frac{PPE_{j,t}}{Assets_{j,t-1}} \right] \right) \quad (5)$$



$$JM_t = \frac{TA_{j,t}}{Assets_{j,t-1}} - \left( \hat{\alpha}_{i,j} \left[ \frac{1}{Assets_{j,t-1}} \right] + \hat{\beta}_{i,j} \left[ \frac{\Delta REV_{j,t} - \Delta AR_{j,t}}{Assets_{j,t-1}} \right] + \hat{\gamma}_{i,j} \left[ \frac{PPE_{j,t}}{Assets_{j,t-1}} \right] \right) \quad (6)$$

where:  $\hat{\alpha}, \hat{\beta}, \hat{\gamma}$  = the fitted coefficients from model (4);  $\Delta AR_{j,t}$  = the change in account receivables for firm j (Compustat #2) in year t.

We use the absolute values of  $J$  and  $JM$ , multiplied by minus one. Large values correspond to good accrual quality, that is, less discretionary accruals.

### *B/ 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. 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.

### *C/ 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.<sup>2</sup> 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.

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<sup>2</sup> We use subsidiaries information from Osiris. We take into account subsidiaries with a minimum of 25.01% of control by the company under analysis.

*D/ 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:

$$Spread_{j,t} = \frac{|bid_{j,t} - ask_{j,t}|}{(bid_{j,t} + ask_{j,t})/2} \quad (7)$$

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  $t$ .

*E/ Controls*

*Size:* Previous literature finds that corporate size is significantly and positively associated with disclosure levels. That is, larger companies disclose more (Buzby, 1975; Diamond and Verrecchia, 1991). 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.

*Growth:* We measure firm's growth as the logarithm of the firm's book to market ratio at the beginning of the fiscal year (Nagar, Nanda and Wysocki, 2003).

*Leverage:* prior studies analyzing its relation with disclosure levels find mixed results (Chow and Wong-Boren, 1987; Wallace, Naser and Mora, 1994; Leuz and Verrecchia, 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:* We include an auditor dummy variable taking the value of 1 if the auditor is a Big Four firm, and 0 otherwise. Such dummy captures the effect on a firm's

disclosure of being audited by one of the Big Four auditing firms (Wallace et al., 1994, Hope, 2003). Large and well-known audit firms pressure their clients for better disclosure.

*Stock exchange status:* This is measured by a dummy variable taking the value of 1 if the firm is listed in the NYSE or in NASDAQ, and 0 otherwise. Wallace et al. (1994) and Leuz and Verrecchia (2000) find a significant relation between disclosure and the listing status of the firm.

*Proprietary costs:* Such costs influence segmental disclosures (Botosan and Stanford, 2005). Disclosure is less likely as proprietary costs increase (Dye, 1985, 1986; Verrecchia, 1983, 1990; Darrough and Stoughton, 1990; Wagenhofer, 1990; Hayes and Lundholm, 1996). Proprietary costs are essentially third party constraints, firms could have competitive disadvantages if they disclose information to their competitors and to regulators, they could also bear disadvantages with both suppliers and consumers, and also, litigation risk increases when firms disclose more. One way to capture proprietary costs is measuring the industry concentration. Higher industry concentration implies higher proprietary costs since current competitors might adversely use the information provided (Verrecchia, 1983). We calculate the industry concentration using the following Herfindhal index:

$$Herf_j = \sum_{i=1}^N \left( \frac{S_{ij}}{S_j} \right)^2 \quad (8)$$

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

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

*New financing:* 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. 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 finance 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).

*Profitability:* We approach this variable through the return on assets (ROA) defined as the ratio of earnings before interests and taxes (EBIT) to the total assets. Previous literature provides mixed results. Some studies find a significant positive relationship (Singhvi and Desai, 1971; Wallace et al., 1994), others find no relationship (Raffournier, 1995) whilst others find a significant negative association (Wallace and Naser, 1995).

*Age:* Such variable is measured by the difference between the current year and the year that the firm appeared in CRSP.

### ***2.3.3 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.<sup>3</sup> Our final sample comprises 10,002 firm-year observations with data on all variables to run all of our tests. We exclude observations with missing

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<sup>3</sup> 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.

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.

[Insert Table 1 about Here]

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, Nanda and Olsson (2008) are, respectively, 0.0159 and 0.0123, while in 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.

## 2.4. RESULTS

### 2.4.1 *The relation between earnings quality and segment disclosure*

#### *A/ Univariate analysis*

[Insert Table 2 about Here]

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 provides preliminary evidence consistent with 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%).

*B/ Multivariate analysis*

[Insert Table 3 about Here]

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, third, fourth and fifth columns of Table 3 we show, respectively, the results of estimating Equation (1), where we regress *Qtt\_Seg* on earnings quality and the determinants of segment disclosure, for each of our proxies for earnings quality (Dechow-Dichev, McNichols, Jones and Modified-Jones). For all measures of earnings quality, results are as expected, as  $\beta_1$  is positive and significant in all cases.<sup>4</sup> This confirms the complementary relation between earnings quality and segment disclosure.<sup>5</sup> Finally, we find that firms with higher information asymmetries provide more segment information. Our results are robust to the use of other earnings quality measures, and to

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<sup>4</sup> Our results are robust to the use of other earnings quality measures based on the standard deviation of the residuals of the Jones, modified Jones and Dechow and Dichev models, calculated at the firm level using rolling five year windows, as in Francis et al. (2004). The results are also robust to the use of signed measures of accruals quality.

<sup>5</sup> To tackle the possible endogeneity in the relationship between segment disclosure and earnings quality, we run the model using the dependent variable one year ahead, and the results do not change.

the use of geographic and business segment quantity measures separately instead of the aggregate measure  $Qtt\_Seg$ . Regarding the fitness of the model, the results show that determinants of disclosure explain a significant amount of the variation in  $Qtt\_Seg$  (around 30%).

[Insert Table 4 about Here]

In the first and second column of Table 4 we show the results of forming two portfolios on earnings quality to test whether the relation between earnings quality and segment disclosure is stronger when firms provide better earnings quality. First, we form two portfolios based on the median of earnings quality. Firms above the median are classified as “good earnings quality”, whilst firms below the median are classified as “poor earnings quality”. Results based on  $JM$  (the other accrual quality measures lead to similar conclusions (not tabulated)) show that earnings quality leads to more pronounced increases in the levels of segment disclosure for firms with earnings quality above the median (the coefficient on earnings quality goes from 47.84 for “good earnings quality” firms, to 3.96 for “poor earnings quality” firms, difference significant at conventional levels). Diversification of the firm leads to higher levels of segment information in a similar way for both types of firms, so both business and geographic diversification are determinants of the level of quantity of information independently of earnings quality. Finally, information asymmetries contribute to increase the levels of segment disclosure more pronouncedly in firms with good quality earnings (the coefficient on information asymmetries goes from 4.18 for “good earnings quality” firms, to 1.48 (not significant) for “poor earnings quality” firms, difference significant at conventional levels). One possible reason for this difference is that companies will not have incentives to provide comprehensive segment information when the quality of the information is not reliable. Then, we create two median clusters according to the

Euclidean distance in earnings quality to the group of firms,<sup>6</sup> and the results (third and fourth columns of Table 4) are robust. In this case, we find that for low earnings quality, the relationship between segment disclosure and earnings quality is independent (coefficient 4.3087, p-value 0.203).

We also use an ordered logit model to study the relation between earnings quality and segment information.<sup>7</sup> The results from this test show that firms providing better earnings quality are more likely to provide more comprehensive segment information, which confirms the complementary relation between segment information and earnings quality. The results are also robust to the estimation of Equation (1) applying a bootstrapped quantile regression.<sup>8</sup> All of these results confirm the robustness of the complementary relationship between the quantity of segment information and earnings quality. Moreover, firm diversification seems to be a critical determinant of the quantity of segment information, as well as information asymmetries in the precedent year.

#### ***2.4.2 The relation between earnings quality and business and geographic segment disclosure***

We replicate all the tests distinguishing between voluntary business segment information and voluntary geographic segment information.

[Insert Table 5 about Here]

In Table 5 we show the results of a fixed effect regression of *Qtt\_Seg\_Bus*, our proxy for the quantity of business segment disclosure, on the determinants of segment disclosure. In the first column, we only include the controls to test the validity of our

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<sup>6</sup> The results are robust to the use of different number of portfolios, and to the use of other criteria to divide the sample (i.e.: clustering earnings quality using different measures of distance (i.e., Squared Euclidean distance and Chebychev distance) and criteria (i.e., mean)).

<sup>7</sup> To apply this methodology, we divide *Qtt\_Seg* into 50 fractiles.

<sup>8</sup> The regression curve gives us a brief summary for the averages of the distributions corresponding to the set of independent variables. With bootstrapped quantile regression, we go further and compute several different regression curves corresponding to the various percentage points of the distributions.



index of voluntary business segment disclosure. We find that the quantity of business segment disclosure (*Qtt\_Seg\_Bus*) 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 age, and decreases with profitability and proprietary costs. All of the firm controls are significantly associated with quantity of segment information at conventional levels.

In the second, third, fourth and fifth columns of Table 5 we show, respectively, results of estimating Equation (1) for business segment disclosure. The results confirms that firms providing better earnings quality are also interested in providing higher levels of business segment information. As in the global index analysis, we find that firms operating in more sectors provide more comprehensive segment information and that firms with higher information asymmetries in the preceding year provide more business segment information. The results show that determinants of disclosure explain a significant amount of the variation in *Qtt\_Seg\_Bus* (around 27%). Results from forming portfolios according to earnings quality (not tabulated) also confirm that below a given level of earnings quality, there is no relation between business segment disclosure and earnings quality.

[Insert Table 6 about Here]

Finally, in Table 6 we show the results of a fixed effect regression of *Qtt\_Seg\_Geo*, our proxy for the quantity of geographic segment disclosure, on the determinants of segment disclosure. We find that the quantity of segment disclosure (*Qtt\_Seg\_Geo*) increases with firm size, being audited by a big-four firm, being listed in NYSE or NASDAQ, issuing new financing and age, and decreases with profitability and proprietary costs. All of the firm controls are significantly associated with quantity

of segment information at conventional levels, except age, which is weakly associated with quantity of geographic segment disclosure (coefficient 0.0097 and p-value 0.266).

In the second, third, fourth and fifth columns of Table 6 we show, respectively, the results of estimating Equation (1) for the geographic segment index. Our results again confirm a complementary relationship between segment disclosure and earnings quality, however, the relationship is weaker than when firms disaggregate business information. Results also point out that such disclosure increases with diversification. In this case, we find that geographic segment disclosure increases as information asymmetries increase, but this relation is not as strong as in the global index analysis and in the business segment disclosure analysis.

As in our previous tests, we also form two portfolios on earnings quality to test whether the relationship between geographic segment disclosure and earnings quality also holds below a given level of earnings quality. The results (not tabulated) show that the relationship is independent for firms providing low earnings quality as the incentives for disaggregating accounting numbers disappear. The results also show that the determinants of disclosure do not explain the variation in *Qtt\_Seg\_Geo* so much as in the previous indexes (in this case, they only explain around 8%).

## **2.5. SUMMARY AND CONCLUSIONS**

In the existing disclosure literature, voluntary disclosure is mostly studied separately from earnings quality. This paper incorporates the relation between segment disclosure and earnings quality. We focus on segment disclosure as it is expected to improve investors' ability to estimate firms' cash flows. We find a significant positive association between segment disclosure and earnings quality: firms with better earnings quality have incentives to provide more comprehensive segment information, but this complementary relation only holds above some threshold level of earnings quality. Our

results hold for both business and geographic segment information. We also find that diversification is a crucial determinant of segment information levels, that is, firms operating in a higher number of sectors provide higher levels of business segment information as well as firms operating in a higher number of countries provide higher levels of geographic segment information. Moreover, our results show that information asymmetries in the preceding year determine the level of segment disclosure.

Our results contribute to the literature on earnings quality and disclosure. The two streams of literature (earnings quality and disclosure) have developed independently from each other. It follows from the results of this paper that voluntary disclosure cannot be studied in isolation without taking into account the impact of earnings quality.

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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

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 reported business/geographic segment in each firm, we analyze whether the segment is reported on a compulsory or voluntary basis. For the compulsory segments, we distinguish between the items reported compulsorily as they are required by SFAS 131, and the items reported on a voluntary basis. Next, we create the business/geographic segment score (*Qtt\_Seg\_Bus*)/(*Qtt\_Seg\_Geo*) by adding 1 point for every voluntarily disclosed item in every mandatory segment, and 1 point for every item in the voluntary segment. Finally, we create the overall index of quantity of voluntary segment disclosure (*Qtt\_Seg*) by adding the business and geographic segment scores.

#### A.3. Available Information

For each business segment we consider whether the firm provides information about the following items:

1. *Business segment availability code*. This code indicates the status of a business for a company.
2. *Business segment ID*. This code identifies the segment for a company or industry for a country.
3. *Business Segment Name*.
4. *Capital expenditure per business segment*.
5. *Capital expenditure note per business segment*. This item represents the funds used for additions to the industry segment's property, plant and equipment, excluding amounts arising from acquisitions (for example, fixed assets of purchased companies).
6. *Customer Name per segment*. This item is a four-element group item containing the names of up to four principal customers to which the company sold goods or services from this industry segment during the year.
7. *Depreciation, depletion and amortization per segment*. This item represents non-cash charges for obsolescence and wear and tear on property, allocation of the current portion of capitalized expenditures and depletion charges for the industry segment.
8. *Employees per business segment*. This item represents the actual number of people employed by the identified industry segments reported by the company.
9. *Employees per business segment note*.
10. *Equity in earnings per segment*. This item represents the consolidated company's equity in the net income of unconsolidated subsidiaries and affiliates, carried at equity in the consolidated financial statements, whose operations are vertically integrated with the reported industry segment.
11. *Equity in earnings per segment note*.

12. *Foreign governments per segment.* This is the name(s) of the foreign government(s) to which the company has sold products or services in the past year.
13. *Identifiable assets per segment.* Identifiable Assets are the tangible and intangible assets that are used by, or directly associated with, each business segment.
14. *Investment at equity per segment.* This item represents the consolidated company's ownership interest in the net assets of unconsolidated subsidiaries and affiliates, carried at equity in the consolidated financial statements, whose operations are integral to the reported industry segment.
15. *Operating profit per segment.* Operating Profit is sales of the identified industry segment minus its allocated share of operating costs and expenses (such as, cost of goods sold, selling, general, and administrative expenses and depreciation, depletion and amortization).
16. *Operating profit note per segment.*
17. *Order Backlog per segment.* Order Backlog is the dollar amount of orders believed to be firm for the industry segment as of the company's fiscal yearend.
18. *Principal Product Name per segment.* This four-element group item contains up to four 20-character names which identify the principal products of the industry segment, with any unused elements being blank. If a company derives 10 percent or more of consolidated revenue (15 percent or more if revenue did not exceed \$50,000,000 during the fiscal year) from any class of similar products or services in an industry segment, this data must be reported by the company.
19. *Principle Product SIC per segment.* This item represents the Standard Industrial Classification (SIC) Code which best describes the corresponding principal product of the industry segment.
20. *R&D - Company Sponsored per segment.* This item represents the estimated costs incurred during the year, by the industry segment, for the development of new products or services which were paid by the company and were not reimbursed by a customer.
21. *R&D - Company Sponsored per segment note.*
22. *R&D - Customer Sponsored per segment.* This item represents the estimated costs incurred during the year, by the industry segment, for the development of new products or services, which were subsequently paid by a customer or a government agency.
23. *Sales to Principal Customer per segment.* This four-element group item identifies up to four principal customers for each industry segment.
24. *Sales of Principle Product per segment.* This item represents the contribution of the identified principal products to the industry segment's revenue.
25. *Sales to Domestic Government per segment.* This item represents the amount of revenue derived from sales to the domestic government of the company.
26. *Sales to Foreign Government per segment.* This item represents the amount of revenue derived from sales to individual foreign government agencies.
27. *Sales to principal customer per segment.*

28. *Sales net per segment.* This item consists of the industry segment's gross sales (the amount of actual billings to customers for regular sales completed during the period) reduced by cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers.
29. *Sales net per segment note.*
30. *SIC Codes per Business Segment (Primary and Secondary).* This two-element group item presents the two SIC codes assigned to each business segment.

For each geographic segment we analyze whether the firm provides information on the following items:

1. *Capital Expenditures per segment.* This item represents the funds used for additions to the geographic segment's property, plant and equipment, excluding amounts arising from acquisitions (for example, fixed assets of purchased companies).
2. *Capital expenditures per segment note.*
3. *Depreciation, Depletion, and Amortization per segment.* This item represents non-cash charges for obsolescence and wear and tear on property, allocation of the current portion of capitalized expenditures, and depletion charges for the geographic segment.
4. *Geographic segment area code.* This five-element group item contains up to five geographic area codes for each of up to five geographic segments for any year.
5. *Availability code per segment.* This code indicates the status of a geographic segment for a company.
6. *Identification code per segment.* This code identifies the company or industry's geographic segment.
7. *Identifiable assets per segment.* Identifiable Assets are the tangible and intangible assets that are used by, or directly associated with, each geographic segment.
8. *Operating profit per segment.* Operating Profit is sales of the identified geographic area segment minus its allocated share of operating costs and expenses, such as, cost of goods sold; selling, general, and administrative expenses, and depreciation, depletion and amortization.
9. *Operating profit per segment note.*
10. *Sales net per segment.* This item consists of the geographic segments gross sales (the amount of actual billings to customers for regular sales completed during the period) reduced by cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers.
11. *Sales net per segment note.*

**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
Qtt_Seg_Bus	10,002	23.3837	17.4141	8	9	18	33	47
Qtt_Seg_Geo	10,002	18.8705	9.0299	11	11	17	24	31
DD	10,002	-0.0645	0.0839	-0.1459	-0.0781	-0.0291	-0.0247	-0.0131
McN	10,002	-0.0642	0.0839	-0.1460	-0.0783	-0.0292	-0.0248	-0.0131
J	10,002	-0.0927	0.1216	-0.2474	-0.1292	-0.0530	-0.0056	-0.0000
JM	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

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; Qtt\_Seg\_Bus = the number of voluntary disclosure elements found in the sample firms' for business segment disclosure; Qtt\_Seg\_Geo = the number of voluntary disclosure elements found in the sample firms' for geographic segment disclosure; DD = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year t working capital accruals on year t, t-1, and t+1 cash flows from operations, (all variables scaled by total assets), where the regression is estimated using data from t = 2000-2007 (It is the Dechow Dichev Model); McN The absolute value, multiplied by minus one, of the residual of a regression of the firm's year t working capital accruals on year t, t-1, and t+1 cash flows from operations, as well as the year t change in revenues and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000-2007 (It is the McNichols model); J = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the Jones (1991) accruals model as applied to total accruals; JM = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied

to total accruals; BusDiversif = number of the different sectors in which the firm operates. GeoDiversif = number of the different countries where the 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 the 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.

