

# Determinants of segment reporting quality: evidence from EU

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## Abstract

**Purpose** – This study aims to provide some empirical evidence on the determinants of segment reporting quality, and to propose a new measurement tool of segment reporting quality – segment reporting quality index (SRQI).

**Design/methodology/approach** – On the basis of hand-collected segment data for a sample of 171 European Union publicly listed companies from the 2006-2012 annual reports, the study uses multiple regression model to investigate the determinants of segment reporting quality. A new measurement of segment reporting quality is constructed. It aggregates different segment reporting practices indicators, including the number of segments, the extent of information disclosed and the geographic fineness. Additional estimations are conducted to test the robustness of the results.

**Findings** – The results suggest that there is a substantial variation in the quality of segment reporting among the sampled European Union firms. Large corporations, audited by Big 4 auditors and more internationally oriented, tend to provide a higher quality of segment reporting. In contrast, debt leverage negatively impacts the quality of segment reporting. However, the quality is not significantly related to profitability. The findings are fairly robust to a number of econometric models that control, for year fixed effects and pre- and post-International Financial Reporting Standards 8 adoption. Overall, the findings are generally consistent with the predictions of agency theory.

**Research limitations/implications** – The results imply that considerable managerial discretion exists. Despite the IFRS commitment to enhance comparability of the financial statements, segment information remains very disparate. It enables investors to get a better understanding of a firm's activities, but it does not allow for a better assessment of a firm as compared to the other firms of the same sector. As compared with other IFRS standards, the segment reporting has more relation with corporate governance structure and specific institutions that regulate a sector or a country. Furthermore, the results show that firm characteristics are associated with the study's aggregated measure of segment reporting quality (SRQI) consistently with theoretical and empirical evidence. SRQI can, thus, be used by researchers for replication or to study new questions on firms' segment disclosure behavior on a much wider set of firms in the economy. While this research makes several noteworthy contributions, the authors acknowledge that SRQI considers only multisegments firms that disaggregate their primary/operating segments by line-of-business and disclose secondary/entity-wide level geographic information.



**Originality/value** – This study offers new evidence on the determinants of segment reporting quality following IFRS adoption, in the European Union context. This study contributes to the existing literature by proposing an aggregated measure of segment reporting quality (SRQI). Unlike previous measures, which were usually limited to researcher self-constructed indexes, SRQI captures different facets of segment information in terms of disaggregation and disclosure extent.

**Keywords** European Union context, Extent of disclosure, Firm’s characteristics, Geographic fineness, Number of segments, Segment reporting quality

**Paper type** Research paper

## 1. Introduction

It has been well established that the firm commitment to a high financial reporting quality reduces the information asymmetries between its managers and stakeholders, and between informed and uninformed investors. As a consequence, [Diamond and Verrecchia \(1991\)](#) argued that it increased the firm’s stock liquidity. In a segment reporting setting, [Knutson \(1993\)](#) reported that users of financial statements, such as analysts, agreed that information was essential in assessing and predicting firm performance.

In recent years, several countries have attempted to secure the potential benefits of increased disclosure by imposing stricter disclosure requirements on firms. In particular, in its regulation N°1606-2002 on July 19, 2002, the European Commission (EC) required listed groups to adopt International Financial Reporting Standards (IFRS) for fiscal years beginning on or after January 1, 2005. Consequently, since the implementation of IFRS, the European Union (EU) listed firms have been required to comply with International Accounting Standards 14 Revised (IAS 14R) “Segment reporting”.

In November 2006, as part of the ongoing convergence project between the Financial Accounting Standards Board (FASB) and the International Accounting Standards Board (IASB), IFRS 8 “Operating segments” was issued to supersede the IAS 14R. IFRS 8 resembles its US counterpart Statement of Financial Accounting Standards (SFAS) 131[1] “Disclosure about segments of an enterprise and related information”, and became mandatory for annual periods beginning on or after January 1, 2009.

The recent trend in segment reporting regulation (IAS 14R and then IFRS 8) led to a proliferation of studies that examined segment reporting practices, their determinants and their value relevance and usefulness [for a literature review, see [Nichols et al. \(2013\)](#)], and the IASB’s IFRS 8 Post-Implementation Review [PIR] (2013)].

Based essentially on a descriptive analysis, previous studies documented considerable diversity in segment reporting practices provided by companies complying with IAS 14R ([Street and Nichols, 2002](#); [Prather–Kinsey and Meek, 2004](#)) and IFRS 8 ([Crawford et al., 2012](#); [Nichols et al., 2012](#); [Leung and Verriest, 2015](#); [Bugeja et al., 2015](#)). This diversity indicated that where a mandated standard existed, considerable managerial discretion was allowed in how the standard was applied ([Berger and Hann, 2007](#)).

To address such diversity, previous studies adopted a positive accounting approach ([Watts and Zimmerman, 1978, 1986](#)) and attempted to identify the determinants of segment reporting quality, which reflect the discretionary choices managers make within mandatory filings. Segment information disclosed may result from a cost–benefit tradeoff. Therefore, firms for which the perceived costs exceeded the benefits reported more aggregated segments and less segment information.

Several researchers such as [Hayes and Lundholm \(1996\)](#), [Harris \(1998\)](#) and [Botosan and Stanford \(2005\)](#) agreed that executives’ main motivation to withhold segment information was generated by their concerns about proprietary costs. This idea was supported by

evidence from empirical results. Other researchers such as [Berger and Hann \(2007\)](#) and [Bugeja et al. \(2015\)](#) asserted that agency costs were also motives for discretionary segment reporting. [Berger and Hann \(2007\)](#) claimed that “managerial self-interest plays a role in segment aggregation decisions”.

Based on the theoretical framework of proprietary costs and agency theories, a great number of works, such as [Salamon and Dhaliwal \(1980\)](#), [McKinnon and Dalimunthe \(1993\)](#), [Mitchell et al. \(1995\)](#), [Herrmann and Thomas \(1996\)](#), [Prather–Kinsey and Meek \(2004\)](#), [Tsakumis et al. \(2006\)](#), [Pisano and Landriani \(2012\)](#), [Nichols and Street \(2007\)](#), [Prencipe \(2004\)](#), [Bugeja et al. \(2015\)](#) and [Leung and Verriest \(2015\)](#) argued that firm size, profitability, leverage, degree of internationalization, audit quality, industry type and country of domicile were determinants of segment reporting.

Unfortunately, these studies did not yield consistent and conclusive results. They adopted different proxies for segment reporting quality. The main proxy is the extent of segment information disclosed. It was measured by counting the number of items disclosed in annual reports per segment or level of segmentation ([Herrmann and Thomas, 1996](#); [Prather–Kinsey and Meek, 2004](#); [Prencipe, 2004](#), [Pisano and Landriani, 2012](#)). Other researchers adopted the number of segments reported as measure of segment reporting quality ([Bugeja et al, 2015](#); [Leung and Verriest, 2015](#)). However, a greater number of segments would not necessarily indicate a firm’s willingness to provide detailed information. Indeed, as was argued by [Herrmann and Thomas \(1996\)](#), firms disclosed more line-of-business (LOB) segments or more geographic segments because they were conglomerate-type firms or they were internationally diverse, respectively. In addition, [Doupnik and Seese \(2001\)](#) assumed that more finely disaggregated geographic areas were of higher quality. A firm discloses geographic information quality if it is disaggregated on an individual country basis with a reduced number of geographic areas rather than on a more aggregated basis with a significant number of geographic areas defined as continents. To measure geographic fineness, [Doupnik and Seese \(2001\)](#) developed a score that combined the number of areas reported, the level of aggregation represented by each area and the percentage of foreign operations in that area. They asserted that the larger the score, the finer the information provided by the company.

