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Are the Quantity and Quality of Sustainability Disclosures Associated with the Innate and Discretionary Earnings Quality?

Zabihollah Rezaee[1] · Ling Tuo[2]

Abstract Voluntary disclosures of sustainability information have recently received considerable attention by investors, regulators, and public companies in improving reliability and integrity of corporate reporting. We examine the association between the quantity and quality of sustainability disclosures and earnings quality in the context of corporate ethical value and culture. We posit that sustainability disclosures of environmental, social, and governance (ESG) performance reports are linked to earnings quality, because of the importance of both earnings quality and ESG sustainability disclosures to investors and trustworthiness of corporate reporting. We collect our sample of 35,110 firm-year observations between 1999 and 2015. Using both difference-in-difference tests and OLS regression, we find that sustainability disclosure quantity is positively associated with innate earnings quality and negatively correlated with discretionary earnings quality in mitigating managerial earnings manipulation and unethical opportunistic reporting behavior. Further tests illustrate that sustainability disclosure quality can strengthen the positive relation between innate earnings quality and sustainability disclosure quantity and mitigate the negative relation between discretionary earnings quality and sustainability disclosure quantity. Finally, additional tests suggest that the relation between earnings quality and sustainability disclosure quantity is moderated by corporate structure and prior-year sustainability performance. Our results provide policy, practical, and research implications as ESG sustainability reporting is being integrated into corporate culture and business models.

Keywords Earnings quality · Sustainability disclosure · Unethical and opportunistic earnings management · Sustainability performance · Corporate social responsibility

Introduction

In the aftermath of financial scandals (e.g., Enron, WorldCom) at the turn of the twenty-first century and the 2007–2009 global financial crisis, public companies have become more sensitive toward disclosing their ethical value, long-term sustainability performance, and reputation (Rezaee 2016). Cohen et al. (2011, 2012) argue that investors are more interested in non-financial disclosures than the disclosure of traditional financial economic indicators. The 2016 report of the Investor Responsibility Research Center Institute (IRRCi) indicates that investors and portfolio managers are integrating environmental social and governance (ESG) information into their investment decisions (IRRCi 2016). Several recent studies address the importance of ESG sustainability performance reporting to business organizations, its relevance as it pertains to corporate culture and reputation, and raised concerns about the greenwashing aspect of sustainability reporting. For example, Rezaee (2017: 63) suggests "…organizations to take their sustainability initiatives from the current greenwashing and publicity stage to the top of the agenda for their directors and executives to integrate into their corporate culture, infrastructure, and

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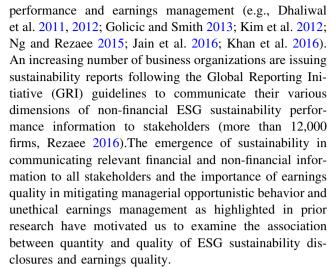
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business models." Unerman and Chapman (2014; 392) state that "Accounting for sustainability development represents a complex and pressingly important area of research". Haffar and Searcy (2017: 514) advocate "Qualitative research into the application of CS [corporate sustainability] initiatives in specific application areas (such as reporting or supply chain management)…" This paper responds to these calls by examining the association between the quantity and quality of ESG sustainability disclosures and earnings quality.[1]

Prior research views corporate social responsibility (CSR) in ESG sustainability dimensions as a proxy for improved ethical behavior. For example, Watts and Holme (1999) define CSR as "the continuing commitment by business to behave ethically…." Carroll (1979) views CSR in the context of economic, legal, ethical, and discretionary expectations and performance. The link between ESG business sustainability and corporate reputation and ethics of management is also examined in several studies. Ameer and Othman (2012) find that firms with sustainability-focused in areas of CSR, ethical practices and ethical work environment, and customer satisfaction experience higher financial performance compared with less sustainability-focused firms. Martinez-Ferrero et al. (2016) report that CSR is positively associated with corporate reputation and lower cost of capital particularly for firms with evidence of earnings management. A 2013 global consumer survey suggests that the firm's ESG sustainability performance can affect both consumer behavior and corporate reputation and ethical practices, which may result in improved financial performance (Cone Communications 2013). Investors are also willing to invest in more socially and environmentally responsible and ethically behaved firms as they evaluate sustainability ESG performance when making investment decisions (Social Investment Forum, SIF 2012). Lee (2017) finds a positive link between ESG/CSR sustainability information and management earnings forecast accuracy, which intends to mitigate unethical managerial earnings manipulation and opportunistic behavior.

Dechow et al. (2014) point out that earnings are important to investors and thus the information content of earnings announcements (earnings quality) and non-financial indicators, in addition to financial earnings, affect stock prices. Other studies link ESG sustainability performance information to firms' financial and market

performance and earnings management (e.g., Dhaliwal et al. 2011, 2012; Golicic and Smith 2013; Kim et al. 2012; Ng and Rezaee 2015; Jain et al. 2016; Khan et al. 2016). An increasing number of business organizations are issuing sustainability reports following the Global Reporting Initiative (GRI) guidelines to communicate their various dimensions of non-financial ESG sustainability performance information to stakeholders (more than 12,000 firms, Rezaee 2016).The emergence of sustainability in communicating relevant financial and non-financial information to all stakeholders and the importance of earnings quality in mitigating managerial opportunistic behavior and unethical earnings management as highlighted in prior research have motivated us to examine the association between quantity and quality of ESG sustainability disclosures and earnings quality.

Consistent with Dichev et al. (2013), and following Moon Jr. (2014), we classify earnings quality into two different aspects: innate earnings quality and discretionary earnings quality. Innate earnings quality refers to earnings quality derived from a firm's innate traits such as production function, business model, and competitive environment (Francis et al. 2008), while discretionary earnings quality refers to earnings quality which is not derived from those innate traits and is likely to be affected by management's short-term control. We use GRI sustainability guidelines as proxies for quality and quantity of sustainability disclosures.[2] We construct two measures of sustainability disclosures. Sustainability disclosure quantity as a proxy for whether the firm issues sustainability reports and sustainability disclosures quality as a proxy for how the firm uses the GRI guidelines in the preparation and assurance of sustainability reports.

We conjecture that ESG sustainability disclosure quantity is positively correlated with innate earnings quality and negatively correlated with discretionary earnings quality, but sustainability disclosure quality is positively correlated with both innate earnings quality and discretionary earnings quality. Our rationale for such an association is that: (1) business sustainability has advanced from a main focus on corporate social responsibility (CSR) to being integrated into corporate culture, mission, strategy, business model, supply chain, and management processes (Kiron et al. 2015; Rezaee 2015, 2016): (2) prior research (Bertoneche

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[1] The terms corporate social responsibility (CSR) and ESG sustainability have been interchangeably used in the business literature. Consistent with Ng and Rezaee (2015), Jain et al. (2016) and Khan et al. (2016), we use ESG sustainability attributes constructed from the Global Reporting Initiative (GRI) database as the proxy for sustainability quality and quantity disclosures. We attempt to address an association between ESG sustainability disclosures and earnings quality and do not claim to provide any causation evidence.

[2] The focus of this paper is on sustainability disclosures. However, there are two aspects of business sustainability, namely sustainability performance and sustainability disclosure, and prior research (e.g., Jain et al. 2016; Ng and Rezaee 2015) argues that both sustainability performance and disclosure are correlated. Prior studies (e.g., Jain et al. 2016; Ng and Rezaee 2015) use the KLD database to construct ESG sustainability performance measures and GRI and/or Bloomberg databases to construct ESG sustainability disclosures. The GRI database used in this study provides both ESG disclosure quality and quantity.

and Lugt 2013; Kiron et al. 2013; Ng and Rezaee 2015; Jain et al. 2016; Khan et al. 2016) reports that ESG sustainability performance affects financial performance, cost of capital, and thus stock price and firm value; (3) management uses its discretion in communicating sustainability information to all stakeholders as well as differentiating its good sustainable performance from other firms with less sustainable performance (Ng and Rezaee 2015; Rezaee 2016; Hummel and Schlick 2016); and (4) anecdotal evidence suggests that integration of ESG into corporate culture and business models can achieve long-term financial stability and success (ICGN 2016; Unruh et al. 2016).