**Table 2**  
**Pairwise correlations between Qtt\_Seg, Earnings Quality, diversification,**  
**information asymmetries and control variables (p=0.05)**

Variable	Qtt_Seg	DD	McN	J	JM	BusDiversif	GeoDiversif	Spread	Ln mve	Ln bm	leverage	auditor	StockExch	Herf	NewFin	Roa
Qtt_Seg																
DD	<b>0.1670</b>															
McN	<b>0.1664</b>	<b>0.9997</b>														
J	<b>0.1809</b>	<b>0.2590</b>	<b>0.2588</b>													
JM	<b>0.2178</b>	<b>0.3265</b>	<b>0.3263</b>	<b>0.7480</b>												
BusDiversif	<b>0.3122</b>	<b>0.1283</b>	<b>0.1282</b>	<b>0.1106</b>	<b>0.1299</b>											
GeoDiversif	<b>0.1053</b>	<b>0.0224</b>	<b>0.0220</b>	<b>0.0312</b>	<b>0.0488</b>	<b>0.0536</b>										
Spread	<b>0.0283</b>	<b>0.0200</b>	<b>0.0203</b>	<b>0.0249</b>	<b>0.0221</b>	-0.0038	0.0172									
Ln mve	<b>0.3399</b>	<b>0.1833</b>	<b>0.1843</b>	<b>0.2469</b>	<b>0.2932</b>	<b>0.2234</b>	<b>0.0269</b>	<b>-0.0183</b>								
Ln bm	<b>0.0482</b>	<b>0.0692</b>	<b>0.0699</b>	<b>0.0738</b>	<b>0.0703</b>	<b>0.0625</b>	0.0147	<b>0.0212</b>	<b>-0.2792</b>							
Leverage	<b>0.1178</b>	<b>0.1042</b>	<b>0.1075</b>	<b>0.1493</b>	<b>0.1494</b>	<b>0.1368</b>	<b>0.0419</b>	<b>0.0525</b>	<b>0.1125</b>	0.0082						
Auditor	<b>0.1318</b>	<b>0.0475</b>	<b>0.0471</b>	<b>0.0726</b>	<b>0.0659</b>	<b>0.0708</b>	0.0049	0.0172	<b>0.1903</b>	-0.0170	<b>0.0287</b>					
StockExch	<b>0.1180</b>	<b>0.1422</b>	<b>0.1420</b>	<b>0.2811</b>	<b>0.2703</b>	<b>0.0464</b>	<b>0.0207</b>	0.0195	<b>0.1131</b>	<b>-0.0232</b>	<b>0.0199</b>	<b>0.0382</b>				
Herf	<b>-0.0674</b>	<b>0.1011</b>	<b>0.0997</b>	<b>0.1173</b>	<b>0.0869</b>	<b>0.0807</b>	0.0010	-0.0012	-0.0080	<b>0.0843</b>	<b>0.0993</b>	0.0101	<b>0.0403</b>			
NewFin	<b>0.1096</b>	<b>0.1155</b>	<b>0.1156</b>	<b>0.0958</b>	<b>0.1080</b>	<b>0.0786</b>	<b>0.0221</b>	0.0094	<b>0.1918</b>	<b>-0.0861</b>	<b>0.1344</b>	<b>0.0548</b>	<b>0.0262</b>	<b>0.0453</b>		
Roa	<b>0.0504</b>	<b>0.1521</b>	<b>0.1512</b>	<b>0.1137</b>	<b>0.1350</b>	<b>0.0232</b>	0.0092	-0.0184	<b>0.3834</b>	<b>-0.3257</b>	<b>-0.1637</b>	<b>0.0240</b>	<b>0.0569</b>	<b>0.0670</b>	<b>0.3164</b>	
Age	<b>0.1943</b>	<b>0.1166</b>	<b>0.1155</b>	<b>0.1328</b>	<b>0.1597</b>	<b>0.1821</b>	0.0152	<b>-0.0190</b>	<b>0.2420</b>	0.0002	<b>0.0697</b>	<b>0.0521</b>	<b>-0.0228</b>	0.0080	<b>0.0785</b>	<b>0.1472</b>

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; DD = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year t working capital accruals on year t, t-1, and t+1 cash flows from operations, (all variables scaled by total assets), where the regression is estimated using data from t = 2000-2007 (It is the Dechow Dichev Model); McN The absolute value, multiplied by minus one, of the residual of a regression of the firm's year t working capital accruals on year t, t-1, and t+1 cash flows from operations, as well as the year t change in revenues and year t property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from t = 2000-2007 (It is the McNichols model); J = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the Jones (1991) accruals model as applied to total accruals; JM = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals; BusDiversif = number of the different sectors in which the firm operates. GeoDiversif = number of the different countries where the 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 the 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.

**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)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
DD	+		10.7867 (0.000)			
McN	+			10.6426 (0.000)		
J	+				7.3726 (0.000)	
JM	+					8.0612 (0.000)
BusDiversif	+		5.4034 (0.000)	5.4038 (0.000)	5.2825 (0.000)	5.2727 (0.000)
GeoDiversif	+		0.2693 (0.000)	0.2693 (0.000)	0.2583 (0.000)	0.2532 (0.000)
Spread	+		3.1141 (0.007)	3.1171 (0.007)	2.9445 (0.013)	2.9581 (0.013)
Ln mve	+	4.5303 (0.000)	3.8769 (0.000)	3.8779 (0.000)	3.9662 (0.000)	3.9419 (0.000)
Ln bm	+	4.3421 (0.000)	3.7574 (0.000)	3.7598 (0.000)	3.9790 (0.000)	3.9496 (0.000)
Leverage	+	0.1006 (0.000)	0.0822 (0.000)	0.0823 (0.000)	0.0854 (0.000)	0.0844 (0.000)
Auditor	+	2.7050 (0.000)	2.3803 (0.000)	2.3813 (0.000)	2.3905 (0.000)	2.3874 (0.000)
StockExch	+	8.4118 (0.000)	7.5772 (0.000)	7.5845 (0.000)	6.3565 (0.000)	6.4297 (0.000)
Herf	-	-0.6394 (0.000)	-0.6138 (0.000)	-0.6137 (0.000)	-0.4777 (0.000)	-0.4776 (0.000)
Newfin	+	2.1688 (0.000)	1.3351 (0.026)	1.3366 (0.000)	1.6655 (0.006)	1.6418 (0.000)
Roa	+/-	-0.0373 (0.000)	-0.0276 (0.001)	-0.0275 (0.001)	-0.0292 (0.000)	-0.0301 (0.000)
Age	+	0.1941 (0.000)	0.1137 (0.000)	0.1138 (0.000)	0.1181 (0.000)	0.1173 (0.000)
Cons		7.2229 (0.000)	2.7340 (0.105)	2.7008 (0.109)	2.2695 (0.195)	2.4034 (0.173)
R <sup>2</sup>		0.1700	0.2788	0.2787	0.2959	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;  $DD$  = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the Dechow Dichev Model);  $McN$  = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, as well as the year  $t$  change in revenues and year  $t$  property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the McNichols model);  $J$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the Jones (1991) accruals model as applied to total accruals;  $JM$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals;  $BusDiversif$  = number of the different sectors in which the firm operates.  $GeoDiversif$  = number of the different countries where the 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 the 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.

**Table 4**  
**Fixed Effect Regression of Qtt\_Seg on earnings quality, diversification, information asymmetries and control variables**  
**for two portfolios of earnings quality**

Variable	Expected sign	High earnings quality	Low earnings quality	High earnings quality	Low earnings quality
		(criteria: median)	(criteria: median)	(criteria: cluster)	(criteria: cluster)
		Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
JM	+	47.8394 (0.099)	3.9633 (0.055)	18.0708 (0.000)	4.3087 (0.203)
BusDiversif	+	4.7856 (0.000)	6.1443 (0.000)	5.2806 (0.000)	5.1446 (0.000)
GeoDiversif	+	0.2168 (0.000)	0.2933 (0.000)	0.2448 (0.000)	0.2889 (0.002)
Spread	+	4.1836 (0.016)	1.4808 (0.350)	3.6153 (0.005)	-1.6332 (0.558)
Ln mve	+	3.9260 (0.000)	3.7787 (0.000)	3.9883 (0.000)	2.8572 (0.000)
Ln bm	+	4.3045 (0.000)	3.5601 (0.000)	4.1041 (0.000)	2.1544 (0.000)
Leverage	+	0.0800 (0.000)	0.0810 (0.000)	0.0772 (0.000)	0.0733 (0.004)
Auditor	+	3.8493 (0.000)	1.6914 (0.025)	2.9292 (0.000)	1.0022 (0.402)
StockExch	+	6.8353 (0.000)	7.0567 (0.000)	7.8663 (0.000)	4.9971 (0.002)
Herf	-	-0.5349 (0.000)	-0.4422 (0.000)	-0.5050 (0.000)	0.1115 (0.629)
Newfin	+	3.1793 (0.002)	0.3825 (0.595)	1.9811 (0.004)	0.5468 (0.611)
Roa	+/-	-0.0575 (0.000)	-0.0064 (0.504)	-0.0431 (0.000)	0.0070 (0.631)
Age	+	0.0704 (0.007)	0.1991 (0.000)	0.1124 (0.000)	0.1749 (0.001)
Cons		2.8340 (0.366)	0.3774 (0.864)	1.4155 (0.501)	2.9162 (0.421)
N		5,000	5,002	6,913	3,089
R <sup>2</sup>		0.2046	0.3606	0.2867	0.2751

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;  $DD$  = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the Dechow Dichev Model);  $McN$  = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, as well as the year  $t$  change in revenues and year  $t$  property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the McNichols model);  $J$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the Jones (1991) accruals model as applied to total accruals;  $JM$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals;  $BusDiversif$  = number of the different sectors in which the firm operates.  $GeoDiversif$  = number of the different countries where the 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 the 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. High earnings quality (criteria: median):  $JM$  above the median; Low earnings quality (criteria: median):  $JM$  below the median; High earnings quality (criteria: cluster): The group with high earnings quality resulting from two median clusters on  $JM$  using Euclidean Distance; Low earnings quality (criteria: cluster): The group with low earnings quality resulting from two median clusters on  $JM$  using Euclidean Distance.

**Table 5**  
**Fixed Effect Regression of Qtt\_Seg\_Bus on earnings quality, diversification, information asymmetries and control variables**

Variable	Expected sign	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
DD	+		8.3385 (0.000)			
McN	+			8.2617 (0.000)		
J	+				5.5197 (0.000)	
JM	+					5.5324 (0.000)
BusDiversif	+		5.5363 (0.000)	5.5366 (0.000)	5.4718 (0.000)	5.4634 (0.000)
Spread	+		2.0133 (0.048)	2.0151 (0.048)	1.8898 (0.068)	1.9122 (0.065)
Ln mve	+	3.3392 (0.000)	2.6696 (0.000)	2.6701 (0.000)	2.6994 (0.000)	2.6884 (0.000)
Ln bm	+	3.3865 (0.000)	2.8118 (0.000)	2.8131 (0.000)	2.8279 (0.000)	2.8164 (0.000)
Leverage	+	0.0845 (0.000)	0.0652 (0.000)	0.0653 (0.000)	0.0657 (0.000)	0.0654 (0.000)
Auditor	+	2.0181 (0.000)	1.6664 (0.002)	1.6671 (0.002)	1.6180 (0.003)	1.6170 (0.003)
StockExch	+	5.3019 (0.000)	4.4394 (0.000)	4.4432 (0.000)	3.2619 (0.001)	3.3996 (0.000)
Herf	-	-0.5463 (0.000)	-0.5121 (0.000)	-0.5120 (0.000)	-0.3719 (0.000)	-.03720 (0.000)
Newfin	+	1.5430 (0.004)	0.9533 (0.069)	0.9541 (0.069)	1.1945 (0.024)	1.1781 (0.026)
Roa	+/-	-0.0261 (0.000)	-0.0157 (0.024)	-0.0156 (0.024)	-0.0172 (0.014)	-0.0177 (0.000)
Age	+	0.1843 (0.000)	0.1109 (0.000)	0.1109 (0.000)	0.1075 (0.000)	0.1072 (0.000)
Cons		-1.2237 (0.385)	-5.5407 (0.000)	-5.5592 (0.000)	-6.0851 (0.000)	-6.1860 (0.000)
R <sup>2</sup>		0.1175	0.2590	0.2590	0.2780	0.2791

The sample consists of 10,002 firm-year observations for the period 2001-2006.  $Qtt\_Seg\_Bus$  = the number of voluntary disclosure elements found in the sample firms' for business segment disclosure;  $DD$  = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the Dechow Dichev Model);  $McN$  The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, as well as the year  $t$  change in revenues and year  $t$  property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the McNichols model);  $J$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the Jones (1991) accruals model as applied to total accruals;  $JM$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals;  $BusDiversif$  = number of the different sectors in which the firm operates.  $GeoDiversif$  = number of the different countries where the 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 the 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.

**Table 6**  
**Fixed Effect Regression of Qtt\_Seg\_Geo on earnings quality, diversification, information asymmetries and control variables**

Variable	Expected sign	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)	Coef. (p-value)
DD	+		2.5431 (0.046)			
McN	+			2.4815 (0.051)		
J	+				1.8775 (0.025)	
JM	+					2.7109 (0.003)
GeoDiversif	+		0.1686 (0.000)	0.1686 (0.000)	0.1635 (0.000)	0.1619 (0.000)
Spread	+		1.0285 (0.079)	1.0295 (0.079)	0.9991 (0.096)	0.9889 (0.099)
Ln mve	+	1.1911 (0.000)	1.1644 (0.000)	1.1648 (0.000)	1.2225 (0.000)	1.2062 (0.000)
Ln bm	+	0.9555 (0.000)	0.8773 (0.000)	0.8783 (0.000)	1.0751 (0.000)	1.0511 (0.000)
Leverage	+	0.0161 (0.004)	0.0149 (0.013)	0.0150 (0.013)	0.0169 (0.006)	0.0162 (0.009)
Auditor	+	0.6869 (0.026)	0.7200 (0.022)	0.7204 (0.022)	0.7721 (0.016)	0.7699 (0.016)
StockExch	+	3.1099 (0.000)	3.0359 (0.000)	3.0390 (0.000)	2.9931 (0.000)	2.8994 (0.000)
Herf	-	-0.0930 (0.005)	-0.0981 (0.007)	-0.0981 (0.007)	-0.0988 (0.008)	-0.0988 (0.008)
Newfin	+	0.6258 (0.027)	0.4432 (0.142)	0.4437 (0.141)	0.5274 (0.085)	0.5175 (0.091)
Roa	+/-	-0.0111 (0.003)	-0.0122 (0.002)	-0.0121 (0.002)	-0.0124 (0.002)	-0.0128 (0.002)
Age	+	0.0097 (0.266)	0.0035 (0.700)	0.0036 (0.697)	0.0109 (0.248)	0.0101 (0.282)
Cons		8.4467 (0.000)	8.5447 (0.000)	8.5315 (0.000)	8.4429 (0.000)	8.7212 (0.000)
R <sup>2</sup>		0.0592	0.0685	0.0684	0.0835	0.0847

The sample consists of 10,002 firm-year observations for the period 2001-2006.  $Qtt\_Seg\_Geo$  = the number of voluntary disclosure elements found in the sample firms' for geographic segment disclosure;  $DD$  = The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the Dechow Dichev Model);  $McN$  The absolute value, multiplied by minus one, of the residual of a regression of the firm's year  $t$  working capital accruals on year  $t$ ,  $t-1$ , and  $t+1$  cash flows from operations, as well as the year  $t$  change in revenues and year  $t$  property, plant, and equipment (PP&E) (all variables scaled by total assets), where the regression is estimated using data from  $t = 2000-2007$  (It is the McNichols model);  $J$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the Jones (1991) accruals model as applied to total accruals;  $JM$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals;  $BusDiversif$  = number of the different sectors in which the firm operates.  $GeoDiversif$  = number of the different countries where the 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 the 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.

## **Chapter 3: Segment Disclosure, Earnings Quality and Cost of Capital.**

### **3.1. INTRODUCTION**

The objective of this paper is to analyze whether firms providing better earnings quality and better segment information enjoy a lower cost of capital. We use the residuals of a regression of quantity of segment information on the determinants of segment disclosure (this regression was already explained in detail in Chapter 2) 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.

In this study, we focus on the relation between cost of capital, earnings quality 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; Ettredge, Kwon, Smith and Zarowin, 2005), 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) 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 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 quality segment information 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 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 complementing earnings numbers of good 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 3.2 we present the theoretical development on the relation between segment disclosure, earnings quality and cost of capital. In Section 3.3 we present the research design, describing our proxies for the quantity and quality of segment information and the methods used to study the impact of segment information quality on cost of capital. In Section 3.4 we present the results. Finally Section 3.5 summarizes and concludes.

