Mitigating information asymmetry through sustainability assurance: The role of accountants and levels of assurance

Beatriz Cuadrado-Ballesteros*, Jennifer Martínez-Ferrero, Isabel María García-Sánchez

University of Salamanca, Facultad de Economía y Empresa – Multidisciplinary Institute for Enterprise (IME), Campus Unamuno, FES, 37007 Salamanca, Spain

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ABSTRACT

This paper aims to examine the usefulness of sustainability reporting in reducing information asymmetry as result of lower dispersion and higher accuracy in financial analysts' earnings forecasts. The empirical results from an international sample of listed companies indicate that the disclosure of sustainability information alone is not sufficient in this regard as our findings indicate that information asymmetry is reduced to a greater when such information is assured, supporting the value relevance role of sustainability reporting and assurance. In addition, the empirical findings suggest differences in terms of assurance attributes (provider and level of engagement) and such differences are even more relevant when controlling the institutional context. Assurance is highly appreciated by investors in more stakeholder-oriented countries; however, in more shareholder-oriented environments, assurance affects information asymmetries only when it is provided by accounting professionals who also report a "reasonable" opinion.

1. Introduction

For some years, there has been a consistent belief that traditional financial reports do not adequately represent the different dimensions of corporate activity, resulting in additional non-financial measures of performance (Simnett, Vanstraelen, & Chua, 2009). This has led companies worldwide to disclose non-financial information, among which it is possible to note the general use of stand-alone reports regarding social and/or environmental concerns, termed sustainability reports. There is no regulation that requires the disclosure of this information and companies publish their sustainability reports voluntarily. This voluntary disclosure can be conceived as a viable mechanism through which firm-specific information improves its usefulness and accuracy (Cho, Lee, & Pfeiffer, 2013). It provides value relevance information for analysts, thus reducing their forecast errors; in particular, it increases the accuracy of information and reduces information asymmetries (Glaum, Baetge, Grothe, & Oberdörster, 2013) by turning private into public information, minimizing the differences between informed and uninformed stakeholders (Diamond & Verrecchia, 1991).

However, the considerably growing trend for sustainability reporting in recent decades has not been accompanied by an increase in information credibility and accuracy due to the sense of a lack of consistency and completeness of sustainability reports (Adams & Evans, 2004). In the context of this lack of credibility, stakeholders demand external assurance (Zorio, García-Benau, & Sierra, 2013) as a means of enhancing the degree of confidence in the outcomes of the evaluation of particular subject matter. Thus, assurances tend to be used to provide greater confidence in the accuracy of reported information (Carey, Simnett, & Tanewski, 2000), expecting that information asymmetries will be lower given the lower dispersion in analysts' forecasts (Shroff, Sun, White, & Zhang, 2013); it is this notion that is tested in this study.

Assurance is not a legal requirement and there is no universal standard, leading to differences that make it relevant to study the "who", "how" and "what" in relation to assurance. Regarding the "who", in the sustainability assurance market, both accounting professionals and specialist practitioners can assure sustainability reports, but some authors suggest differences between them. While other assurance providers (e.g. sustainability consultants) possess a higher level of subject matter expertise (Simnett et al., 2009), Big *N* firms (accountants in general) have made significant investments in training their professionals on sustainability issues, with the aim of providing high-quality assurance statements (Hodge, Subramaniam, & Stewart, 2009). These characteristics have led to the expectation that information asymmetries will be lower when the assurance service is provided by accounting professionals.

Another relevant attribute of the assurance process is the level of assurance (the "how" aspect), which indicates the extent of practitioners' work and therefore the degree of confidence in the sustainability report assured. In general, two levels are offered, "reasonable/high" and "limited/moderate", according to the standard followed by

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the practitioner. Reasonable assurance engagement communicates a higher level of verification than the limited level, so more rigour is expected in the assurance process (Hasan, Roebuck, & Simnett, 2003). It is expected that the information asymmetries will be lower when the assurance concludes that the sustainability reporting is at a reasonable/high level.

In sum, the aims of this study concern two questions: (i) Does the assurance of sustainability information affect analysts' forecast predictions concerning future earnings and then the level of information asymmetry? (ii) Do the attributes of assurance determine the level of information asymmetry as result of the reduction in the dispersion of analysts' assessments of future cash flows? In addition to these questions, it is expected that sustainability assurance may be strongly influenced by institutional factors (Kolk & Perego, 2010; Martínez-Ferrero & García-Sánchez, 2017; Simnett et al., 2009). This will be examined by considering the national legal system as a proxy of stakeholder orientation (Martínez-Ferrero & García-Sánchez, 2016; Perego, 2009) and the efficiency and effectiveness of legal enforcement as a proxy of shareholder orientation (La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1998; Martínez-Ferrero & García-Sánchez, 2017).

To test these objectives, we use an initial international sample composed of 740 companies for the period 2007–2014 from 17 countries and 9 activity sectors. In brief, our empirical results suggest that sustainability assurance tends to influence the market's expectations of firm value by enhancing the credibility of sustainability reporting, reducing analysts' forecast errors and thence the information asymmetry that operates to the advantage of better informed investors. Furthermore, these boundaries are greater when the assurance service is provided by accounting professionals and when the level of sustainability assurance is "reasonable/high".

However, these results are influenced by the legal and institutional context. In more shareholder-oriented countries, sustainability information tends to reduce asymmetries, but assurance is only relevant when it is provided by accounting professionals and when the final output is a "reasonable/high" opinion. In more stakeholder-oriented countries, assurance enhances the reduction in information asymmetries achieved by sustainability reporting independently of the type of provider or the level of assurance reported.

The paper is structured as follows: Section 2 develops the theoretical background and Section 3 the research hypotheses; the research methodology is explained in Section 4 and in Section 5 we present the empirical results obtained, followed by a discussion of our findings in Section 6; finally, we conclude with some remarks, limitations and future lines of research in Section 7.

2. Theoretical background: sustainability reporting and information asymmetry

The rationale for this study is based on the fusion of two frameworks that justify the need for sustainability reporting and – more concretely – assured information: (i) stakeholder theory; (ii) agency theory. Drawing on stakeholder theory, voluntary corporate disclosures play a fundamental role in the functioning of an efficient capital market. In relation to voluntary disclosure and subsequent assurance demand, it argues the need for organizations to interact with a broad set of stakeholders to ensure their long-term survival through the so-called "social contract" between the firm and society (Deegan, Cooper, & Shelly, 2006); as Ullman (1985) suggested, the social and environmental commitment is a mechanism for dealing with stakeholders' demands.

Moreover, most large companies are owned by a multitude of shareholders and investors. Such companies are characterized by a clear separation between property and control, which is the basis for agency theory. According to this theory, a shareholder (the principal) delegates the management of the firm to managers (agents). The latter should act in line with the former's goals and intentions; however, the principal and the agents have different interests, leading managers to

act in their own self-interests. It is difficult for the principal to control managers because of differences in access to information (Jensen & Meckling, 1976). The different abilities to access corporate information may generate expropriation issues as a result of information asymmetries between the two (Shleifer & Vishny, 1992).

In this agency context, firms can combat market frictions by increasing corporate disclosure, thus inducing the optimal functioning of an efficient capital market (Healy & Palepu, 2001). Firms that consistently make quality disclosures are perceived in the market to have a lower likelihood of withholding relevant unfavourable information and thus they are accorded a lower risk in the market (Sengupta, 1998). Thus, information is highly appreciated by investors, who employ corporate disclosures to evaluate their investment opportunities (Barberis & Thaler, 2003). In this regard, a number of studies have suggested that corporate disclosures tend to reduce information asymmetry as an agency cost. For example, Healy, Hutton, and Palepu (1999) and Leuz and Verrecchia (2000) found a negative link between disclosure quality and the firms' bid-ask spread as a proxy for information asymmetry. Voluntary sustainability disclosures contribute to reducing the information asymmetry that arises from differences in information available to and held by stakeholders (Cormier, Ledoux, & Magnan, 2011; Healy et al., 1999; Leuz & Verrecchia, 2000; Verrecchia, 2001). Informed stakeholders – usually managers – have access to more data than uninformed ones, who have access only to public information.

Thus, voluntary sustainability information may contribute to an increase in information accuracy, a reduction in the dispersion of analysts' forecasts and thus asymmetry between more and less informed stakeholders (Dhaliwal, Li, Tsang, & Yang, 2011; Dhaliwal, Radhakrishnan, Tsang, & Yang, 2012; Verrecchia, 2001). In this regard, Schipper (1991) suggested that the dispersion in analysts' earnings forecasts can be viewed as a measure of investors' uncertainty about a firm's future economic performance, which arises from information asymmetries between the different stakeholders. Similarly, Lang and Lundholm (1996) documented that companies reporting additional non-financial information enjoy greater accuracy and less volatility in forecast revisions, which reduces the estimation risk and the information asymmetry problem.

3. Research hypotheses

3.1. Sustainability assurance and information asymmetry

According to the previous theoretical framework, sustainability reporting may reduce information asymmetry. However, a credibility problem arises from the incentives of more informed stakeholders to make their private information public. Users may view the management's decision to disclose voluntary information as a strategic decision (Coram, Monroe, & Woodliff, 2009), giving rise to a credibility problem.

In this regard, auditing plays a relevant role in the market, improving the credibility and quality of reported information and reducing the information asymmetry between shareholders and managers (Watts & Zimmerman, 1983), regardless of whether the information is financial or non-financial (Coram et al., 2009). The auditing of financial statements reduces the dispersion of analysts' forecasts with regard to future earnings, thus enhancing information accuracy and mitigating conflict arising from information asymmetry (Clinch, Stokes, & Tanewski, 2012); similarly, we expect assurance to reduce the asymmetry between informed and uninformed stakeholders, enhancing the credibility and accuracy of sustainability reporting and improving its value relevance.

According to Mercer (2004), the credibility of voluntary disclosures by managers depends on different factors, including validation by external sources, among others. In this attempt, several authors have concluded that the external assurance of sustainability reports is a relevant mechanism to ensure the credibility of information for the

decision-making users (Adams & Evans, 2004; Hodge et al., 2009), thus ensuring that voluntary sustainability disclosures will be of value relevance for investors and stakeholders. In other words, assurance increases the credibility and trustworthiness of the information disclosed (Simnett et al., 2009), increasing the value of reporting for external and internal stakeholders. On this basis, we propose the following hypothesis:

Hypothesis 1. Assured sustainability reporting reduces the level of information asymmetry to a greater extent than non-assured reporting.