The aforementioned rationale provides a justifiable basis for our main hypothesis that ESG sustainability disclosure quantity is: (1) positively associated with innate earnings quality (the supplementary relation) because the preparation of sustainability report encourages management to improve the firm's innate traits and (2) negatively associated with discretionary earnings quality (the substitutable relation) because the flexibility in preparing sustainability report may increase the information asymmetry. Furthermore, we address how disclosure quality can influence the relation between innate/discretionary earnings quality and sustainability disclosure primarily because: (1) the quality of the disclosure can affect its usefulness by affecting the perceptions and behaviors of investors and financial analysts (Kothari et al. 2009) and (2) long-term value creation can be shaped by sustainable financial economic performance as reflected in earnings quality as well as non-financial ESG quality by aligning investors' long-term financial interests with those of society and the environment (S&P 2016). We collect quantity and quality of sustainability disclosures data from the GRI database and earnings quality data from COMPUSTAT. We use both the OLS regression approach and the difference-in-difference (DID) analysis of matching groups approach based on propensity scores to test our hypotheses.

Our OLS regression results suggest that sustainability disclosure quality is positively associated with both innate earnings quality and discretionary earnings quality. In contrast, sustainability disclosure quantity is positively associated with innate earnings quality but negatively correlation with discretionary earnings quality. Moreover, the DID analysis adds more support for the relationship between sustainability disclosures and earnings quality. Additional robustness tests also suggest that the relation between earnings quality and sustainability disclosure quantity is moderated by other factors, such as institutional ownership and prior-year sustainability performance.

This paper contributes to the literature in several ways. First, this paper is the first to address the link between quantity and quality of sustainability disclosures intended to provide relevant information to investors and both innate

and discretionary earnings quality aimed at reducing unethical managerial earnings manipulation and opportunistic behavior. This paper is different from much of prior research, which focuses on the association between CSR performance and discretionary accruals, earnings management, and information asymmetry. Kim et al. (2012) report that CSR firms exhibit a lower level of discretionary accruals, whereas Cho et al. (2013) document that CSR performance decreases information asymmetry. Our study is different from both Kim et al. (2012) and Cho et al. (2013) by investigating the link between earnings quality (both innate and discretionary) and quality and quantity of sustainability disclosures not addressed in prior research. Innate earnings quality, which is driven by firms' fundamental factors, is perceived differently in the capital market compared to discretionary earnings quality, which is driven by managers' discretionary behaviors (Hou 2015). Furthermore, we examine the firm-specific characteristics that could possibly attenuate or exacerbate the relationship between quality and quantity of sustainability disclosures and innate and discretionary earnings quality.

Second, as more companies release sustainability reports and regulators worldwide consider mandatory sustainability performance reporting, there is a need for a better understanding of guidelines use in the preparation of these reports, their information content, materiality and their link to earnings quality to mitigate unethical earnings management (Rezaee 2016). Our results complement findings of Khan et al. (2016) that firms with superior material sustainability initiatives (good ratings) significantly outperform those with poor ratings on their sustainability issues. Several professional organizations, including the GRI, the International Integrated Reporting Council (IIRC), and the Sustainability Accounting Standards Board (SASB), have recently developed initiatives, guidelines and best practices to advance sustainability reporting and assurance. Our results support these initiatives and further suggest more robust GRI reporting guidelines to improve the quality of sustainability disclosure. Finally, our paper provides new evidence for the current accounting research debate on earnings quality and its measurements in terms of innate and discretionary earnings quality (Dichev et al. 2013; Moon Jr. 2014). Our results suggest that high-quality ESG sustainability disclosure can be used as a signal of superior sustainability performance, which was found to be linked to financial and market performance (Ng and Rezaee 2015; Khan et al. 2016). Thus, our study adds to this line of research on sustainability performance disclosures by showing that sustainability disclosures are associated with earnings quality, which is important to investors in their investment decisions (IRRCi 2016) and to companies worldwide in integrating sustainability into their strategies, business models, ethical practices, operations, and culture (UNGC 2013).

The remainder of the paper is organized as follows: We review the related literature in the second section and develop our theory-driven hypotheses in the third section. We discuss the sample selection and descriptive statistics in the fourth section. A detailed research design, which includes measurements and models, is described in the fifth section. Empirical results and additional tests are provided in the sixth section and the seventh section, respectively. Finally, we present the conclusion in the eighth section.

Literature Review

Non-financial Sustainability Disclosures

In recent years, investors, regulators, and corporations have paid more attention to disclosure of non-financial ESG sustainability performance information (Rezaee 2016). Prior research has traditionally focused more on financial disclosure than non-financial ESG disclosure, primarily because limited access to non-financial databases existed until recently. Robb et al. (2001) is one of the earliest studies to examine firms' strategies of voluntary non-financial disclosure and find that larger firms and firms with global operations tend to voluntarily disclose more non-financial information. Vanstraelen et al. (2003) investigate the benefits of non-financial disclosure and find that the quantity of non-financial disclosures is negatively correlated with errors and dispersions of financial analysts' earnings forecasts. Both Robb et al. (2001) and Vanstraelen et al. (2003) construct their variables of non-financial disclosure by self-counting the non-financial information conveyed in annual financial reports. Cohen et al. (2011, 2012) examine the voluntary disclosure of a set of financial economic indicators as well as non-financial ESG sustainability performance and conclude that there is a lack of expansive and rigorous voluntary disclosure practice and credibility of such voluntary information would be improved by the availability of assurance services.

Another stream of non-financial disclosure study focuses on investigating the management discussion and analysis (MD&A) section of annual financial reports.[3] Prior research suggests MD&A is determined by firm-specific characteristics and management strategies (Clarkson et al. 1994, 1999) and can reduce information asymmetry and help information users make decisions (Cole and Jones 2004, 2015; Sun 2010; Wheeler et al. 2014). Brown and

Tucker (2011) find that the frequency of MD&A modifications has declined and price reaction to MD&A modification scores has weakened in the past decade despite the continuous increase in the length of MD&A. Ball et al. (2015) find that discretionary accruals unexplained (explained) by the text in the MD&A disclosure do (do not) predict future restatements and litigation, and thus this suggests that lower discretionary earnings quality is associated with management's discretion to intentionally make the MD&A disclosure less informative.

To satisfy investors' demand for more tailored and focused non-financial information, public companies have recently disclosed non-financial information, including environmental, CSR, and governance information. Investors demand, regulators require, and companies voluntarily release their ESG sustainability reports, and yet many companies continue to struggle to integrate sustainability reports with financial statements (Rezaee 2016). For example, investors consider sustainability information in their investment analysis, as documented by the rise of socially responsible investing (SRI) by 22% to $3.74 trillion in managed assets during the 2010–2012 period (Social Investment Forum (SIF) 2012). Stock exchanges worldwide either require or recommend that their listed companies issue reports (Toronto Stock Exchange (TSX) 2014). Since 2015 the Hong Kong Exchange has required its listed companies to provide ESG sustainability performance information in addition to financial information to their investors (Hong Kong Stock Exchange 2015). More than 6000 European companies will be required to issue sustainability reports on their non-financial ESG and diversity information for their 2017 financial year (European Commission 2014).[4] A growing number of institutional and individual investors have recently devoted attention to ESG sustainability performance as they consider ESG initiatives are material to the company's financial success. A 2016 survey conducted by MIT Sloan Management Review reveals that more than 60% of surveyed investors believe that sustainability performance reduces a company's risks and cost of capital and thus they divest from companies with poor sustainability performance (Unruh et al. 2016).

The feasibility of issuing ESG sustainability reports and their integration into corporate reports and possible links to financial and market performance has also been addressed in several streams of research. The first stream investigates the factors that influence the management strategies to voluntarily disclose ESG sustainability information. For

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[3] Although MD&A contains financial information related to past earnings and future earnings forecast, it also provides investors with supplementary non-financial information related to management strategies and planning.

[4] We use the definition of sustainability reports provided by the Global Reporting Initiatives (GRI) as reports published by entities about the economic, environmental, and social impacts caused by their everyday activities.

example, consistent with stakeholder theory and legitimacy theory, prior research suggests that firms with better corporate governance, such as intensive monitoring (Mallin et al. 2013), higher corporate governance ratings (Chan et al. 2014), the presence of an environmental committee and a Chief Sustainability Officer (Peters and Romi 2014), and more independent and larger boards (Jizi et al. 2014) tend to provide more sustainability disclosures to the public. Furthermore, some institutional factors, such corporate psychopaths (Boddy et al. 2010), may also influence firms' sustainability disclosure strategies.