### **3.2. SEGMENT DISCLOSURE, EARNINGS QUALITY AND COST OF CAPITAL**

There is an ongoing debate on whether better accounting information decreases cost of capital. Some studies suggest that information asymmetries affect the cost of capital. As high quality accounting 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), Francis et al. (2008) and Garcia Lara, Garcia Osma and Penalva (2010) find a negative relation between accounting quality and cost of capital, others like Core, Guay and Verdi (2008) or McInnis (2010) 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. Early evidence by Kinney (1971), Collins (1976), Baldwin (1984) and Balakrishnan et al. (1990) shows that segment reporting contributes to improve analysts' ability to estimate future accounting numbers. Also, Greenstein and Sami (1994) find that segment reporting contributes to reduce information asymmetries, and Berger and Hann (2003, 2007) and Hope and Thomas (2008) show that segment reporting contributes to reduce agency

costs. All of these findings in prior literature suggest a link between segment reporting and cost of capital. However, we should consider not only the quantity, but the quality of the disclosures. 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) would capture whether the firm provides more segmental information than expected given its degree of diversification. Such measure of quality of segment disclosure would be a good indicator of investor's capability to estimate firm's cash flows. This increase in investors' capability to estimate firm's cash flows is expected to reduce estimation risk. However, this reduction in estimation risk will only take place if high quality segment disclosure goes hand in hand with earnings numbers that provide a true and fair view of the situation of the firm. If this is the case, and the firm provides good quality earnings, we expect that high quality segment information will additionally contribute to facilitate the estimation of firm's cash flows. This leads to our second hypothesis:

*Hypothesis 1: Firms providing better segment information, contingent upon high earnings quality, are expected to be rewarded with a lower cost of capital.*

### **3.3. RESEARCH DESIGN**

#### ***3.3.1 Quantity of segment disclosure ( $Qtt\_Seg$ ) and quality of segment disclosure ( $Qlt\_Seg$ )***

To create a proxy for the quality of segment information, we start taking the proxy for the quantity of segment disclosure ( $Qtt\_Seg$ ) that we develop in Chapter 2.<sup>1</sup>

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<sup>1</sup> To elaborate this index for the quantity of segment disclosure ( $Qtt\_Seg$ ), we analyse disclosures on both business and geographic segments. In a first step, for every reported business/geographic segment in each firm, we analyse whether the segment is reported on a compulsory or voluntary basis. For the compulsory segments, we distinguish between the items reported compulsorily as they are required by SFAS 131, and the items reported on a voluntary basis. Next, we create the business/geographic segment score

Then, we estimate a regression of quantity of segment information ( $Qtt\_Seg$ ) on earnings quality, the main determinants of segment disclosures (business and geographic diversification and information asymmetries) and controls. The model is as follows:

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

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.

The variables in Equation (1) are defined as follows:

#### *A/Earnings quality*

To estimate earnings quality, we use the modified Jones model as defined by Dechow, Sloan and Sweeney (1995):

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

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$(Qtt\_Seg\_Bus)/(Qtt\_Seg\_Geo)$  by adding 1 point for every voluntarily disclosed item in every mandatory segment, and 1 point for every item in every voluntary segment. Finally, we create the overall index of quantity of voluntary segment disclosure ( $Qtt\_Seg$ ) by adding the business and geographic segment scores.

where:  $TA_{j,t}$ <sup>2</sup> 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:

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

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.

#### *B/ 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. 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.

<sup>2</sup> Measured as  $\Delta CA_{j,t} - \Delta CL_{j,t} - \Delta Cash_{j,t} + \Delta STDEBT_{j,t} - \Delta DEPN_{j,t}$ ;  $\Delta CA_{j,t}$  is firm j's change in current assets (Compustat #4) between year t-1 and year t;  $\Delta CL_{j,t}$  is firm j's change in current liabilities (Compustat #5) between year t-1 and year t;  $\Delta Cash_{j,t}$  is firm j's change in cash (Compustat #1) between year t-1 and year t;  $\Delta STDEBT_{j,t}$  is firm j's change in debt in current liabilities (Compustat #34) between year t-1 and year t;  $\Delta DEPN_{j,t}$  firm j's depreciation and amortization expense (Compustat #14) in year t.

*C/ 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.<sup>3</sup> 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.

*D/ 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:

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

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  $t$ .

*E/ Controls*

We measure firm size as the natural logarithm of firm's market value, measured at the beginning of the fiscal year. Firm's growth is measured as the logarithm of the firm's book to market ratio at the beginning of the fiscal year. We measure leverage as the ratio of total debt to total assets. Auditor is a dummy variable taking the value of 1 if the auditor is a Big Four firm, and 0 otherwise. Listing Status is a dummy variable taking the value of 1 if the firm is listed in the NYSE or in NASDAQ, and 0 otherwise.

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<sup>3</sup> We use subsidiaries information from Osiris. We take into account subsidiaries with a minimum of 25.01% of control by the company under analysis.

Proprietary costs are proxy for Herfindahl index. New Financing is 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. Profitability is measured as return on assets and age is measured as the difference between the first year when the firm appears in CRSP and the current year.

### ***3.3.2 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.

#### ***3.3.2.1 Analysts' forecast errors***

More comprehensive segment information is useful for analysts because it helps to predict more accurately earnings per share (Hopwood, Newbold and Silhan, 1982; Silhan, 1983; Baldwin, 1984; Balakrishnan et al., 1990; Swaminathan, 1991; 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 1, we study whether better quality segment disclosure that complements good quality earnings, reduces analysts' forecast errors. To do so, we use the following model, estimated with industry fixed effects:

$$\begin{aligned}
Forecast\ error_{j,t} = & \alpha + \beta_1 Qlt\_Seg_{j,t} + \beta_2 DummyEarnings\_Qlt_{j,t} + \\
& + \beta_3 Qlt\_Seg_{j,t} * DummyEarnings\_Qlt_{j,t} + \\
& + \beta_4 Number\ analysts_{j,t} + \beta_5 DesvForecast_{j,t} + \\
& + \beta_6 Size_{j,t} + \sum_k \beta_k Control\ year_{j,t} + \epsilon_{j,t}
\end{aligned} \tag{5}$$

The coefficient of interest in Equation (5) is  $\beta_3$ . A negative coefficient implies a reduction in forecast error when segment information quality increases and earnings quality is high (above the median for the sector and year). 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  $\beta_4$  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  $\beta_5$  coefficient. Finally, we include firm size as prior research shows this is associated to lower forecast errors (negative  $\beta_6$  coefficient).

### 3.3.2.2 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, and that this disclosure effect is not diversifiable. In their framework, this leads to improved disclosure reducing cost of capital. To test this empirically, we use actual returns as a 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 the annual covariance between the monthly returns of the firm and the monthly returns of the sector in which the firm operates. With this test, we analyze whether better quality segment disclosure, conditional upon high earnings quality, reduces the firm's assessed covariance with other firms' returns in the



same sector, which in turn contributes to reduce the cost of capital. We use the following model, estimated with industry fixed effects:

$$\begin{aligned}
Cov(r_i, r_{sector})_{j,t} = & \alpha + \beta_1 Qlt\_Seg_{j,t} + \beta_2 DummyEarnings\_Qlt_{j,t} + \\
& + \beta_3 Qlt\_Seg_{j,t} * DummyEarnings\_Qlt_{j,t} + \beta_4 Size_{j,t} + \\
& + \beta_5 Booktomarket_{j,t} + \beta_6 Herf_{j,t} + \beta_7 Leverage_{j,t} + \\
& + \beta_8 Business\ Diversification_{j,t} + \beta_9 Geographic\ Diversification_{j,t} + \\
& + \beta_{10} Listing\ Status_{j,t} + \beta_{11} Profitability_{j,t} + \beta_{12} Age_{j,t} + \\
& + \sum_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t}
\end{aligned} \tag{6}$$

The coefficient of interest in Equation (6) is  $\beta_3$ . A reduction in risk due to increases in segment information quality, contingent upon good earnings quality, implies a significantly negative  $\beta_3$ . That is, if segment information quality and earnings quality complements each other to reduce the assessed covariance of the firm's returns with the returns of the firms in the same industry,  $\beta_3$  will be significantly negative.

Regarding the control variables in Equation (6), previous literature finds that size, industry concentration, age, listing status and diversification of the firm decrease firm's beta (Subrahmanyam and Thomadakis, 1980; Caves, 1982; Kim, Hwang and Burgers, 1989; Lubatkin and Rogers, 1989; Harvey, 1991; Fama and French, 1992, 1993, 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).

### 3.3.2.3 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, earnings quality, the interaction between quality of segment disclosure and earnings quality and control variables commonly used in the cost of capital literature: size, the book-to-market ratio, beta, 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:

$$\begin{aligned}
 r_{PEG_{j,t}} = & \alpha + \beta_1 Qlt\_Seg_{j,t} + \beta_2 DummyEarnings\_Qlt_{j,t} + \\
 & + \beta_3 Qlt\_Seg_{j,t} * DummyEarnings\_Qlt_{j,t} + \beta_4 Size_{j,t} + \\
 & + \beta_5 Booktomarket_{j,t} + \beta_6 Beta_{j,t} + \beta_7 Leverage_{j,t} + \\
 & + \beta_9 Business\ Diversification_{j,t} + \beta_{10} Geographic\ Diversification_{j,t} + \\
 & + \sum_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t}
 \end{aligned} \tag{7}$$

The coefficient of interest in Equation (7) is  $\beta_3$ . A reduction in cost of capital related to increases in segment information quality, contingent upon good earnings quality, will lead to a significantly negative  $\beta_3$ . That is, if segment information quality and earnings quality complement each other to reduce the cost of capital,  $\beta_3$  will be significantly negative.

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

$$r_{PEG} = \sqrt{\frac{eps_5 - eps_4}{P_0}} \tag{8}$$

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 than changes in near-term forecasts.

Regarding the control variables in Equation (7), 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. Thus, we include the log of the book-to-market ratio (Fama and French, 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. Given this, 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).

#### 3.3.2.4 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 (1992, 1993) three factor model, which has recently been applied in the accounting literature (Core et al., 2008; Francis et al., 2008; McInnis, 2010; Garcia Lara et al., 2010) 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.<sup>4</sup> We include size (*SMB*) and book-to-market (*HML*) portfolios as in Fama and French (1992, 1993). We also include the excess market

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<sup>4</sup> One criticism of cross-sectional tests is that realized returns are noisy, particularly at the firm level. That is, firm-specific news may 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).

return ( $RMRF$ ).<sup>5</sup> 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 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:

$$R_{jt} - R_t^f = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_t \quad (9)$$

In this model,  $\alpha$  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, if it includes all risk factors that affect the firm), the estimated  $\alpha$  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  $\alpha$ , 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  $\alpha$  in Equation (9) as we move from good to poor earnings quality portfolios, so we expect a negative and statistically significant  $\alpha$  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 (9) for the hedge accounting information quality portfolio, ( $Acc\_Qlt$ ) that combines earnings quality and segment information quality. To build this new variable, first, we create a dummy variable of earnings quality: 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 Equation 1 are positive and zero

<sup>5</sup> 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](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)

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  $\alpha$  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  $HILOEarnings\_Qlt$  factor, a  $HILOQlt\_Seg$  factor and  $HILOAcc\_Qlt$  factor. The  $HILOEarnings\_Qlt$  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  $HILOQlt\_Seg$  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  $HILOAcc\_Qlt$  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 sorted on B/M and Accounting Quality<sup>6</sup> using a time-series regression of excess returns for a portfolio on the contemporaneous returns to the Fama–French factors, the earnings quality factor and the segment disclosure quality factor:

$$R_{p,t} - R_t^f = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 HILOQt\_Seg_t + \beta_5 HILOEarnings\_Qlt_t + \varepsilon_t \quad (10)$$

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.  $HILOQt\_Seg$  is the monthly return of good quality segment disclosure firms over poor quality segment disclosure firms and  $HILOEarnings\_Qlt$  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:

$$R_{p,t} - R_t^f = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 HILOAcc\_Qlt_t + \varepsilon_t \quad (11)$$

where all variables are the same as in Equation (10) and  $HILOAcc\_Qlt$  is the monthly return of good accounting information quality firms over poor accounting information quality firms.

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<sup>6</sup> 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  $DummyEarnings\_Qlt$ .

In the second stage, we collect the portfolio-specific loadings from (10) and (11), respectively, and estimate the factor premium conditional on the first stage loadings with cross-sectional regressions 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:

$$\begin{aligned} \overline{R_{pt} - R_t^f} = & \alpha + \delta_1 \beta_{RMRF} + \delta_2 \beta_{SMB} + \delta_3 \beta_{HML} + \delta_4 \beta_{QIt\_Seg} + \\ & + \delta_5 \beta_{Earnings\_QIt} + \varepsilon_t \end{aligned} \quad (12)$$

Firms providing better earnings quality and better segment information quality should enjoy lower cost of capital, so  $\delta_4$  and  $\delta_5$  are expected to be negative.

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

$$\overline{R_{pt} - R_t^f} = \alpha + \delta_1 \beta_{RMRF} + \delta_2 \beta_{SMB} + \delta_3 \beta_{HML} + \delta_4 \beta_{Acc\_QIt} + \varepsilon_t \quad (13)$$

Consistent with the individual analysis of earnings quality and segment information quality, we expect that firms providing better overall accounting information quality will have smaller excess returns. Consequently, we expect a significantly negative  $\delta_4$ . This would imply that firms providing good segment information quality that complements good quality earnings will enjoy a lower risk premium, leading to a reduction in cost of capital.

### 3.3.3 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.<sup>7</sup> 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 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.

[Insert Table 1 about Here]

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. Mean leverage is 20.19%, indicating that our sample firms are relatively low leveraged. The mean number of analysts following a firm in our sample firms is 8. The mean beta of our sample firms is 1.17, indicating that our sample firms, in mean, are more risky than the market. The mean cost of capital is 13.47% for the implied cost of capital measure, and the mean excess monthly return is 1.3%.

### 3.4. RESULTS

#### 3.4.1 *Forecast errors and segment disclosure*

[Insert Table 2 about Here]

In Table 2 we show the results on whether segment disclosure reduces analysts' forecast 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

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<sup>7</sup> 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.



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  $\beta_1 = -0.0001$  (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 ( $\beta=0.0074$  and p-value=0.006 when we do not control by earnings quality and  $\beta=0.0073$ , 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 2 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 (5)– 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 for this result is that once we include the interaction effect, the

coefficient on segment reporting quality might be only capturing firms providing poor quality segment information that is not useful for analysts in making their forecasts.

The F-ratio test on the  $R^2$  increment is statistically significant at p-value 0.04 (not tabulated), so we should take into account that quality of segment information and earnings quality are related when we explain their effect on the forecast errors. Given this result, we expect firms providing high segment disclosure quality will enjoy lower cost of capital only when earnings quality is high.

### ***3.4.2 Firm's assessed covariance with other firms' returns and segment quality***

[Insert Table 3 about Here]

In Table 3 we show the results on whether segment disclosure reduces firm's assessed covariance between firm' returns and returns of the firms operating in the same sector. In the first column of the table we show the results of the regression of the covariance between firm's 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 to reduce the information risk of the firm. The results confirm this, as the coefficient of  $Qtt\_seg$  is not significant. 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. So, we find that better quality segment information reduces the assessed covariance with sector firms' returns. We also find that having earnings quality above the median also leads to a reduction in the risk of the firm.

Finally, in the last column of Table 3 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 reduces information risk to a larger extent

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 do not provide useful information to investors. Or alternatively, that firms providing poor earnings quality do not provide high quality segment information. The F-ratio test on the  $R^2$  increment is statistically significant at p-value 0.0002 (not 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 earnings quality is high, reduce the estimation risk of the firm. In the Lambert et al. (2007) setting, these results are consistent with firms providing high quality segment disclosure, contingent upon high earnings quality, enjoying a lower cost of capital.

### ***3.4.3 Ex-ante cost of capital estimates and segment disclosure***

[Insert Table 4 about Here]

In Table 4 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 find 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 1. As expected, earnings quality is negatively related with  $r_{PEG}$  (12.36%) indicating that firms with good earnings quality enjoy lower cost of capital.

[Insert Table 5 about Here]

In Table 5 we show results of regressions of implied cost of capital on segment information quality, earnings quality, the interaction between segment information quality and earnings quality, and controls. In the first column of this table we validate our proxy for the ex-ante cost of capital ( $r_{PEG}$ ). We find that the cost of capital decreases with firm size and 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 5 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 (not 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.

#### ***3.4.4 Asset-pricing-based tests of the relation between segment disclosure and cost of capital***

[Insert Table 6 about Here]

In Table 6, Panel A we show 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 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 7 we explore whether accounting quality (measured as earnings quality  $-Earnings\_Qlt-$ , 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  $\alpha$  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  $\alpha = -0.00052$  (p-value 0.000). This is consistent with accounting quality being an omitted factor in the Fama-French three factor model, as firms providing poor accounting quality have greater average excess returns unexplained.

In Table 8, we show the results on whether segment disclosure reduces cost of capital using asset pricing tests. We find that the sensitivity of portfolios' returns to segment information quality is negative. However, when we include earnings quality (in Table 8, column 9), the sensitivity of portfolios' returns to this factor is not significant (p-value=0.120), while the sensitivity of portfolios' returns to the 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 8 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 in the mean cost of capital when segment information quality and earnings quality are complementary, for 25 portfolios sorted on book-to-market and accounting quality, is of  $-0.0007121$  (not tabulated), which is consistent with the results in Table 5. 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).

In Table 9 we present the results of the two-stage regression to obtain the risk premium factors. We find that quality of the segment information risk premium is negative ( $\delta_4 = -0.0187$ ; 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 ( $\delta_4 = -0.0150$ ; 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 (13)–. We find that when earnings quality and segment quality information are complementary, this accounting quality factor is, as expected, a priced risk factor ( $\delta_4 = -0.0148$ ; p-value 0.014). These findings suggest that firms with better quality segment information that complements high quality earnings, 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.

#### **3.4.5 Additional sensitivity tests**

In this section we describe untabulated additional sensitivity tests. The results of the estimation of Equations (5), (6) and (7), about the effect of segment disclosure on a) forecast errors, b) the covariance of the firm's cash flows with other firms' cash flows, and c) implied cost of capital estimates, are robust to the interaction between *Qlt\_Seg* and *Earnings\_Qlt* using the values of earnings quality instead of a dummy variable for high/low earnings quality firms. We divided the sample in observations with poor *Qlt\_Seg* (negative residuals from Equation (1)) and observations with good *Qlt\_Seg* (positive residuals from Equation (1)). We do this as the interaction variable is non-linear. We run Equations (5), (6) and (7) for each group, and inferences remain unchanged. Our results are also robust to using our overall accounting quality measure (*Acc\_Qlt*). Finally, we also run Equations (5), (6) and (7) including *Good\_Comp* (when earnings quality is above the median and residuals of Equation (1) are positive), *Non\_Comp* (when earnings quality is above the median and residuals of Equation (1)

are negative) and *Bad\_Comp* (earnings quality is below the median and residuals of Equation (1) are negative) and the results are qualitatively similar.

Our results are robust to the use of the absolute values of the residuals of the Jones (1991), Dechow and Dichev (2002) and McNichols (2002) models, and of the standard deviation of the residuals of the Jones, modified Jones, Dechow and Dichev, and McNichols models, calculated at the firm level using rolling windows of five years as in Francis et al. (2004).