3.2. The role of accountants in reducing information asymmetry

A higher level of credibility results from the technical and ethical competence of the assurers and their independence from the final opinion (IAASB, 2010). In general, external assurance services are provided by three different providers: (i) accountancy/auditing firms; (ii) engineering firms, which offer technical certification; (iii) sustainability consultants, who have great expertise in sustainability- and stakeholder-related issues. This has resulted in a debate concerning the most appropriate assurance practitioner.

Non-accounting professionals tend to be sustainability experts, possessing a higher level of subject matter expertise (Huggins, Green, & Simnett, 2011). Although auditing professionals follow global standards, strict ethical requirements and quality control mechanisms, other providers are specialists in sustainable topics (Simnett et al., 2009). They tend to focus on the accuracy and relevance of the issues that matter to stakeholders and provide additional comments and greater clarity (Deegan et al., 2006; Perego, 2009).

Subject matter knowledge and expertise in sustainability are needed to verify sustainability reports, but these could be complemented by accounting professionals' skills in enhancing credibility (Huggins et al., 2011). According to Perego (2009), accounting (auditing) firms have greater experience in providing financial auditing services, thus exhibiting competitive advantage with respect to assurance services. The superiority of accountants in assurance services derives from the stringent education and experience required for entry into the profession, the detailed code of ethics with which they must comply and the strict disciplinary processes in place in the case of failure (IFAC, 2014). These characteristics usually lead to accounting professionals demonstrating greater independence and objectivity than non-accountants (Knechel, Wallage, Eilifsen, & Van Praag, 2006).

This suggests that accountants are well placed to enhance the credibility of non-financial information, as Huggins et al. (2011) argued in the case of greenhouse gas reporting and Pflugrath, Roebuck, and Simnett (2011) found in their experimental case on sustainability reports. Based on the literature on financial auditing, it is expected that the assurance developed by Big 4[1] auditing firms is of higher quality than that of other assurers (Francis, 2004); auditing firms tend to issue accurate reports and produce high-quality outcomes, thus reducing the firm risk and enhancing the analysts' predicted earnings for these firms.

From the above, we expect that sustainability information will be perceived as more credible when the assurer is a professional from a Big *N* firm and accordingly we propose the following hypothesis:

Hypothesis 2. Sustainability assurance provided by a Big *N* firm reduces the level of information asymmetry to a greater extent than assurance services provided by other professionals.

3.3. The role of the level of assurance in reducing information asymmetry

According to the assurance standard, the level of assurance refers to

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[1] EY, Deloitte, PWC and KPMG.

the extent of the assurers' work and therefore the degree of confidence in the sustainability report. In general, there are two levels, "reasonable/high" for practitioners following ISAE3000 and "limited/moderate" for practitioners following AA1000AS. An assurance opinion of reasonable/high communicates a high level of verification, but is not absolute because of some possible limitations in the internal control systems; conclusions are worded in a positive way. At a "limited/moderate" level, the assurance risk is acceptable, but greater than the risk expressed by a "reasonable" opinion. The practitioner's opinion is expressed in a negative way. This means that the sustainability information lacks sufficient specificity to be useful and results in a negative conclusion, meaning that the sustainability report does not cover the total performance in a reliable and unbiased manner (Manetti & Becatti, 2009).

The perceived credibility of an assurance statement is positively influenced by the level of the assurance opinion provided. In the financial information literature, Schelluch and Gay (2006) suggested that greater reliability is accorded to audit reports with positive opinions as users recognize the greater responsibility of auditors.

In the case of non-financial information, Hasan et al. (2005) found that users generally perceive a reasonable/high level of assurance as providing greater assurance than the limited/moderate level. From their experimental case, Hodge et al. (2009) found that sustainability reports with a reasonable level of assurance tend to be more reliable than those with a limited level. As confidence and the users' perceptions are affected by the level of assurance, when the level of assurance is reasonable/high, the confidence in the accuracy of this information is greater. This greater confidence increases the ability of analysts to predict future earnings and cash flows, thus reducing the dispersion in their forecasts dispersion and contributing to greater accuracy in financial analysts' earnings forecasts (Vanstraelen, Zarzeski, & Robb, 2003). Thus, it is expected that a reasonable/high assurance opinion supports the value relevance of the information in such reporting by increasing its credibility, which in turn reduces the information asymmetry level.

On this basis, we propose the following hypothesis:

Hypothesis 3. Sustainability reporting with a reasonable/high level of assurance reduces the level of information asymmetry to a greater extent than sustainability reporting with a limited/moderate level of assurance.

3.4. The role of the institutional context

The growth of the global marketplace has led shareholders and other stakeholders to develop knowledge of the regulations, laws, norms and social and cultural boundaries of different countries to develop their businesses. This has fostered the application of institutional theory in multiple business and management studies, especially at the international level. According to this theory, firms are economic units that operate within contexts formed by a nexus of institutions that affect their behaviour (Campbell, 2007; Campbell, Hollingsworth, & Lindberg, 1991; Roe, 1991).

The institutional context defines the rules of the game for social interactions (North, 1990). Organizations operating in countries with similar institutional structures will adopt homogeneous patterns (Campbell, 2007; La Porta et al., 1998). DiMaggio and Powell (1983) termed this process "isomorphism" and argued that it enhances companies' stability and survival, facilitating political power and institutional legitimacy.

As other scholars have noted previously (e.g. Kolk & Perego, 2010; Martínez-Ferrero & García-Sánchez, 2017; Simnett et al., 2009), it is expected that sustainability assurance may be strongly influenced by institutional factors; companies could modify their sustainability behaviour according to the context in which they operate (Smith, Haniffa, & Fairbrass, 2011).

Previous studies have considered the legal tradition of the country as a key institutional factor (Martínez-Ferrero & García-Sánchez, 2016; Perego, 2009). Companies that operate in a strong legal system aimed at the protection of stakeholders tend to be more likely to act in a socially responsible way (Campbell, 2007; Frías-Aceituno, Rodríguez-Ariza, & García-Sánchez, 2013; García-Sánchez, Cuadrado-Ballesteros, & Frias-Aceituno, 2016). Smith, Adhikari, and Tondkar (2005) provided evidence that firms located in countries that are more stakeholder-oriented report higher quality sustainability information as they have social responsibilities beyond shareholder maximization (Kolk & Perego, 2010). In countries where stakeholders have a greater influence on corporate decisions, sustainability performance tends to be more informative and companies show a greater preference for assured information (Kolk & Perego, 2010; Simnett et al., 2009; Zhou, Simnett, & Green, 2013).

Beyond the legal tradition, the efficiency and effectiveness of legal enforcement mechanisms have also acted as a relevant institutional factor (La Porta et al., 1998). Control mechanisms ensure compliance with regulations and reduce the informational advantage of shareholders versus other stakeholders (Deffains & Guigou, 2002). Related to this, we undertake a comparison between weak and strong enforcement mechanisms and the influence on assurance.

On the one hand, Zhou et al. (2013) and Herda, Taylor, and Winterbotham (2014) support the notion that there is greater demand to enhance the credibility and transparency of the social and environmental information issued in countries where the legal enforcement system is weaker. Similarly, Perego (2009) and Kolk and Perego (2010) confirm that sustainability assurance services replace poor investor protection. In contrast, as Doidge, Karolyi, and Stulz (2007) have shown for corporate governance and transparency practices, there is a positive association between strong legal enforcement and social and environmental activities. Simnett et al. (2009) extend this evidence to voluntary assurance; they demonstrate that assurance is not used as a mechanism to increase credibility in weaker legal systems. Bearing in mind this latter evidence, it is expected that companies operating in an institutional setting with strong legal enforcement aimed at the protection of stakeholders will be more likely to report assured sustainability information, a proposition that is in line with the previous evidence of Martínez-Ferrero and García-Sánchez (2017).

From the above discussion, it could be expected that the previous hypotheses are affected by the institutional context in terms of the legal tradition and investor protection. Thus:

Hypothesis 4. The role of assurance and its attributes (provider and level) in reducing information asymmetry is higher in institutional context characterized by strong protection of stakeholders (i.e. low investor protection).

4. Research methodology

4.1. Sample

The data were sourced based on an initial selection from the world's largest 2000 listed firms provided by Forbes,[2] a selection that is widely employed in prior research on assurance (e.g. García-Sánchez & Martínez-Ferrero, 2017; Martínez-Ferrero & García-Sánchez, 2016). We based the composition of our sample on the information available in: (i) Thomson One Analytics[3] for accounting and financial information (e.g. total assets, leverage, market-to-book ratio, etc.) provided in consolidated financial statements; (ii) Ethical Investment

Research Services (EIRIS) for data on sustainability reporting and assurance; (iii) the I/B/E/S database, for analysts' forecast data. Information concerning the level of sustainability reporting and the assurance process was obtained by examining the yearly sustainability reports from each company's own website.

The sampling procedure was as follows: for the initial largest 2000 firms, we included their economic, financial and accounting data obtained from Thomson One Analytics. At this stage, we recruited 1560 international non-financial listed companies. Then, we combined the information for these firms with data available in the I/B/E/S database, resulting in a sample composed of 1404 companies for the period 2007–2014. Finally, two different samples were used with the aim of testing the proposed hypotheses.

Sample 1: Companies that disclose sustainability information. From the data described above (1404 companies and 8156 observations), we deleted those that do not disclose sustainability information, resulting in 2859 observations for 740 companies in the period 2007–2014. We were interested in testing whether assured sustainability reports would have an impact on the level of information asymmetry, so we selected companies that disclose information; some of them assure such information, but others do not.

Sample 2: Companies that disclose assured sustainability information. From Sample 1, we deleted the companies that do not assure their sustainability reports, resulting in 1145 observations for 316 companies in the period 2007–2014. This allowed us to focus on the attributes of assurance statements (i.e. assurance provider and level of assurance) for companies that assure sustainability reports.

The firms in the two samples operate in different sectors (basic materials, construction, financial, industrial, retail, services, telecommunications, transportation, utilities, etc.). In addition, they are from different countries: Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, India, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom [UK] and the United States [US], which allowed us to test the effect of the institutional context.

Because some companies might have filed for bankruptcy, merged, been delisted or been created during our period of analysis, the two samples comprise unbalanced panel datasets; i.e. information is not available for every period. Although the use of an unbalanced sample is very common in sustainability assurance studies (e.g. Martínez-Ferrero & García-Sánchez, 2016; Moroney, Windsor, & Aw, 2012; Simnett et al., 2009), we should ensure that there is random attrition as there could be some unobserved factors that should be controlled for. To avoid this risk, we cut every sample to obtain a balanced panel. The empirical results are presented in the section on sensitivity analyses, together with the rest of the additional analyses.