In the same manner, [Tsakumis et al. \(2006\)](#) revealed that firms utilizing country-specific disclosures to disaggregate their foreign revenues provided more detailed disclosures than firms disclosing a smaller proportion of their foreign revenue by country. A more recent study ([Leung and Verriest, 2015](#)) assessed the quality of segment reporting using four proxies. The first was the income report assigning 1 if a firm reported an income measure at the segment level and 0, otherwise. The second proxy was the number of items reported per geographic or business segment. The third one was the number of segments. Finally, the fourth proxy was the geographic fineness, i.e. the adoption of [Doupnik and Seese’s \(2001\)](#) score. [Leung and Verriest \(2015\)](#) found that segment reporting quality decreased on some disclosure aspects, such as reporting segment income, following the IFRS 8 implementation. However, it increased on other measures such as disaggregation.

Despite a vast empirical literature on corporate disclosures in general and segment reporting in particular, there is surprisingly no overall measure of segment reporting quality based on a comprehensive set of indicators. Indeed, most of the existing measures are either researcher self-constructed indexes ([Herrmann and Thomas, 1996](#); [Prather–Kinsey and Meek, 2004](#); [Prencipe, 2004](#), [Pisano and Landriani, 2012](#)) or other proxies such as the number of segments ([Bugeja et al., 2015](#); [Leung and Verriest, 2015](#)) and the fineness of geographic segments ([Doupnik and Seese, 2001](#); [Leung and Verriest, 2015](#)). The fineness of geographic

segments, though an important aspect of firms segment reporting behavior, has not received much research attention to date.

The purpose of this study is to examine the association between firm characteristics and segment reporting quality using a sample of large publicly listed firms in the EU. In addition, it attempts to propose a more comprehensive measure of segment reporting quality. The restriction of the study to a European setting intended to ensure the standardization of a required minimum level of segment reporting for all the examined companies because the European countries are ruled by the same regulations.

Our study contributes to the extant segment reporting literature. First, using data extracted directly from annual reports of a sample of 171 EU listed corporations from 2006 to 2012, the study provides empirical evidence on the determinants of segment reporting quality. To the best of our knowledge, apart from [Nichols \*et al.\* \(2012\)](#) and [Leung and Verriest \(2015\)](#), no studies were conducted in the EU context with a specific focus on segment reporting. Second, our study attempts to construct a new measurement tool of segment reporting quality – called the segment reporting quality index (SRQI). SRQI would differ from all the previously used measures as it aggregates five proxies used separately in previous studies. Additionally, it may be considered a comprehensive measure of segment reporting quality because it would capture different segment reporting practices. Finally, it should be emphasized that SRQI is not simply a measure of quantity and frequency. It is also a proxy for disclosure quality. Nonetheless, SRQI applies only to multisegments firms disaggregating their primary/operating segments by LOB and disclosing secondary/entity-wide level geographic information.

The results suggest that there is a substantial variation in the quality of segment reporting among the sampled EU firms. Large corporations, audited by Big 4 auditors and more internationally oriented, tend to provide a higher quality of segment reporting. In contrast, debt leverage negatively impacts the quality of segment reporting. However, the quality is not significantly related to profitability. The findings are fairly robust to a number of econometric models that control, for year fixed effects and pre- and post-IFRS 8 adoption. Overall, the findings are generally consistent with the predictions of agency theory.

The subsequent sections of this paper are organized as follows. Section 2 briefly considers segment reporting reforms in the EU context. Section 3 presents the theoretical framework. Section 4 reviews the empirical literature and develops hypotheses. Section 5 outlines the research methodology. Section 6 discusses the findings of the study. Sections 7 and 8 provide, respectively, additional analyses and robustness tests. The concluding remarks of the study are provided in the final section.

## 2. Segment reporting reforms in the European Union context

The 4th directive in Article 43, 78/660 CEE (OJEC, 78) was the first legal document in the EU to enforce legal rules on segment reporting. It required the reporting of the net turnover broken down by categories of activity and into geographical markets.

Since 2005, and based on a “risk and rewards approach”, IAS 14R required EU listed companies to disclose segment information by both LOB and geographic area. A segment, either business or geographic, should be presented, as a primary or a secondary level, if the majority of its products are derived from sales to external customers and if it is responsible for 10 per cent or more of total firm revenues, operating profits or identifiable assets (IAS 14R, § 35). IAS 14R also required a range of mandatory disclosures for primary and secondary segments.

As part of a convergence project with the FASB, the IASB issued, in November 2006, IFRS 8, which followed, fairly closely, the requirements of SFAS 131 and became effective for fiscal years beginning on or after January 1, 2009.

IFRS 8 requires entities to identify only one set of operating segments rather than the primary and secondary segments required by IAS 14R. Based on a “management approach”, IFRS 8 requires companies to provide information consistent with the way management organizes the firm internally for making operating decisions and assessing performance. The aim of the “management approach” to segment reporting is to allow investors and analysts to see the entity through the eyes of management (IASB, 2013). However, compared to the previous standard, IFRS 8 reduces the number of segment information items previously mandated by IAS 14R, and requires the disclosure of some items, including revenue, liabilities, depreciation and capital expenditures, only if they are presented regularly to the Chief Operating Decision-Maker (CODM) to assess segment performance. Furthermore, IFRS 8 requires an entity – including an entity with a single reportable segment – to disclose information about its products and services, its geographic areas and its major customers (IFRS 8, § 31-34). Table I presents a summary of the key differences between IAS 14R and IFRS 8.

Subsequent trends in segment reporting regulation generated a large amount of research in an attempt to examine if the switch to IAS 14R (Street and Nichols, 2002; Prather–Kinsey and Meek, 2004) and then to IFRS 8 (Crawford *et al.*, 2012; Nichols *et al.*, 2012; Leung and Verriest, 2015; Bugeja *et al.*, 2015) yielded an improvement in segment reporting practices. To date, these studies have reported mixed results. They showed diversity in segment reporting practices in terms of the extent of segment information disclosed and the number of segments reported, and even non full compliance with IAS 14R/IFRS 8 requirements. This was an indicator that the decision to disclose or withhold segment information did not depend only on the segment rule, but also on the disclosure behavior adopted by the company. Therefore, this study purported to examine the determinants of segment reporting quality after IFRS adoption with a specific focus on the EU context. Our purpose was to investigate whether firm characteristics could explain the observable diversity in segment reporting quality. Therefore, the next two sections will consider the theoretical motives for segment reporting quality, the evidence and insights from previous studies and, subsequently, will state the potential hypotheses.

### 3. Agency and proprietary costs as motives for segment reporting quality

Previous researchers such as Berger and Hann (2007) used agency and proprietary costs theories to examine what drives segment reporting practices.