The second stream of research intends to discuss whether ESG sustainability disclosures provide useful information to users and whether the contents of such disclosure are perceived and valued by the public. For example, Dhaliwal et al. (2011, 2012, 2014) provide evidence on the informativeness of standalone CSR reports by showing an information asymmetry reduction after CSR reporting. Moreover, Clarkson et al. (2013) find that voluntary environmental disclosures are value-relevant and enhance firm value through signaling the firms' proactive environmental strategies to investors. Other studies examine the value relevance of non-financial information in specific industries such as airlines, e-commerce, and wireless communications (e.g., Amir and Lev 1996; Behn and Riley Jr. 1999; Hughes 2000; Ittner and Larcker 1998). Furthermore, Plumlee et al. (2015) report that voluntary environmental quality as measured by the GRI disclosure index is associated with firm value through cash flow and the cost of equity components. Ng and Rezaee (2015) find that financial economic sustainability performance disclosures are negatively associated with the cost of equity and that ESG disclosures enhance such an association. Jain et al. (2016) report that short sellers avoid firms with high ESG scores and tend to target firms with low ESG scores.

The final stream of related research examines whether and how sustainability disclosure is associated with sustainability performance and their integrated effect on financial and market performance. According to voluntary disclosure theory, firms with better sustainability performance tend to signal more sustainability information to the public and thus they also have better financial performance. For example, Al-Tuwaijri et al. (2004) develop a simultaneous equation approach and find that environmental disclosure is positively correlated with both environmental performance and financial economic performance. Clarkson et al. (2008) revisit the relation between environmental performance and environmental disclosure and also support the voluntary disclosure theory. Consistently, Herbohn et al. (2014) using the sample of Australian extractive industries also find a positive correlation between sustainability disclosure and sustainability performance. Specifically regarding the relation between sustainability and firm

financial performance, Friedman (1970) argues that the responsibility of a corporation is to earn profits, and thus CSR/ESG programs are distributions of shareholder wealth for the pursuit of managers' own interests. Huang and Watson (2015) argue prior research (more than 100 CSR-related empirical studies) provides mixed results regarding the feasibility of the CSR/ESG investment.

Others studies (e.g., Dhaliwal et al. 2011; El Ghoul et al. 2011; Lev et al. 2009; Golicic and Smith 2013) also provide empirical evidence that suggests that ESG sustainability programs improve a firm's future financial performance. However, according to social–political theory (legitimacy theory), sustainability disclosure is associated with worse sustainability performance due to possible social–political problems and thus may not lead to better financial performance. For example, Cho et al. (2012) suggest that firms have the incentive to release environmental disclosure to mitigate the negative effect of poor environmental performance on their environmental reputation, because they find that firms with more environmental disclosure usually are worse environmental performers, but have better environmental reputation measured by Dow Jones Sustainability Index.

Hummel and Schlick (2016) suggest that voluntary disclosure theory and legitimacy theory are complementary to each other, and specifically they find that superior sustainability performers increase the level of sustainability disclosures with high disclosure quality to signal the market and that in contrast, poor sustainability performers also increase the level of sustainability disclosures with low disclosure quality to mitigate the possible legal problems. Jain et al. (2016) report that non-financial ESG sustainability performance dimensions are linked to financial economic sustainability performance. Lee (2017) finds a positive link between ESG/CSR sustainability information and management earnings forecast accuracy, which intends to mitigate unethical managerial earnings manipulation and opportunistic behavior. Sethi et al. (2017) report positive association between components of sustainability such as environmental, bribery, corruption, philanthropy, and integrity assurance, and CSR reporting practices in common law tradition and high-quality legal regimes. Maniora (2017) documents that integrated reporting is a better mechanism of reporting ESG sustainability than just reporting ESG in annual reports.

In conclusion, prior research suggests that non-financial disclosure including ESG is informative and value-relevant and thus can benefit the firm and its investors in the long run. With sustainability-related investment funds amounting to trillions of dollars and anecdotal evidence and empirical research suggesting that greater numbers of investors are making investment decisions based on sustainability performance disclosures, this study contributes to the above literature by testing the association between

quantity and quality of ESG sustainability disclosures and both innate and discretionary earnings quality intended to improve reliability and trustworthiness of disclosed financial and non-financial information.

Voluntary Disclosure and Earnings Quality

Prior research has addressed the link between voluntary disclosure and earnings quality in a variety of settings. Earlier papers (e.g., Milgrom 1981; Sengupta 1998; Tasker 1998; Verrecchia 1983) suggest that voluntary disclosure is associated with worse earnings quality (substitutive relation). For example, Milgrom (1981) examines how the market interprets the good news and bad news in the information economy by developing analytical models, and finds that management fully discloses at every sequential equilibrium because investors hold a skeptical view of any information that management conceals. Verrecchia (1983) finds a similar result when the firm tries to disclose more information, because otherwise the market interprets the silence as bad news and then discounts the firm's value. Sengupta (1998) concludes that disclosure is more important where there is greater market uncertainty about the firm. This stream of research considers earnings quality as exogenous and usually uses information asymmetry to measure earnings quality. Cho et al. (2013) find that both positive (strengths) and negative (concerns) of CSR performance reduce information asymmetry. Taken together, these studies conclude that firms with lower earnings quality (higher information asymmetry) are more likely to disclose private information.

Empirical research also addresses the concern that some firms may choose to disclose sustainability performance information, while others do not make such disclosures, as well as the concern about the credibility of the sustainability disclosure, since firms may disclose different sustainability information in different channels. For example, Depoers et al. (2016) suggest that French listed firms tend to disclose significantly lower amounts of greenhouse gas but provide more explanations in the corporate reports than the Carbon Disclosure Project. Consistently, Mio et al. (2015) find that there is a discrepancy between CSR information disclosed in sustainability reports and mandatory reports generated by Italian firms.

Several studies show there is an endogenous relation between disclosure and earnings quality (Dye 1985; Francis et al. 2008; Jung and Kwon 1988; Verrecchia 1990; Waymire 1985). This research stream indicates that firms with higher earnings quality tend to disclose more information (the complementary relation). For example, using the model of voluntary disclosure provided by Verrecchia (1983, 1990) uses the precision of information observed by management to measure information quality, instead of

information asymmetry and then finds that the disclosure is positively related to the quality of private information. Francis et al. (2008) find a positive relation between voluntary disclosure using the self-constructed measurement in Botosan (1997) and earnings quality measured in terms of the accruals quality, earnings variability, and absolute abnormal accruals. Dichev et al. (2013) find that high-quality earnings are sustainable, persistent, the best predictor of future long-run earnings, and are supported by actual cash flows (innate earnings), whereas transitory earnings are non-persistent, non-sustainable, non-repeatable, and are generated through accounting accruals (discretionary earnings). Although innately sustainable earnings are desirable and considered as high-quality earnings, transitory discretionary earnings are not necessarily low quality and both are intended to reduce unethical earnings manipulation and managerial opportunistic behavior.

Taken together, prior research suggests that voluntary disclosures including ESG sustainability disclosures are either substitutable for lower earnings quality (Milgrom 1981; Sengupta 1998; Tasker 1998; Verrecchia 1983), or complementary to higher earnings quality and mandatory financial reports (e.g., Dye 1985; Francis et al. 2008; Jung and Kwon 1988; Penno 1997; Verrecchia 1990; Ball et al. 2012). Thus, these studies support the complementary relation that firms with higher earnings quality tend to release more disclosures, which enhance reliability and trustworthiness of corporate reporting. We contribute to prior research by investigating the relationship between quality and quantity of sustainability disclosures, intended to provide useful financial and non-financial information to shareholders and other stakeholders, and earnings quality aimed at mitigating unethical earnings manipulation and managerial opportunistic behavior.