4.2. Variables

4.2.1. Measure of information asymmetry

As in Lang and Lundholm (1996), Marquardt and Wiedman (1998), and more recently, Shroff et al. (2013) and Martínez-Ferrero, Ruiz-Cano, and García-Sánchez (2017), we employ the analysts' forecast accuracy as a proxy for information asymmetry (*IA*). This proxy is appropriate given the finding of Elton, Gruber, and Gultekin (1984) that errors in analysts' earnings forecasts are reduced as predictions approach the end of the fiscal year. In addition, they found that around 84 per cent of the error in the final month could be attributed to the incorrect estimation of specific characteristics of the firm, rather than economic and industrial factors. This finding suggests that analysts' forecast errors could to a great extent represent the level of information asymmetry.

Forecast accuracy is calculated as thee absolute value of actual earnings per share, minus the median forecasted earnings per share, scaled by share price, i.e.:

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[2] The FORBES Global 2000 is a comprehensive list of the world's largest, most powerful public companies, as measured by revenues, profits, assets and market value.

[3] Thomson One Analytics delivers a broad range of financial content. This database on financial data integrates Datastream, Worldscope, Extel, IBES, Compustat, IDC pricing and A-T Financial News. It is provided by Thomson Reuters.

$$IA = \frac{|EPS_{it} - \text{median of forecasted EPS}|}{P_{it}}$$

where EPS is the actual earnings per share of firm i in year t and P_{it} is the share price of firm i in year t. Lower absolute errors suggest greater availability of information and therefore a lower level of information asymmetry (Marquardt & Wiedman, 1998).

4.2.2. Measure of sustainability reporting

To represent social reporting quality, we propose the triangulation of discourse analysis; that is, we consider both the quantity and the quality of sustainability disclosures. Quality is determined on the basis of international standards for sustainability information, specifically the GRI G3.1 guidelines.[4] Through the comparison of the information contained in sustainability reports and the recommendations of the GRI standards, we can determine the extent to which this information is comprehensive, comparable and harmonized. Our proposal takes into account the quantification of the number of GRI indicators included in the sustainability reports, as well as the requirement to disclose a minimum number of indicators according to the GRI application levels. Companies should incorporate the same indicators and number of these indicators at any of these levels, ensuring comparability between companies and between years.

Declaring an application level results in a clear communication concerning which elements of the GRI framework have been applied in the preparation of a report: these are designated A, B and C. The reporting criteria reflect the application or coverage of the GRI framework at each level, assessing the information output related to profile disclosures, disclosures concerning the management approach and performance indicators and supplementary sectoral performance indicators.

Information on sustainability reporting and assurance was obtained from the EIRIS database. This provides information through string variables concerning whether each firm reports sustainability information and whether that report is developed according to GRI guidelines (specifying the guidelines that the firm follows). Moreover, EIRIS also provides information on the application level of these guidelines. Concretely, there are three levels, A, B and C, each of which defines the extent of GRI standard disclosures covered in a sustainability report: level A represents the greatest compliance with the GRI guidelines, including the most extensive amount of GRI standard disclosures, whereas level C represents the lowest compliance with the GRI and the least extensive amount of GRI standard disclosures.

Having collected EIRIS information regarding the application levels and GRI indicators, we created the variable SR by assigning values to each level of application. More concretely, the value 25 was assigned to firms disclosing sustainability information but not complying with the GRI guidelines and scores of 50, 75 and 100 were assigned to firms disclosing sustainability information according to the levels C, B and A of the GRI guidelines, respectively. Thus, SR takes values between 25 and 100, as indicated in Table 1.

Table 1 also shows the distribution of observations. For Sample 1 (2859 observations of companies that disclose sustainability information), 1560 observations (more than 50% of the sample) comprise firms that disclose sustainability information but not in compliance with the GRI guidelines. The rest of the observations relate to companies that follow the guidelines at different levels of application: 483 observations

(around 17% of the sample) comply at level C, 246 (8.60%) at level B and 570 (around 20%) at level A. Regarding Sample 2 (1145 observations of companies that disclose assured sustainability information), the results are similar: a little more than 50% of observations relate to companies that do not follow the GRI guidelines in reporting sustainability information; 218 observations (around 20% of the sample) relate to observations that comply at level C, 74 observations (around 6%) at level B and 233 observations (around 20%) at level A.

4.2.3. Measure of assurance services and their attributes

The assurance decision is represented by a dummy variable (Assurance) that takes the value 1 when the company has purchased assurance and 0 otherwise. This coding has frequently been used in previous research, for instance Simnett et al. (2009), Moroney et al. (2012), Kolk and Perego (2010) and Zorio et al. (2013), among others. Similarly, we employ a dummy variable (Accountant) that takes the value 1 when the assurance service is provided by a Big N auditing firm and 0 otherwise (Clinch et al., 2012; Perego, 2009; Simnett et al., 2009). Finally, the level of assurance provided is represented by a dummy variable (Reasonable/High) that takes the value 1 for a "reasonable/high" opinion and the value 0 for a "limited/moderated" opinion.

4.2.4. Control variables

The results are controlled by different corporate characteristics, the impacts of which on information asymmetry have been studied in the literature (e.g. Cormier et al., 2011; Healy et al., 1999; Leuz & Verrecchia, 2000). Specifically, we control: (i) firm size (Size), represented by the natural logarithm of the total assets; (ii) firm leverage (Leverage), measured by the ratio of total debt to total equity; (iii) dispersion of analyst forecasts (Dispersion), defined as the coefficient of the variation in one-year-ahead analyst forecasts of earnings per share; (iv) financial reporting quality (FRQ).[5] As a proxy of financial reporting quality, we created the FRQ variable based on the accruals quality model proposed by Ball and Shivakumar (2006). We use the inverse of the absolute value of the residuals from this model as a proxy for FRQ. These authors suggest the following nonlinear accrual model, in which the change in working capital accruals from year $t-1$ to t is expressed as $\Delta WC = \Delta \text{Accounts Receivable} + \Delta \text{Inventory} - \Delta \text{Accounts Payable} - \Delta \text{Taxes Payable} + \Delta \text{Other Assets}$:[6]

$$\begin{aligned} \Delta WC_{it} &= \beta_0 + \beta_1 OCF_{it-1} + \beta_2 OCF_{it} + \beta_3 OCF_{it+1} + \beta_4 \Delta REV_{it} \\ &\quad + \beta_5 PPE_{it} + \beta_6 DOCF_{it} + \beta_7 OCF_{it}*DOCF_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

In addition, the results are controlled by activity sector, country and temporal moment. Operationally, this involves employing 10 dummy variables to represent the different activity sectors (basic materials, construction, financial, industrial, retail, services, telecommunications, transportation, utilities, other), 17 dummy variables to represent country of origin (Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, India, Italy, Japan, the Netherlands, Norway,

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[4] From May 2013, the GRI G3.1 guidelines were updated in the G4 version of the guide, which examines general and specific disclosures, but without assigning standard application levels. As the period examined is 2007–2014, in both 2013 and 2014 some companies in the sample followed the G4 version. Thus, to unify the variable, we reviewed each of sustainability reports following the G4 guide. Depending on the contents with regard to indicators and the information disclosed, we assigned the values A, B, or C. In this regard, it should be noted that GRI recognizes reports drawn from the G3 or G3.1 versions for two full reporting cycles. However, all reports published after 31 December 2015 should be developed "in accordance" with the G4 guidelines.

[5] Regarding the inclusion of financial reporting quality, Leuz and Verrecchia (2000) adopted a cross-sectional approach to examine the link between quality of information and information asymmetry in the German capital market. They focused on a sample of German companies that had adapted their accounting standards to the IFRS and empirically determined that the greater the amount of information available to investors and the higher the quality of the information, the lower the agency conflicts. Finally, Brown and Hillegeist (2007) evaluated asymmetric information using the probability of informed trade developed by Easley, Hvidkjaer, and O'hara (2002) as a proxy. They concluded that the highest quality disclosure reduces the likelihood that investors will seek or find private information and trade on the basis of this information.

[6] ΔWC denotes the change in working capital accruals from year $t-1$ to t; ΔAccounts Receivable denotes the change in accounts receivable; ΔInventory denotes the change in inventory; ΔTaxes Payable denotes the change in taxes payable; ΔOther Assets denotes the change in other assets; OCF denotes the operating cash flow; ΔRevenues denotes the change in revenues; PPE denotes plan, property and equipment; DOCF is an indicator variable for negative cash flows, taking the value 1 if there is a negative OCF and 0 otherwise; i indicates the company and t refers to the time period. All the variables are scaled by total assets.

Table 1
Categories of SR variable.
Source: The authors, based on García-Sánchez, Cuadrado-Ballesteros, and Sepúlveda (2014), García-Sánchez and Martínez-Ferrero (2017), Martínez-Ferrero et al. (2017).

SR values	Type of CSR report	Sample 1		Sample 2	
		Freq.	*Percent*	*Freq.*	*Percent*
GRI = 25	Companies that disclose CSR information which does not comply with GRI guidelines.	1,560	54.56	620	54.15
GRI = 50	Companies that disclose CSR information following the C level of the GRI guidelines, i.e. their reports are very basic. More specifically, the report incorporates information on: *Profile disclosures*: statement numbers 1.1; 2.1–2.10; 3.1–3.8; 3.10–3.12; 4.1–4.4; 4.14–4.15 (see GRI guidelines version 3). *Disclosures on management approach*: not required. *Performance indicators and sector supplement performance indicators*: a minimum of any 10 performance indicators, including at least one from each of the social, economic and environment categories. Performance indicators may be selected from any finalized sector supplement, but 7 of the 10 must be from the original GRI guidelines.	483	16.89	218	19.04
GRI = 75	Companies that disclose CSR information following the B level of the GRI guidelines, i.e. their reports are complete. Specifically, the report contains information on: *Profile disclosures*: statement numbers 1.1; 1.2; 2.1–2.10; 3.1–3.13; 4.1–4.17 (see GRI guidelines version 3). *Disclosures on management approach*: for each indicator category. *Performance indicators and sector supplement performance indicators*: a minimum of any 20 performance indicators, including at least one from each of the economic, environment, human rights, labour, society and product responsibility categories. Performance indicators may be selected from any finalized sector supplement, but 14 of the 20 must be from the original GRI guidelines.	246	8.60	74	6.46
GRI = 100	Companies that disclose CSR information following the A level of the GRI guidelines, i.e. their reports are very advanced. More specifically, the report incorporates information on: *Profile disclosures*: 1.1; 1.2; 2.1–2.10; 3.1–3.13; 4.1–4.17 (see GRI guidelines version 3). *Disclosures on management approach*: for each indicator category. *Performance indicators and sector supplement performance indicators*: incorporates each core and sector supplement indicator.	570	19.94	233	20.35

Sample 1. Companies that disclose sustainability information: 2,859 observations of 740 companies in 2007–2014.
Sample 2. Companies that disclose assured sustainability information: 1,145 observations 316 companies in 2007–2014.