Criterion	IAS 14R	IFRS 8
Segments	Risk and rewards approach Primary and secondary level: LOB segments or geographic areas Focuses only on segments that earn a majority of their revenue from sales to external customers	Management approach Operating segments Includes operating segments of an entity that sell primarily or exclusively to other operating segments
Disclosure	Disclosure of primary and secondary segment information	Disclosure of information per operating segments and on an entity-wide basis

**Table I.**  
Key differences  
between IAS 14R and  
IFRS 8

It is well established that disclosure reveals proprietary information that may harm the firm's competitive position. Verrecchia (1983) referred primarily to the proprietary costs theory to explain the company's segment reporting behavior. Within the same line of thought, Emmanuel and Garrod (1987) argued that the competitive disadvantage is a determining factor of the type and the extent of financial information disclosed. They demonstrated that firms strived to divide alternative methods of publishing valuable information that would reduce the cost of capital to capital markets. At the same time, firms limited the publication of information that they would perceive as competitively harmful such as disclosing sales while withholding results. More recently, Emmanuel and Garrod (2004) returned to this idea and confirmed that the costs of competitive disadvantage could constrain the disclosure of segment information considered as strategic. In the same context, Elliott and Jacobson (1994) asserted that segment income was an information item that put the firm at a competitive disadvantage insofar as competitors were interested in the most profitable segments of the firm. Similarly, Hayes and Lundholm (1996) revealed that the decision of managers to release segment information resulted from a trade-off between the advantage of informing the capital market about the firm value and the competitive cost disadvantage. Analytically, they showed that under severe competition, a firm with two separate activities will report one segment if these activities had disparate results to avoid communicating to competitors the activity that is more profitable. Otherwise, if the activities are similar, a firm will report separate segments. They concluded that the decision to not disaggregate segments depended on the desire to protect highly profitable segments. Harris (1998) also echoed this idea stating that diversified or multinational companies tended to aggregate their segments to reduce competitive disadvantage. Similarly, Botosan and Stanford (2005) found that firms concealed profitable segments in less competitive industries, to protect profits. Furthermore, Nichols and Street (2007) and Bugeja *et al.* (2015) showed that firms limited industry segments disaggregation to protect excess returns. In addition, Tsakumis *et al.* (2006) affirmed that management was reluctant to provide geographic area disclosures, which were likely to be associated with potential competitive harm costs. They found that firms exposed to greater competitive harm costs, provided less detailed country specific revenue disclosures.

Drawing on insights from agency theory, Berger and Hann (2007) considered segment reporting as a discretionary choice of disclosure. They argued that managers had to face agency costs of segment reporting if the revelation of an underperforming segment revealed unresolved agency problems. As a consequence, segment reporting would alert external monitoring. They showed that managers were reluctant to disclose the segments with relatively low abnormal profits to avoid shareholder scrutiny.

#### 4. Empirical literature review and hypotheses development

Our study relates to a mainstream of literature that addresses the determinants of segment reporting (Salamon and Dhaliwal, 1980; McKinnon and Dalimunthe, 1993; Mitchell *et al.*, 1995; Herrmann and Thomas, 1996; Prather-Kinsey and Meek, 2004; Tsakumis *et al.*, 2006; Pisano and Landriani, 2012; Nichols and Street, 2007; Prencipe, 2004; Bugeja *et al.*, 2015; Leung and Verriest, 2015). The incentives for disclosing or withholding segment information, which have received prominence in previous studies, relate to minimizing agency and proprietary costs. Our study examines how firm size, profitability, leverage, degree of internationalization and audit quality affect segment reporting quality.

#### 4.1 Firm size

Firm size may proxy for a number of firm attributes including information production costs, competitive costs and vulnerability to political costs. [Salamon and Dhaliwal \(1980\)](#) observed that larger companies showed lower information production costs as the information was already available within the company for internal management purposes.

In the same manner but adopting the proprietary costs theory, [Ball and Foster \(1982\)](#) concluded that larger companies were less sensitive to competitive costs associated with the disclosure of segment information even when considered strategic and proprietary. Size was also found to affect the political sensitivity of firms. Indeed, [Watts and Zimmerman \(1986\)](#) affirmed that larger companies were more politically sensitive than smaller ones. [Craswell and Taylor \(1992\)](#) further clarified that naturally, larger firms were willing to disclose additional information to improve their corporate image and valuation and to reduce potential political costs. These researchers explained that the motivation of larger firms to disclose disaggregated information by LOB and by geographic area came from their desire to have their activities legitimized by the political powers and influential interest groups. Equally, [Berger and Hann \(2003\)](#) found that firm size was positively associated with improved information disaggregation by LOB, after the SFAS 131 implementation.

Agency theory demonstrated that due to their larger ownership dispersion and their complexity ([Meek et al., 1995](#)), larger firms were exposed to high monitoring costs ([Jensen and Meckling, 1976](#)) and, thus, have extra incentive to minimize monitoring costs by providing more voluntary disclosure, including high quality of segment information ([Pisano and Landriani, 2012](#)). Segment reporting can also reduce the cost of capital ([Blanco et al., 2015](#)) of larger firms by enhancing their valuation ([Verrecchia, 1983](#)).

The majority of empirical studies reported a positive connection between firm size and segment reporting ([Salamon and Dhaliwal, 1980](#); [Mckinnon and Dalimunthe, 1993](#); [Mitchell et al., 1995](#); [Prather–Kinsey and Meek, 2004](#); [Pisano and Landriani, 2012](#); [Tsakumis et al., 2006](#); [Nichols and Street, 2007](#)). In the EU context, [Herrmann and Thomas \(1996\)](#) found that larger firms provided more item disclosures per LOB or geographic segment than smaller firms. Similarly, [Leung and Verriest \(2015\)](#) found a positive effect of firm size on the number of items disclosed per business and geographic segments, on the number of business and geographic segments reported, as well as on the probability of reporting income item per business segment.

Therefore, one may suppose the following:

*H1.* Firm size affects positively the quality of segment reporting.

#### 4.2 Profitability

Theoretically, the effect of profitability on segment reporting was ambiguous ([Ahmed and Courtis, 1999](#)). On the basis of proprietary costs theory, companies were reluctant to provide information that may affect their competitive position in a market ([Verrecchia, 1990](#)). They tended to aggregate their business when they had different performance across segments or highly profitable segments, to protect excess returns ([Hayes and Lundholm, 1996](#); [Botosan and Stanford, 2005](#); [Nichols and Street, 2007](#)). On the basis of agency theory, [Berger and Hann \(2007\)](#) found that managers had incentives to conceal bad performance by aggregating underperforming segments with profitable segments to avoid shareholder scrutiny.

In contrast, [Bugeja et al. \(2015\)](#) found a positive effect on the increase in the number of segments reported both post-IAS 14R and post-IFRS 8. [Singhvi and Desai \(1971\)](#) reported that managers of profitable companies had many reasons to signal this fact. First, they

wanted to increase the market value of their human capital. Second, they aimed to demonstrate to shareholders their good intention to act in favor of their interests. Finally, they needed to differentiate their firms from the less profitable ones. Moreover, [Prencipe \(2004\)](#) revealed another motivation for segment reporting related to profitability, i.e. to reduce the risk to be adversely selected by the market. Finally, [Blanco et al. \(2015\)](#) justified this behavior by the desire of the managers to reduce the cost of capital. However, [Prencipe \(2004\)](#) undertook a study in the Italian context and found no significant effect of profitability on segment reporting quality. Of direct relevance to our study, [Leung and Verriest \(2015\)](#) also reported no significant association between profitability and segment reporting quality of EU listed firms.

As can be seen from this review, we can conclude in total agreement with [Ahmed and Courtis \(1999\)](#) that the effect of profitability on segment reporting remains ambiguous. Indeed, there are mixed theoretical as well as empirical opinions on the relation between profitability and segment reporting.

Given this ambiguity of positions, our second hypothesis can be stated as follows:

*H2. Profitability affect the quality of segment reporting.*

#### 4.3 Leverage

According to the agency theory, highly geared firms face potential monitoring costs ([Jensen and Meckling, 1976](#)). This was confirmed and further explained by [Mitchell et al. \(1995\)](#) and [Prencipe \(2004\)](#). These scholars reported that highly geared firms had extra incentives to provide extensive disclosure, in particular more segment information, to better meet the informational needs of creditors and reduce the monitoring costs of debt.