In our main tests we use industry-year fixed effects models to control for industry and year specific shocks to quantity of segment reported information, analysts' forecast errors, systematic risk and cost of equity capital. We check the robustness of our results calculating standard errors clustered by industry,<sup>8</sup> and we find that results are robust.

Finally, we replicate all the tests distinguishing between voluntary business segment information and voluntary geographic segment information. Our results are robust to the separate use of business segment information quality and geographic segment information quality. These results are especially significant given the debate on the reduction of geographic segment information requirements introduced by SFAS 131.

### 3.5. SUMMARY AND CONCLUSIONS

In this paper we analyze 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. We provide empirical evidence supporting the claim that through high segment disclosure quality, when earnings quality is high, investors are better able to

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<sup>8</sup> Following Petersen (2009, pp 475-476), we estimate robust standard errors clustered by industry. It is not necessary to estimate robust standard error two-way clustered (industry-year) since our models contain year fixed effects.



estimate firm's cash flows more accurately, and, as a result, demand lower returns, which leads to a lower cost of capital for the 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 better segment disclosure reduce the assessed covariance between firm's returns, and the returns of the firms in the same industry.

Our results contribute to the current debate, 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, and add to prior evidence showing that permitting firms to reduce the amount of segment information may have undesirable economic consequences (Hope and Thomas, 2008). In particular, we show that improved segment reporting helps estimating firms' future cash flows and contributes to decrease firms' cost of capital. We also show that this effect also holds if we consider only the quality of geographic disclosures.

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**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 controls and determinants of segment disclosure.  $Qtt\_Seg\_Bus$  = 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 controls and determinants of segment disclosure;  $Earnings\_Qlt$  = The absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals;  $BusDiversif$  = number of the different sectors in which the firm operates.  $GeoDiversif$  = number of the different countries where the 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 the 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 forecasted eps for the year  $t$  - eps of the year  $t$ , scaled by the absolute value of eps in the year  $t$ .  $Dev.\ Forecast\ error$  = Deviation of analysts' forecasts. It is calculated as the standard deviation of analysts' 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 the risk free rate.

**Table 2**  
**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)
DummyEarnings_Qlt	-			-0.0507 (0.003)	0.0023 (0.953)
Qlt_Seg*DummyEarnings_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 <sup>2</sup>		0.0342	0.0368	0.0381	0.0385

The sample consists of 10,002 firm-year observations for the period 2001-2006. AbsForecast 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 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 controls and determinants of segment disclosure. We then rank the residuals from this model into deciles. DummyEarnings\_Qlt = it is dummy variable which takes value of 1 if Earnings\_Qlt is above median, and zero otherwise, where Earnings\_Qlt is the absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals. Number of analysts = number of eps forecasts of the firm in the year t. Dev. Forecast error= Deviation of analysts' forecasts. 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 3**  
**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)
DummyEarnings_Qlt	-			-0.0061 (0.016)	0.0066 (0.194)
Qlt_Seg*DummyEarnings_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 <sup>2</sup>		0.0271	0.0272	0.0280	0.0294



The sample consists of 10,002 firm-year observations for the period 2001-2006.  $\text{Cov}(r_i, r_{\text{sector}})$  = 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.  $\text{Qtt\_Seg}$  = the number of voluntary disclosure elements found in the sample firms' for segment disclosure;  $\text{Qlt\_Seg}$  = the regression residuals obtained from a regression of the firm's year t  $\text{Qtt\_Seg}$  on controls and determinants of segment disclosure. We then rank the residuals from this model into deciles.  $\text{DummyEarnings\_Qlt}$  = it is dummy variable which takes value of 1 if  $\text{Earnings\_Qlt}$  is above median, and zero otherwise, where  $\text{Earnings\_Qlt}$  is the absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals..  $\text{Ln mve}$  = the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006;  $\text{Ln bm}$  = the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006.  $\text{Herf}$

= Herfindahl index in percentage, calculated as 
$$\text{Herf}_j = \sum_{i=1}^N \left( \frac{S_{ij}}{S_j} \right)^2$$
.  $\text{Leverage}$  = debt to total assets ratio in percentage.  $\text{BusDiversif}$  = number of the different sectors in

which the firm operates.  $\text{GeoDiversif}$  = number of the different countries where the firm operates.  $\text{Roa}$  = percentile rank of return on assets.  $\text{Age}$  = the difference between the first year when the firm appears in CRSP and the current year.

**Table 4**  
**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	<b>-0.1283</b>	<b>0.7087</b>	1							
DummyEarnings_Qlt	<b>-0.1236</b>	<b>0.2207</b>	-0.0039	1						
Ln mve	<b>-0.1888</b>	<b>0.3399</b>	-0.0032	<b>0.2936</b>	1					
Ln bm	<b>0.1813</b>	<b>0.0482</b>	0.0047	<b>0.0218</b>	<b>-0.2792</b>	1				
Beta	<b>0.0921</b>	0.0090	0.0004	0.0095	<b>-0.0413</b>	<b>0.0320</b>	1			
Leverage	<b>0.1222</b>	<b>0.1178</b>	-0.0071	<b>0.0995</b>	<b>0.1125</b>	0.0082	0.0149	1		
BusDiversif	<b>-0.0852</b>	<b>0.3122</b>	-0.0094	<b>0.1231</b>	<b>0.2234</b>	<b>0.0625</b>	<b>-0.0137</b>	<b>0.1368</b>	1	
GeoDiversif	<b>-0.0600</b>	<b>0.1053</b>	0.0002	<b>0.0413</b>	<b>0.0269</b>	0.0147	0.0342	<b>0.0419</b>	<b>0.0536</b>	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; Qlt\_Seg = the regression residuals obtained from a regression of the firm's year t Qtt\_Seg on controls and determinants of segment disclosure. We then rank the residuals from this model into deciles. DummyEarnings\_Qlt = it is dummy variable which takes value of 1 if Earnings\_Qlt is above median, and zero otherwise, where Earnings\_Qlt is the absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals. 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 the firm operates. GeoDiversif = number of the different countries where the firm operates.

**Table 5**  
**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)
DummyEarnings_Qlt	-				-0.0139 (0.000)	0.0035 (0.100)
Qlt_Seg*DummyEarnings_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)	-0.0007 (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 <sup>2</sup>		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; Qlt\_Seg = the regression residuals obtained from a regression of the firm's year t Qtt\_Seg on controls and determinants of segment disclosure. We then rank the residuals from this model into deciles. DummyEarnings\_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 absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals. 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 the firm operates. GeoDiversif = number of the different countries where the firm operates.

**Table 6**  
**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%
HILOQt_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	HILOQt_Seg	HILOAQ	HILOAcc_Qlt
RMRF	1					
SMB	<b>0.3308</b>	1				
HML	<b>-0.4618</b>	<b>-0.2407</b>	1			
HILOQt_Seg	<b>0.0324</b>	<b>-0.2163</b>	<b>0.4018</b>	1		
HILOEarnings_Qlt	<b>0.0624</b>	<b>-0.2421</b>	<b>0.5009</b>	<b>0.3925</b>	1	
HILOAcc_Qlt	<b>0.0435</b>	<b>-0.3651</b>	<b>0.3069</b>	<b>0.4009</b>	<b>0.6927</b>	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 Qt\_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 7**  
**Firm-specific time-series regressions of contemporaneous excess returns on the Fama –French 3 factors**

Variable	HEDGE Earnings_Qlt	HEDGE Qlt_Seg	HEDGE Acc_Qlt
	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 <sup>2</sup>	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 8**  
**Average factor loadings across 25 portfolios sorted on B/M and Accounting Quality**

Variable	CAPM						FF 3 FACTOR MODEL			
			Coef.		(p-value)		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)
HILOQt_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 <sup>2</sup>	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. HILOQt\_Seg factor is the return to the segment quality factor-mimicking portfolio for Qt\_Seg. HILOEarnings\_Qlt factor is the return to the earnings quality factor-mimicking portfolio for Earnings\_Qlt. HILOAcc\_Qlt factor is the return to the accounting quality factor-mimicking portfolio for Acc\_Qlt.

**Table 9**  
**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	-0.0680	-0.1027	-0.1517
							(0.006)	(0.179)	(0.057)	(0.003)
HML							-0.0300	-0.0938	-0.1112	-0.0533
							(0.624)	(0.065)	(0.007)	(0.288)
RMRF			0.2061	0.1922	0.1883	0.1316	0.2393	0.2767	0.1552	0.1387
			(0.028)	(0.014)	(0.000)	(0.203)	(0.004)	(0.000)	(0.138)	(0.121)
HILOQt_Seg	-0.0198	-0.0179								
	(0.000)	(0.000)								
HILOEarnings_Qlt		-0.0127								
		(0.074)								
HILOAcc_Qlt						-0.0091				-0.0148
						(0.416)				(0.014)
cons	1.9404	1.8493	-0.5824	-0.3754	-0.0005	0.2978	0.2603	-0.6522	1.0148	1.5227
	(0.000)	(0.000)	(0.577)	(0.665)	(0.000)	(0.808)	(0.772)	(0.395)	(0.464)	(0.139)
R <sup>2</sup>	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. HILOQt\_Seg factor is the return to the segment quality factor-mimicking portfolio for Qt\_Seg. HILOEarnings\_Qlt factor is the return to the earnings quality factor-mimicking portfolio for Earnings\_Qlt. HILOAcc\_Qlt factor is the return to the accounting quality factor-mimicking portfolio for Acc\_Qlt.

## **Chapter 4: The Role of Segment Disclosure in Corporate Governance and its Effect on Firm Investment Efficiency**

### **4.1. INTRODUCTION**

Prior literature finds that better segment disclosure improves the information environment of the firm, reducing information asymmetries (Berger and Hann, 2003), and facilitating the monitoring over managers decisions. Regarding this monitoring role of segment reporting, Berger and Hann (2007) show that managers tend to hide information about poorly performing segments, and that firms that withhold information about their foreign investments invest more abroad and obtain lower profitability out of these investments (Hope and Thomas, 2008). Overall, these findings suggest a link between the quality of segment information and firm investment efficiency. We further explore this issue by showing (1) that the sensitivity of firms' investments to the availability of internal cash flows is reduced in firms providing better segment disclosure, and (2) that better quality segment disclosure contributes to reduce both over and underinvestment problems.

Our first objective is to test whether firms providing better segment disclosure present a lower sensitivity of investments to cash flows. Firms disclosing higher quality segment information provide shareholders with more accurate information about their business activities, so we expect that investments decisions in these firms will be less sensitive to cash holdings. This is mainly because without good quality segment information it is more difficult to detect and deter investment decisions that decrease firm value (Hope and Thomas, 2008). Therefore, when firms do not reveal precise information, as monitoring manager's investment decisions becomes more difficult, investors will demand higher returns as the likelihood of expropriation increases. This leads to a higher cost of capital for the firm (Easley and O'Hara, 2004; Hughes, Liu and Liu, 2007; Lambert,



Leuz and Verrecchia, 2007, 2008; Garcia Lara, Garcia Osma and Penalva, 2010a). Consequently, holding everything else constant, firms providing poor segment disclosure are more likely to finance their projects with internally generated cash flows. This is so because this financial alternative is cheaper (Fazzari, Hubbard, and Petersen, 1988; Allayannis and Mozumdar, 2004).

The second objective of the paper is to test whether high quality segment reporting mitigates under-investment or over-investment problems. On the one hand, we expect that firms providing better segment disclosure quality will be less likely to underinvest. The reason is that, as previously explained, firms with stronger corporate governance mechanisms and higher accounting quality enjoy a lower cost of capital. This lower cost of capital will provide firms with more alternatives to finance externally their projects, as well as with a larger span of projects that generate value. The result is a decrease in under-investment due to firms having less financial constraints. On the other hand, we also expect firms providing better segment disclosure quality to be less likely to over-invest. The reason is that shareholders of firms providing better segment information will be more able to detect and deter those investment decisions that are not in their best interests (Hope and Thomas, 2008). The result is that managers will not implement investment projects that reduce the value of the firm, leading to fewer situations of overinvestment due to deficiencies in the monitoring process.

Using a sample of non regulated and non financial US firms for the period 2001-2006, we find that segment disclosure leads to lower cost differences between internal and external financing, which in turn leads to lower investment cash flow sensitivity after controlling for growth opportunities. This is consistent with quality of segment disclosure reducing firm investment inefficiency. Additionally, we provide empirical evidence on

firms providing better segment disclosure reducing under- and over-investing problems. However, under too tight monitoring, managers might deviate from the optimal investment policies (Hermalin and Weisbach, 2009; Barger, Lehn and Zutter, 2010), exacerbating under-investment and over-investment problems. In this context, high quality segment information plays a crucial role to avoid investment inefficiencies under excessive monitoring.

Our study contributes to the recent stream of literature on the effects of higher accounting quality and other corporate governance mechanisms on investment inefficiency (Biddle and Hilary, 2006; Biddle, Hilary and Verdi, 2009; Beatty, Liao and Weber, 2010), and particularly, on how segment reporting quality influences investment decisions (Berger and Hann, 2003, 2007; Hope and Thomas, 2008). We find a non-linear relationship between corporate governance mechanisms and investment efficiency, consistent with recent research pointing at negative economic consequences of excess monitoring (Hermalin and Weisbach, 2009; Barger et al., 2010). We also show that segment disclosure and other corporate governance mechanisms complement each other in enhancing firm's investment efficiency. Our findings suggest that segment reporting leads to more investment efficiency. Thus, withholding information about firms' earnings on foreign investments could have undesirable economic consequences.

The remainder of this paper is organized as follows. In Section 4.2 we present the theoretical development on the relation between segment disclosure and investment efficiency. In Section 4.3 we present the research design, describing the methods we use to analyze the relation between segment information and cash flow sensitivity and to study how segment reporting impacts the likelihood of under- or over-investing. In this section we also describe our proxies for the optimal level of investment and for the quality of

segment information. In Section 4.4 we present the results. Finally Section 4.5 summarizes and concludes.

## **4.2. SEGMENT DISCLOSURE QUALITY AND INVESTMENT EFFICIENCY**

Agency theory predicts that managers have more information about the expected profitability and financial condition of the firm. In this context, when managers are not monitored by shareholders they can make decisions that maximize their own wealth instead of firm's value (Jensen and Meckling, 1976). The role of financial accounting is to reduce these information asymmetries providing details about firms' profitability and financial condition (Healy and Palepu, 2001). Thus, accounting information is expected to be used by shareholders as an additional governance tool to monitor managers, dissuading them from taking investment decisions that are not in the best shareholders' interests (Bushman and Smith, 2001; Garcia Lara, Garcia Osma and Penalva, 2009). Consistent with this role of accounting information, previous literature finds that firms providing better quality accounting information show lower investment-cash flow sensitivity (Biddle and Hilary, 2006; Beatty et al. 2010). Also, the likelihood of firms over or under investing is lower for firms providing improved accounting numbers (Biddle, et al., 2009; Garcia Lara, Garcia Osma and Penalva, 2010b). In the same vein, previous literature finds that firms providing higher levels of disclosure make more efficient investment decisions (Khurana, Pereira and Martin, 2006; Hope and Thomas, 2008).

Regarding the specific role of segment reporting, in a framework where firms are increasingly international and increasingly diversified, segment information becomes crucial. 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 helps 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." (SFAS 131, paragraph 3).

A wealth of academic research shows the importance of providing segment information to shareholders. Previous literature finds that different segments have different investment opportunities, so disaggregating information helps current and potential investors to improve their capital allocation decisions (Foster, 1975; Tse, 1989; Wysocki, 1998; Basu, Kim and Lim, 1999; Chen and Zhang, 2003). Moreover, segment information is crucial as it facilitates shareholders as well as debtholders' monitoring over manager's decisions. Previous literature shows that information asymmetries are greater for firms providing no disaggregated information than for firms providing comprehensive segment information (Greenstein and Sami, 1994; Hope, Thomas, and Winterbotham, 2009). This evidence is consistent with improved segment disclosure facilitating the monitoring of managers' decisions. Regarding this monitoring role of segment disclosure, Berger and Hann (2003, 2007) find that firms revealing information about the firm's diversification strategy and their resource transfers across segments are easier to monitor, and that more

disaggregated information on earnings profits reduces agency costs. Similarly, Hope and Thomas (2008) demonstrate that geographic segment information plays an important role in monitoring managers. Under SFAS 131, firms are not required to disclose geographic segment earnings, which potentially reduces the ability of shareholders to monitor managers' decisions related to foreign operations. They find that firms providing information related to geographic earnings show lower expansion of foreign sales, produce higher foreign profit margins, and have higher firm value. Summarizing, this literature highlights the important role of segment disclosures in monitoring managers' decisions. Next, we describe in detail the specific channels through which we expect segment information to improve investment efficiency.

#### ***4.2.1 Segment information and investment cash flow sensitivity***

In an incomplete information framework, where managers have more precise information than shareholders, shareholders will require higher return for providing funds as they have to monitor the managers' investment decisions to avoid that they pursue their own interests at the expense of shareholders' wealth (Hubbard 1998). The Pecking Order Theory (Myers, 1984; Myers and Majluf, 1984) affirms that cash flow is an important determinant of investment spending due to internal finance having important cost advantages over external finance. In imperfect markets, due to information asymmetries and imprecise information, some firms cannot finance their investments with external funds because their cost is very high. This situation leads managers to finance the projects using internally generated cash flows as this financial alternative is cheaper than the use of external funds. Nevertheless, as the information provided to shareholders becomes more accurate and the information asymmetries decrease, the cost of external funds decreases

too, which opens the possibility of issuing new debt or new equity as a financing alternative. In this situation, firms are less financially constrained and their investment decisions are not so sensitive to the internal generation of cash flows. This rationale is supported by empirical literature like Fazzari et al. (1988) and Allayannis and Mozumdar (2004) among others, who find that the capital investment of financially constrained firms is more sensitive to their internally generated cash flows than in those firms which are less financially constrained.