Spain, Sweden, Switzerland, the UK and the US) and 8 dummy variables to represent the years of the sample (2007–2014).

4.3. Analytic models

The relationship between the level of information asymmetry and sustainability assurance is empirically tested using the following models. As the two samples are panel datasets, the variables refer to company i in year t. First, Hypothesis 1 is tested using model 1: we are interested in the link between sustainability reporting (SR) and information asymmetry (IA) and whether the effect is moderated by the variable $Assurance$. The moderating effect is represented by $SR\_Assurance$, which is the interaction between the variables SR and $Assurance$.

$$
\begin{aligned}
IA_{it} = {} & \beta_0 + \beta_1 SR_{it} + \beta_2 Assurance_{it} + \beta_3 SRAssurance_{it} + \beta_4 Size_{it} + \beta_5 \\
& Leverage_{it} + \beta_6 Dispersion_{it} \\
& + \beta_7 FRQ_{it} + \sum_{k=8}^{17} \beta_k Industry_{k_{it}} + \sum_{j=18}^{29} \beta_j Country_{j_{it}} \\
& + \sum_{t=30}^{37} \beta_t Year_t + u_{it}
\end{aligned}
$$

(Model 1)

Model 1 is estimated using Sample 1, i.e. focusing on companies that disclose sustainability information. In addition, we are interested in analysing whether the assurance provider and the level of assurance affect information asymmetry. For this purpose, models 2 and 3 are proposed, in which the variables *Accountant* and *Reasonable/High* are entered. In addition, the interactions between *SR* and these two variables are also considered through the interaction terms *SR_Accountant* and *SR_Reasonable/High* with the aim of testing Hypotheses 2 and 3; the former is tested using model 2 and the latter using model 3, as follows:

$$
\begin{aligned}
IA_{it} = {} & \beta_0 + \beta_1 SR_{it} + \beta_2 Accountant_{it} + \beta_3 SRAccountant_{it} + \beta_4 \\
& Reasonable/High_{it} + \beta_5 Size_{it} + \beta_6 Leverage_{it} \\
& + \beta_7 Dispersion_{it} + \beta_8 FRQ_{it} + \sum_{k=9}^{18} \beta_k Industry_{k_{it}} + \sum_{j=19}^{35} \beta_j Country_{j_{it}} \\
& + \sum_{t=36}^{43} \beta_t Year_t + u_{it}
\end{aligned}
$$

(Model 2)

$$
\begin{aligned}
IA_{it} = {} & \beta_0 + \beta_1 SR_{it} + \beta_2 Reasonable/High_{it} + \beta_3 SR\_Reasonable/High_{it} + \beta_4 \\
& Accountant_{it} + \beta_5 Size_{it} \\
& + \beta_6 Leverage_{it} + \beta_7 Dispersion_{it} + \beta_8 FRQ_{it} + \sum_{k=9}^{18} \beta_k Industry_{k_{it}} \\
& + \sum_{j=19}^{35} \beta_j Country_{j_{it}} + \sum_{t=36}^{43} \beta_t Year_t + u_i t
\end{aligned}
$$

(Model 3)

Finally, Hypothesis 4 takes into account the institutional context. To test this hypothesis, we empirically estimated models 1, 2 and 3 again, controlling for stakeholder orientation and also the level of investor protection. The former is represented by the two major legal traditions: common law and civil law. In general, companies operating in a common law context tend to be more shareholder-oriented, i.e. the main corporate purpose is the shareholders' wealth maximization. In contrast, companies operating in civil law countries address social responsibilities beyond economic efficiency (La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1997). According to these two categories, Sample 2 is divided into common law versus civil law countries and the three models are estimated for the two sub-samples.

Investor protection refers to a country's legal environment in protecting investor rights as a principal factor of the legal tradition, an anti-director rights index and the mechanism of law enforcement. The legal tradition is represented by common versus civil law, anti-director rights represent the ease with which investors can exercise their rights against opportunistic behaviour and legal enforcement is

measured as by La Porta et al. (1998), including efficiency of the judicial system, the assessment of the rule of law and the level of corruption. Accordingly, Sample 2 is again broken into two groups according to factorial values: countries with weaker investor protection versus countries with stronger investor protection. The three models are estimated for the two sub-samples.

Initially, a fixed- or random-effects estimator could be used to estimate the three models, but the errors must be conditionally homoscedastic and not serially correlated. Thus, first we test whether our model presents heteroscedasticity and serial correlation problems using the Breusch–Pagan test and the Wooldridge test, respectively. The p-values obtained for each test are 0.0000, which means that we must reject the null hypotheses of homoscedastic errors and no serially correlated errors.

Another problem, namely endogeneity, could appear in our models, due to reverse causality (Wooldridge, 2010). This arises when the selection of the disclosure policy is a strategic decision considering the costs versus the benefits of increasing disclosure and thus the proposed models might suffer from self-selection bias (Hail, 2002). Instrumental variables (IVs) may solve endogeneity, but the conventional IV estimator (although consistent) is inefficient in the presence of heteroscedasticity (Baum, Schaffer, & Stillman, 2003). The dynamic panel estimator proposed by Arellano and Bond (1991), based on the generalized method of moments (GMM) introduced by Hansen (1982), overcomes this limitation. More concretely, we use the two-step estimator of Arellano and Bond (1991), which was implemented in Stata by Roodman (2009). Suitable instruments adopted in GMM are the lagged values of the right-hand side variables included in the model as instruments, because they are uncorrelated with the error term when deriving the estimator (Arellano & Bond, 1991). The closest lags are the most appropriate as the furthest do not contain information on the current value of the variables; specifically, $t-2$ for the lagged value of the dependent variable and $t-1$ for the remaining explanatory variables that are not strictly exogenous (Pindado & Requejo, 2015).

5. Results

5.1. Descriptive results

Table 2 shows the distribution of assurance services by year, industry and country. In accordance with GRI (2013) and KPMG (2011), we can see that the assurance of sustainability reporting has increased, especially in recent years. In 2014, 67.22% of the observations show assured sustainability reports. The distribution by activity sector indicates that the most sensitive industries, such as the industrial sector, basic materials and financial services, tend to assure sustainability reports to a greater extent (see Mock, Strohm, & Swartz, 2007; Simnett et al., 2009). Finally, regarding the distribution by country, we can see that Switzerland, Hong Kong, India, Spain, Italy and the UK tend to assure sustainability reporting to a greater extent than the rest of the countries. More specifically, more than 50% observations concern assured sustainability reports, reaching 82.61% in Switzerland and 66.67% in Hong Kong.

This is important because previous scholars have suggested that the institutional and legal context may affect corporate reporting and the verification of such information in particular (Zhou et al., 2013). However, there are no conclusive results. In general, the literature suggests that companies operating in more stakeholder-oriented countries are more likely to assure sustainability information than firms operating in more shareholder-oriented countries (Kolk & Perego, 2010; Martínez-Ferrero & García-Sánchez, 2016; Simnett et al., 2009). This is the case for Switzerland, Spain and Italy. However, the national legal environment also affects the provision of assurance services, although the link is not so clear (Kolk & Perego, 2010). Assurance may facilitate contracting by reducing information asymmetries; in a weak legal context, assurance services could be hindered because of the lack of

credibility of the legal system (Ball, 2001); on the other hand, assurance services will not be as necessary in a strong legal environment because national institutions provide sufficient protection. These two streams may explain the large percentage of assurance services in the UK and Hong Kong. Based on the above differences between countries, we run complementary analyses to control the institutional context and test Hypothesis 4.

Focusing on the distribution by year, industry and country of assurance attributes shown also in Table 2, we can see that companies tend to prefer to purchase this service from accounting professionals over the sample years, especially in Germany, France, Finland and the Netherlands. In addition, over time, the level of assurance tends to be limited/moderate, as we can see in Table 2; in Belgium, France, Germany, Hong Kong, India, Italy, the UK and the US, more than 90% observations show limited/moderate assurance statements. Regarding the activity sectors, there are no great differences between them; in general, we can see the same trend that we have just noted, that is, accounting professionals are preferred for assuring sustainability reports, with a limited/moderate level of assurance.

Table 3 shows the mean values and standard deviations, as well as bivariate correlations. Panel A shows the descriptive statistics for Sample 1, i.e. companies that disclose sustainability information. The mean value of *SR* is 26.45 (range 0–100), suggesting a rather low level of sustainability reporting. The mean value of *Assurance* is 0.4, indicating that 40% of the sample observations relate to companies that disclose assured sustainability reports. These observations then constitute Sample 2, the descriptive statistics of which are shown in Panel B. The mean value of *SR* increases to 48.25 for companies that assure information, although this is still a relatively low value considering the range (0–100). Nevertheless, it can be argued that the quality of sustainability reporting is higher when reports are assured by external professionals. For 63.14% of the observations in Sample 2, assurance was provided by accountants (*Accountant*) and only 16.77% of assured reports showed a reasonable/high level of assurance (*Reasonable/High*).

In addition, in each panel of Table 2 we can see the mean values of the rest of the variables that represent corporate characteristics, that is, firm size, leverage, dispersion and financial reporting quality. In general, the mean values are similar in the two samples. Information asymmetry (*IA*) is slightly higher in companies in Sample 1, which comprises companies that disclose sustainability information, regardless of whether they externally assure such information or not.

Furthermore, the Pearson correlations between variables entered into each model for the two samples, shown in Table 3, are of interest; higher coefficients between independent variables might suggest multi-collinearity problems. Clearly, we can see large correlations between the interaction terms (*SR_Assurance*, *SR_Accountant* and *SR_Reasonable/High*) and the individual variables (*SR*, *Assurance*, *Accountant* and *Reasonable/High*), but in general there are no cases of high values for the rest of the independent variables. In addition, we calculated the variance inflation factors (VIFs) for each model estimated.[7] In general, a VIF of 1 means that there is no correlation between a predictor and the remaining predictor variables; the general rule of thumb is that VIF values equal to or exceeding 4 warrant further investigation. Our results comply with this limit, except for the interaction terms, but there are no adverse consequences from multicollinearity in this case[8] (Allison, 2012).