In contrast, [Wallace et al. \(1994\)](#) and [Eng and Mak \(2003\)](#) considered that high debt levels mitigated the problem of “free cash flow” and, then, substituted for voluntary disclosure. In addition, [Jensen \(1993\)](#) argued that the presence of restrictive clauses in debt contracts was likely to reduce the agency costs of debt without adopting extensive disclosure in annual reports. [Pisano and Landriani \(2012\)](#) and [Bugeja et al. \(2015\)](#) found a positive relationship between the level of debt and segment reporting.

Finally, studies by [Mckinnon and Dalimunthe \(1993\)](#) and [Leung and Verriest \(2015\)](#) found no significant relationship between leverage and segment reporting.

Given the mixed results about, the study’s third hypothesis is the following:

*H3. Leverage affect the quality of segment reporting.*

#### 4.4 Degree of internationalization

On the basis of agency theory, firms listed on multiple stock exchanges were likely to be held by a large number of shareholders and incurred greater monitoring costs. [Herrmann and Thomas \(1996\)](#) argued that to mitigate these costs, managers were willing to provide additional information. Furthermore, these authors noted that companies listed on multiple country exchanges were more likely to have debt financed by foreign capital. Therefore, they had a stronger motivation to be transparent, i.e. to respond to capital market pressures.

Empirically and consistent with the theoretical predictions, previous studies reported a positive connection between foreign exchange listing and voluntary disclosure ([Meek et al., 1995](#)) and IFRS compliance ([Street and Gray, 2001](#)). With regard to segment reporting, the degree of internationalization was found to be significantly and positively associated with segment reporting quality ([Mitchell et al., 1995](#), [Herrmann and Thomas, 1996](#)) and IAS 14R compliance ([Prather-Kinsey and Meek, 2004](#)). However, upon examining different



dimensions of segment reporting, [Leung and Verriest \(2015\)](#) reported mixed effects. They found that the percentage of foreign sales to total sales was positively related to the number of geographic segments reported, geographic fineness and probability of reporting income item by business segment. In contrast, it was negatively related to the probability of reporting income by geographic segment and to the number of business segments reported. Nevertheless, there was no significant relationship with the extent of business and geographic disclosures.

Consistent with theoretical predictions and the major empirical evidence, we hypothesize the following:

*H4.* Internationalization degree affect positively the quality of segment reporting.

#### *4.5 Audit quality (audit firm size)*

According to agency theory, external auditors play a crucial role in monitoring managers to limit their discretionary behavior and, then, reduce agency conflicts ([Jensen and Meckling, 1976](#); [Han et al., 2012](#)). [DeAngelo \(1981\)](#), [Choi et al. \(2008\)](#) and [Ntim et al. \(2012\)](#) praised the role of larger and well-known audit firms in the reinforcement of financial reporting quality. These audit firms had a greater financial strength, expertise and knowledge. They were motivated to supply a higher level of audit quality to maintain their reputation and legal liability exposure.

[DeAngelo \(1981\)](#) defined audit quality as “the market-assessed joint probability that a given auditor would both discover a breach in the client’s accounting system and would report the breach”. [Prather–Kinsey and Meek \(2004\)](#) and [Al-Bassam et al. \(2015\)](#) focused on audit quality in relation to the auditor choice such as Big 4 compared to non-Big 4. [Singhvi and Desai \(1971\)](#) and [Owusu–Ansah \(1998\)](#) found that firms audited by a big and prestigious audit firm, i.e. Big 4, showed a higher financial reporting quality. Similarly, [Ntim et al. \(2012, 2014\)](#) found that firms audited by a Big 4 had higher Tobin’s Q. This would not be surprising as [Firth \(1979\)](#) and [Street and Gray \(2001\)](#) demonstrated that a Big 4 auditor exercised a stronger control over managerial decisions and pressed their clients for better disclosure and for better complying with complex and stringent standards such as IAS/IFRS.

Empirically, works by [Eng and Mak \(2003\)](#) and [Prather–Kinsey and Meek \(2004\)](#) reported a positive connection between audit firm size and corporate disclosure. Of direct relevance to our study, [Prather–Kinsey and Meek \(2004\)](#) found that compliance with IAS 14R was greater for firms audited by a Big 4.

Consistent with theoretical predictions and the major empirical evidence, we hypothesize the following:

*H5.* Audit firm size affect positively the quality of segment reporting.

## **5. Data and research method**

### *5.1 Sample selection*

Potential sample companies were initially identified from the list of active listed companies in 2006 in InFinancials database, excluding the financial sector operating firms (SIC 6000–6999). Initially, we identified 6076 potential firms domiciled in 27 countries. Focusing on a cross-country sample of European listed firms allows our analysis to be based on a set of annual reports prepared in accordance with IFRS, which became mandatory for fiscal years beginning on or after January 1, 2005. Only firms whose SIC codes were available and total

revenues exceeded €1bn, in 2006, were included in our study. A first total-revenue based selection identified a number of 717 firms. In line with [Herrmann and Thomas \(1996\)](#), [Street et al. \(2000\)](#) and [Tsakumis et al. \(2006\)](#), we selected the largest firms in each country to increase the likelihood of firms being conglomerate and/or being active in diverse geographic areas. A second selection based on the three-digit SIC codes, for which there should be at least ten firms, yielded a sample composed of 238 listed firms.

Another 67 companies were dropped for a number of reasons, mainly the unavailability of some annual reports, non-adoption of IFRS in 2006 and being involved in a merger, major acquisition or being unlisted during our study period (2006-2012). In accordance with [Nichols et al. \(2000\)](#), [Street et al. \(2000\)](#) and [Prather-Kinsey and Meek \(2004\)](#), this latter criterion ensured that any differences identified in the segment reporting practices were not driven by changes in the company's structure.

Because our SRQI applied only to multisegment firms, disaggregating their primary/operating segments by LOB and disclosing secondary/entity-wide level geographic information, a subset of 720 observations was dropped. The sample selection process is illustrated in [Table II](#), Panel A. The final sample consisted of 440 firm-year observations.

[Table II](#) also shows the distribution of firms across industries (Panel B) and countries (Panel C). Most of the companies included in the study's sample were in manufacturing and services industries and were domiciled in Germany, followed by France and the UK.

## 5.2 Definition of variables

To test our hypotheses – *H1* to *H5* – we classified the variables of this study into three main types. [Table III](#) contains full definitions of all the variables. First, the main dependent variable of the study was SRQI

To calculate SRQI, we hand-collected segment reporting data from the annual reports of the period between 2006 and 2012. In total agreement with [Pisano and Landriani \(2012\)](#), only the information included in financial statements and their notes was considered because only this type of information constituted the exclusive subject to both IAS 14R and IFRS 8.

To construct our segment reporting quality index, we took multiple steps. First, we constructed five separate indicators describing segment reporting practices, including the number of LOB segments (NLOB), the number of geographic areas (NGEOG), the extent of information disclosed by LOB segments (LOBIND), the extent of information disclosed per geographic area (GEOGIND) and the geographic fineness (FINENESS).

NLOB and NGEOG were obtained by counting, respectively the number of primary/operating LOB segments provided and secondary/entity-wide geographic areas reported.

LOBIND and GEOGIND were two self-constructed indexes relative to the disclosure of information, respectively, by LOB segment and geographic area in annual reports[2]. A list of 20 items constituting the first disclosure index (LOBIND) is presented in [Appendix 1](#). A list of 16 items constituting the second disclosure index (GEOGIND) is presented in [Appendix 2](#).