Following this stream of literature, Biddle and Hilary (2006) and Beatty et al. (2010) explore whether investment by firms providing better quality accounting is less sensitivity to firms' cash flows. 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 (Foster, 1975; Tse, 1989; Wysocki, 1998; Basu, Kim and Lim, 1999). This is so as it contributes to increase the value relevance of accounting numbers (Chen and Zhang, 2003), to reduce information asymmetries (Greenstein and Sami, 1994), and agency costs (Berger and Hann, 2003, 2007; Hope and Thomas, 2008). Given this reduction in information asymmetries and agency costs, through higher good quality segment disclosure is expected to facilitate the estimation of firms' future cash flows by investors. As a result, firms providing better segment disclosure are rewarded with a lower cost of capital (See Chapter 3). This reduction in the cost of capital is expected to reduce financing constraints, with which firms will rely to a lower extent on internally generated cash flows to finance their investments. This leads to the following hypothesis:

*Hypothesis 1: Firms providing higher quality segment information are expected to have lower investment cash flow sensitivity.*

#### ***4.2.2 Segment information and suboptimal investment decisions***

The first hypothesis deals with the role of segment information quality in reducing the sensitivity of investments to cash flows, which may reduce distortions in investment decisions. We further develop whether higher quality segment information mitigates under or over-investment problems.

An investment is efficient and should be implemented if its NPV is positive, otherwise it should be rejected (Ross, Westerfield and Jaffe, 2002; Brealey and Myers, 2003). However, managers are likely to deviate from investment efficiency for several reasons. On the one hand, because the cost of external financing is high and consequently most projects become unviable. On the other hand, because opportunistic managers pursue their own private benefits at the expense of shareholders' wealth (Jensen and Meckling, 1976). Opportunistic investment decisions include empire building investments, investment in 'pet' projects or 'trophy' acquisitions.

Segment information is predicted to increase firm investment efficiency through two main channels: (i) firms providing better segment information are rewarded with lower cost of capital (as we demonstrate in Chapter 3) so managers can raise funds externally through debt or equity at a lower cost (reducing under-investment), and with that are subject to external (market or bank) monitoring (reducing over-investment), (ii) managers who provide more segment information permit better monitoring of investment decisions by shareholders (Berger and Hann, 2003, 2007; Hope and Thomas, 2008). Improved monitoring leads in turn to penalties to managers in case they engage in inefficient investment, leading to reduced over-investment. Next, we explain these two channels in more detail.

#### *4.2.2.1 Segment information and underinvestment*

The provision of accurate information is the key element for predicting and estimating firm's risk, which leads to better capital allocation by investors (Lambert et al. 2007, 2008). As we discussed previously, prior literature shows that segment reporting provides useful information to investors, as it helps them in predicting firms' future cash flows more accurately, reducing information asymmetries and agency costs, and contributing to reduce cost of capital (See Chapter 3). If a firm has a lower cost of financing, more projects become viable. Thus, we expect that higher quality segment information, as it facilitates the access to external funds at lower cost, will reduce underinvestment problems.

*Hypothesis 2: The provision of good quality segment information decreases underinvestment problems.*

#### *4.2.2.2 Segment information and overinvestment*

Previous literature stresses the important monitoring role of segment reporting. Given that segment reporting reduces information asymmetries between managers and other parties with an interest in the firm (Greenstein and Sami, 1994), these other parties are expected to be better prepared to monitor managerial decisions. Berger and Hann (2003, 2007) and Hope and Thomas (2008) provide additional evidence of this monitoring role of segment reporting. Consequently, we expect improved segment reporting to permit better monitoring over managers investment decisions. Given that investors/directors might take actions against managers that deviate from optimal investments, the provision of segment reporting is expected to dissuade managers from implementing value reducing strategies, i.e., empire building, investment in 'pet' projects or 'trophy' acquisitions, reducing overinvestment problems.



*Hypothesis 3: The provision of good quality segment information decreases overinvestment problems.*

### 4.3. RESEARCH DESIGN

#### 4.3.1 Segment information and investment cash flow sensitivity

To test Hypothesis 1, we estimate a variation of the model of investment cash flow sensitivity proposed by Fazzari et al. (1988) and Hoshi, Kashyap and Scharfstein (1991), among others, where we also incorporate a measure of segment reporting quality. The model is as follows:

$$\begin{aligned} \frac{Inv_{i,t}}{TA_{i,t-1}} = & \frac{\beta_0}{TA_{i,t-1}} + \beta_1 \frac{CF_{i,t}}{TA_{i,t-1}} + \beta_2 MTB_{i,t} + \beta_3 Qlt\_Seg\_Dummy_{i,t} + \\ & + \beta_4 \frac{CF_{i,t}}{TA_{i,t-1}} * Qlt\_Seg\_Dummy_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where  $Inv_{i,t}$  is the sum of research and development expenditures (Compustat item 46), capital expenditures (item 128) and acquisition expenditures (item 129), less cash receipts from sales of property, plant and equipment (item 107), multiplied by 100 and scaled by lagged total assets (item 6), for firm  $i$  in year  $t$ .  $TA_{i,t-1}$  is the total assets for firm  $i$  in year  $t-1$ .  $MTB_{i,t}$  is the market to book ratio of assets for firm  $i$  in year  $t$ .<sup>1</sup>  $CF_{i,t}$  represents cash flows of firm  $i$  in year  $t$  as measured by the sum of income before extraordinary items and depreciation and amortization expense.<sup>2</sup>  $Qlt\_Seg\_Dummy_{i,t}$  is a dummy variable that takes value one if the firm provides good segment reporting and zero otherwise (This variable will be defined in detail in Section 4.3.3.2). In their seminal paper, Fazzari et al. (1988) find that firms facing high financial constraints, that is, a large difference between internal and external financing, have higher investment cash flow sensitivity after

<sup>1</sup> Defined as total assets in year  $t$  – book value of equity in year  $t$  – deferred taxes in year  $t$  + market value of equity in year  $t$  (i.e., number of shares outstanding multiplied by market price at year  $t$ ) / total assets in year  $t-1$ .

<sup>2</sup> In additional tests, we also use cash flow from operations taken directly from the cash flow statement (Compustat item 308).

controlling for their growth opportunities. With this model, they intend to capture how firms finance their investments. We expect  $\beta_1$  to be positive indicating firms financing investment with cash flows.  $\beta_2$  is expected to be positive, indicating that firms with higher growth opportunities invest more. *MTB* is included to control for the effect of growth opportunities in financial constraints. Our first hypothesis is that higher segment information quality reduces investment cash flow sensitivity, therefore, we expect coefficient  $\beta_4$  to be negative indicating that higher segment information quality reduces investment cash flow sensitivity. We exclude negative cash flow observations since when this happens, firms' investment cannot respond to cash flow (Allayannis and Mozumdar, 2004).

#### 4.3.2 Segment information and investment efficiency

To explore whether a firm is deviating from optimal levels of investment we regress a fixed effect model of quantity of Investment (*Inv*) on the main determinants of levels of investment and controls. The model is as follows:

$$\begin{aligned}
 Inv_{j,t+1} = & \alpha + \beta_1 Inv_{j,t} + \beta_2 LogAssets_{j,t} + \beta_3 LogAssets_{j,t}^2 + \beta_4 Tang_{j,t} + \\
 & + \beta_5 Dividend_{j,t} + \beta_6 Coven_{j,t} + \beta_7 Zscore_{j,t} + \beta_8 OperCycle_{j,t} + \\
 & + \beta_9 MTB_{j,t} + \beta_{10} Slack_{j,t} + \beta_{11} Leverage_{j,t} + \beta_{12} CFOsale_{j,t} + \\
 & + \beta_{13} Age_{j,t} + \beta_{14} Profitability_{j,t} + \beta_{15} DevInv_{j,t} + \beta_{16} DevSales_{j,t} + \\
 & + \beta_{17} DevCFO_{j,t} + \beta_{18} SD_{j,t} + \beta_{19} Beta_{j,t} + \\
 & + \sum_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t}
 \end{aligned} \tag{2}$$

Hypotheses 2 and 3 predict that firms providing better quality segment information are less likely to under/over invest. To test this hypothesis, we take the residuals of model (2) as our proxy for deviations from optimal levels of investment. In this model we control for innate determinants of investment levels. Following Biddle et al. (2009), we control for firm size, tangibility, dividend pay out ratio, bankruptcy risk, operating cycle, *MTB*,

financial slack, capital structure, CFO to sale, age, volatility of investment levels, volatility of sales and volatility of cash flow from operations (*CFO*). We also include controls for lagged investment, covenants to investment, profitability, idiosyncratic risk and beta of the firm. We include these controls because lagged investment could be view as a benchmark of the level of current investment levels (Fiegenbaum, Hart and Schendel, 1996). In the same way, we include covenants to investment as firms with this type of covenants are expected to invest less (Nash, Netter and Poulsen, 2003). We also include size squared, since investment decisions are also driven by life cycle of the firm. Younger firms (smaller firms) need to invest more than older firms (bigger firms) (Mueller, 1972; Audretsch and Elston, 2002) so we expect a U-shape relation between investment levels and size. We include profitability as previous literature finds that investment level is related to firm's profitability (Huang, Ou, Chen and Lin, 2006). Finally, we include proxies of risk, given that risk is also affecting investment decisions (i.e., Froot, Scharfstein and Stein, 1993).

We define firm size (*LogAssets*) as the log of total assets. Tangibility (*Tang*) is the ratio of property, plant and equipment to total assets. Dividend payout ratio (*Dividend*) is a dummy variable that takes the value of 1 if the firm paid a dividend; 0 otherwise. Covenant to investment (*Coven*) is a dummy variable that takes the value of 1 if the firm must use the free cash flow to pay loans and 0 otherwise. *Z-Score* is the measure of bankruptcy risk defined in Biddle and Hilary (2006) and calculated with the following Compustat data items:  $Z\text{-Score} = [3.3 \cdot \text{item170} + \text{item12} + 0.25 \cdot \text{item36} + 0.5 \cdot (\text{item4} - \text{item5})] / \text{item6}$ . Length of the operating cycle (*OperCycle*) is the log of receivables to sales plus inventory to COGS multiplied by 360. *MTB* is the market to book ratio of assets for firm *i* in year *t*. Financial slack (*Slack*) is the ratio of cash to property, plant and equipment. Leverage (*Leverage*) is ratio of total debt to total assets. CFO to sale (*CFOsale*) is measured as the

ratio of CFO to sale. *Age* is measured as the difference between the first year when firm appears in CRSP and the current year. *Profitability* is measured as percentile rank of return on assets. Volatility of investment (*DevInv*) is the firm-specific standard deviation of investment levels measured in the five-year period ending in the current fiscal year. Volatility of sales (*DevSales*) is the firm-specific standard deviation of sales measured in the five-year period ending in the current fiscal year. Volatility of cash flow from operations (*DevCFO*) is the firm-specific standard deviation of the cash flow from operations measured in the five-year period ending in the current fiscal year. Standard deviation of returns (*SD*) is measured as the standard deviation of one year of monthly stock returns the returns of the year. Beta (*Beta*) is the coefficient from firm-specific CAPM regressions using the 60 months preceding fiscal year *t* and a value weighted NYSE/AMEX/Nasdaq market index return.

#### *4.3.2.1 Segment information and deviations from optimal investment levels*

We model the probability of firms deviating from their optimal level of investment, conditional on their level of quality of segment information and on other corporate governance mechanisms. We control for corporate governance because corporate governance mechanisms are associated with investment efficiency (Biddle et al., 2009), and also to discard the possibility that segment information quality and our measure of corporate governance quality capture the same governance attributes. Regarding the relation between governance and investment efficiency, previous literature shows conflicting results. While Gompers, Ishii and Metrick (2003), Chang, Dasgupta and Hilary (2006) and Ferreira and Matos (2008) show that good corporate governance mechanisms help to mitigate over- and under-investment problem, others like Zajac and Westphal

(1994), Hermalin and Weisbach (2009) and Barger et al. (2010) find strong corporate governance mechanisms lead to inefficient risk-taking decisions. These conflicting results could be mainly attributable to the existence of a non-linear relationship between corporate governance mechanisms and investment efficiency. When shareholders are monitoring managers' decisions, managers feel that they cannot risk investing in inefficient projects because they put their positions at risk as shareholders are aware of their actions (i.e., Tosi, Katz and Gomez-Mejia, 1997). However, when managers feel that shareholders exert excess monitoring, managers are likely to react taking actions that shield them from any reaction from shareholders that might affect their personal interests negatively (Ashforth and Lee, 1990). Under this intensive pressure from shareholders, managers could behave taking too risky or too conservative investment decisions, in an attempt to ensure their position in the firm (managerial entrenchment). This behavior could turn in over- or under-investment problems. On the one hand, managers undertake low-risk projects, which do not compromise their position in the firm, as they can allege that they are taking decisions aligned with shareholders' interests (Zajac and Westphal, 1994; McAllister, 1995; Hermalin and Weisbach, 2009; Barger et al., 2010). However, these conservative decisions are likely to hinder future profitability. On the other hand, excessive monitoring encourages managers to engage in aggressive investment behavior aimed at generating short-term profits that might satisfy myopic shareholders, and that might come at the expense of reducing firm's long-term value generation (Bushee, 1998, 2001).

We take the residuals from model (2) as our proxy for deviations from optimal levels of investment. Following the methodology in Biddle et al. (2009) we use these residuals to form groups to test hypotheses 2 and 3. We form groups clustering the residuals from this model into three groups. Firms in the cluster with more negative residuals are

classified as under investing, whilst firms in the cluster with more positive residuals are classified as over investing. We use firms in the remaining cluster as the benchmark group, given that their investment level is closer to the prediction. We assign values to those groups: 1 if the firm is classified as over investing; 2 if the firm is in the benchmark group; and 3 if it is classified as under investing. Then we estimate a multinomial logit model that predicts the likelihood that a firm will be on the extreme clusters instead of being on the benchmark cluster. That is, the likelihood that a firm will not invest in an optimal way. The model is as follows:

$$\begin{aligned} Prob(Investment_{i,t}=j) = & \beta_0 CorpGov_{i,t} + \beta_1 CorpGov_{i,t}^2 + \\ & + \beta_2 Dummy\_Qlt\_Seg_{i,t} + \beta_3 Dummy\_Qlt\_Seg_{i,t} * CorpGov_{i,t} + \\ & + \beta_4 Dummy\_Qlt\_Seg_{i,t} * CorpGov_{i,t}^2 + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where  $j$  takes the value of 1, 2 or 3 depending on the group that the firm belongs to. *CorpGov* is our measure of corporate governance quality (this variable will be defined in detail in section 4.3.4). If corporate governance mechanisms dissuade firms from over and under investing,  $\beta_0$  is expected to be negative both for over investment and under investment situations, indicating that firms with better corporate governance mechanisms are less likely to be in the groups of over or under investing. That is, firms with better corporate governance mechanisms are less likely to deviate from the predicted investment levels. However, if the monitoring over managers is excessive, managers can deviate from the predicted investment as he/she will be more interested in protecting him/herself than in shareholders' wealth. If this is the case,  $\beta_1$  would be positive both for the over investment and for under investment situations. *Dummy\_Qlt\_Seg* is a dummy variable that takes value 1 if the firm provides good segment quality, and zero otherwise (we define in detail our proxy for segment reporting quality in the following section). Consistent with hypotheses 2

and 3, we expect segment information quality to reduce the likelihood of the firm under- or over-investing. As a consequence,  $\beta_2$  is expected to be negative both for the under-investment and for the over-investment situations. When segment reporting quality interacts with other corporate governance mechanisms to monitor managers' decisions, we could expect this will lead to a reduction in the likelihood of managers deviating from optimal investment levels. This is so because shareholders are endowed with good mechanisms to detect and deter those managerial investment decisions that do not increase the value of the firm. In this case  $\beta_3$  is expected to be negative both for the under-investment and for the over-investment situations. However, under strict governance provisions, the provisions of improved disclosure might be seen by managers as excess monitoring. In this case, managers can behave taking too risky or too conservative investment decisions, in an attempt to ensure their position in the firm. In this case  $\beta_3$  is expected to be positive both for the under-investment and for the over-investment situations. Finally, if corporate governance provisions, per se, are considered by managers to be leading to excess monitoring, we expect segment information to be useful to reduce the likelihood of managers deviating from the optimal levels of investment. This is so because managers providing detailed information about their business activities have less incentives to deviate from optimal levels of investments given that any deviations from the optimal will be easy to detect. As a consequence, we expect  $\beta_4$  to be negative both for the over investment and for under investment situations.

### 4.3.3 Measuring segment information quantity and quality

#### 4.3.3.1 Creation of an index of segment information quantity (*Qtt\_Seg*)

We proxy the quantity of segment information using the index developed in Chapter 2. We create this index (*Qtt\_Seg*), analyzing disclosures on both business and geographic segments. In a first step, we classify segments into mandatory and voluntary reported segments. Then, for each mandatory segment, we identify which items are compulsory and which are voluntary under SFAS 131. We create the business segment score by adding 1 point for every voluntary disclosed item in every mandatory business segment, and by adding 1 point for every item disclosed in every voluntary business segment. In a second step, we do the same for every reported geographic segment in each firm. Finally, we create the overall index of quantity of voluntary segment disclosure (*Qtt\_Seg*) by adding the business and geographic segment scores.

#### 4.3.3.2 Creation of an index of segment information quality (*Qlt\_Seg*)

To create the index of quality of segment information, we replicate our tests in Chapter 3. 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 and information asymmetries) and controls. The model is as follows:

$$\begin{aligned}
 Qtt\_Seg_{j,t} = & \alpha + \beta_1 Earnings\ Quality_{j,t} + \beta_2 Business\ Diversification_{j,t} + \\
 & + \beta_3 Geographic\ Diversification_{j,t} + \beta_4 Information\ Asymmetries_{j,t-1} + \\
 & + \beta_5 Size_{j,t} + \beta_6 Growth_{j,t} + \beta_7 Leverage_{j,t} + \beta_8 Audit\ Firm_{j,t} + \\
 & + \beta_9 Listing\ Status_{j,t} + \beta_{10} Proprietary\ Costs_{j,t} + \\
 & + \beta_{11} New\ Financing_{j,t} + \beta_{12} Profitability_{j,t} + \beta_{13} Age_{j,t} + \\
 & + \sum_k \beta_k Control\ year_{j,t} + \varepsilon_{j,t}
 \end{aligned} \tag{4}$$



When firms provide more (less) information than predicted by the model, we expect they will contribute to improve (reduce) investors' ability to estimate their cash flows because they provide more (less) accurate information.