5.2. Empirical results

The empirical results are obtained using the GMM estimator of

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[7] Values are showed in the tables of results obtained from each model (Tables 4–7).
[8] Correlations may be greatly reduced by "centring" the variables, i.e. subtracting their means, but in our case the variables involved are not continuous, so centring the variables would not make economic sense.

Table 2
Distribution of observations of assurance and attributes by year, sector and country.

Panel A. Assurance attributes distribution by year						
	Non-assured	*Assured*	*Non-accountant*	*Accountant*	*Reasonable/high*	*Limited/moderate*
2007	65.25%	34.75%	37.14%	62.86%	30%	70%
2008	69.78%	30.22%	34.41%	65.59%	26.88%	73.12%
2009	60.00%	40.00%	35.71%	64.29%	26.53%	73.47%
2010	62.95%	37.05%	34.02%	65.98%	28.87%	71.13%
2011	66.12%	33.88%	40%	60%	17.58%	82.42%
2012	62.70%	37.30%	38.65%	61.35%	9.18%	90.82%
2013	56.38%	43.62%	35.85%	64.15%	10.38%	89.62%
2014	32.78%	67.22%	36.45%	63.55%	10.84%	89.16%
Panel B. Assurance attributes distribution by industry						
Basic materials	54.81%	45.19%	27.78%	72.22%	25%	75%
Construction	56.00%	44.00%	28.81%	71.19%	15.25%	84.75%
Financial	55.06%	44.94%	36.67%	63.33%	10.83%	89.17%
Industrial	45.37%	54.63%	43.88%	56.12%	17.67%	82.33%
Retail	73.66%	26.34%	26.53%	73.47%	20.41%	79.59%
Services industry	72.15%	27.85%	36.36%	63.64%	22.73%	77.27%
Telecommunications	56.36%	43.64%	37.19%	62.81%	12.40%	87.60%
Transportation	59.73%	40.27%	23.40%	76.60%	10.64%	89.36%
Utilities	56.80%	43.20%	23.15%	76.85%	16.67%	83.33%
Others	85.07%	14.93%	50%	50%	30%	70%
Panel C. Assurance attributes distribution by country						
Belgium	68.97%	31.03%	44.44%	55.56%	0%	100%
Canada	62.71%	37.29%	19.32%	80.68%	11.36%	88.64%
Denmark	62.22%	37.78%	23.53%	76.47%	100%	0%
Finland	61.46%	38.54%	8.11%	91.89%	100%	0%
France	65.79%	34.21%	7.69%	92.31%	5.13%	94.87%
Germany	50.00%	50.00%	1.30%	98.70%	1.30%	98.70%
Hong Kong	33.33%	66.67%	63.64%	36.36%	0%	100%
India	40.61%	59.39%	46.94%	53.06%	7.14%	92.86%
Italy	47.59%	52.41%	23.47%	76.53%	2.04%	97.96%
Japan	67.74%	32.26%	80%	20%	100%	0%
Netherlands	68.29%	31.71%	11.54%	88.46%	100%	0%
Norway	53.74%	46.26%	47.06%	52.94%	100%	0%
Spain	45.85%	54.15%	16.22%	83.78%	13.51%	86.49%
Sweden	72.58%	27.42%	23.53%	76.47%	23.53%	76.47%
Switzerland	17.39%	82.61%	42.11%	57.89%	0%	100%
UK	48.23%	51.77%	45.79%	54.21%	9.47%	90.53%
USA	75.20%	24.80%	64.38%	35.62%	6.85%	93.15%

Frequencies of assured and non-assured observations are obtained from Sample 1. Companies that disclose sustainability information: 2,859 observations of 740 companies in 2007–2014. Frequencies of accountant vs. non-accountant and reasonable/high vs. limited/moderate observations are obtained from Sample 2. Companies that disclose assured sustainability information: 1,145 observations 316 companies in 2007–2014.

Arellano and Bond (1991). The estimated coefficients are shown in Tables 4 and 5, together with the Arellano–Bond test for AR(2) in first differences and the Hansen test of over-identification restrictions. The former is a test of second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0, 1)$ under the null hypothesis that there is no serial correlation of the error terms; the second is a test of the validity of the over-identifying restrictions for the GMM estimator, asymptotically distributed as χ^2, under the null hypothesis that the over-identifying restrictions are valid. In addition, the tables include the VIF values, as explained in Section 5.1.

The empirical results of model 1 are shown in Panel A of Table 4. These were obtained using Sample 1 (i.e. companies that disclose sustainability reports). Eq. (1) does not include the interaction term (*SR_Assurance*), whereas Eq. (2) does. The *SR* indicator variable affects the dependent variable negatively, this result being statistically significant at the 99% confidence level for both equations. *Assurance* also exerts a negative on the dependent variable, again relevant at the 99% confidence level for both equations. The interaction term *SR_Assurance*, the effect of which can be seen in Eq. (2), is also negative and relevant at the 99% level. This result suggests that sustainability reporting tends to reduce the information asymmetry between stakeholders, but this reduction is greater when such information is externally assured, which

is in line with Hypothesis 1.

Regarding the companies that assure sustainability reporting (Sample 2), we analyze the assurance provider and the level of assurance, with models 2 and 3, to test Hypotheses 2 and 3 respectively. The empirical results are shown in Panel B of Table 4. Three equations are estimated: Eq. (3) shows the effect of the single independent variables (*SR*, *Accountant* and *Reasonable/High*) and Eqs. (4) and (5) show the effects of the interaction terms *SR_Accountant* and *SR_Reasonable/High* respectively.

Focusing on Eq. (3), we can see a positive effect of *SR* on *IA*, although it is not statistically relevant, which suggests that information asymmetry is not reduced through sustainability reporting. However, *Accountant* and *Reasonable/High* show negative effects and these are statistically significant. These findings suggest that information asymmetry is reduced only when sustainability information is assured by accounting professionals, or when the level of assurance is reasonable/high.

The results are stronger for Eqs. (4) and (5), in which the interaction terms are entered, suggesting that the effect of *SR* on *IA* is moderated by the assurance provider and the level of assurance. More specifically, in Eq. (4) *SR* negatively affects *IA* and *Accountant* also has a negative effect, as does the interaction term *SR_Accountant*, these effects being

Table 3
Descriptive statistics and bivariate correlations.

Panel A. Sample 1. Companies that disclose sustainability information

	Descriptive statistics		Bivariate correlations							
	Mean	Std. dev.	1	2	3	4	5	6	8	9
1. IA	0.0331	0.0798	1							
2. SR	26.4522	34.7866	−0.0282	1						
3. Assurance	0.4005	0.4896	−0.0068	−0.0045	1					
4. SR_Assurance	13.3459	27.4961	−0.0178	0.5059***	0.5971***	1				
5. Size	15.4884	2.2564	−0.0082	0.228***	0.113***	0.1712***	1			
6. Leverage	1.9288	13.6800	0.0272	0.0183	0.0224	0.0152	0.0812***	1		
7. Dispersion	49.2778	20.7047	−0.051*	−0.064***	0.0451*	−0.0428*	−0.0062	−0.0197	1	
8. FRQ	0.2046	0.1078	−0.0492	−0.0228	−0.0031	−0.0033	0.1027**	−0.017	0.0085	1

Panel B. Sample 2. Companies that disclose assured sustainability information

	Descriptive statistics		Bivariate correlations									
	Mean	Std. dev.	1	2	3	4	5	6	7	8	10	11
1. IA	0.0324	0.0678	1									
2. SR	48.2532	34.9728	−0.0318	1								
3. Accountant	0.6314	0.4821	−0.0029	0.1429**	1							
4. Reasonable/High	0.1677	0.2489	0.0298	0.0913**	−0.0486	1						
5. SR_Accountant	23.6489	34.3003	0.0076	0.7857**	0.5248**	0.0312	1					
6. SR_Reasonable/High	3.0164	15.0467	0.0077	0.2551**	−0.0107	0.753**	0.1538**	1				
7. Size	15.8020	2.3163	−0.0579	0.1998**	0.0448	0.0366	0.1765**	0.0138	1			
8. Leverage	2.3064	6.6163	0.0305	0.0065	0.0881**	−0.0076	0.0384	0.0339	0.1547**	1		
9. Dispersion	50.4316	20.3511	−0.067†	−0.1402**	0.0095	−0.0237	−0.101**	−0.0305	−0.066*	−0.0436	1	
10. FRQ	0.2042	0.1176	0.0195	−0.0025	0.0854†	−0.0094	0.0534	0.0083	0.1614**	0.0175	0.0507	1

†, *, **, and *** represent statistically significance at 90%, 95%, 99% and 99.9%, respectively.
Bivariate correlations tables also include the 8 dummy variables that represent sample years, 10 dummy variables that refer to each activity sector, and 17 dummy variables that represent countries of origin. However, results are deleted because of space limitations, but they are available for readers under request. Anyway, all of them are lower than |0.3|.

statistically relevant at the 99.9% confidence level. This suggests that assurance services provided by professional accountants reduce information asymmetry to a greater extent than those provided by non-accountants, which is in line with Hypothesis 2.

Regarding Eq. (5), *SR* is not statistically relevant, but *Reasonable/High* and *SR_Reasonable/High* show negative coefficients (significant at the 99.9% and 99% levels respectively). This finding indicates that information asymmetry is reduced to a greater extent with a reasonable or high level of assurance than with a limited or moderate level, as proposed in Hypothesis 3.

Hypothesis 4 takes into account the institutional context. Models 1, 2 and 3 were estimated by breaking Samples 1 and 2 into two sub-samples according to (i) the legal tradition and (ii) the level of efficiency and effectiveness of the legal enforcement. Table 6 shows the results obtained for the three models regarding common law countries and civil law countries. Specifically, the results for model 1 are shown in Panel A, from which we can see that in general *SR* negatively affects *IA* in both cases, but *Assurance* is only statistically relevant in the case of the civil law context. Models 2 and 3 were also estimated using Eqs. (3)–(5) for the two specific contexts, the empirical findings of which are shown in Panel B. Here, we can see that accountants and a reasonable/high level of assurance are only relevant in explaining *IA* in common law countries. *Accountant* negatively affects the dependent variable in Eq. (4); also the interaction terms *SR_Accountant*, *Reasonable/High* and *SR_Reasonable/High* negatively affect *IA*. However, in civil law contexts, the variables that represent assurance attributes are not statistically relevant (only *SR* affects *IA* negatively in Eqs. (3)–(5)).