FINENESS was a score initially developed by [Doupnik and Seese \(2001\)](#) and, then, used by [Leung and Verriest \(2015\)](#) to measure geographic fineness. The fineness score was calculated as follows for each company:

*PANEL A: Summary of sample selection procedure*

Listed EU firms active in InFinancials database, excluding financial firms	6076
Firms with unavailable SIC codes and whose total revenues are less than €1 billion, in 2006	(5359)
Number of firms classified by three-digit SIC code below 10	(479)
Firms excluded for several reasons, including unavailability of annual reports, mergers, major acquisitions etc.	(67)
<i>Final number of firms</i>	171
<i>Total initial number of firm-year observations</i>	1 160
<i>Excluding enterprises</i>	(616)
✓ With no segment information or claiming to operate in a single reportable segment	
✓ For which segment information is not disclosed by operating/primary LOB segment	
✓ With no secondary/entity-wide level geographic information	
Data not available for independent and control variables	(100)
Outliers	(4)
<i>Total final number of firm-year observations</i>	440

*PANEL B: Distribution of firms across industries*

<i>SIC Division</i>	<i>Industry type</i>	<i>No. of Obs</i>	<i>Percentage</i>
20-39	Manufacturing	274	62.27
70-89	Services	92	20.91
52-59	Retail trade	7	1.59
15-17	Construction	28	6.36
40-49	Utilities	39	8.86
	TOTAL	440	100.00

*PANEL C: Distribution of firms across countries*

<i>Country</i>	<i>No. of Obs</i>	<i>Percentage</i>
Germany	88	20.00
France	67	15.23
UK	66	15.00
Spain	38	8.64
Finland	38	8.64
Sweden	26	5.91
Italy	22	5.00
Austria	22	5.000
Belgium	17	3.86
The Netherlands	13	2.95
Greece	12	2.73
Ireland	10	2.27
Poland	8	1.82
Denmark	4	0.91
Czech Republic	4	0.91
Slovakia	4	0.91
Hungary	1	0.23
TOTAL	440	100.00%

**Table II.**  
Summary of the  
sample selection  
procedure and  
sample  
characteristics

	<i>Frequency</i>	<i>Percentage</i>
IFRS 8: 0	122	27.73
1	318	72.27

*Dependent variable*

SRQI: A segment reporting quality index as described above which aggregates five proxies:  
 NLOB: number of LOB segments reported;  
 NGEOG: number of geographic segments reported;  
 LOBIND: LOB disclosure index (see detailed items in [appendix 1](#));  
 GEOGIND: geographic disclosure index (see detailed items in [appendix 2](#)); and  
 FINENESS: geographic fineness score, which is calculated as follows:

$$F = \sum_{i=1}^n (\text{AREAREV}_i / \text{FORREV}) * \text{Weight}_i$$

with:

AREAREV = revenue for geographic area i;

FORREV = total foreign revenues; and

Weight = 0: for geographic area described as “Foreign” or “Others”;  
 1: for geographic area described as “multi-continent”;  
 2: for geographic area described as “continent”;  
 3: for geographic area described as “country”.

*Independent variables*

FSIZE: Log of total assets;

ROA: Return on assets;

LEV: Total debt/total assets;

EXPORT: Percentage of foreign sales to total sales;

BIG4: 1, if a firm is audited by a big4 audit firm (Pricewaterhouse Coopers, Deloitte & Touche, Ernst & Young and KPMG), 0 otherwise;

*Control variables*

IFRS 8: 1, for the post-IFRS 8 period, 0 otherwise;

IDUMs: Dummies for each of the 4 industries: construction, utilities, retail trade and services

CDUMs: Dummies for each of the countries: Austria, Belgium, Denmark, Spain, Finland, France, Greece, Hungary, Ireland, Italy, The Netherlands, Poland, Czech Republic, UK, Slovakia and Sweden

**Notes:** SRQI = segment reporting quality index; FSIZE = firm size; ROA = profitability; LEV = leverage; EXPORT = degree of internationalization; BIG4 = audit quality (audit firm size); IFRS 8 = post-IFRS8 period; IDUMs = industry dummies; CDUMs = country dummies

**Table III.**  
Summary definition  
of variables

$$F = \sum_{i=1}^n (\text{AREAREV}_i / \text{FORREV}) * \text{Weight}_i$$

with:

AREAREV = revenue for geographic area i;

FORREV = total foreign revenues; and

Weight = 0: for geographic area described as “Foreign” or “Others”;  
 1: for geographic area described as “multi-continent”;  
 2: for geographic area described as “continent”;  
 3: for geographic area described as “country”.

The second step consisted of ranking and averaging the five reporting indicators constructed. In fact, for each indicator, we calculated its median value and, then,

transformed it into a dichotomous variable that took the value 1 if its value was above the median value and 0 otherwise.

Finally, for each company, we calculated a SRQI that could be obtained by dividing the sum of the values assigned to the five dichotomous indicators and the theoretical score that was equal to the number of indicators (5). Such index would present our proposed measure of segment reporting quality. Figure 1 shows the different components of our SRQI.

Unlike previous studies, our SRQI included different facets of segment information disclosed by a company in terms of disaggregation (NLOB, NGEOG and FINENESS), and extent of the disclosure (LOBIND and GEOGIND). It would be very likely that this index presents an advantage of taking into account different segment reporting practices, and thus, it may provide a comprehensive measure of segment information, regardless of its type, business or geographic and its nature, quantitative or qualitative.

Second, to test our hypotheses – *H1* to *H5* – we collected data on firm size (FSIZE), profitability (ROA), leverage (LEV), degree of internationalization (EXPORT) and audit quality (BIG 4) from *InFinancial database*. In addition, to control for the switch from IAS 14R to IFRS 8 during our study period, we included a dummy variable IFRS 8, which took the value of 1 in the post-IFRS 8 period and 0, otherwise.

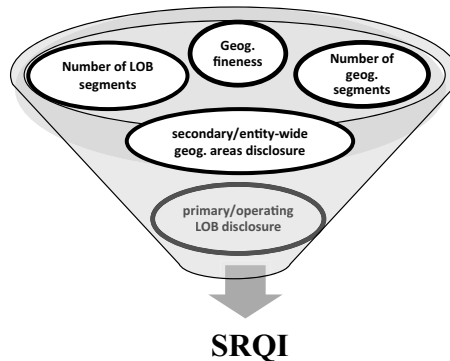
Finally, in total agreement with Herrmann and Thomas (1996), Prather–Kinsey and Meek (2004) and Leung and Verriest (2015), who asserted that segment reporting varied across industries and countries, our analysis controls for the possible impact of industry type and country of domicile by including in our model industry dummies (IDUMs) and country dummies (CDUMs).

### 5.3 Model specification

To examine the association between SRQI and firm characteristics, we performed a multiple regression model as follows:

$$SRQI_{i,t} = \beta_0 + \beta_1(FSIZE)_{i,t} + \beta_2(ROA)_{i,t} + \beta_3(LEV)_{i,t} + \beta_4(EXPORT)_{i,t} + \beta_5(BIG\ 4)_{i,t} + \beta_6(CONROLS)_{i,t} + \varepsilon_{i,t}$$

where the variables are defined as follows: SRQI is the segment reporting quality index, FSIZE is the firm size, ROA is the profitability, LEV is the leverage, EXPORT indicates the degree of internationalization, Big4 is the audit quality and CONTROLS refers to all the



**Figure 1.**  
Segment reporting  
quality index

control variables, including post-IFRS 8 period (IFRS8), four industry dummies (IDUMs) and sixteen country dummies (CDUMs).

## 6. Empirical results and discussion

### 6.1 Descriptive statistics

Table IV, Panel A, presents the summary descriptive statistics relating to the SRQI and its components. SRQI ranges from a minimum of 0 to a maximum of 1 with the average (median) index of 0.44 (0.4). Disclosure indexes LOBIND and GEOGIND vary, respectively, from a low of 0.05 to a high of 0.86, and from a low of 0.13 to a high of 0.63. Both indexes have, respectively, an average (median) of 0.5 (0.48) and 0.29 (0.25). The fineness score (FINENESS) ranges from a minimum of 0 and a maximum of 3, with an average (median) score of 1.82 (1.9). The NLOB ranges from a minimum of 2 to a maximum of 11, with the average (median) number of 4.2 (4). The NGEOG ranges from a minimum of 2 to a maximum of 17, with the average (median) number of 5.47 (5).