To estimate earnings quality, we use the modified Jones model as defined by Dechow, Sloan and Sweeney (1995):

$$\frac{TA_{j,t}}{Assets_{j,t-1}} = \alpha_{i,j} \left[ \frac{1}{Assets_{j,t-1}} \right] + \beta_{i,j} \left[ \frac{\Delta REV_{j,t}}{Assets_{j,t-1}} \right] + \gamma_{i,j} \left[ \frac{PPE_{j,t}}{Assets_{j,t-1}} \right] + \varepsilon_{j,t} \quad (5)$$

where:  $TA_{j,t}$ <sup>3</sup> 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 (5) using data annually for each 2-digit SIC industry groups. Next, for each firm j, we calculate its discretionary accruals as:

$$DA_t = \frac{TA_{j,t}}{Assets_{j,t-1}} - \left( \hat{\alpha}_{i,j} \left[ \frac{1}{Assets_{j,t-1}} \right] + \hat{\beta}_{i,j} \left[ \frac{\Delta REV_{j,t} - \Delta AR_{j,t}}{Assets_{j,t-1}} \right] + \hat{\gamma}_{i,j} \left[ \frac{PPE_{j,t}}{Assets_{j,t-1}} \right] \right) \quad (6)$$

where:  $\hat{\alpha}, \hat{\beta}, \hat{\gamma}$  = the fitted coefficients in model (5) 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 ( $Earnings\_Qlt$ ). Large values of ( $Earnings\_Qlt$ ) correspond to good accrual quality, that is, to less discretionary accruals.

Business diversification is a score in which we assign 1 point for every different 2-digit SIC code assigned by Compustat to the firm as forming part of its primary or

<sup>3</sup> Measured as  $\Delta CA_{j,t} - \Delta CL_{j,t} - \Delta Cash_{j,t} + \Delta STDEBT_{j,t} - \Delta DEPN_{j,t}$ ;  $\Delta CA_{j,t}$  is firm j's change in current assets (Compustat #4) between year t-1 and year t;  $\Delta CL_{j,t}$  is firm j's change in current liabilities (Compustat #5) between year t-1 and year t;  $\Delta Cash_{j,t}$  is firm j's change in cash (Compustat #1) between year t-1 and year t;  $\Delta STDEBT_{j,t}$  is firm j's change in debt in current liabilities (Compustat #34) between year t-1 and year t;  $\Delta DEPN_{j,t}$  firm j's depreciation and amortization expense (Compustat #14) in year t.

secondary activities. Geographic diversification is the number of different countries where the firm has subsidiaries.<sup>4</sup> Information asymmetries is measured by the bid-ask spread. 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. We measure leverage as the ratio of total debt to total assets. Auditor is a dummy variable taking the value of 1 if the auditor is a Big Four firm, and 0 otherwise. Listing Status is a dummy variable taking the value of 1 if the firm is listed in the NYSE or in NASDAQ, and 0 otherwise. The Herfindahl index of the industry concentration is a proxy for proprietary costs. New financing is a dummy variable taking the value of 1 if the firm raised new capital funds or increased debt this year, and 0 otherwise. We include ROA as a control variable for firm-specific factors that influence segment disclosure policy, and finally, age is measured as the difference between the first year when firm appears in CRSP and the current year.

#### ***4.3.4 Creation of an index of corporate governance quality***

We develop a corporate governance index including both, external and internal governance attributes (Bertrand and Mullainathan, 2001; Davila and Penalva, 2006; Garcia Lara et al., 2009). Our index (*CorpGov*) covers eight different attributes of governance that previous literature identifies as useful for shareholders to monitor managers' decisions, and that are expected to contribute to reduce agency costs. For each of these eight attributes, we assign the firm a score of 1(0) if the firm presents strong (weak) governance with respect to the attribute. We create the overall index on corporate governance (*CorpGov*) by adding the

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<sup>4</sup> We use subsidiaries information from Osiris. We take into account subsidiaries with a minimum of 25,01% of control by the company under analysis.

8 scores. Consequently, *CorpGov* ranges from 0 to 8, and it is increasing in the quality of governance. Next, we describe the 8 attributes of governance that we consider.

#### 4.3.4.1 External governance

*Anti-takeover provisions:* We take the antitakeover protection index developed by Gompers, Ishii and Metrick (2003). They develop an index by adding one point for every provision that decrease takeover vulnerability. Higher values of the index correspond to higher anti-takeover provisions. Previous literature documents that takeovers are beneficial for shareholders (Cremers and Nair, 2005), so low anti-takeover provisions are associated with better corporate governance. We create a dummy variable (*InvG\_INDEX*), which takes value of 1 if firm has low anti-takeover provision (if the inverse of Gompers et al. (2003) index is above the median) and zero otherwise.

*Auditor:* Previous literature finds that being audited by a large auditing firm is associated with higher accounting quality, since these audit firms are more able to detect accounting irregularities (i.e., Becker, DeFond, Jiambalvo and Subramanyam, 1998). Given this, we see being audited by a large auditing firm as a good corporate governance provision per se. We create a dummy variable (*Auditor*), which takes value of 1 if the firm is audited by a Big-4 auditor and zero otherwise.

*Analysts following:* Previous literature documents that financial analysts monitor firm and managerial performance (Bushman, Chen, Engel and Smith, 2004). Given this, greater analysts' coverage is expected to be associated with corporate governance quality. We create a dummy variable (*Analysts*), which takes value of 1 if the firm has high analysts' coverage (if the number of analysts is above the median) and zero otherwise.

#### 4.3.4.2 Internal governance

*Ownership concentration:* Previous literature finds ownership concentration is a crucial corporate governance mechanism (Sheffer and Vishny, 1997). We create a Herfindahl-type index as the sum of the squared holding proportion of shareholders holding more than 5% of shares of the firm. Higher values correspond to higher concentration. If ownership is more concentrated, we assume it is easier to monitor managers' decisions. We create a dummy variable (*OC*), which takes value of 1 if ownership is concentrated (values above the median of the index) and zero otherwise.

*Board independence:* Prior research shows that the board of directors is more effective when it is more independent from the CEO (Hermalin and Weisbach, 1998, 2003). We create a dummy variable (*Board\_Ind*), which takes value of 1 if the % of executive directors on the board is below the median, and zero otherwise.

*Number of Board meetings:* Adams (2000), among others, suggests that higher numbers of board meetings is a good proxy for directors' monitoring effort. We create a dummy variable (*Meetings*), which takes value of 1 if the number of meetings is above the median and zero otherwise.

*Non-duality of CEO:* We include an indicator on whether the CEO and chairman in a firm is not the same person, since the CEO will have less influence on governance when he/she is not also the chairman. We expect non-duality will be related to higher corporate governance quality. We create a variable (*Non\_dual*), which takes value of 1 if the CEO is not the chair of the board and zero otherwise.

*CEO tenure:* We include also an indicator of the number of years that the CEO has been in office, since previous literature shows that at the beginning of their tenure CEOs interests are more aligned with those of shareholders (Morck, Shleifer and Vishny, 1988;

Hill and Phan, 1991; Allgood and Farrell, 2000). It is also documented that higher CEO tenure is associated with a reduced number of board meetings and with a higher proportion of inside directors on the board (Hermalin and Weisbach, 1998; Hermalin, 2005). We create a dummy variable (*InvCEOTen*), which takes value of 1 if CEO tenure is below the median and zero otherwise.

#### 4.3.4.3 Endogeneity of corporate governance

We use an instrumental variable of corporate governance to consider the endogenous nature of governance. To create this instrumental variable, we take the prediction values from a negative binomial model of governance choice of *DummyCorpGov* (1 corresponds to strong values of corporate governance, that is, values of *CorpGov* above the industry-year median) on the main determinants of corporate governance taken from previous literature. In addition, with this model we can also assess the validity of *CorpGov* as a measure corporate governance quality. The model is as follows:

$$\begin{aligned}
 \text{Probability} ( \text{DummyCorpGov}_t=1 ) = & \beta_0 \text{Size}_{j,t} + \beta_1 \text{Growth}_{j,t} + \beta_2 \text{Age}_{j,t} + \\
 & + \beta_3 \text{FCF}_{j,t} + \beta_4 \text{SD}_{j,t} + \beta_5 \text{Leverage}_{j,t} + \beta_6 \text{Business Diversification}_{j,t} + \quad (7) \\
 & + \beta_7 \text{Geographic Diversification}_{j,t} + \beta_8 \text{Profitability}_{j,t} + \\
 & + \sum_k \beta_k \text{Control year}_{j,t} + \varepsilon_{j,t}
 \end{aligned}$$

Previous literature documents that larger firms are more complex and demand stronger governance structures (Demsetz and Lehn, 1985; Garcia Lara et al., 2009). We measure *Size* as the natural logarithm of market value of equity. In this context we also include Business and Geographic diversification, as the firm's complexity increases as diversification increases (Bushman et al., 2004). As in model (4) we measure *Business Diversification* with a score in which we assign 1 point for every different 2-digit SIC code assigned by Compustat to the firm as forming part of its primary or secondary activities.

*Geographic Diversification* is the number of different countries where the firm has subsidiaries. Also growth opportunities explain differences across corporate governance structures, so we include growth opportunities as the natural logarithm of book-to-market value. Previous literature also shows that age is related with the governance structure of the firm. We measure it as the difference between the first year when the firm appears in CRSP and the current year. In the absence of appropriate incentives or sufficient monitoring to align managers' interests with those of shareholders, managers can use their discretion to expropriate firm cash flows from shareholders by implementing value reducing strategies, i.e., empire building, investment in 'pet' projects or 'trophy' acquisitions, as these projects are used as entrenchment mechanisms or to maximize their own wealth (Jensen and Meckling; 1976). Higher Free Cash Flow (*FCF*) is expected be associated with stronger corporate governance structures. We measure it as the ratio of operating cash flow minus preferred and common dividends to total assets if the book-to-market ratio is greater or equal to one, and zero otherwise. Higher noise in the firm's operating environment will increase the demand on the corporate governance structure as it is more costly to monitor managers' decisions (Demsetz and Lehn, 1985). We include the standard deviation of one year of monthly stock returns as our measure of noise. Highly leveraged firms are less likely to be the object of a takeover, so in these firms, anti-takeover mechanisms are less effective (Cremers and Nair, 2005; Garcia Lara et al., 2009). We include the ratio of total debt to total assets as a proxy of firm's leverage. Finally, it is well documented in previous literature (Hermalin and Weisbach, 1988; Murphy and Zimmerman, 1993) the association of past firm performance and corporate governance. We measure it as the mean of returns over the 36 previous months.

We use model (7) to calculate predicted values of *DummyCorpGov* that are then used as an instrumental variable in model (3).

#### ***4.3.5 Capital expenditure and non-capital expenditure investment measures***

Similar to Biddle et al. (2009), we divide investments into Capital expenditures (*Capex*) and Non-capital expenditures (*NonCapex*). We measure *Capex* as the capital expenditures, scaled by lagged property, plant and equipment. We measure *NonCapex* as the sum of R&D expenditures and acquisitions, scaled by lagged total assets. We re-estimate our models from (1) to (3) using these two alternative (more restrictive) measures of investment. We expect similar results using these disaggregated measures.

#### ***4.3.6 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 and ownership data are extracted from BvD Osiris.<sup>5</sup> Market data are extracted from CRSP and covenants data from DealScan. Number of analysts covering the firm is extracted from I/B/E/S. The anti-takeover provisions index is extracted from Andrew Metrick's webpage.<sup>6</sup> Board characteristics data are extracted from ExecuComp. We exclude firms having negative cash flow observations. These data requirements yield 5,172 firm-year observations with data on all variables. We exclude observations with missing

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<sup>5</sup> 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.

<sup>6</sup> <http://finance.wharton.upenn.edu/~metrick/governance.xls>

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.

[Insert Table 1 about Here]

Table 1 presents descriptive statistics for the variables described above. The mean (median) *Inv* across all firm-years equals 14.90 % (13.36%) of prior years' assets. Regarding *Capex* and *NonCapex*, they represent 24.15% (18.37%) and 10.33% (8.32%) respectively. The mean (median) value for *Dummy\_Qlt\_Seg* in the sample is 0.57 (1), indicating more firms providing better segment information quality. The mean (median) value of our corporate governance index (*CorpGov*) is 3.85 (4), indicating that, in mean, shareholders use half of the mechanisms used to create the index to monitor managers' decisions. Control variables are also consistent with prior research. In Table 2 we present pairwise correlations among main variables, and they behave as expected according to previous literature. In Table 3 we show the results of an industry fixed effect regression of *Qtt\_Seg*. In the first column, we only include the controls. We find that the quantity of segment disclosure (*Qtt\_Seg*) 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 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 the index of voluntary segment information (*Qtt\_Seg*) is a valid measure of disclosure. In the second column we also include determinants of disclosure drawn from prior literature. As expected, firms providing better quality earnings,<sup>7</sup> operating

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<sup>7</sup> The results are robust to the use of other measures of earnings quality, based on the residuals of the Jones (1991), Dechow and Dichev (2002) and McNichols (2002) models. We also use earnings quality measures based on the standard deviation of the residuals of these models, calculated at the firm level using rolling five year windows, as in Francis et al. (2004).



in a higher number of industry sectors and countries, and subject to higher information asymmetries, provide more segment information.

[Insert Table 2 about Here]

[Insert Table 3 about Here]

## 4.4. RESULTS

### 4.4.1 *Segment information and investment cash flow sensitivity*

[Insert Table 4 about Here]

In Table 4 we show the results of a firm-year fixed effect regression of different measures of investment, on *CF*, *MTB*, *Dummy\_Qlt\_Seg* and the interaction term between *CF* and *Dummy\_Qlt\_Seg*. In this table we present the results on whether firms providing higher segment information quality reduce investment cash flow sensitivity. As expected, we find  $\beta_1$  is positive indicating firms financing investment with cash flows ( $\beta_1 = 0.0048$ , p-value = 0.007), and we also find  $\beta_2$  is positive ( $\beta_2 = 0.93$ , p-value=0.000), indicating that firms with higher growth opportunities invest more.

In this table we show the results using *Inv*, *Capex* and *NonCapex* as proxies for investment quantity in the first, second and third column respectively. The regression results show that the coefficient on cash flow is statistically different (and robust to the use of different measures of cash flows) between firms providing high quality segment information and firms providing low quality segment information, as the coefficient on  $(CF_{i,t}/TA_{i,t-1}) * Dummy\_Qlt\_Seg_{i,t}$  is negative and statistically significant, ( $\beta_3 = -0.0094$ , p-value=0.000). This suggests that firms providing higher segment information quality have lower investment-cash flow sensitivity, supporting our Hypothesis 1.

Following Beatty et al. (2010), we perform the same analysis using the following industry-year fixed effect regression of different measures of investment:

$$\begin{aligned}
\frac{Inv_{i,t}}{TA_{i,t-1}} = & \frac{\beta_0}{TA_{i,t-1}} + \beta_1 \frac{CF_{i,t}}{TA_{i,t-1}} + \beta_2 MTB_{i,t} + \beta_3 Qlt\_Seg\_Dummy_{i,t} + \\
& + \beta_4 \frac{CF_{i,t}}{TA_{i,t-1}} * Qlt\_Seg\_Dummy_{i,t} + \beta_5 Coven_{i,t} + \beta_6 \frac{CF_{i,t}}{TA_{i,t-1}} * Coven_{i,t} + \\
& + \beta_7 \frac{CF_{i,t}}{TA_{i,t-1}} * Qlt\_Seg\_Dummy_{i,t} * Coven_{i,t} + \beta_8 Qlt\_Seg\_Dummy_{i,t} * Coven_{i,t} + \\
& + \beta_9 Leverage_{i,t} + \beta_{10} Slack_{i,t} + \beta_{11} Earnings\_Quality_{i,t} + \\
& + \beta_{12} \frac{CF_{i,t}}{TA_{i,t-1}} * Earnings\_Quality_{i,t} + \beta_{13} \frac{CF_{i,t}}{TA_{i,t-1}} * Earnings\_Quality_{i,t} * Coven_{i,t} + \\
& + \beta_{14} Earnings\_Quality_{i,t} * Coven_{i,t} + \varepsilon_{i,t}
\end{aligned} \tag{8}$$

Untabulated results show that even when firms face contractual restrictions on investments, firms providing higher segment information quality have lower investment-cash flow sensitivity, providing strong evidence in favor of the previous findings. As Beatty et al. (2010), we find that when firms have covenants to investment earnings quality does not affect the sensitivity of investments to internally generated cash flows.

#### ***4.4.2 The role of segment information in corporate governance and deviations from optimal investment***

[Insert Table 5 about Here]

In Table 5 we show the results of a regression of investment proxies on its determinants. We take the residuals of these regressions as proxies for deviations from optimal levels of investment. Previous levels of investment appear as an important benchmark explaining the levels of investment. Size shows a U-shape relation with investment levels, confirming that smaller firms need to invest more than bigger firms. Our

results also show that covenants to investment, as expected, reduce levels of investment. In our sample, more profitable firms invest more in capital expenditures, but not in non-capital investments. Riskier firms allocate fewer funds to investments.