Table 6 presents a similar analysis but considering the level of investor protection as a country-level factor that affects the previous findings. Again, the three models were estimated for environments with a higher versus a lower level of investor protection following La Porta

et al.'s (1998) approach. In general, companies operating in countries with poor protection have dominant insiders with non-trivial cash flow rights, leading to private benefits from their control (Stulz, 2005). In this situation, Perego (2009) and Kolk and Perego (2010) confirm that sustainability assurance services replace a low investor protection level, overcoming the effect of ineffective legal regulation.

Our findings are accordance with these previous arguments and corroborate Hypothesis 4: we can see that *Assurance* and *SR_Assurance* negatively affect the level of information asymmetry in countries characterized by low investor protection. However, when such protection is higher (i.e. in more shareholder-oriented countries), assurance does not seem to be relevant in reducing information asymmetry (neither *Assurance* nor *SR_Assurance* are statistically significant in Eqs. (1) and (2)), unless the verification is provided by accounting professionals (see *SR_Accountant* in Eq. (4)) and the level of assurance is reasonable/high (see *SR_Reasonable/High* in Eq. (5)).

Overall, our institutional analyses report the following: while assurance services are relevant as a credibility tool that reduce information asymmetries in stakeholder-oriented countries, independently of the assurance practitioner or the level of assurance opinion reported, in more shareholder-oriented countries, assurance only reduces asymmetries when this service is entrusted to an accounting firm and the practitioner issues a reasonable/high opinion expressed in a positive way.

5.3. Sensitivity analyses

We also carried out some sensitivity analyses to control for some specific characteristics of the sample. Models 1, 2 and 3 were estimated: (i) by dropping observations from some specific contexts such as the US, India and Hong Kong; (ii) by dropping the financial and utilities sectors; (iii) by using a balanced panel dataset. All of the results are shown in

Table 4
Empirical results.

Panel A. Empirical results for Model 1

	Equation 1		Equation 2	
	Coeff.	*Std. err.*	*Coeff.*	*Std. err.*
SR	−0.0019[**]	0.0007	−0.0022[**]	0.0008
Assurance	−0.0085[**]	0.0031	−0.0216[**]	0.0070
SR_Assurance			−0.0027[**]	0.0010
Size	−0.0553[***]	0.0114	−0.0341[**]	0.0101
Leverage	0.0010[*]	0.0004	0.0011[***]	0.0003
Dispersion	−0.0036[***]	0.0005	−0.0039[***]	0.0004
FRQ	−0.1606[***]	0.0188	−0.0611[***]	0.0107
AR(2) Arellano–Bond test	Pr > z = 0.893		Pr > z = 0.541	
Hansen test	Prob > χ^2 = 0.587		Prob > χ^2 = 0.366	
VIF values	Mean = 1.09		Mean = 2.16	
	Max: SR = 1.18		Max: SR_Assurance = 4.75	

Panel B. Empirical results for Models 2 and 3

	Equation 3		Equation 4		Equation 5	
	Coeff.	*Std. err.*	*Coeff.*	*Std. err.*	*Coeff.*	*Std. err.*
SR	0.0013	0.0007	−0.0031[***]	0.0008	−0.0028	0.0025
Accountant	−0.0067[†]	0.0039	−0.0344[***]	0.0074	−0.0072[*]	0.0033
SR_Accountant			−0.0041[***]	0.0008		
Reasonable/High	−0.0086[*]	0.0038	−0.0298[***]	0.0046	−0.0135[***]	0.0036
SR_Reasonable/High					−0.0011[**]	0.0003
Size	−0.0272[***]	0.0052	−0.0006	0.0044	0.0078	0.0051
Leverage	0.0013[***]	0.0002	0.0013[***]	0.0002	0.0020[**]	0.0007
Dispersion	−0.0004[**]	0.0001	−0.0006[**]	0.0002	0.0000	0.0000
FRQ	−0.0174[***]	0.0044	−0.0138[*]	0.0056	−0.0143[**]	0.0047
AR(2) Arellano–Bond test	Pr > z = 0.299		Pr > z = 0.379		Pr > z = 0.382	
Hansen test	Prob > χ^2 = 0.640		Prob > χ^2 = 0.999		Prob > χ^2 = 0.790	
VIF values	Mean = 1.14		Mean = 2.7		Mean = 2.24	
	Max: SR = 1.22		Max: SR_Accountant = 7.95		Max: SR_Reasonable/High = 5.57	

In every equation, results are controlled by industry, country, and year dummy variables.
Equations 1 and 2 are estimated by using Sample 1. Companies that disclose sustainability information: 2,859 observations of 740 companies in 2007–2014.
Equations 3, 4, and 5 are estimated by using Sample 2. Companies that disclose assured sustainability information: 1,145 observations 316 companies in 2007–2014.
[†], [*], [**], and [***] represent statistically significance at 90%, 95%, 99% and 99.9%, respectively.

Table 7, in which we can see the coefficients for the main variables; although the results are controlled using the same variables as in the previous estimations, the coefficients are not included because of space restrictions.

Regarding the first sensitivity analysis, Samples 1 and 2 were reduced by dropping observations from the US; as almost 37% of observations relate to the US, the previous findings could be biased. The empirical results of the five equations are shown in Panel A of Table 7; we can see that *SR* reduces *IA*, especially when the information is assured. Moreover, *Accountant* and *Reasonable/High* negatively affect the dependent variable, but the interaction terms are not statistically significant. This is in line with previous findings obtained by controlling the legal and institutional context; as the US observations comprise a large part of the sample and represent a more shareholder-oriented environment, the results tend to be dominated by stakeholder-oriented contexts if US observations are not taken into account.

Furthermore, Eqs. (1)–(5) were estimated by also dropping observations from India and Hong Kong because of the general scepticism of analysts concerning sustainability reporting in these countries. The findings obtained are shown in Panel B of Table 7 and suggest that sustainability reporting reduces information asymmetry in companies that assure such information, especially when the assurance service is provided by accounting professionals. The level of assurance does not seem to be relevant.

In addition, as the financial and utilities sectors are both regulated industries, with specific characteristics, they tend to be excluded from studies of this kind. Accordingly, the five equations were again estimated dropping observations for companies that operate in such sectors. The empirical results are shown in Panel C of Table 7; in general, sustainability reporting reduces information asymmetry, especially when such information is externally assured, mainly by accounting professionals. The level of assurance does not seem be relevant.

Finally, in the last sensitivity analysis, we changed Samples 1 and 2 from unbalanced to balanced panel datasets. Balanced datasets allow the observation of the same unit (in our case, the company) in every time period (2007–2014), which reduces the noise introduced by firm heterogeneity, although this issue was controlled using the GMM estimator. The reduction of Sample 1 (2859 observations from 740 firms in the period 2007–2014) obtained 600 firm-year observations from 75 unique firms covering the period 2007–2014; the reduction of Sample 2 (1145 observations from 316 firms over the period 2007–2014) resulted in 272 observations from 34 unique firms covering the period 2007–2014. The empirical findings obtained using the five equations are shown in Panel D of Table 7; the coefficients are not statistically significant because of the reduction in the sample size, meaning that there are insufficient data to obtain consistent evidence.

Table 5
Empirical results by legal tradition.

Panel A. Empirical results for Model 1

| | Common Law context | | | | Civil Law context | | | |
| | Equation 1 | | Equation 2 | | Equation 3 | | Equation 4 | |
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
SR	−0.0011*	0.0005	−0.0017***	0.0003	−0.0061***	0.0015	−0.0017†	0.0009
Assurance	0.0048	0.0041	0.0012	0.0034	−0.0114***	0.0016	−0.0456***	0.0082
SR_Assurance			0.0022	0.0037			−0.0039***	0.0010
Size	−0.0577***	0.0160	−0.0372***	0.0055	0.0426***	0.0049	0.0854***	0.0096
Leverage	0.0019*	0.0009	0.0070	0.0098	−0.0072***	0.0009	−0.0016***	0.0003
Dispersion	−0.0008	0.0005	−0.0012***	0.0002	−0.0074***	0.0004	−0.0068***	0.0006
FRQ	−0.0096	0.0182	−0.0705***	0.0110	−0.1494***	0.0100	−0.1579***	0.0258
AR(2) Arellano–Bond test	$Pr > z = 0.526$		$Pr > z = 0.698$		$Pr > z = 0.983$		$Pr > z = 0.889$	
Hansen test	$Prob > \chi^2 = 0.305$		$Prob > \chi^2 = 0.758$		$Prob > \chi^2 = 0.628$		$Prob > \chi^2 = 0.315$	
VIF values	Mean = 1.1		Mean = 2.21		Mean = 1.17		Mean = 2.29	
	Max: SR = 1.17; Size = 1.17		Max: SR_Assurance = 5.02		Max: Size = 1.44		Max: SR_Assurance = 4.97	

Panel B. Empirical results for Models 2 and 3

| | Common Law context | | | | | | Civil Law context | | | | | |
| | Equation 3 | | Equation 4 | | Equation 5 | | Equation 3 | | Equation 4 | | Equation 5 | |
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
SR	−0.0035*	0.0017	−0.0007*	0.0010	−0.0010	0.0062	−0.0071*	0.0032	−0.0055*	0.0026	−0.0024***	0.0005
Accountant	−0.0260*	0.0128	−0.0532***	0.0121	−0.0193***	0.0040	0.0039	0.0192	−0.0042	0.0024	−0.0168	0.0137
SR_Accountant			−0.0056***	0.0014					−0.0102	0.0383		
Reasonable/High	−0.0172	0.0105	−0.0072	0.0043	0.0232*	0.0103	0.0187	0.0112			0.0016	0.0095
SR_Reasonable/High					−0.0060***	0.0008					−0.0041	0.0099
Size	−0.0639†	0.0320	0.0196	0.0191	−0.0791*	0.0167	−0.0163	0.0163	0.0399	0.0324	0.0318	0.0542
Leverage	0.0076**	0.0026	0.0090**	0.0026	−0.0068†	0.0040	0.0011	0.0030	0.0003	0.0012	0.0067	0.0113
Dispersion	−0.0002	0.0008	0.0002	0.0006	−0.0002	0.0004	−0.0018*	0.0007	−0.0006	0.0015	0.0005	0.0192
FRQ	−0.0181	0.0297	−0.0152	0.0195	−0.0953***	0.0154	−0.0066	0.0149	0.0705	0.0460	−0.0407*	0.0178
AR(2) Arellano–Bond test	$Pr > z = 0.799$		$Pr > z = 0.568$		$Pr > z = 0.344$		$Pr > z = 0.368$		$Pr > z = 0.135$		$Pr > z = 0.133$	
Hansen test	$Prob > \chi^2 = 0.916$		$Prob > \chi^2 = 1.000$		$Prob > \chi^2 = 0.587$		$Prob > \chi^2 = 1.000$		$Prob > \chi^2 = 1.000$		$Prob > \chi^2 = 0.989$	
VIF values	Mean = 1.14		Mean = 2.36		Mean = 2.13		Mean = 1.27		Mean = 3.26		Mean = 2.33	
	Max: Accountant = 1.21		Max: SR_Accountant = 5.96		Max: SR_Reasonable = 4.79		Max: Size = 1.69		Max: SR = 8.69		Max: SR = 4.46; SR_Reasonable = 4.46	

In every equation, results are controlled by industry, country, and year dummy variables.
Equations 1 and 2 are estimated by using Sample 1. Companies that disclose sustainability information: 2,859 observations of 740 companies in 2007–2014.
Equations 3, 4, and 5 are estimated by using Sample 2. Companies that disclose assured sustainability information: 1,145 observations 316 companies in 2007–2014.
†, *, **, and *** represent statistically significance at 90%, 95%, 99% and 99.9%, respectively.