In summary, these statistics suggest that segment reporting practices, in particular, among EU listed corporations, still differ substantially from one company to another. This is in line with the diversity in segment reporting practices reported by previous IAS 14R (Street and Nichols, 2002; Prather-Kinsey and Meek, 2004) and IFRS 8 studies (Crawford *et al.*, 2012; Nichols *et al.*, 2012; Leung and Verriest, 2015; Bugeja *et al.*, 2015). This result seemed surprising because we expected that the implementation of IFRS would speed up the convergence of financial reporting practices. Nevertheless, it can be explained by the fact that EU corporations differ in terms of the compliance with the various requirements of IAS 14R/IFRS 8.

Dep. Var.	N	Mean	SD	Minimum	Maximum	Median
<i>Panel A: Summary descriptive statistics of SRQI and its components</i>						
SRQI	440	0.44	0.26	0	1	0.4
NLOB	440	4.20	1.81	2	11	4
LOBIND	440	0.5	0.13	0.05	0.86	0.48
NGEOG	440	5.47	2.35	2	17	5
GEOGIND	440	0.29	0.9	0.13	0.63	0.25
FINENESS	440	1.82	0.64	0	3	1.9
<i>Panel B: Summary descriptive statistics of independent variables</i>						
FSIZE	440	15.91	1.44	12.95	19.55	15.61
ROA	440	0.04	0.05	-0.15	0.25	0.05
LEV	440	0.27	0.14	0.006	0.60	0.26
EXPORT	440	0.61	0.27	0	0.97	0.68
	N				Frequency	Percentage
BIG 4: 0	440				24	5.45
1					416	94.55
IFRS 8: 0	440				122	27.73
1					318	72.27

**Notes:** SRQI = segment reporting quality index; NLOB = number of LOB segments reported; NGEOG = number of geographic segments reported; LOBIND = LOB disclosure index; GEOGIND = geographic disclosure index; FINENESS = geographic fineness score; FSIZE = firm size; ROA = profitability; LEV = leverage; EXPORT = degree of internationalization; BIG4 = audit quality (audit firm size) and IFRS 8 = post-IFRS8 period

**Table IV.**  
Summary descriptive  
statistics of  
dependent and  
independent  
variables

Table IV, Panel B, reports the summary descriptive statistics relating to the independent and control variables used. The distribution of all the independent variables generally displays wide variations. For example, firm size (FSIZE) ranges from a minimum of 12.95 to a maximum of 19.55, with a mean (median) of 15.91 (15.61). Profitability (ROA) ranges from a minimum of  $-0.15$  to a maximum of  $0.25$ , with a mean (median) of  $0.04$  ( $0.05$ ), suggesting that the average EU listed firms was profitable over the period analyzed. In addition, leverage (LEV) ranges from a minimum of  $0.006$  to a maximum of  $0.6$ , with a mean (median) of  $0.27$  ( $0.26$ ). Furthermore, the degree of internationalization (EXPORT) ranges from a minimum of  $0$  to a maximum of  $0.97$ , with a mean (median) of  $0.61$  ( $0.68$ ). These statistics compare well with the findings of Leung and Verriest (2015), relating to the distribution of profitability ( $0.06$ ), leverage ( $0.22$ ) and degree of internationalization ( $0.73$ ).

The figures for the SRQI, FSIZE, ROA, LEV and EXPORT variables in Table IV suggest substantial variation in our sample, which would reduce the possibilities of sample selection bias. Furthermore, Table IV shows that the majority of the sampled firms chose a Big 4 auditor.

We used the OLS regression technique. As robustness check, both the Pearson's parametric and Spearman's non-parametric coefficients are reported in Table V, and, observably, the magnitude and direction of both coefficients are very similar, indicating that no major non-normalities remain. Furthermore, correlation matrix suggest that the correlations among the variables are fairly low (less than  $0.8$ ) and all "variance inflation factors" do not exceed  $10$ , indicating that no serious multicollinearities exist.

Table V shows that there are statistically significant connections between the SRQI and the explanatory variables FSIZE, ROA, LEV and EXPORT. As hypothesized, FSIZE and EXPORT are statistically significant and positively associated with the SRQI, while ROA and LEV are statistically significant and negatively related to the SRQI. Observably, however, BIG 4 is statistically insignificant. Also, there is no significant connection between IFRS 8 and SRQI.

### 6.2 Empirical results from multivariate regression analysis

We used panel data to test all the five hypotheses developed in Section 4. Thus, it is imperative to carry out some specific tests to achieve robust estimations mainly a Breusch – Pagan test for heteroscedasticity and Wooldridge test for autocorrelation. Results shown in Table VI indicate the presence of both problems of heteroscedasticity and autocorrelation. Therefore, we report regression results using "feasible generalized least square" to obtain robust results.

Variables	VIF	1	2	3	4	5	6	7
1. SRQI		1	0.091*	$-0.093^*$	$-0.103^{**}$	$0.250^{***}$	$-0.002$	$-0.085^*$
2. FSIZE	1.16	0.101**	1	0.094**	$0.229^{***}$	$0.171^{***}$	0.043	0.025
3. ROA	1.22	$-0.161^{***}$	0.057	1	$-0.269^{***}$	$-0.106^{**}$	0.060	$-0.208^{***}$
4. LEV	1.25	$-0.110^{**}$	$0.199^{***}$	$-0.299^{***}$	1	$-0.152^{***}$	0.045	$-0.029$
5. EXPORT	1.13	$0.230^{***}$	$0.142^{***}$	$-0.042$	$-0.149^{**}$	1	$-0.103^{**}$	0.040
6. BIG 4	1.02	$-0.001$	0.022	0.086*	0.038	$-0.107^{**}$	1	$-0.037$
7. IFRS 8	1.06	$-0.081$	0.029	$-0.186^{***}$	$-0.035$	0.060	$-0.037$	1

**Table V.**  
Correlation matrix  
and VIF coefficients

**Notes:** The bottom left half of the table contains Spearman's non-parametric correlation coefficients, while the upper right half of the table shows Pearson's parametric correlation coefficients. \*\*\*, \*\*, and \* indicate that correlation is significant at the 1, 5 and 10 per cent levels, respectively

Independent variables	Dependent variable: SRQI	
	Coef	(Z statistic)
FSIZE	0.040***	5.87
ROA	0.025	0.32
LEV	-0.120**	-2.27
EXPORT	0.178***	4.65
BIG 4	0.190***	2.90
IFRS 8	0.000	0.04
Industry dummies	Included	
Country dummies	Included	
Intercept	-0.561***	
Number of observations	433 [3]	
Wald chi <sup>2</sup>	1001.51	
Prob > chi <sup>2</sup>	0.0000	
R <sup>2</sup>	31.21	
Breusch-Pagan test for heteroscedasticity		
F-statistic	105.28	
Prob > F	0.0000	
Wooldridge test for autocorrelation		
F-statistic	55.699	
Prob > F	0.0000	

**Table VI.**  
The effect of firm  
characteristics on  
segment reporting  
quality

**Notes:** \*\*\* and \*\* denote significant at the 1, 5 and 10 per cent levels, respectively. Variables are defined, as follows: SRQI = segment reporting quality index; FSIZE = firm size; ROA = profitability; LEV = leverage; EXPORT = degree of internationalization; BIG4 = audit quality (audit firm size) and IFRS 8 = post-IFRS8 period

Table VI reports the results from multivariate analysis, and shows that the regression model has significant explanatory power at a probability 0.000 (*Wald Chi<sup>2</sup>* test is significant).