[Insert Table 6 about Here]

Using the residuals from the regressions presented in Table 5 as proxies for deviations from optimal levels of investment, we group firms into three median clusters according to the Euclidean distance.<sup>8</sup> Firms in the cluster with more negative residuals are classified as under investing, whilst firms in the cluster with more positive residuals are classified as over investing. In Table 6 Panel A we present results on the likelihood of under-investing (cluster with more negative residuals) with respect to a benchmark group of firms (the firms in the intermediate cluster). In the first column of the table we show the results of the likelihood of under-investing when we include only segment information quality as independent variable. As expected, better segment information reduces the likelihood of under-investing (significantly negative coefficient on *Dummy\_Qlt\_Seg*). In the second column, we test whether corporate governance helps in reducing investment inefficiencies, and we find that they reduce such inefficiencies up to a certain threshold (the coefficient on *CorpGov* is significantly negative). However, beyond that threshold (*CorpGov* above 4.67 (calculated from estimates of Equation (3) for *Investment* proxy), corporate governance stimulates underinvestment (significantly positive coefficient on the square of *CorpGov*). These results indicate that managers respond to excess monitoring taking inefficient investment decisions (underinvestment) aimed at securing their position in the firm, rather than at maximizing shareholders' wealth. In columns 4, 5 and 6, we

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<sup>8</sup> The results are robust to the use of other criteria to divide the sample (i.e.: clustering residuals from the regressions presented in Table 5 using different measures of distance (i.e., Squared Euclidean distance and Chebychev distance) and criteria (i.e., mean)). Results are also robust to form groups dividing residuals into three groups sorting residuals into quartiles and quintiles, as in previous literature (Biddle et al., 2009, Garcia Lara et al., 2010b).

include segment information quality interacted with corporate governance to test whether segment information quality ameliorates the problems caused by corporate governance mechanisms that lead to excess monitoring. We find a positive coefficient for the linear interaction (Coeff.=0.87, p-value=0.000) and a negative one for the quadratic interaction (Coeff.=-0.10, p-value=0.000). As we predicted, managers feel that they are under intensive pressure from shareholders, so they behave taking too conservative investment decisions, in an attempt to ensure their position in the firm. However, when corporate governance is too strong, segment disclosure quality prevents managers' negative reaction leading to underinvestment. In Table 6 Panel B we present results on the likelihood of over-investing (cluster with more positive residuals) with respect to a benchmark group of firms (the firms in the intermediate cluster). The findings are similar to those presented in Panel A. We find that higher segment disclosure quality reduce the likelihood of over-investing, and that firms with better corporate governance mechanisms are less likely to belong to the groups of over investing. We also see that under excessive monitoring (*CorpGov* above 4.56), managers have more incentives to deviate from optimal levels of investment to protect their job status (Coeff. on  $CorpGov^2=0.24$ , p-value=0.000). As before, we find that segment information quality ameliorates the problems caused by corporate governance mechanisms in exacerbating investment inefficiencies (the coefficient on the interaction between squared governance and segment reporting quality is significantly negative). Overall, the results show that, both, corporate governance mechanisms to monitor managers' decisions and higher quality segment information quality reduce investment inefficiencies (over-investment and under-investment) individually. We also show that better segment reporting contributes to reduce inefficiencies in the investment process driven by excess monitoring over the managerial team.

In order to provide robust results, we tackle the potential endogeneity problems between corporate governance and investment inefficiencies. To this end, we use an instrumental variable for corporate governance. To create this instrumental variable, we use the prediction values from a negative binomial model of governance choice of *DummyCorpGov* (1 correspond with strong values of corporate governance, which is *CorpGov* having values above the median) on the main determinants of corporate governance taken from previous literature. The correlation between *DummyCorpGov* and the instrumental variable is 39.55%, so it seems to be a relevant instrument to use.

[Insert Table 7 about Here]

In Table 7 we show the results of the negative binomial model in which we regress *DummyCorpGov*, our proxy for the corporate governance mechanisms that shareholders use to monitor managers' decisions, on the determinants of corporate governance. We find that corporate governance (*DummyCorpGov*) increases with firm size, the book to market ratio, Free Cash Flow, standard deviation of returns, business diversification and geographic diversification, and decreases with age, leverage and profitability. All of the firm controls are significantly associated with corporate governance at conventional levels. These results corroborate that of our index of mechanisms to monitor managers' decisions (*CorpGov*) is a valid measure of corporate governance.

[Insert Table 8 about Here]

In Table 8 we replicate the tests from Table 6, on the effects of segment reporting and governance on the likelihood of under and over-investing, but using our instrumental variable to measure corporate governance.<sup>9</sup> The results provide strong evidence in favor of

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<sup>9</sup> Our results are robust to (1) the use of Heckman Two-Step Estimation Models; (2) the use of an alternative proxy for *CorpGov*: first principal component of *CorpGov* as a proxy for *CorpGov* (correlation between First Principal Component and *CorpGov* = 73.13%), and

the previous findings, and are robust to the use of *Capex* and *NonCapex* as alternative proxies of investment.

#### 4.5. SUMMARY AND CONCLUSIONS

In this paper we analyze the effects of segment disclosure quality and other governance provisions firm investment efficiency. Segment disclosure quality is predicted to increase firm investment efficiency as: (i) firms providing better segment information are rewarded with lower cost of capital (See Chapter 3), so more projects become viable, decreasing the sensitivity of investments to internally generated cash flows, and also reducing under-investment problems, and (ii), more segment information facilitates monitoring over managers' decisions (Berger and Hann, 2003, 2007; Hope and Thomas, 2008), dissuading them from implementing value reducing strategies, which in turn will reduce over-investment problems.

Some firms cannot finance their investments with external funds because their cost is very high when information asymmetries between managers and outside suppliers of capital are large. In this case, firms have to finance their investments with internally generated funds. But when information provided to shareholders becomes more accurate and information asymmetries decrease, the cost of external funds decreases too, which opens the possibility of issuing new debt or new equity as a financing alternative. In this situation, firms are less financially constrained and their investment decisions are not so sensitive to the internal generation of cash flows. We provide empirical evidence showing that in firms providing better segment disclosure, the sensitivity on investments to internally generated cash flows is lower than in firms with poorer segment reporting.

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to the use of the mean of *CorpGov* by industry-year as a proxy for *CorpGov* (correlation between mean industry-year *CorpGov* and *CorpGov* = 27.19%).

Additionally, we find that firms providing better segment disclosure are less likely to deviate from the optimal investment policies (they are less likely to under and over invest). Our results also show that firms under strong governance structures are less likely to deviate from optimal investment levels, but that if governance mechanisms to monitor managers are too tight, managers react exacerbating under-investment and over-investment problems. This is consistent with claims in prior literature about the negative effects of very stringent governance structures (Hermalin and Weisbach, 2009; Barger et al., 2010). Finally, we show that segment information quality contributes to decrease the undesired effects of excess monitoring.

Our results add to the recent stream of empirical literature on the effects of accounting information quality in investment efficiency and more concretely, on whether the provision of good segment reporting has economic effects. We contribute to the current debate, started after the passage of SFAS 131, on whether it is advisable to reduce the amount of geographic segment information that firms are required to present. We find that segment information quality helps in detecting and deterring those managerial investment decisions that do not increase the value of the firm by showing that better segment information enhances investment efficiency. We also show that in situations of excess monitoring through other corporate governance provisions, in which corporate governance stimulates deviations from the optimal investment policies, segment information quality contributes to decrease the negative effects of excess monitoring and improves investment efficiency.

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**Table 1**  
**Descriptive Statistics**

Variable	N	Mean	Std. Dev.	10%	25%	Median	75%	90%
Inv <sub>t+1</sub>	5,172	14.9094	11.8376	5.8977	9.9940	13.3647	14.9503	24.6753
Capex <sub>t+1</sub>	5,172	24.1582	21.4450	5.4593	10.8134	18.3779	29.2253	51.4084
NonCapex <sub>t+1</sub>	5,172	10.3332	10.2481	1.6508	5.3649	8.3297	10.9964	20.8657
Dummy_Qt_Seg	5,172	0.5760	0.4942	0	0	1	1	1
CorpGov	5,172	3.8591	1.4215	2	3	4	5	6
LogAssets	5,172	5.9093	0.8197	4.8295	5.3950	5.9195	6.4626	6.9773
Tang	5,172	0.2496	0.2302	0.0131	0.0431	0.1900	0.3785	0.6116
Dividend	5,172	0.5805	0.4935	0	0	1	1	1
Coven	5,172	0.0741	0.2619	0	0	0	0	0
Zscore	5,172	1.2910	1.2292	0.0381	0.6132	1.3122	1.9245	2.6345
Opercycle	5,172	3.8370	1.1784	2.2341	3.0606	4.0694	4.6543	5.1664
MTB	5,172	1.6596	0.7405	0.9781	1.2052	1.5281	1.7883	2.6142
Slack	5,172	1.2539	1.6245	0.0294	0.1507	0.6864	1.5030	3.5942
Leverage	5,172	21.2135	18.1546	0.0000	4.1915	19.6705	32.5675	45.2965
CFOSale	5,172	0.2753	1.6934	0.0000	0.0001	0.0013	0.0356	0.3210
Age	5,172	14.3751	10.6064	4	7	11	19	33
Profitability	5,172	0.0386	0.1160	-0.0553	0.0125	0.0508	0.0907	0.1338
DevInv	5,172	9.2792	6.9251	3.6293	5.6742	7.1513	9.9465	19.0926
DevCapex	5,172	15.2939	13.7594	6.3683	9.0126	12.0913	15.5249	28.0988
DevNonCapex	5,172	6.2175	6.4967	0.8647	3.0174	3.8228	8.3829	16.3954
DevSales	5,172	19.3958	18.9909	0.9038	5.1806	16.3332	26.9979	41.5093
DevCFO	5,172	13.4737	13.1627	1.9615	6.6536	9.8622	13.7397	29.5507
SD	5,172	1.9144	3.4289	0.1300	0.3246	0.8372	1.9250	4.6624
Beta	5,172	0.8106	0.8516	0.1523	0.4745	0.6222	1.0359	1.8077
CF	5,172	1.093	1.4060	0.0291	0.1014	0.4381	1.6065	3.2706

The sample consists of 5,172 firm-year observations for the period 2001-2006. Inv is a measure of investment calculated as the sum of research and development expenditure, capital expenditure, and acquisition expenditure less cash receipts from sale of property, plant and equipment multiplied by 100 and scaled by lagged total assets. Capex is a measure of investment calculated as capital expenditure multiplied by 100 and scaled by lagged property, plant and equipment. NonCapex is a measure of investment

calculated as the sum of research and development expenditure and acquisition expenditure multiplied by 100 and scaled by lagged total assets. Dummy\_Qlt\_Seg is dummy variable taking value 1 if Qlt\_Seg is positive and zero otherwise, where Qlt\_Seg is the firm-year-specific residual obtained from a regression of the firm's year t quantity of segment disclosure on controls and determinants of segment disclosure. CorpGov is a measure of corporate governance. LogAssets is the log of total assets. Tang is the ratio of property, plant and equipment to total assets. Dividend is a dummy variable that takes the value of 1 if the firm paid dividends and 0 otherwise. Coven is a dummy variable that takes the value of 1 if the firm has to use the excess of cash flow to paid loans and 0 otherwise. Z-Score is a measure of bankruptcy risk. OperCycle is the log of receivables to sales plus inventory to COGS multiplied by 360. MTB is the ratio of the market value of total assets to book value of total assets. Slack is the ratio of cash to property, plant and equipment. Leverage = debt to total assets ratio in percentage. CFOsale is the ratio of CFO to sales in percentage. Age is the difference between the first year when the firm appears in CRSP and the current year. Profitability = return on assets. DevInv is the firm-specific standard deviation of Inv over the last three years (t-2 to t) in percentage. DevCapex is the firm-specific standard deviation of Capex over the last three years (t-2 to t) in percentage. DevNonCapex is the firm-specific standard deviation of NonCapex over the last three years (t-2 to t) in percentage. DevSales is the firm-specific standard deviation of sales over the last three years (t-2 to t) in percentage. DevCFO is the firm-specific standard deviation of cash flow from operations over the last three years (t-2 to t) in percentage. SD is the standard deviation of monthly returns in percentage. Beta is the coefficient from firm-specific CAPM regressions using the 60 months preceding the fiscal year end. CF is the sum of income before extraordinary items and depreciation and amortization expense multiplied by 100 and scaled by lagged total assets.

**Table 2**  
**Pairwise correlations between Inv, Capex, NonCapex, Dummy\_Qlt\_Seg, CorpGov and control variables**  
**(p=0.05)**

Variable	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	
a Inv	1																								
b Capex	0.18	1																							
c NonCapex	0.61	0.17	1																						
d Dummy_Qlt_Seg	-0.15	-0.07	-0.19	1																					
e CorpGov	-0.03	-0.01	-0.04	0.01	1																				
f LogAssets	-0.01	0.00	-0.03	0.00	0.08	1																			
g Tang	0.12	-0.13	-0.12	0.02	0.02	0.21	1																		
h Dividend	-0.01	-0.02	-0.01	0.00	0.00	0.44	0.03	1																	
i Coven	-0.02	-0.04	-0.03	0.02	0.01	-0.08	0.07	-0.18	1																
j Zscore	-0.04	0.01	-0.05	0.02	-0.02	-0.03	-0.13	0.25	-0.19	1															
k Opercycle	-0.08	0.06	-0.03	0.00	0.00	-0.16	-0.15	-0.13	0.03	-0.04	1														
l MTB	0.12	0.10	0.11	0.00	0.06	-0.07	-0.13	-0.13	0.04	-0.05	0.02	1													
m Slack	0.12	0.23	0.17	-0.01	-0.02	-0.12	-0.11	-0.03	0.02	-0.03	0.00	0.07	1												
n Leverage	-0.13	-0.11	-0.14	0.00	-0.06	0.11	0.12	-0.01	0.25	0.05	-0.08	-0.08	-0.06	1											
o CFOsale	0.07	0.09	0.07	0.02	0.01	0.10	0.08	0.10	-0.09	-0.04	-0.03	-0.14	-0.09	0.03	1										
p Age	-0.11	-0.12	-0.11	0.00	-0.04	0.19	0.06	0.21	-0.11	0.02	-0.01	-0.08	-0.03	0.06	0.05	1									
q Profitability	0.02	0.02	0.01	0.00	-0.07	0.05	-0.02	-0.04	-0.03	0.01	0.00	0.12	-0.01	-0.02	0.02	0.07	1								
r DevInv	0.17	0.06	0.09	0.01	0.01	-0.03	-0.11	-0.08	0.09	-0.09	-0.03	0.12	0.03	0.03	-0.03	0.07	0.01	1							
s DevCapex	0.06	0.19	0.08	0.01	0.02	-0.02	-0.12	-0.10	0.13	-0.11	-0.04	0.08	0.02	0.02	-0.05	0.04	0.03	0.22	1						
t DevNonCapex	0.08	0.06	0.13	0.01	0.01	-0.04	-0.11	-0.11	0.15	-0.08	-0.02	0.10	0.05	0.03	-0.03	0.08	0.03	0.88	0.13	1					
u DevSales	-0.02	-0.02	-0.02	0.01	-0.01	-0.12	-0.08	-0.07	0.09	0.02	-0.05	0.11	0.09	-0.04	-0.06	-0.03	0.01	0.05	0.04	0.06	1				
v DevCFO	0.13	0.16	0.12	-0.02	0.01	-0.14	-0.06	-0.06	0.13	-0.03	0.05	0.13	0.11	-0.08	-0.09	0.02	0.01	0.02	0.02	0.01	0.23	1			
w SD	-0.06	-0.08	-0.04	0.01	0.04	-0.03	0.02	0.02	0.07	0.02	0.01	0.03	-0.03	0.03	-0.01	-0.01	0.05	0.02	0.02	0.03	0.02	0.01	0.26	1	
x Beta	-0.05	-0.09	-0.08	0.01	0.05	-0.02	0.03	0.01	0.05	0.01	0.00	0.05	-0.04	0.02	-0.01	-0.02	0.04	0.01	0.03	0.04	0.01	0.00	0.26	1	

The sample consists of 5,172 firm-year observations for the period 2001-2006. Inv is a measure of investment calculated as the sum of research and development expenditure, capital expenditure, and acquisition expenditure less cash receipts from sale of property, plant and equipment multiplied by 100 and scaled by lagged total assets. Capex is a measure of investment calculated as capital expenditure multiplied by 100 and scaled by lagged property, plant and equipment. NonCapex is a measure of investment calculated as the sum of research and development expenditure and acquisition expenditure multiplied by 100 and scaled by lagged total assets. Dummy\_Qlt\_Seg is dummy variable taking value 1 if Qlt\_Seg is positive and zero otherwise, where Qlt\_Seg is the firm-year-specific residual obtained from a regression of the firm's year t quantity of

segment disclosure on controls and determinants of segment disclosure. CorpGov is a measure of corporate governance. LogAssets is the log of total assets. Tang is the ratio of property, plant and equipment to total assets. Dividend is a dummy variable that takes the value of 1 if the firm paid dividends and 0 otherwise. Coven is a dummy variable that takes the value of 1 if the firm has to use the excess of cash flow to paid loans and 0 otherwise. Z-Score is a measure of bankruptcy risk. OperCycle is the log of receivables to sales plus inventory to COGS multiplied by 360. MTB is the ratio of the market value of total assets to book value of total assets. Slack is the ratio of cash to property, plant and equipment. Leverage = debt to total assets ratio in percentage. CFOsale is the ratio of CFO to sales in percentage. Age is the difference between the first year when the firm appears in CRSP and the current year. Profitability = return on assets. DevInv is the firm-specific standard deviation of Inv over the last three years (t-2 to t) in percentage. DevCapex is the firm-specific standard deviation of Capex over the last three years (t-2 to t) in percentage. DevNonCapex is the firm-specific standard deviation of NonCapex over the last three years (t-2 to t) in percentage. DevSales is the firm-specific standard deviation of sales over the last three years (t-2 to t) in percentage. DevCFO is the firm-specific standard deviation of cash flow from operations over the last three years (t-2 to t) in percentage. SD is the standard deviation of monthly returns in percentage. Beta is the coefficient from firm-specific CAPM regressions using the 60 months preceding the fiscal year end. CF is the sum of income before extraordinary items and depreciation and amortization expense multiplied by 100 and scaled by lagged total assets.