Table 6
Empirical results by the efficiency and effectiveness of legal enforcement.

Panel A. Empirical results for Model 1

| | High investor protection context | | | | Low investor protection context | | | |
| | Equation 1 | | Equation 2 | | Equation 1 | | Equation 2 | |
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
SR	−0.0019***	0.0002	−0.0022***	0.0004	−0.0415***	0.0060	−0.0017***	0.0005
Assurance	0.0006	0.0018	0.0008	0.0028	−0.0149***	0.0034	−0.0322***	0.0049
SR_Assurance			0.0001	0.0057			−0.0038***	0.0006
Size	−0.0357***	0.0039	−0.0317***	0.0046	−0.0323**	0.0114	−0.0079	0.0064
Leverage	0.0003*	0.0001	0.0007	0.0015	0.0030	0.0027	−0.0027*	0.0010
Dispersion	−0.0012***	0.0001	−0.0001†	0.0000	−0.0007***	0.0005	−0.0007***	0.0000
FRQ	−0.0887***	0.0083	−0.0904***	0.0088	−0.1894***	0.0276	−0.0732***	0.0084
AR(2) Arellano–Bond test	$Pr > z = 0.720$		$Pr > z = 0.790$		$Pr > z = 0.620$		$Pr > z = 0.782$	
Hansen test	$Prob > \chi^2 = 0.540$		$Prob > \chi^2 = 0.624$		$Prob > \chi^2 = 0.547$		$Prob > \chi^2 = 0.700$	
VIF values	Mean = 1.08		Mean = 2.18		Mean = 1.11		Mean = 2.2	
	Max: SR = 1.15; Size = 1.15		Max: SR_Assurance = 4.96		Max: SR = 1.27		Max: SR_Assurance = 4.76	

Panel B. Empirical results for Models 2 and 3

| | High investor protection context | | | | | | Low investor protection context | | | | | |
| | Equation 3 | | Equation 4 | | Equation 5 | | Equation 3 | | Equation 4 | | Equation 5 | |
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
SR	−0.0038†	0.0020	−0.0010†	0.0005	−0.0019**	0.0005	−0.0029**	0.0010	0.0005	0.0264	−0.0025**	0.0008
Accountant	−0.0409**	0.0152	−0.1560*	0.0598	0.0020	0.0195	−0.0007	0.0036	0.0137	0.0259	0.0130	0.0168
SR_Accountant			−0.0011†	0.0006					0.0019	0.0026		
Reasonable/High	−0.0088***	0.0020	−0.0044	0.0054	−0.1124***	0.0275	0.0116	0.0109	0.0003	0.0197	0.0375	0.0670
SR_Reasonable/High					−0.0013**	0.0005					−0.0084	0.0088
Size	−0.0077	0.0081	−0.0495*	0.0213	−0.0374*	0.0177	−0.0822***	0.0182	−0.0644†	0.0367	0.0291	0.0256
Leverage	0.0010	0.0007	−0.0103	0.0076	0.0055*	0.0026	0.0185***	0.0020	−0.0177*	0.0083	0.0154***	0.0031
Dispersion	−0.0009***	0.0002	−0.0010	0.0008	−0.0002	0.0009	−0.0005	0.0009	−0.0004	0.0015	−0.0001	0.0092
FRQ	−0.0150	0.0166	0.0396	0.0599	−0.0333***	0.0082	−0.0500***	0.0074	−0.0076	0.0242	−0.0408***	0.0124
AR(2) Arellano–Bond test	$Pr > z = 0.379$		$Pr > z = 0.281$		$Pr > z = 0.754$		$Pr > z = 0.317$		$Pr > z = 0.642$		$Pr > z = 0.632$	
Hansen test	$Prob > \chi^2 = 1.000$		$Prob > \chi^2 = 1.000$		$Prob > \chi^2 = 1.000$		$Prob > \chi^2 = 0.995$		$Prob > \chi^2 = 0.947$		$Prob > \chi^2 = 1.000$	
VIF values	Mean = 1.19		Mean = 2.55		Mean = 2.06		Mean = 1.21		Mean = 2.46		Mean = 2.5	
	Max: SR = 1.4		Max: SR_Accountant = 5.32		Max: SR_Reasonable/High = 4.58		Max: Accountant = 1.44		Max: SR_Accountant = 5.99		Max: Reasonable/High = 6.62; SR_Reasonable/High = 6.62	

In every equation, results are controlled by industry, country, and year dummy variables.

Equations 1 and 2 are estimated by using Sample 1. Companies that disclose sustainability information: 2,859 observations of 740 companies in 2007–2014.

Equations 3, 4, and 5 are estimated by using Sample 2. Companies that disclose assured sustainability information: 1,145 observations 316 companies in 2007–2014.

†, *, **, and *** represent statistically significance at 90%, 95%, 99% and 99.9%, respectively.

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Table 7
Sensitive analyses.

	Panel A. Empirical results by dropping observations from the USA									
	Equation 1		**Equation 2**		**Equation 3**		**Equation 4**		**Equation 5**	
	Coeff.	*Std. err.*	*Coeff.*	*Std. err.*	*Coeff.*	*Std. err.*	*Coeff.*	*Std. err.*	*Coeff.*	*Std. err.*
SR	−0.0021[*]	0.0001	−0.0023[**]	0.0008	−0.0023[***]	0.0003	−0.0012	0.0153	0.0042	0.0030
Assurance	−0.0088[*]	0.0044	−0.0268[***]	0.0070	−0.0185[***]	0.0044				
SR_Assurance			−0.0029[**]	0.0010						
Accountant							0.0043	0.0141	−0.0065[*]	0.0025
SR_Accountant							0.0017	0.0016		
Reasonable/High					−0.0113[***]	0.0031	−0.0134[***]	0.0037	0.0041	0.0071
SR_Reasonable/High									−0.0016	0.0011
	Controlled by size, leverage, market-to-book ratio, dispersion, and FRQ, as well as by industry, country, and year									
AR(2) Arellano–Bond test	Pr > z = 0.955		Pr > z = 0.525		Pr > z = 0.335		Pr > z = 0.335		Pr > z = 0.412	
Hansen test	Prob > χ² = 0.551		Prob > χ² = 0.347		Prob > χ² = 0.346		Prob > χ² = 0.162		Prob > χ² = 0.980	
VIF values	Mean = 1.09 Max: SR = 1.18; Size = 1.18		Mean = 2.16 Max: SR_Assurance = 4.77		Mean = 1.14 Max: Accountant = 1.26		Mean = 2.7 Max: SR_Accountant = 7.97		Mean = 2.24 Max: SR_Reasonable/ High = 5.57	
	Panel B. Empirical results by dropping observations from India and Hong Kong									
SR	−0.0096[**]	0.0031	−0.0002[**]	0.0001	−0.0041[***]	0.0004	−0.0024[**]	0.0007	−0.0056[†]	0.0033
Assurance	−0.0071[***]	0.0016	−0.0258[***]	0.0067						
SR_Assurance			−0.0003[*]	0.0001						
Accountant					−0.0178[***]	0.0039	−0.0249[***]	0.0066	−0.0115[**]	0.0042
SR_Accountant							−0.0038[***]	0.0007		
Reasonable/High					0.0046	0.0064	0.0023	0.0057	0.0016	0.0047
SR_Reasonable/High									0.0010	0.0015
	Controlled by size, leverage, market-to-book ratio, dispersion, and FRQ, as well as by industry, country, and year									
AR(2) Arellano–Bond test	Pr > z = 0.623		Pr > z = 0.651		Pr > z = 0.346		Pr > z = 0.354		Pr > z = 0.387	
Hansen test	Prob > χ² = 0.581		Prob > χ² = 0.507		Prob > χ² = 0.477		Prob > χ² = 0.608		Prob > χ² = 0.587	
VIF values	Mean = 1.1 Max: Size = 1.22		Mean = 2.17 Max: SR_Assurance = 4.81		Mean = 1.16 Max: Accountant = 1.38		Mean = 2.92 Max: SR_Accountant = 8.47		Mean = 2.51 Max: SR_Reasonable/ High = 6.57	
	Panel C. Empirical results by dropping financial and utilities sectors									
SR	−0.0052[*]	0.0021	−0.0020[***]	0.0004	−0.0010[***]	0.0003	−0.0049[***]	0.0009	−0.0070[*]	0.0030
Assurance	−0.0035	0.0057	−0.0141[**]	0.0045						
SR_Assurance			−0.0021[***]	0.0006						
Accountant					−0.0175[***]	0.0045	−0.0225[*]	0.0086	−0.0164[**]	0.0048
SR_Accountant							−0.0053[***]	0.0009		
Reasonable/High					−0.0084[*]	0.0039	−0.0044	0.0052	−0.0269[**]	0.0099
SR_Reasonable/High									0.0025	0.0017
	Controlled by size, leverage, market-to-book ratio, dispersion, and FRQ, as well as by industry, country, and year									
AR(2) Arellano–Bond test	Pr > z = 0.847		Pr > z = 0.781		Pr > z = 0.246		Pr > z = 0.777		Pr > z = 0.353	
Hansen test	Prob > χ² = 0.120		Prob > χ² = 0.698		Prob > χ² = 0.979		Prob > χ² = 0.595		Prob > χ² = 0.939	
VIF values	Mean = 1.08 Max: SR = 1.19		Mean = 2.13 Max: SR_Assurance = 4.68		Mean = 1.15 Max: Accountant = 1.3		Mean = 2.78 Max: SR_Accountant = 7.85		Mean = 2.54 Max: SR_Reasonable = 6.77	
	Panel D. Empirical results for a balanced panel									
SR	0.0015	0.0115	0.0042	0.0763	0.0058	0.0043	−0.0012	0.0024	0.0015	0.0040
Assurance	−0.0393	0.0184	−0.0144	0.0858						
SR_Assurance			−0.0001	0.0010						
Accountant					0.2351	0.2702	−0.1046	0.2536	0.0121	0.0681
SR_Accountant							0.0016	0.0030		
Reasonable/High					−4.3942	5.2447	−0.0018	0.0811	0.0166	0.3251
SR_Reasonable/High									−0.0001	0.0035
	Controlled by size, leverage, market-to-book ratio, dispersion, and FRQ, as well as by industry, country, and year									
AR(2) Arellano–Bond test	Pr > z = 0.506		Pr > z = 0.897		Pr > z = 0.603		Pr > z = 0.323		Pr > z = 0.838	
Hansen test	Prob > χ² = 1.000		Prob > χ² = 1.000		Prob > χ² = 1.000		Prob > χ² = 1.000		Prob > χ² = 1.000	
VIF values	Mean = 1.67 Max: Size = 2.45		Mean = 4.37 Max: SR_Assurance = 8.63		Mean = 1.21 Max: Size = 1.5		Mean = 3.3 Max: SR_Accountant = 8.68		Mean = 3.14 Max: SR_Reasonable = 9.18	