The results generally indicate that the independent variables are significant in explaining cross-sectional differences in the quality of segment reporting. The coefficients on FSIZE, EXPORT and BIG4 are statistically significant and positively related to the SRQI, implying that large EU corporations that are more internationally oriented and audited by a BIG 4 auditor, generally, make significantly higher quality of segment reporting. In addition, the coefficient on LEV is statistically significant and negatively related to the SRQI, implying that highly geared EU corporations provide a lower level of segment reporting quality. However, the results in Table VI show a positive but insignificant effect of ROA on SRQI. This finding corroborates Leung and Verriest's (2015) and Prencipe's (2004) findings. However, they do not offer an empirical support for the existence of a significant association between profitability and segment reporting quality.

The positive association between FSIZE and the SRQI provide empirical support for *H1*. This finding corroborates the theoretical predictions and the previous empirical evidence that large corporations have additional incentives to provide a higher quality of segment reporting (Salamon and Dhaliwal, 1980; Mckinnon and Dalimunthe, 1993; Mitchell *et al.*, 1995; Prather-Kinsey and Meek, 2004; Pisano and Landriani, 2012; Tsakumis *et al.*, 2006; Nichols and Street, 2007; Herrmann and Thomas, 1996; Leung and Verriest, 2015). Theoretically, this result confirms the predictions of our multitheoretical framework that draws, mainly, on insights from agency and proprietary costs theories. For example, agency theory suggests that owing to their larger ownership dispersion and their complexity (Meek *et al.*, 1995), large firms have



extra incentives to minimize highly monitoring costs, by disclosing additional segment information (Pisano and Landriani, 2012). With regard to proprietary costs theory, larger firms are subject to lower competitive costs disadvantages but potential political costs, and then, they tend to provide more segment information to improve their corporate image and reduce such political costs (Herrmann and Thomas, 1996).

The negative coefficient on LEV support our hypothesis H3. This finding offers new empirical support for the Wallace *et al.*'s (1994) and Eng and Mak's (2003) findings arguing that high leverage acts as a substitute for voluntary disclosure as it helps mitigate the free cash flow problem. However, this finding is no consistent with agency theory, which suggests that as the debt level intensifies, the agency costs of debt become higher, and thus, firms are encouraged to provide a higher quality of information.

The positive connection between EXPORT and the SRQI provides empirical support to our hypothesis H 4 and the findings of past studies (Mitchell *et al.*, 1995; Herrmann and Thomas, 1996; Prather–Kinsey and Meek, 2004). Furthermore, it supports agency theory predictions and totally endorses Herrmann and Thomas's (1996) explanation that firms with substantial foreign operations are encouraged to improve segment reporting quality to reduce agency costs.

Fifth, the positive coefficient on Big 4 confirms our hypothesis H 5. This result is in line with previous empirical evidence (Eng and Mak, 2003; Owusu–Ansah, 1998; Prather–Kinsey and Meek, 2004; Al-Bassam *et al.*, 2015). It suggests that choosing a Big 4 auditor can contribute positively toward enhancing segment reporting quality by monitoring managers to limit their discretionary behavior in disclosing segment information and complying with IAS 14R/IFRS 8 (Agency theory). Furthermore, larger audit firms have greater experience and expertise and more possibility of reputation damage, which can have a positive effect on segment reporting quality (DeAngelo, 1981; Al-Bassam *et al.*, 2015; Prather–Kinsey and Meek, 2004).

Finally, as can be seen in Table VI, the coefficient on IFRS 8 is not statistically significant. This result confirms Leung and Verriest's (2015) who cautioned against using a single disclosure quality measure, when analyzing the impact of a switch in standards. With a particular relevance to this study, these scholars observed that IFRS 8 had an impact on the individual proxies of the segment reporting examined in different directions. Nevertheless, it was not significantly associated with two single aggregate measures of segment reporting quality, namely, business and geographic.

## 7. Additional analyses

Our research goal is to advance one summary measure of firms segment reporting quality based on five components. The findings of this study suggest that cross-sectional differences in the SRQI can be explained by the independent variables. However, as it contains different proxies of segment reporting practices, it is possible for the link between each component and the independent variables to vary, with some potentially having strong connections with these variables and others maintaining weak associations. In this section, we reestimate our regression model by replacing SRQI with NLOB, NGEOG, LOBIND, GEOGIND and FINENESS to examine the link between each component and the independent variables. Furthermore, to ascertain whether there are differences in the results of this study with respect to the type of segment reporting [business (LOB) or geographic], we reestimate the regression of this study by splitting the SRQI into two subindexes: business disclosure quality index (LOBQI), which aggregates the two components NLOB and LOBIND, and geographic disclosure quality index (GEOGQI), which aggregates the three remaining components NGEOG, GEOGIND and FINENESS.

Table VII reports the results of the regressions analyses of the effect of firm characteristics on the different components of SRQI and shows mixed results. The significance and direction of all the independent variables included in our model differ depending on the considered component of segment reporting quality considered. Indeed, the coefficients on the FSIZE (except the coefficient on the GEOGQI, NGEOG and FINENESS), EXPORT (except the coefficient on the NLOB and GEOGIND), Big 4 (except the coefficient on the NLOB and FINENESS) remain statistically significant and positively related to all five segment reporting quality components. Hence, this result seems to add a strong empirical support for our previous findings.

Similarly, the coefficient on LEV (except the coefficient on the LOBQI, NLOB, LOBIND and GEOGIND) remains statistically significant and negatively associated with all five segment reporting components. However, Table VII shows the existence of a significant negative effect of ROA on NLOB and FINENESS, implying that the higher the profitability is, the lower LOB segments number and fineness of geographical disclosure are reported. Theoretically, the results are largely in line with the predictions of proprietary costs theory, which suggests that when the profitability increases, firms have incentives to aggregate their segments to minimize potential competitive costs (Pisano and Landriani, 2012).

These results confirm previous observations by Street and Nichols (2002), Prather-Kinsey and Meek (2004), Crawford *et al.* (2012), Nichols *et al.* (2012), Leung and Verriest (2015) and Bugeja *et al.* (2015), who reported diversity in segment reporting practices. Hence, it would be safe to deduce that EU corporations differ in terms of the compliance with the various requirements of IAS 14R/IFRS 8. Therefore, we would recommend greater efforts on behalf of corporations, governments and researchers to find better ways of improving segment reporting and compliance with disclosure regulations.

## 8. Robustness tests

To investigate the robustness of our findings, the study conducted robustness tests. First, our sample period covered the 2006 to 2012 period where two successive standards were applied: IAS 14R then IFRS 8. Therefore, to ascertain whether there were differences in this study's results with respect to the standard applied, we reestimated the study regression by examining the pre-IFRS 8 and post-IFRS 8 periods (as shown in Table VIII). Our results seemed consistent with those shown in Table VI above.

Second, the segment reporting practices could be influenced by experience with standard requirements (IAS 14R/IFRS 8) and by external events such as the financial crisis. Hence, we reestimated the study regression by including year dummies to control for year effect, as shown in Table VIII. Our results remain largely unaltered, implying that these findings are not sensitive to year examined.

Third, we reestimated the study regression by using return on equity as an alternative measure for the profitability variable. However, our results (not tabulated) remained unchanged.

Overall, it can be concluded that the evidence emerging from the robustness tests is a good indicator of the robustness of our results.

## 9. Conclusions

This study investigated the association between firm characteristics and segment reporting quality. We developed an aggregated measure of segment reporting quality (SRQI) based on the segment data disclosed in firms annual reports of 171 EU listed firms from 2006 to 2012.