Hypotheses Development

The relationship between earnings quality and sustainability disclosure quantity and quality is an important research issue because earnings quality is viewed as an important firm attribute that benefits investors and could curtail unethical earnings management (Dichev et al. 2013) and recent anecdotal and empirical evidence suggests that corporations, regulators, and investors are paying more attention to sustainability performance information when assessing firms' financial performance and earnings quality (Kiron et al. 2015; Rezaee 2015, 2016; SEC 2016; Ng and Rezaee 2015; Khan et al. 2016; Jain et al. 2016). A growing number of institutional and individual investors are considering ESG initiatives to be material to the company's financial success and more than 20% of funds

invested, amounting to 8.7 trillion, were on ESG-related strategies in 2015 (KPMG 2016). According to voluntary disclosure theory, firms signal their good news/performance through releasing sustainability reports in order to distinguish themselves from poor competitors (e.g., Lys et al. 2015; Huang and Watson 2015; Hummel and Schlick 2016). Recent empirical evidence supports voluntary disclosure theory by suggesting that firms with good ratings on material (immaterial) sustainability ESG issues, significantly outperform (not outperform) firms with poor ratings on sustainability issues (Khan et al. 2016). In contrast, according to legitimacy theory, firms tend to release the sustainability report in order to mitigate the negative effect of bad news/performance (e.g., Rezaee 2016; Hummel and Schlick 2016). We address the theoretical justification of the possible link between the quantity and quality of sustainability disclosures and the innate and discretionary components of earnings quality in two ways.

First, prior research (e.g., Ng and Rezaee 2015; Jain et al. 2016) suggests sustainability reporting, reflecting both disclosure quality and quantity, provides information pertaining to financial economic and non-financial ESG dimensions of sustainability performance as well as the related risks from managerial strategic decisions to supply chain processes, which is expected to affect and be affected by innate earnings quality. However, sustainability reporting also provides more discretion for management to signal its good sustainability performance according to the signaling/voluntary disclosure theory (Grinblatt and Hwang 1989; Healy and Palepu 2001; Kanagaretnam et al. 2007; Lys et al. 2015; Hummel and Schlick 2016). Thus, management has the incentive and discretion to selectively choose the type (quality) and extent (quantity) of voluntary non-financial ESG disclosures by releasing good and favorable sustainability performance consistent with voluntary disclosure theory while withholding unfavorable sustainability performance following legitimacy theory (Hummel and Schlick 2016).

Second, to construct our hypotheses, we apply organized hypocrisy theory and organizational façade theory suggested by Cho et al. (2015) as well as two traditional signaling/voluntary and legitimacy theories to postulate the possible relation between quality and quantity of sustainability disclosures and innate/discretionary earnings quality (Hummel and Schlick 2016). Indeed, anecdotal evidence suggests that "businesses are taking sustainability seriously and making it a part of the business strategy" (Cerruti 2013) and non-financial ESG sustainability performance affects financial economic performance and thus, stock prices and firm value (Kiron et al. 2013 and 2015). Business sustainability can also be considered by management as a greenwashing, branding, and publicity scheme to establish an intended façade in accordance with legitimacy theory and organized hypocrisy theory. Thus, management has incentive and also the ability to partially disclose or modify the desired content and tone of sustainability reports. Recent studies (Hahn and Lulfs 2014; Mio et al. 2015; Depoers et al. 2016) find that management behaves opportunistically in preparing sustainability disclosures by highlighting sustainability strengths and mitigating sustainability concerns.

In summary, the quantity of ESG sustainability disclosures: (1) could have a positive impact on innate earnings quality by providing value-relevant ESG information to the stakeholders consisting with voluntary/signaling and organized hypocrisy theories and (2) could affect discretionary earnings quality by increasing the risk of managerial opportunism to mislead investors through partial or biased disclosure of firms' sustainability concerns following legitimacy and organizational façade theories. However, we conject that sustainability disclosure quality instead of sustainability disclosure quantity may have different effects on earnings quality. First, better sustainability disclosure quality can further improve firm operations derived from preparing the sustainability disclosure and thus can strengthen the positive relation between sustainability disclosure quantity and innate earnings quality. Second, according to agency theory, requiring a higher level of standards for sustainability disclosure quality can improve monitoring and limit managerial discretion in preparing sustainability reports and thus alleviates the negative relation between sustainability disclosure quantity and discretionary earnings quality. Third, according to legitimacy theory, firms which prepare voluntary sustainability disclosures with better quality have moral motivation to satisfy the social norms and values and thus they are less likely to engage into earnings management.

Prior research provides support for our two propositions as stated above, that earnings is important to investors and non-financial performance indicators (ESG disclosures) in addition to financial earnings affect stock prices (Dechow et al. 2013; Amir and Lev 1996; Trueman et al. 2001) and non-financial components of earnings are less persistent than financial components (Lipe (1986). Ioannou and Serafeim (2011) argue that sustainability disclosures can have two effects of increasing transparency sustainability performance information and improving managerial practices that lead to better relationships between management and all stakeholders. Thus, when managerial sustainability practices are improved and transparency is high, earnings should be more informative and earnings quality should also be high. We posit that the quality of sustainability disclosure is associated with better innate earnings quality, which is driven from firms' fundamental factors as well as the discretionary earnings quality triggered by management's opportunistic behavior. Therefore, we develop the

following two hypotheses regarding the relation between innate/discretionary earnings quality sustainability disclosure quality and quantity:

H1a There is a positive association between ESG sustainability disclosure quantity and innate earnings quality.

H1b There is a negative association between ESG sustainability disclosure quantity and discretionary earnings quality.

H2a There is a positive association between ESG sustainability disclosure quality and innate earnings quality.

H2b There is a positive association between ESG sustainability disclosure quality and discretionary earnings quality.

Sample Selection and Matching Procedure

We collect sustainability reporting data (quality and quantity of disclosures) from the GRI[5] database. The GRI provides a list of organizations releasing sustainability reports since 2000 and also evaluates the quality of sustainability reports based on the GRI Sustainability Reporting Framework. Although the GRI provides the information of sustainability reports released by organizations worldwide, we only use the data of sustainability reports released by corporations in the USA.[6] We also collect fundamental variables and stock market performance from the COMPUSTAT and CRSP database, respectively. In our main test, we implement the OLS regression to test the relation between innate (discretionary) earnings quality and sustainability disclosure quantity/quality. After merging databases, our final sample of OLS regressions without missing values include 35,110 firm-year observations between 1999 and 2015, including 1180 firm-year releasing sustainability reports.

We also employ a matching procedure for difference-in-difference (DID) tests[7] due to following reasons. First, our main independent variable, whether the firm issues the sustainability report reflecting disclosure quantity, is the dummy variable, and thus we cannot construct the interaction term between sustainability disclosure quality and sustainability disclosure quantity, since only firms with sustainability disclosure will be given the disclosure quality scores. However, we can test the integrated effect of the

quality and quantity of sustainability disclosure on earnings quality (H1 and H2) in the DID context. Second, earnings quality may be sticky at the firm level and solve the possible stickiness of earnings quality, we use the DID method to investigate whether there is a change in earnings quality before and after the significant change in sustainability disclosure. Finally, GRI issued the G4 guideline after 2012, which reforms the format of sustainability disclosures by combining the economic sustainability disclosure and ESG sustainability disclosure. This GRI guideline reform provides a natural exogeneity for the DID test. Therefore, in addition to the OLS regression tests, we perform the DID test, respectively, for the pre-G4 period and the post-G4 period to test the relation between earnings quality and sustainability disclosure.

We use the propensity score matching method to construct the matched DID group. To construct our propensity score, we first calculate the conditional probability of the treatment (the decision to issue the sustainability report in the given sample year) on the following cofounding variables, including institutional ownership, the number of financial analysts following, managers' incentive measured by managers' ownership, firm size, return on asset, and book-to-market ratio. After getting the predicted value of treatment from the first step regression, we match our sample firms with disclosing sustainability reports against sample firms without disclosing sustainability reports during the same year and in the same SIC three-digit industry based on the nearest neighbor of propensity score. We believe our matching procedure based on propensity score can rule out the influences of many other factors and can attribute the changes in earnings quality to the release of sustainability reports.

Methodology

Sustainability Disclosure Quality and Quantity

Following (Dhaliwal et al. 2011, 2012), we employ a dummy variable to proxy the firms' sustainability disclosure quantity. Disclose is equal to 1 if the firm releases a sustainability report in the sample year and the report has been recorded in the GRI database. Otherwise Disclose is equal to zero. To measure the quality of sustainability disclosure, we construct two measurements: First, we determine whether the sustainability report is produced based on the GRI Framework.[8] The GRI Framework

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[5] The GRI is a not-for-profit organization which "promotes the use of sustainability reporting as a way for organizations to become more sustainable and contribute to sustainable development".