[†], [*], [**], and [***] represent statistically significance at 90%, 95%, 99% and 99.9%, respectively.
Equations 1 and 2 are estimated by using Sample 1. Companies that disclose sustainability information: 2,859 observations of 740 companies in 2007–2014.
Equations 3, 4, and 5 are estimated by using Sample 2. Companies that disclose assured sustainability information: 1,145 observations 316 companies in 2007–2014.

6. Discussion

Based on the above results, our evidence provides support for the proposition that firms with a higher quality of sustainability information enjoy lower information asymmetry. Voluntary reporting mitigates information asymmetry based on the lower forecasting errors and dispersion. Accordingly, our study supports the previous evidence of Dhaliwal et al. (2011), Cormier et al. (2011) and Verrecchia (2001), for example, who have previously documented a negative relationship between voluntary disclosure and information asymmetry.

Moreover, our evidence also indicates that this reduction is shown to be especially salient when sustainability information is assured by external professionals, thus increasing the credibility and reliability of social and environmental information, as suggested by Adams and Evans (2004) and Zorio et al. (2013). Based on our findings, we observe that assurance services are useful in overcoming a lack of accuracy and confidence in forecasting (Healy & Palepu, 2001), increasing the ability of analysts to predict future performance. This ability allows them to mitigate the possible prediction risk, reduce the dispersion in their forecasts and thus increase the accuracy of their forecasts concerning earnings and cash flows. Our results support those of Glaum et al. (2013), who suggest that the decrease in analysts' forecast errors in turn diminishes the information asymmetry conflict.

Moreover, our findings also show that asymmetry tends to be reduced to a greater extent when assurance is carried out by accounting professionals rather than others, such as sustainability consultants or engineering firms. Therefore, the appointment of Big *N* auditing companies could be used to represent the audit/assurance quality, as the literature has suggested previously for financial information (e.g. Francis, Maydew, & Sparks, 1999; Lennox, Francis, & Wang, 2012). Our evidence suggests that analysts give a positive assessment when assurance is undertaken by an accounting firm as the practitioner. These results confirm those of the previous studies by Perego (2009) and Pflugrath et al. (2011), among others, who have pointed out that analysts tend to give more credibility to auditors than consultants.

Nevertheless, these findings should be interpreted cautiously because they are affected by the legal and institutional context. Our analyses indicate that accountants are of greater use in reducing information asymmetry in more shareholder-oriented environments; in other words, assurance reduces information asymmetry only when it is provided by accounting professionals. It is likely that in environments in which shareholders' wealth maximization is the main corporate objective and stakeholders are emphasized to a lesser extent, accounting professionals are more valued in terms of verification, not only of financial statements, but also of sustainability information. This suggests that accountants are well placed to enhance the credibility of non-financial information (Huggins et al., 2011; Pflugrath et al., 2011), but only in common law countries and environments with high investor protection (i.e. more shareholder-oriented countries). Their attributes in terms of education, experience, objectivity and independence are perceived as being preferred, as Knechel et al. (2006) suggested, but we find that this preference is developed in a context in which financial and economic performance is more relevant than other stakeholders' interests.

This study contributes to the debate on assurance providers: accountants versus non-accountants. In general, studies have noted that accountants are preferred for assuring sustainability reports because of their professional attributes of expertise and objectivity, as projected by their profession (Knechel et al., 2006; Perego, 2009). Our empirical findings corroborate this argument, but only in shareholder-oriented environments (common law and high investor protection).

We also found a general and slight effect of the level of assurance on information asymmetry; i.e. the reduction in asymmetry obtained through disclosing sustainability information is greater when the assurance output shows a reasonable/high level opinion, i.e. there is higher credibility and lower informational risk. With the greater confidence and accuracy obtained from reasonable/high assurance opinions, the ability of analysts to predict future firm performance increases, which in turn diminishes the dispersion of their forecasts and increases the accuracy of this information. It is likely that greater reliability is accorded reports with positive opinions, as Hasan et al. (2005) suggested in the case of non-financial information and Gay, Schelluch, and Baines (1998) and Schelluch and Gay (2006) noted for financial information. Nevertheless, our sensitivity analyses do not yield conclusive results because the effect of the level of assurance does not appear to statistically significant. Thus, further research is needed in this respect.

7. Conclusions

This research is a first attempt to analyze the role of sustainability assurance in reducing information asymmetry, proxied by analysts' forecast accuracy. Using a sample of international listed companies for the period 2007–2014, we find that sustainability reporting reduces information asymmetry when such information is assured, when assurance is provided by accounting professionals and when practitioners report a reasonable/high level of opinion concerning the sustainability report. Overall, sustainability assurance is a valuable tool for improving the accuracy and credibility of sustainability information, thus increasing the analysts' ability to predict future cash flows.

Our study makes a number of important contributions. First, it extends the research on the topic of assurance, which is a relatively new but growing research topic due to the increasingly common practice of ensuring the credibility of sustainability reports (KPMG, 2013). In addition, this study contributes to the assurance literature by analysing specific characteristics, namely the assurance provider and the level of assurance engagement. First, our findings suggest that assurance increases information credibility, regardless of whether the information is financial or non-financial (Coram et al., 2009). This transfers the findings obtained by Clinch et al. (2012), Francis (2004), Francis et al. (1999) and Healy and Palepu (2001) concerning financial auditing to the field of sustainability assurance. Moreover, it enhances the work of accounting professionals (and Big *N* firms in particular) in assuring the credibility of sustainability reporting, as Huggins et al. (2011) argued for greenhouse gas reporting. The arguments of Francis (2004), and Francis et al. (1999) with regard to financial auditing may now be used for sustainability assurance; Big *N* firms are less economically dependent and have a greater reputation to lose, so it is expected that they will tend to issue accurate reports and produce high-quality outcomes.

Second, as far as we know, there are no comparable empirical studies concerning levels of assurance. Only Manetti and Becatti (2009) have analyzed these, but they did not use a multivariate approach and their sample was composed of 34 selected assurance statements on sustainability reports. Previously, Hasan et al. (2003) and Hodge et al. (2009) were the only studies to analyze the level of assurance. However, this study has added exploratory evidence by using a panel data set, in contrast to all previous studies which were descriptive in nature.

In addition, this paper contributes to the growing literature on international business by extending the prior research on assurance services in different institutional contexts (Kolk & Perego, 2010; Perego & Kolk, 2012; Peters & Romi, 2014; Simnett et al., 2009). Previous literature in this respect is scarce (e.g. Perego, 2009; Simnett et al., 2009), but the topic is of extreme relevance nowadays. It is an opportunity to understand how the strength of the legal and shareholder context affects corporate decisions related to assurance and – further yet – how assurance tools as a mechanism for reducing agency costs affect information asymmetry. While several papers have analyzed country-level factors concerning assurance demand and the choice of assurance provider (Kolk & Perego, 2010; Simnett et al., 2009; Zhou et al., 2013), we extend these previous findings by

examining how these aspects act as effective mechanisms to mitigate the informational advantages of insiders in an international context. Thus, our international sample addresses the limitation suggested by Fifka (2013), who pointed out that the largest body of literature has been produced in the UK and US, by considering industrialized, emerging and developing countries.

Our findings are also highly relevant from a practical point of view. They may not only stimulate international corporations to report sustainability information, but also to assure such information in order to reduce information asymmetry. This could benefit investors, for instance through a reduction in the cost of capital. In addition, for companies, it is of great relevance to know which practitioners are more credible to different stakeholders in providing assurance statements. By engaging such practitioners, they may in part legitimize their corporate actions and strategies in the context in which they operate and at the same time mitigate information asymmetries between informed and uninformed investors.

For policymakers and regulators, our findings may be informative given the increased demand for assurance, particularly in terms of understanding some of the advantages that pertain to assurance services, such as the reduction of information asymmetry. Regulators could collaborate with companies and other stakeholders in promoting institutional support programmes to ensure the assurance of sustainability reports. Public authorities should be able to institute new laws and requirements, legislative reforms, institutional programmes or financial support, thus inducing an increase in sustainability assurance, which adds value to organizations without costly regulation. The combined work of national governments seems necessary to achieve improvements in assurance demand; for example, this might entail the development of regulatory laws and/or a generalized standard at the international level.

The main limitation of this study is the criticism of the use of forecast errors as a proxy for information asymmetry. Easterwood and Nutt (1999) found that analysts over/under-react to positive/negative corporate information; thus, this proxy could be biased. In this respect, microstructure measures, based on the adverse selection component of the bid-ask spread, have several potential advantages (see Clarke & Shastri). Thus, in the future, researchers may benefit greatly from replicating our study using different measures of information asymmetry. Another limitation is the definition of assurance: we use a dummy variable, but it would be interesting to represent the quality of assurance rather than the existence of a statement. This could also be considered for future research.

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