The study revealed two main findings. First, EU corporations differ in terms of compliance with the various requirements of IAS 14R/IFRS 8. Second, firm size, leverage, degree of internationalization and audit quality are significant in explaining differences in

**Table VII.**  
Reestimating our regression model by replacing SRQI with its components

Independent variables	SRQI	LOBQI	GEOGQI	NLOB	NGEOG	LOBIND	GEOGIND	FINENESS
FSIZE	0.040*** (5.87)	0.055*** (6.67)	-0.005 (-0.68)	0.418*** (9.56)	0.024 (0.48)	0.013*** (4.20)	0.009*** (5.93)	0.002 (0.11)
ROA	0.025 (0.32)	0.001 (0.01)	-0.002 (-0.02)	-0.549** (-2.40)	-0.502 (-0.87)	-0.032 (-1.14)	0.003 (0.30)	-0.268* (-1.66)
LEV	-0.120** (-2.27)	0.020 (0.38)	-0.109** (-2.10)	-0.669*** (-2.84)	-0.178 (-0.45)	-0.037 (-1.61)	-0.006 (-0.89)	-0.420*** (-3.62)
EXPORT	0.178*** (4.65)	0.106*** (3.15)	0.140*** (3.81)	-0.082 (-0.62)	1.692*** (7.95)	0.052*** (3.86)	-0.008** (-2.40)	0.289*** (3.44)
BIG 4	0.190*** (2.90)	0.149** (2.01)	0.239*** (4.78)	-0.421 (-1.52)	1.164*** (4.15)	0.040** (2.05)	0.016* (1.92)	-0.108 (-1.31)
CONTROLS	Included	Included	Included	Included	Included	Included	Included	Included
Intercept	-0.561***	-0.642***	0.128	-2.631***	2.323***	0.274***	0.138***	1.665***
Wald chi <sup>2</sup>	1001.51	3495.67	5432.53	923.09	2469.17	1046	2411.74	2739.45
Prob > chi <sup>2</sup>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R <sup>2</sup>	31.21	27.08	26.46	31.98	33.67	21.90	22.67	41.88

**Notes:** Z statistics are in parentheses; \*\*\*, \*\*, \* denote significant at the 1, 5 and 10 per cent levels, respectively. Variables are defined, as follows: SRQI = segment reporting quality index; LOBQI = LOB disclosure quality index; GEOGQI = geographic disclosure quality index; NLOB = number of LOB segments reported, NGEOG = number of geographic segments reported; LOBIND = LOB disclosure index; GEOGIND = geographic fineness score; FSIZE = firm size; ROA = profitability; LEV = leverage; EXPORT = degree of internationalization; BIG4 = audit quality (audit firm size) and CONTROLS = IFRS 8, IDUMs and CDUMs

**Table VIII.**  
Sensitivity analyses  
of the effect of firm  
characteristics on  
segment reporting  
quality

Independent variables	Dependent variable: SRQI			
	Pooled sample	Year fixed effects	Post-IFRS 8 period	Pre-IFRS 8 period
SIZE	0.040*** (5.87)	0.044*** (6.32)	0.019*** (3.69)	0.088*** (12.51)
ROA	0.025 (0.32)	-0.001 (-0.01)	-0.066 (-0.90)	-0.054 (-0.25)
ENDET	-0.120** (-2.27)	-0.185*** (-2.99)	-0.092** (-2.41)	-0.338*** (-4.59)
CAETCA	0.178*** (4.65)	0.221*** (5.71)	0.214*** (6.91)	0.263*** (4.46)
BIG 4	0.190*** (2.90)	0.195*** (3.03)	0.053 (1.09)	0.123 (0.79)
IFRS 8	0.000 (0.04)	0.011 (0.51)	-	-
Industry dummies	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included
Year dummies	Excluded	Included	Excluded	Excluded
Intercept	-0.561***	-0.664***	-0.114	-0.439***
Wald chi <sup>2</sup>	1001.51	827.36	2168.59	715.58
Prob > chi <sup>2</sup>	0.0000	0.0000	0.0000	0.0000
R <sup>2</sup>	31.21	31.86	31.11	25.8

**Notes:** Z statistics are in parentheses. \*\*\* and \*\* denote significant at the 1, 5, and 10 per cent levels, respectively. Variables are defined, as follows: SRQI = segment reporting quality index; FSIZE = firm size; ROA = profitability; LEV = leverage; EXPORT = degree of internationalization; BIG4 = audit quality (audit firm size) and IFRS 8 = post-IFRS8 period

segment reporting quality. Large corporations, which are audited by Big 4 auditors and more internationally oriented, tend to provide a higher quality of segment reporting. However, debt leverage seems to impact the segment reporting quality negatively. These results are robust to various econometric models that control year fixed effects and pre- and post-IFRS 8 adoption.

The results would imply that considerable managerial discretion exists. Despite the IFRS commitment to enhance comparability of the financial statements, segment information remains very disparate. The existence of such a commitment would enable investors to get a better understanding of a firm's activities, but it does not allow for a better assessment of a firm as compared to the other firms operating in the same sector. As compared with the IFRS standards, the segment reporting has more relation with corporate governance structure and specific institutions that regulate a sector or a country.

Our analysis suggests that both corporate governance structure and local institutions should be integrated in a future analysis of segment reporting practices. Therefore, our measure SRQI could be used and extended to assess the reasons that help understand the adequacy of segment reporting to the investors' expectations. For instance, SRQI could be associated with variables such as analyst forecasts dispersion and cost of capital. Moreover, our model could also be used to assess whether other stakeholders are interested and implicated in business reporting performance.

## Notes

1. Now ASC 280 "Segment reporting".
2. Similar to the previous studies (Wallace *et al.*, 1994; Prather-Kinsey and Meek, 2004), and to avoid a maximum of subjectivity in the construction of our disclosure indexes, all segment information items were considered equally relevant for external users of information. A score of 1 was assigned to an item if it was disclosed and a score of 0 otherwise.
3. Seven observations are dropped because there is only one observation in group.

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## Appendix 1

## Determinants of segment reporting quality

Revenue from external customers	X	
Revenues from transactions with other operating segments of the same entity	X	
Profitability measure	X	
Segment assets	X	
Segment liabilities	X	
Additions to non-current assets (capital expenditures required under IAS 14R)	X	
Depreciation/amortization	X	
Material non-cash items other than depreciation and amortization (impairment)	X	
Equity method income	X	
Equity method investment	X	
Interest revenue	X	
Interest expense	X	
Income tax expense/benefit	X	
Additional assets detail	X	
Additional liabilities detail	X	
R&D expenses	X	
Number of employees	X	
Cash-flow information	X	
Restructuring expense	X	
Exceptional items	X	
<i>Sub-total 2</i>	20	

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**Table AI.**  
List of items  
disclosed per  
primary/operating  
segment

## Appendix 2

Revenue from external customers	X	
Revenue from external customers/country of domicile	X	
Segment assets	X	
Non-current assets	X	
Non-current assets/country of domicile	X	
Additions to non-current assets	X	
Current assets	X	
Other assets (intangible assets+PPE. . .)	X	
Revenues from transactions with other operating segments of the same entity	X	
Profitability measure	X	
Segment liabilities	X	
Depreciation/amortization	X	
Material non-cash items other than depreciation and amortization (impairment)	X	
Number of employees	X	
R&D expenses	X	
Other items (equity method income, equity method investment, working capital, used capital, exceptional items and personnel expenses)	X	
<i>Total</i>	16	

**Table AII.**  
List of items  
disclosed per  
secondary/entity-  
wide geographic  
segment



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