[6] We limited our sample to US companies that could construct both innate and discretionary earnings quality.

[7] DID is a more effective technique when explaining a casual relation and data of certain control variables are not available.

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[8] According to the introduction on the GRI website, "GRI's mission is to make sustainability reporting standard practice for all companies and organizations. Its Framework is a reporting system that provides metrics and methods for measuring and reporting sustainability-related impacts and performance." GRI has already released several

includes guidelines and other resources that help organizations report a systematic disclosure of their ESG and economic sustainability performance and also improve the usefulness of disclosure that can be easily used and understood by shareholders and other stakeholders (potential investors, financial analysts, experts, labor, civil society, and government). The GRI database evaluates whether the sustainability reports follow the GRI Framework and classifies the sustainability reports into seven ranks, including following G1, following G2, following G3, following G3.1, following G4, following GRI only referenced, and non-following GRI. Our first disclosure quality variable (DIS_Q1) is equal to 1 if the firms release sustainability reports following GRI Framework G1, G2, G3, G3.1 or G4. The variable (DIS_Q1) is equal to 0 if the firms release sustainability reports which are not based on any GRI Framework or which only mention the GRI Framework as reference. We examine whether those sustainability reports following GRI Frameworks have better disclosure quality than those reports which don't follow any GRI Framework.

The second measurement of disclosure quality (DIS_Q2) is how disclosing firms apply GRI Frameworks in preparing their sustainability reports. GRI classifies the sustainability reports' application level of GRI Frameworks into 11 ranks. We give corresponding scores to each firm based on their application level. We respectively give 1–9 scores to each firm with application level as "Undeclared", "Reference Only", "In Accordance" or "In accordance—Core", "Content Index Only", "C", "C+", "B", "B+", "A" and "A+". Higher scores indicate a better application level of GRI Framework and thus better disclosure quality. In the robustness test, we also use the third measure of sustainability quality of whether sustainability reports were accompanied by an assurance report provided by either internal or external assurance providers as well as the type of the assurance report.

Earnings Quality

We employ a modified Dechow and Dichev (2002) approach as the measurement of earnings quality. Following McNichols (2002), Dechow and Dichev (2002) and Francis et al. (2005), we estimate the following cross-sectional regression for each firm-year:

$$\frac{TCA_t}{Assets_t} = \phi_0 + \phi_1 \frac{CFO_{t-1}}{Assets_t} + \phi_2 \frac{CFO_t}{Assets_t} + \phi_3 \frac{CFO_{t+1}}{Assets_t} + \phi_4 \frac{\Delta S_t}{Assets_t} + \phi_5 \frac{PPE_t}{Assets_t} + \varepsilon_1 \tag{1}$$

where TCA_t is the total current accrual in year t, $Assets_t$ is the average total assets in year t and year $t-1$, and CFO_{t-1}, CFO_t, and CFO_{t+1} are, respectively, cash flow from year $t-1$, t, and $t+1$, measured as total accruals minus net income before extraordinary items and discontinued operations. We obtain residuals from the above regression (1) for each firm and each year. Our second variable of earnings quality (EQ) is the standard deviation of the residuals during the 5-year period prior to the year t.

To investigate the relationship between earnings quality and voluntary disclosure, we also distinguish the innate and discretionary earnings quality. Following Moon Jr. (2014), the innate (discretionary) earnings quality refers to the degree of estimation error attributable (not attributable) to the inherent firm trait. Therefore, innate earnings quality is associated with the inherent operating uncertainty, such as firms' cash flow or sales volatility. In contrast, discretionary earnings quality reflects the management discretionary behaviors. Therefore, the innate earnings quality (IEQ) is the predicted value, and the discretionary earnings quality (DEQ) is the residual from the Eq. (2) developed by Francis et al. (2008) and Moon Jr. (2014).

$$\begin{aligned} EQ = {} & \beta_0 + \beta_1 SIZE + \beta_2 CFVOL + \beta_3 SALEVOL \\ & + \beta_4 OPCYCLE + \beta_5 NEG + \beta_6 INT + \beta_7 INTDUM \\ & + \beta_8 CAP + \varepsilon \end{aligned} \tag{2}$$
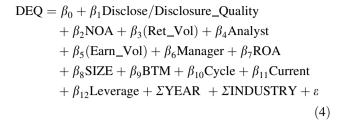
This equation regresses earnings quality on inherent firm traits, including firm size (SIZE) (defined as the natural logarithm of total assets), cash flow volatility (CFVOL), sales volatility (SALEVOL), operating cycle (OPCYCLE) (defined as the natural logarithm of operating cycle), the frequency of negative earnings realizations during the previous 5 years (NEG), intangible assets scaled by total assets[9] (INT), and capital expenditures scaled by total assets (CAP). Specifically, CFVOL (SALEVOL) is the standard deviation of cash flows (sales) scaled by total assets over the previous 5 year window. We also include a dummy variable (INTDUM), if research and development expenditure or advertising expenditure is missing. To run the regression of Eq. 2, we winsorize all variables based on the top and bottom 1 percentile level, except dummy variables. Following Moon Jr. (2014), we also implement

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Footnote 8 continued

versions of sustainability reporting frameworks, including G1, G2, G3, G3, and G4. The G1 is the earliest version and implemented by sustainability reports released in early twenty-first century. G4 is the latest version of GRI Framework and employed by most recent sustainability reports.

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[9] Following Moon Jr. (2014), intangible assets are measured as the sum of R&D expenditures and advertisement expenditures, and missing values are set to zero.

the BOX–COX transformation method to improve the linear fit of the Model 2. Finally, we multiply EQ, IEQ, and DEQ by −1 except in Eq. 2, and thus the higher the value of EQ, IEQ, and DEQ, the better the quality.

We also employ several control variables associated with the costs of accrual earnings managements.[10] First, the flexibility of firms' accounting systems influences the accruals level. Following Barton and Simko (2002), we use net operating assets at the beginning year (NOA_{t-1}) to proxy managers' accounting choice. If firms have more net operating assets at the year beginning, the firms have less pressure to manipulate accruals and thus have better earnings quality. Following Zang (2012), we measure NOA as 1 if a firm's net operating assets at the year beginning scaled by beginning sales are above the median of the corresponding industry's net operating assets, 0 otherwise. Second, because prior research suggests the information environment influences managerial strategy of dealing with accrual earnings, we, respectively, use previous 5-year stock return volatility (Ret_Vol), previous 5-year earnings volatility (Earn_Vol), and the number of financial analyst following (Analyst) to measure the information environment faced by management. We also use the firm operating cycle (Cycle) to measure the flexibility of firms' accounting system. Firms with a longer operating cycle in accounts receivables and inventories will have more flexibility in accruals management and thus have higher likelihood of lower earnings quality. Moreover, executives also play a very important role in affecting the firm's earnings quality. We measure the management incentive to engage in discretional behaviors and thus to influence earnings quality using the percentage of stock shares owned by management (Manager). Finally, we include the natural logarithm of total assets (SIZE), book-to-market ratio at the beginning year (BTM), return on assets (ROA), current assets to total assets ratio (Current), and the leverage ratio (LEV) to control for firm financial attributes. We control year fixed effect for macroeconomy condition and Fama–French 48 industry fixed effect for industry tradition. To test our hypotheses, we construct following regressions:

$$
\begin{aligned}
IEQ = {} & \beta_0 + \beta_1 \text{Disclose/Disclosure\_Quality} \\
& + \beta_2 \text{NOA} + \beta_3 (\text{Ret\_Vol}) + \beta_4 \text{Analyst} \\
& + \beta_5 (\text{Earn\_Vol}) + \beta_6 \text{Manager} + \beta_7 \text{ROA} \\
& + \beta_8 \text{SIZE} + \beta_9 \text{BTM} + \beta_{10} \text{Cycle} + \beta_{11} \text{Current} \\
& + \beta_{12} \text{Leverage} + \Sigma \text{YEAR} + \Sigma \text{INDUSTRY} + \varepsilon
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
DEQ = {} & \beta_0 + \beta_1 \text{Disclose/Disclosure\_Quality} \\
& + \beta_2 \text{NOA} + \beta_3 (\text{Ret\_Vol}) + \beta_4 \text{Analyst} \\
& + \beta_5 (\text{Earn\_Vol}) + \beta_6 \text{Manager} + \beta_7 \text{ROA} \\
& + \beta_8 \text{SIZE} + \beta_9 \text{BTM} + \beta_{10} \text{Cycle} + \beta_{11} \text{Current} \\
& + \beta_{12} \text{Leverage} + \Sigma \text{YEAR} + \Sigma \text{INDUSTRY} + \varepsilon
\end{aligned}
\tag{4}
$$

where IEQ refers to innate earnings quality and DEQ refers to discretionary earnings quality (DEQ). Disclose indicates whether the firm discloses sustainability report as a proxy for sustainability disclosure quantity. Disclosure_Quality refers alternatively to whether firms prepare sustainability reports following the GRI Framework (DIS_Q1) or the application level of GRI Framework (DIS_Q2) as a proxy for sustainability disclosure quality.