**Table 3**  
**Industry Year Fixed Effect Regression of Qtt\_Seg on earnings quality, diversification, information asymmetries and control variables**

$$Qtt\_Seg_{j,t} = \alpha + \beta_1 Earnings\_Qlt_{j,t} + \beta_2 Business\ Diversification_{j,t} + \beta_3 Geographic\ Diversification_{j,t} + \beta_4 Information\ Asymmetries_{j,t-1} + \beta_5 Size_{j,t} + \beta_6 Growth_{j,t} + \beta_7 Leverage_{j,t} + \beta_8 Audit\ Firm_{j,t} + \beta_9 Listing\ Status_{j,t} + \beta_{10} Proprietary\ Costs_{j,t} + \beta_{11} New\ Financing_{j,t} + \beta_{12} Profitability_{j,t} + \beta_{13} Age_{j,t} + \sum_k \beta_k Control\ year_{j,t} + \epsilon_{j,t}$$

Variable	Expected sign	Coef. (p-value)	Coef. (p-value)
Earnings_Qlt	+		6.8121 (0.000)
BusDiversif	+		5.2645 (0.000)
GeoDiversif	+		0.2195 (0.000)
Spread	+		1.8667 (0.048)
Ln mve	+	4.8034 (0.000)	4.1831 (0.000)
Ln bm	+	4.3507 (0.000)	4.1777 (0.000)
Leverage	+	0.0945 (0.000)	0.0884 (0.000)
Auditor	+	3.6362 (0.000)	3.1667 (0.000)
StockExch	+	9.4565 (0.000)	7.6444 (0.000)
Herf	-	-0.7403 (0.000)	-0.5108 (0.000)
Newfin	+	1.5899 (0.047)	1.6824 (0.040)
Roa	+/-	-0.0621 (0.000)	-0.0531 (0.000)
Age	+	0.1766 (0.000)	0.0932 (0.000)
Cons		7.7317 (0.000)	1.8993 (0.403)
R <sup>2</sup>		0.1755	0.3074

The sample consists of 5,172 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 absolute value, multiplied by minus one, of discretionary accruals calculated as the residual of the modified version of the Jones (1991) accruals model (Dechow et al. 1995), as applied to total accruals;  $BusDiversif$  = number of the different sectors in which the firm operates.  $GeoDiversif$  = number of the different countries where the 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 the 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**  
**Firm Year Fixed Effect Regression of Inv, Capex and NonCapex on Qlt\_Seg, CF and MTB**

$$\frac{Inv_{i,t}}{TA_{i,t-1}} = \frac{\beta_0}{TA_{i,t-1}} + \beta_1 \frac{CF_{i,t}}{TA_{i,t-1}} + \beta_2 MTB_{i,t} + \beta_3 Qlt\_Seg\_Dummy_{i,t} + \beta_4 \frac{CF_{i,t}}{TA_{i,t-1}} * Qlt\_Seg\_Dummy_{i,t} + \varepsilon_{i,t}$$

Variable	Expected sign	<i>Inv</i> Coef. (p-value)	<i>Capex</i> Coef. (p-value)	<i>NonCapex</i> Coef. (p-value)
CF	+	0.0048 (0.007)	0.0069 (0.048)	0.0033 (0.003)
Dummy_Qlt_Seg	?	5.0719 (0.000)	6.5785 (0.000)	4.0118 (0.000)
CF*Dummy_Qlt_Seg	-	-0.0094 (0.000)	-0.0181 (0.000)	-0.0082 (0.000)
MTB	+	0.9313 (0.000)	1.3258 (0.000)	0.9171 (0.000)
R <sup>2</sup>		0.3101	0.3082	0.3029

The sample consists of 5,172 firm-year observations for the period 2001-2006. *Inv* is a measure of investment calculated as the sum of research and development expenditure, capital expenditure, and acquisition expenditure less cash receipts from sale of property, plant and equipment multiplied by 100 and scaled by lagged total assets. *Capex* is a measure of investment calculated as capital expenditure multiplied by 100 and scaled by lagged property, plant and equipment. *NonCapex* is a measure of investment calculated as the sum of research and development expenditure and acquisition expenditure multiplied by 100 and scaled by lagged total assets. *CF* is the sum of income before extraordinary items and depreciation and amortization expense multiplied by 100 and scaled by lagged total assets. *Dummy\_Qlt\_Seg* is dummy variable taking value 1 if *Qlt\_Seg* is positive and zero otherwise, where *Qlt\_Seg* is the firm-year-specific residual obtained from a regression of the firm's year t quantity of segment disclosure on controls and determinants of segment disclosure. *MTB* is the ratio of the market value of total assets to book value of total assets.

**Table 5**  
**Industry Year Fixed Effect Regression of Inv, Capex and NonCapex on determinants of Investment levels**

$$Inv_{i,t+1} = \alpha + \beta_1 Inv_{i,t} + \beta_2 LogAssets_{i,t} + \beta_3 LogAssets^2_{i,t} + \beta_4 Tang_{i,t} + \beta_5 Dividend_{i,t} + \beta_6 Coven_{i,t} + \beta_7 Zscore_{i,t} + \beta_8 OperCycle_{i,t} + \beta_9 MTB_{i,t} + \beta_{10} Slack_{i,t} + \beta_{11} Leverage_{i,t} + \beta_{12} CFOsale_{i,t} + \beta_{13} Age_{i,t} + \beta_{14} Profitability_{i,t} + \beta_{15} DevInv_{i,t} + \beta_{16} DevSales_{i,t} + \beta_{17} DevCFO_{i,t} + \beta_{18} SD_{i,t} + \beta_{19} Beta_{i,t} + \sum_k \beta_k Control_{i,t} + \epsilon_{i,t}$$

Variable	Expected sign	Inv Coef. (p-value)	Capex Coef. (p-value)	NonCapex Coef. (p-value)
Lagged Investment proxy	+	0.1681 (0.000)	0.2221 (0.000)	0.1424 (0.000)
LogAssets	+	6.6628 (0.001)	6.5766 (0.062)	3.3583 (0.032)
LogAssets <sup>2</sup>	-	-0.5608 (0.001)	-0.5408 (0.079)	-0.3012 (0.027)
Tang	+/-	1.2388 (0.043)	-2.2002 (0.051)	-1.2134 (0.015)
Dividend	-	-0.0801 (0.779)	-0.9744 (0.092)	-0.3672 (0.151)
Coven	-	-1.0997 (0.037)	-3.4298 (0.000)	-1.0754 (0.012)
Zscore	+/-	-0.0824 (0.044)	0.1392 (0.065)	-0.0553 (0.097)
Opercycle	+/-	-0.2493 (0.037)	0.4769 (0.031)	-0.0877 (0.336)
MTB	+	0.2748 (0.000)	0.2942 (0.000)	0.1825 (0.000)
Slack	+	0.1176 (0.000)	0.4835 (0.000)	0.1632 (0.000)
Leverage	-	-0.0265 (0.003)	-0.0381 (0.018)	-0.0125 (0.081)
CFOsale	+	0.3149 (0.000)	0.6457 (0.000)	0.2103 (0.000)
Age	-	-0.0235 (0.081)	-0.0433 (0.081)	-0.0104 (0.340)
Profitability	+/-	-0.0017 (0.755)	0.0180 (0.077)	-0.0033 (0.464)
Dev Investment proxy	+	0.3579 (0.000)	0.0529 (0.076)	0.3126 (0.000)
DevSales	-	-0.0153 (0.048)	-0.0312 (0.076)	-0.0120 (0.056)
DevCFO	+	0.0189 (0.067)	0.0333 (0.079)	0.0144 (0.086)
SD	+/-	-0.0989 (0.014)	-0.1331 (0.069)	-0.0567 (0.080)
Beta	+/-	-0.3407 (0.042)	-0.5672 (0.065)	-0.2764 (0.083)
R <sup>2</sup>		0.1228	0.1717	0.1197

The sample consists of 5,172 firm-year observations for the period 2001-2006. Inv is a measure of investment calculated as the sum of research and development expenditure, capital expenditure, and acquisition expenditure less cash receipts from sale of property, plant and equipment multiplied by 100 and scaled by lagged total assets. Capex is a measure of investment calculated as capital expenditure multiplied by 100 and scaled by lagged property, plant and equipment. NonCapex is a measure of investment calculated as the sum of research and development expenditure and acquisition expenditure multiplied by 100 and scaled by lagged total assets. Lagged Investment proxy corresponds to Inv in year t, Capex in year t and lagged NonCapex in year t. LogAssets is the log of total assets. Tang is the ratio of property, plant and equipment to total assets. Dividend is a dummy variable that takes the value of 1 if the firm paid dividends and 0 otherwise. Coven is a dummy variable that takes the value of 1 if the firm has to use the excess of cash flow to paid loans and 0 otherwise. Z-Score is a measure of bankruptcy risk. OperCycle is the log of receivables to sales plus inventory to COGS multiplied by 360. MTB is the ratio of the market value of total assets to book value of total assets. Slack is the ratio of cash to property, plant and equipment. Leverage = debt to total assets ratio in percentage. CFOsale is the ratio of CFO to sales in percentage. Age is the difference between the first year when the firm appears in CRSP and the current year. Profitability = return on assets. DevInv is the firm-specific standard deviation of Inv over the last three years (t-2 to t) in percentage. DevCapex is the firm-specific standard deviation of Capex over the last three years (t-2 to t) in percentage. DevNonCapex is the firm-specific standard deviation of NonCapex over the last three years (t-2 to t) in percentage. DevSales is the firm-specific standard deviation of sales over the last three years (t-2 to t) in percentage. DevCFO is the firm-specific standard deviation of cash flow from operations over the last three years (t-2 to t) in percentage. SD is the standard deviation of monthly returns in percentage. Beta is the coefficient from firm-specific CAPM regressions using the 60 months preceding the fiscal year end.

**Table 6**  
**Effect of Qlt\_Seg and CorpGov on the likelihood of under- or over- investing with respect to a benchmark group of firms**

$$Prob(Investment_{i=j}) = \beta_0 CorpGov_{i,t} + \beta_1 CorpGov^2_{i,t} + \beta_2 Dummy\_Qlt\_Seg_{i,t} + \beta_3 Dummy\_Qlt\_Seg_{i,t} * CorpGov_{i,t} + \beta_4 Dummy\_Qlt\_Seg_{i,t} * CorpGov^2_{i,t} + \varepsilon_{i,t}$$

Panel A. Under-investment versus normal investment

Variable	Expected sign	<i>Inv</i> Coef. (p-value)	<i>Inv</i> Coef. (p-value)	<i>Inv</i> Coef. (p-value)	<i>Inv</i> Coef. (p-value)	<i>Capex</i> Coef. (p-value)	<i>NonCapex</i> Coef. (p-value)
Dummy_Qlt_Seg	-	-0.5299 [-0.0852] (0.000)		-0.4712 [-0.0792] (0.017)	-1.5873 [-0.2625] (0.000)	-0.4619 [-0.0367] (0.092)	-1.6826 [-0.2577] (0.000)
CorpGov	-		-0.6033 [-0.0985] (0.000)	-0.5432 [-0.0881] (0.000)	-0.7138 [-0.1153] (0.000)	-0.1672 [-0.0090] (0.007)	-0.5976 [-0.0877] (0.000)
CorpGov <sup>2</sup>	+		0.0647 [0.0105] (0.000)	0.0510 [0.0082] (0.000)	0.0822 [0.0132] (0.000)	0.0159 [0.0006] (0.159)	0.0648 [0.0094] (0.000)
Dummy_Qlt_Seg*CorpGov	+			0.1038 [0.0173] (0.034)	0.8738 [0.1441] (0.000)	0.1755 [0.0131] (0.242)	0.8169 [0.1266] (0.000)
Dummy_Qlt_Seg*CorpGov <sup>2</sup>	-				-0.1076 [-0.0177] (0.000)	-0.0131 [-0.0003] (0.511)	-0.0968 [-0.0150] (0.000)
Year Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes
Firm cluster		Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>		0.3847	0.4331	0.4344	0.4383	0.1526	0.3317

## Panel B. Over-investment versus normal investment

Variable	Expected sign	<i>Inv</i> Coef. (p-value)	<i>Inv</i> Coef. (p-value)	<i>Inv</i> Coef. (p-value)	<i>Inv</i> Coef. (p-value)	<i>Capex</i> Coef. (p-value)	<i>NonCapex</i> Coef. (p-value)
Dummy_Qlt_Seg	-	-1.9967 [-0.0510] (0.000)		-0.9796 [-0.0164] (0.005)	-3.0952 [-0.0695] (0.000)	-1.6555 [-0.1424] (0.000)	-2.2893 [-0.1172] (0.000)
CorpGov	-		-1.7956 [-0.0285] (0.000)	-1.6861 [-0.0270] (0.000)	-2.0874 [-0.0333] (0.000)	-0.8336 [-0.0657] (0.000)	-1.2204 [-0.0588] (0.000)
CorpGov <sup>2</sup>	+		0.1970 [0.0031] (0.000)	0.1727 [0.0027] (0.000)	0.2409 [0.0038] (0.000)	0.0860 [0.0068] (0.000)	0.1353 [0.0065] (0.000)
Dummy_Qlt_Seg*CorpGov	+			0.1893 [0.0028] (0.062)	1.8058 [0.0278] (0.000)	0.7732 [0.0602] (0.000)	1.1485 [0.0521] (0.000)
Dummy_Qlt_Seg*CorpGov <sup>2</sup>	-				-0.2304 [-0.0035] (0.001)	-0.0739 [-0.0058] (0.012)	-0.1338 [-0.0060] (0.001)
Year Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes
Firm cluster		Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>		0.3847	0.4331	0.4344	0.4383	0.1526	0.3317

The sample consists of 5,172 firm-year observations for the period 2001-2006. Dummy\_Qlt\_Seg is dummy variable taking value 1 if Qlt\_Seg is positive and zero otherwise, where Qlt\_Seg is the firm-year-specific residual obtained from a regression of the firm's year t quantity of segment disclosure on controls and determinants of segment disclosure. CorpGov is a measure of corporate governance. This table presents result from multinomial logit pooled regression. The dependent variable is based on the level of unexplained investment. Firms in the cluster with more negative residuals are classified as under investing, whilst firms in the cluster with more positive residuals are classified as over investing. Firms in the remaining cluster are the benchmark group, given that their investment level is closer to the prediction. The assigned values are: 1 if the firm is classified as over investing; 2 if the firm is in the benchmark group; and 3 if it is classified as under investing. Square brackets show marginal values.

**Table 7**  
**Negative binomial regression of CorpGov on its determinants**

Variable	Expected sign	Coef. (p-value)
Ln mve	+	0.0812 (0.000)
Ln bm	+	0.1846 (0.000)
Age	-	-0.0026 (0.015)
FCF	+	0.0031 (0.089)
SD	+	0.0058 (0.045)
Leverage	-	0.0011 (0.100)
BusDiversif	+	0.0509 (0.000)
GeoDiversif	+	0.0057 (0.006)
Profitability	-	-0.0054 (0.000)
Year Dummies		Yes
Wald $\chi^2$		478.35
p-value		0.000

The sample consists of 5,172 firm-year observations for the period 2001-2006. Dependent variable is a dummy variable which takes value of 1 if CorpGov is above median of this variable. Ln mve is the logarithm of firm's market value of equity measured at the beginning of fiscal year for 2001-2006; Ln bm is the logarithm of firm's book-to-market ratio measured at the beginning of fiscal year 2001-2006; Age is the difference between the first year when the firm appears in CRSP and the current year. FCF is (operating cash flow minus preferred and common dividends)/total assets if book-to-market ratio is greater or equal to one, and zero otherwise. SD is the standard deviation of monthly returns in percentage. Leverage = debt to total assets ratio in percentage. BusDiversif = number of the different sectors in which the firm operates. GeoDiversif = number of the different countries where the firm operates. Profitability = return on assets.



**Table 8**  
**Effect of Qlt\_Seg and Instrument variable on CorpGov on the likelihood of under- or over- investing**  
**with respect to a benchmark group of firms**

$$Prob(Investment_{i,j}) = \beta_0 CorpGov_{i,t} + \beta_1 CorpGov^2_{i,t} + \beta_2 Dummy\_Qlt\_Seg_{i,t} + \beta_3 Dummy\_Qlt\_Seg_{i,t} * CorpGov_{i,t} + \beta_4 Dummy\_Qlt\_Seg_{i,t} * CorpGov^2_{i,t} + \varepsilon_{i,t}$$

Panel A. Under-investment versus normal investment

Variable	Expected sign	<i>Inv</i> Coef. (p-value)	<i>Capex</i> Coef. (p-value)	<i>NonCapex</i> Coef. (p-value)
Dummy_Qlt_Seg	-	-4.6490 [-0.0256] (0.058)	-3.8087 [-0.4842] (0.087)	-6.1510 [-0.4069] (0.081)
CorpGov	-	-0.7938 [-0.1241] (0.000)	-0.2937 [-0.0381] (0.030)	-0.4968 [-0.0684] (0.005)
CorpGov <sup>2</sup>	+	0.1002 [0.0155] (0.004)	0.0486 [0.0081] (0.146)	0.0392 [0.0046] (0.375)
Dummy_Qlt_Seg*CorpGov	+	2.4460 [0.3775] (0.048)	1.7234 [0.3250] (0.129)	3.1926 [0.4849] (0.083)
Dummy_Qlt_Seg*CorpGov <sup>2</sup>	-	-0.3207 [-0.0493] (0.042)	-0.1887 [-0.0356] (0.197)	-0.4198 [-0.0632] (0.083)
Year Fixed effect		Yes	Yes	Yes
Firm cluster		Yes	Yes	Yes
R <sup>2</sup>		0.4470	0.1555	0.3359

## Panel B. Over-investment versus normal investment

Variable	Expected sign	<i>Inv</i> Coef. (p-value)	<i>Capex</i> Coef. (p-value)	<i>NonCapex</i> Coef. (p-value)
Dummy_Qlt_Seg	-	-16.6034 [-0.9851] (0.000)	-4.9820 [-0.2777] (0.094)	-8.8271 [-0.5290] (0.085)
CorpGov	-	-2.4716 [-0.0405] (0.000)	-0.8685 [-0.0633] (0.000)	-1.3360 [-0.0656] (0.000)
CorpGov <sup>2</sup>	+	0.3421 [0.0056] (0.002)	0.0932 [0.0061] (0.077)	0.1675 [0.0085] (0.022)
Dummy_Qlt_Seg*CorpGov	+	8.9546 [0.1484] (0.020)	2.2919 [0.1328] (0.119)	4.9780 [0.2276] (0.068)
Dummy_Qlt_Seg*CorpGov <sup>2</sup>	-	-1.2038 [-0.0199] (0.017)	-0.2497 [-0.0144] (0.079)	-0.6990 [-0.0323] (0.089)
Year Fixed effect		Yes	Yes	Yes
Firm cluster		Yes	Yes	Yes
R <sup>2</sup>		0.4470	0.1555	0.3359

The sample consists of 5,172 firm-year observations for the period 2001-2006. Dummy\_Qlt\_Seg is a dummy variable taking value 1 if Qlt\_Seg is positive and zero otherwise, where Qlt\_Seg is the firm-year-specific residual obtained from a regression of the firm's year t quantity of segment disclosure on controls and determinants of segment disclosure. CorpGov is an instrumental variable of corporate governance, measured as predicted values obtained from a negative binomial regression of CorpGov on its determinants. This table presents results from multinomial logit pooled regression. The dependent variable is based on the level of unexplained investment. Firms in the cluster with more negative residuals are classified as under investing, whilst firms in the cluster with more positive residuals are classified as over investing. Firms in the remaining cluster are the benchmark group, given that their investment level is closer to the prediction. The assigned values are: 1 if the firm is classified as over investing; 2 if the firm is in the benchmark group; and 3 if it is classified as under investing. Square brackets show marginal values.