Empirical Results

OLS Regression Results

Table 1 illustrates the descriptive statistics of the OLS sample. There are in total 35,110 sample firm-year observations between 1999 and 2015. Among these, there are 1180 firm-year, which disclose at least one sustainability report during the sample year. Table 2 describes the Pearson correlation for the OLS sample. We find that firms that issue sustainability reports (Disclose) are positively associated with innate earnings quality (IEQ) and negatively associated with discretionary earnings quality (DEQ) as expected. Moreover, the disclosure quality measured by whether firms follow the GRI guideline to issue sustainability reports (DIS_Q1) is significantly and positively associated with innate earnings quality, and in contrast is negatively associated with discretionary earnings quality, but the correlation is insignificant at the 5% level. Another disclosure quality measured by the application level of the GRI guideline in preparing sustainability reports is significantly and positively associated with both innate earnings quality and discretionary earnings quality. We further examine the relationship between innate (discretionary) earnings quality, sustainability disclosure quantity, and sustainability disclosure quality in the multivariate regression tests. We conduct multicollinearity diagnostic tests for all variables in the models and review the VIFs for each variable. There is no evidence of any multicollinearity concerns that would affect our inferences.

Table 3 provides some evidence for our main hypotheses. In the Panel A, we investigate the relation between sustainability disclosure quantity/quality and innate earnings quality. First, we find that releasing sustainability reports in the sample year (Disclose) is significantly and

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[10] Consistent with prior studies (e.g., Kim et al. 2012; Demerjian et al. 2012), we don't control firms' previous achievement of earnings targets, because the relation between benchmark meeting and earnings management has not yet obtained a conclusive agreement.

Table 1 Descriptive statistics for OLS regression sample

Variables	Mean	Median	SD	25 Pctl	75 Pctl
IEQ	3.8789	3.9484	1.1753	3.0033	4.7314
DEQ	−0.0984	−0.0767	1.7230	−1.1829	1.0089
NOA	0.4960	0.0000	0.5000	0.0000	1.0000
Ret_Vol	0.1561	0.1359	0.0859	0.0950	0.1948
Analyst	6.2647	2.0000	9.4043	0.0000	9.0000
Earn_Vol	0.1380	0.0446	0.3274	0.0194	0.1143
SIZE	5.9675	6.0617	2.5420	4.1198	7.8500
ROA	−0.0699	0.0292	0.3888	−0.0414	0.0698
BTM	0.5366	0.4958	1.1875	0.2610	0.8404
Cycle	4.0536	4.2131	0.9835	3.6736	4.6165
Current	0.4711	0.4657	0.2495	0.2645	0.6665
LEV	0.2262	0.1691	0.2594	0.0133	0.3298

This table illustrates the descriptive statistics for OLS regression sample which includes 35,110 firm-year between 1999 and 2015. The descriptions of all the variables contained in this table can be found in the "Appendix"

positively correlated with the IEQ (Coefficient = 0.3092, P value <0.0001). This suggests that sustainability disclosure quantity is associated with better innate earnings quality. Second, results reveal an insignificant but positive correlation between following the GRI framework (DIS_Q1) and IEQ (Coefficient = 0.0574, P value = 0.1008) as well as a significant and positive correlation between the application level of the GRI framework (DIS_Q2) and IEQ (coefficient = 0.0028 and P value <0.0037).[11] Therefore, consistent with our conjecture, the sustainability disclosure quantity and/or the application level of the GRI framework reflecting sustainability disclosure quality are positively associated with innate earnings quality.

In the Panel B of Table 3, we investigate the relation between sustainability disclosure quantity/quality and discretionary earnings quality. First, results presented in Panel B show that the release of sustainability reports (disclosure quantity) is significantly and negatively correlated with discretionary earnings quality (coefficient = −0.0766, P value = 0.0413). This suggests that sustainability disclosure quantity is associated with worse discretionary earnings quality due to more managerial discretion. Second, we find that following the GRI framework in preparing sustainability disclosure quality (DIS_Q1) is significantly correlated with better discretionary earnings quality (coefficient = 0.0343, P value <0.0001). Finally,

we find that the application level of GRI framework in preparing sustainability disclosures is significantly and positively correlated with discretionary earnings quality (coefficient = 0.0372, P value = 0.0190). Therefore, the results of the OLS regression support our hypotheses that although sustainability disclosure quantity is associated with worse discretionary earnings quality, whereas sustainability disclosure quality in following the latest GRI framework in preparing sustainability disclosure and stricter application of the GRI framework in preparing sustainability disclosure can limit managerial discretion and thus is associated with better discretionary earnings quality. The findings fit the contrasting two theories of voluntary disclosures. On the one hand, the signaling theory suggests that firms have the incentive to voluntarily signal their good news to the public. However, the rewards of voluntary disclosure from financial markets may also encourage managers of "bad" firms to mimic the "good" firms' strategy by disclosing unverified information with less credibility (Clarkson et al. 2008). Therefore, the increase in quantity of sustainably disclosure may aggravate agency problem and thus reduce the discretionary earnings quality. On the other hand, according to the legitimacy theory, to conform to societal expectations "good" firms tend to disclose truthful and verified information which cannot be easily mimicked by "bad" firms (Clarkson et al. 2008). Therefore, the increase in quality of sustainability disclosure tends to mitigate agency problem and thus improve the discretionary earnings quality.

DID Test Results

We implement the DID method to conduct additional robustness tests for three reasons. First, DID tests can investigate the moderator or mediator role of sustainability disclosure quality in the relation between earnings quality and the sustainability disclosure quantity, because the sustainability disclosure quantity is a dummy variable and we cannot directly construct the interaction term between the quantity and quality of sustainability disclosures. Second, based on the OLS empirical results, our measure of sustainability disclosure quality of whether firms follow the GRI guideline to prepare a sustainability report (DIS_Q1) is not significantly correlated with innate earnings quality (IEQ). To test whether the form of the GRI guideline proxies the quality of sustainability disclosures, we implement the DID tests by investigating the change in earnings quality before and after the issuance of the G4 Guideline. The GRI issued the G4 Guideline for sustainability report preparers after 2012 and encourages firms to generate more reliable and relevant sustainability information for decision making. Therefore, pre-G4 and post-G4 are the natural exogenous factors which may suggest

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[11] When we test the relation between disclosure quality and earnings quality, the sample size is significantly reduced to 1180, since only sample firm-year which disclose sustainability reports contain the variables of disclosure quality.

Table 2 Pearson correlations for the OLS regression sample

	IEQ	DEQ	Disclose	DIS_Q1	DIS_Q2	NOA	Ret_Vol	Analyst
IEQ	1***							
DEQ	0.0017	1						
Disclose	0.0867***	−0.0428***	1					
DIS_Q1	0.1092***	−0.0403	0.2376*	1				
DIS_Q2	0.0512**	0.0423**	0.1645*	0.5620***	1			
NOA	0.1338***	0.0099**	0.0175***	−0.0722*	−0.0280**	1		
Ret_Vol	−0.5732***	−0.0145***	−0.1464***	0.0401	0.0916***	−0.1002***	1	
Analyst	0.2381***	−0.0487***	0.3216***	−0.0103	−0.0036	0.0999***	−0.2665***	1
Earn_Vol	−0.4564***	−0.1331***	−0.0516***	0.0415	0.0643**	−0.1409***	0.4063***	−0.1422***
Manager	0.1071***	−0.0417***	0.0164***	0.0489**	0.0653**	0.0287***	−0.1204***	0.1578***
SIZE	0.6987***	0.0541**	0.2375***	0.0764***	0.0386	0.1664***	−0.5263***	0.5038***
ROA	0.4481***	0.0174***	0.0521***	0.0727***	0.0386	0.0762***	−0.3637***	0.1551***
BTM	0.1161***	0.0952***	−0.0170***	−0.0432	−0.0406	0.1520***	−0.0716***	−0.0424***
Cycle	−0.3033***	−0.0146***	−0.0404***	−0.0702**	−0.0520**	0.1936***	0.0968***	−0.0685***
Current	−0.5646***	0.0739***	−0.0855***	0.0402	0.0388	−0.2405***	0.3072***	−0.1325***
LEV	−0.0603***	−0.0104**	0.0078**	−0.1274***	−0.0650**	0.0465***	0.0035	−0.0132***

	Earn_Vol	Manager	SIZE	ROA	BTM	Cycle	Current	LEV
IEQ								
DEQ								
Disclose								
DIS_Q1								
DIS_Q2								
NOA								
Ret_Vol								
Analyst								
Earn_Vol	1							
Manager	−0.0657***	1						
SIZE	−0.4134***	0.1038***	1					
ROA	−0.5506***	0.0743***	0.4178***	1				
BTM	−0.2429***	−0.0035	0.0647***	0.1404***	1			
Cycle	0.0414***	−0.0118***	−0.1849***	−0.0565***	0.0616***	1		
Current	0.1929***	0.0129***	−0.4980***	−0.1480***	−0.0226***	0.3488***	1	
LEV	0.0976***	−0.0455***	0.0844***	−0.2089***	−0.2434***	−0.1358***	−0.3081***	1

This table illustrates the Pearson correlations for OLS regression sample which includes 35,110 firm-year between 1999 and 2015. The descriptions of all the variables contained in this table can be found in the "Appendix". The *P* values are presented below the univariate values. Since only sample firms which disclose sustainability reports will be evaluated for their disclosure quality, the two variables of disclosure quality, DIS_Q1 and DIS_Q2, have no valid correlations with the dummy variable, Disclose, whether the firm disclose at least one sustainability report during the sample year

*,**,*** Respectively indicate that the mean difference is significant at 10, 5 and 1% level

the causal effect of disclosure quality on the relation between earnings quality and sustainability disclosure. Finally, the DID test can investigate our hypotheses even though each firm's earnings quality is usually sticky.

Table 4 provides the descriptive statistics and Pearson correlation for the DID sample. Panel A provides the descriptive statistics for the dependent variables examined in the DID test, including earnings quality (EQ), innate earnings quality (IEQ), and discretionary earnings quality (DEQ). Panel B displays the Pearson correlation among the different components of earnings quality. We find that total earnings quality is significantly and positively correlated with either innate earnings quality or discretionary earnings quality. Consistent with Moon Jr. (2014), we find that

Table 3 The relation between earnings quality and sustainability report

	Dependent variable = IEQ					
	Coefficient	P value	Coefficient	P value	Coefficient	P value
Panel A: Innate earnings quality and sustainability disclosure						
Intercept	4.3333	<0.0001	6.2986	<0.0001	6.0450	<0.0001
Disclose	0.3092	<0.0001				
DIS_Q1			0.0574	0.1008		
DIS_Q2					0.0028	0.0037
NOA	0.0443	<0.0001	0.0528	0.014801	0.0645	0.00287
Ret_Vol	−2.5043	<0.0001	−2.3148	<0.0001	−2.9518	<0.0001
Analyst	0.0026	<0.0001	0.0020	0.0496	0.0153	<0.0001
Earn_Vol	−0.8689	<0.0001	−7.8713	<0.0001	−7.1600	<0.0001
Manager	2.8549	<0.0001	0.0535	0.0301	0.0504	0.0637
SIZE	0.1358	<0.0001	0.1270	<0.0001	0.1350	<0.0001
ROA	0.5365	<0.0001	0.9229	<0.0001	0.9937	<0.0001
BTM	−0.0147	0.0009	−0.0524	0.0239	−0.0629	0.0353
Cycle	−0.1100	<0.0001	−0.0189	0.0488	−0.0223	0.04722
Current	−0.8202	<0.0001	−1.7675	<0.0001	−1.5088	<0.0001
LEV	−0.0750	0.0002	−0.8721	<0.0001	−0.6597	0.0004
Year fixed effect	Yes		Yes		Yes	
Industry fixed effect	Yes		Yes		Yes	
Adjusted R^2	0.6391		0.5828		0.5776	
Observations	35,110		1180		1180	

	Dependent variable = DEQ					
	Coefficient	P value	Coefficient	P value	Coefficient	P value
Panel B: Discretionary earnings quality and sustainability report						
Intercept	−0.0777	0.5519	−0.4630	0.4054	−0.5420	0.3733
Disclose	−0.0766	0.0413				
DIS_Q1			0.0343	<0.0001		
DIS_Q2					0.0372	0.0190
NOA	0.0315	0.1143	0.0317	0.0151	−0.1842	0.1128
Ret_Vol	−0.0326	0.7771	−0.1716	0.3390	0.1270	0.0243
Analyst	0.0069	<0.0001	0.0166	<0.0001	0.0113	0.0202
Earn_Vol	−0.4565	<0.0001	−2.0159	0.0133	−2.4805	0.0766
Manager	−1.3963	<0.0001	−2.7710	0.0389	−1.5684	0.0594
SIZE	0.0603	<0.0001	0.1566	<0.0001	0.1391	0.0071
ROA	0.5997	<0.0001	−1.6142	<0.0001	−2.0946	<0.0001
BTM	0.0423	<0.0001	0.1336	<0.0001	0.1765	0.0021
Cycle	−0.1207	<0.0001	−0.1272	<0.0001	−0.1679	0.0098
Current	0.1534	0.0053	0.6454	0.0202	0.6072	0.0488
LEV	−0.0096	0.8166	−0.4824	0.4362	−0.6247	0.1164
Year fixed effect	Yes		Yes		Yes	
Industry fixed effect	Yes		Yes		Yes	
Adjusted R^2	0.3220		0.6572		0.6118	
Observations	35,110		1180		1180	

This table illustrates the relation between earnings quality and sustainability report. In the Panel A the dependent variable is innate earnings quality, and in the Panel B the dependent variable is discretionary earnings quality. In the first column, we test the relation between earnings quality and the issuance of sustainability report. In the second column, we test whether the firm follows any GRI guideline to prepare the sustainability report is associated with earnings quality. In the last column, we test the relation between the application level of GRI guideline in preparing sustainability report and the firm's earnings quality. Other variables are explained in the "Appendix". All the P values are presented after clustering standard errors at the firm-level and year-level

innate earnings quality and discretionary earnings quality are not significantly and highly correlated to each other. This suggests that our measurements of innate earnings quality and discretionary earnings quality are valid, because the independent variable, IEQ, is not correlated with the residual, DEQ, in Eq. 2. Panel C displays the regression results of Eq. 2 after the BOX–SOX transformation. Our regression results are consistent with prior research, and we find that firm size and the capital expenditure ratio are significantly and negatively correlated with total earnings quality and that cash flow volatility, sales volatility, frequency of negative earnings, and intangible assets ratio are significantly and positively correlated with total earnings quality. This suggests our measurements of different components of earnings quality are valid.

The main results of DID tests are presented in Table 5. In Panel A, we investigate how the difference in earnings quality between disclosing firms and matched nondisclosing firms changes before and after the issuance of the G4 guideline. There are in total 785 sample firm-year disclosing sustainability reports before the release of G4 guideline (between year 1999 and 2012) and 602 sample firm-year disclosing sustainability reports after the release of G4 guidelines (between year 2013 and 2015). Then using propensity score method mentioned before, we, respectively, find 785 matched nondisclosing firm-year during pre-G4 period and 602 matched nondisclosing firm-year during post-G4 period. Because pre-G4 period and post-G4 period have different quantities of sample firm-year, we calculate the average innate earnings quality and average discretionary earnings quality before and after the release of the G4 guideline for each sample firm and its matched firm/firms. There are 182 sample firms that disclose sustainability reports in both pre-G4 and post-G4 period. Thus final sample size for our DID tests in the Panel A is 182.

First, we find that disclosing firms have higher innate earnings quality compared to nondisclosing firms in the post-G4 period (Mean $\text{IEQ}_{\text{disclosing–nondisclosing, post-G4}} = 0.1259$, P value $= 0.0228$) and disclosing firms have insignificantly lower innate earnings quality compared to nondisclosing firms in the pre-G4 period (Mean $\text{IEQ}_{\text{disclosing–nondisclosing, pre-G4}} = -0.018$, P value $= 0.6594$). Moreover, the mean difference in innate earnings quality between disclosing firms and nondisclosing firms post G4 is greater than the mean difference pre G4 and the mean difference is significant at the 10% level (Mean $\text{IEQ}_{\text{disclosing–nondisclosing, post-G4}} -$ Mean $\text{IEQ}_{\text{disclosing–nondisclosing, pre-G4}} = 0.0859$, P value $= 0.0743$). This suggests that the positive relation between innate earnings quality and sustainability disclosure is strengthened by the higher disclosure quality due to the

issuance of the G4 guideline. Second, the results show that disclosing firms have an insignificantly higher discretionary earnings quality compared to nondisclosing firms in the post-G4 period level (Mean $\text{DEQ}_{\text{disclosing–nondisclosing, post-G4}} = 0.0291$, P value $= 0.6468$). However, in the pre-G4 period, disclosing firms have significantly lower discretionary earnings quality compared to nondisclosing firms (Mean $\text{DEQ}_{\text{disclosing–nondisclosing, pre-G4}} = -0.2327$, P value $= 0.0022$). The change of the difference in discretionary earnings quality before and after the issuance of the G4 guideline is significant at the 5% level (Mean $\text{DEQ}_{\text{disclosing–nondisclosing, post-G4}} -$ Mean $\text{DEQ}_{\text{disclosing–nondisclosing, pre-G4}} = 0.1948$, P value $= 0.0432$). This suggests that the negative relation between innate earnings quality and sustainability disclosure is more pronounced before the issuance of G4 guideline. In conclusion, Panel A illustrates that the firms that issue sustainability reports in the post-G4 period tend to improve their sustainable operations and pay more attention to firm long-term performance, and thus they experience a greater amount of the increase in the innate earnings quality and a smaller amount of the decrease in discretionary earnings quality.

Panel B shows how the change in the disclosure quality proxied by the application level of the GRI guideline in preparing the sustainability report tends to influence the relation between earnings quality and sustainability disclosure quantity. We construct subsamples based on whether the disclosing firms experience the improvement in the application level of the GRI guideline. We expect that firms demonstrating better application of the GRI guideline to their sustainability report tend to have better quality of sustainability disclosure, and thus disclosing firms are expected to have better (worse) disclosure quality after (before) they increase the application level of the GRI guideline. First, the DID results of Panel B suggest that post-improvement, disclosing firms tend to have higher innate earnings quality than nondisclosing firms post-improvement (Mean $\text{IEQ}_{\text{disclosing–nondisclosing, after increase}} = 0.2601$, P value $= 0.0153$), whereas we do not find that disclosing firms have significantly higher innate earnings quality than nondisclosing firms pre-improvement. The increase in innate earnings quality after firms improve their application level of the GRI guideline is significantly greater than the increase in innate earnings quality before improving their application level (Mean $\text{IEQ}_{\text{disclosing–nondisclosing, after increase}} -$ Mean $\text{IEQ}_{\text{disclosing–nondisclosing, before increase}} = 0.2225$, P value $= 0.0284$). This suggests that disclosing firms compared to nondisclosing firms experience an increase in innate earnings quality, and such an improvement is more pronounced if firms improve the GRI guideline application level when they prepare the sustainability report. Second, we find that after improving the GRI guideline application level, disclosing firms do not have a significantly different discretionary

Table 4 Descriptive statistics and Pearson correlation for DID test

Variable	Mean	Median	SD	25th Pctl	75th Pctl
Panel A: Descriptive statistics					
EQ	4.1506	4.2624	2.3500	2.4091	5.6715
IEQ	4.4676	4.5343	1.0999	3.8348	5.2297
DEQ	−0.3091	−0.1668	2.0286	−1.6697	1.1180

	EQ	IEQ	DEQ
Panel B: Pearson correlation			
EQ	1		
IEQ	0.4623***	1	
DEQ	0.8763***	−0.0136	1

Variables	Coefficient	P value
Panel C: Validity test of measurements of earnings quality		
Intercept	−3.0010	<0.0001
SIZE	−0.4253	<0.0001
CFVOL	0.0051	<0.0001
SALEVOL	0.0019	<0.0001
OPCYCLE	−0.0441	0.6319
NEG	0.6397	<0.0001
INT	3.5026	<0.0001
INTDUM	−0.0325	0.8188
CAP	−15.0222	<0.0001
Year fixed effect	Yes	
Industry fixed effect	Yes	
Adjusted R^2	0.3165	
Observations	35,110	

This table describes the descriptive statistics and Pearson correlation for variables examined in the DID test. Panel A provides the descriptive statistics. Panel B displays the Pearson correlation among the variables examined in the DID test. Panel C tests the validity of measurements of earnings quality (EQ). The innate earnings quality (IEQ) is the predicted value of the regression and the discretionary earnings quality (DEQ) is the residual obtained from the regression. We use the BOX–COX transformation method to improve the linear fit of model, following Francis et al. (2008) and Moon Jr. (2014)

earnings quality compared to nondisclosing firms. In contrast, disclosing firms, prior to improving their guideline application level, have a significantly lower discretionary earnings quality compared to nondisclosing firms at the same period (Mean DEQ$_{disclosing–nondisclosing, \text{ after increase}}$ = −0.2228, P value = 0.0844). This change of the difference in discretionary earnings quality before and after the increase in application level is significantly positive at the 5% level (Mean DEQ$_{disclosing–nondisclosing, \text{ after increase}}$ − Mean DEQ$_{disclosing–nondisclosing, \text{ before increase}}$ = 0.3107, P value = 0.0245). This suggests that the negative effect on discretionary earnings quality due to sustainability reporting is

reduced if firms increase their application level of the GRI guideline in preparing the sustainability disclosure.

In conclusion, through employing the DID method based on propensity score matching, we investigate whether disclosure quality influences the relation between innate earnings quality and sustainability disclosure quantity and the relation between discretionary earnings quality and sustainability disclosure quantity. We, respectively, use the issuance of the advanced version of the GRI guideline (before and after the issuance of G4 guideline) and the change in the GRI guideline application level (before and after the increase in application level) to proxy the disclosure quality. We find that better disclosure quality proxied by the two measures tends to strengthen the positive relation between innate earnings quality and sustainability disclosure quantity and mitigate the negative relation between discretionary earnings quality and sustainability disclosure quantity. We also conduct robustness tests by employing the DID method based on both firm size and firm performance. Following Barth et al. (2012), we first match the firms which disclose at least one sustainability report according to the GRI database (Disclosing Firms) with firms which never disclose sustainability reports according to the GRI database (nondisclosing Firms) in the same industry (three-digit SIC code). Then we match disclosing firms and those nondisclosing firms based on market value to mitigate the cost of capital and other economic differences unattributable to sustainability disclosure. We select the matched nondisclosing firms with market value closest to the disclosing firms' market value. Finally, the untabulated results of sensitive tests suggest similar conclusions.

Additional Tests

Alternative Measurements of Disclosure Quality

As mentioned before, in the robustness tests, we also use alternative variables to measure the sustainability disclosure quality. First, we use whether the disclosing firms' sustainability reports are accompanied by external assurance to proxy the disclosure quality. Second, we also use whether the disclosing firms' sustainability reports are assured by accounting firms to proxy the disclosure quality.[12] We conjecture that sustainability reports assured by external parties and/or assured by accounting firms tend to have higher disclosure quality and thus the disclosure of

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[12] The external assurance and accounting firm assurance data are also available in the GRI database. However, these two variables are provided by GRI since 2014. Therefore, the sample sizes are quite small when we implement the two alternative measurements of disclosure quality.

Table 5 DID test of earnings quality for the firms with high or low disclosure quality

	IEQ	DEQ
Panel A: Before and after the issuance of G4 sustainability report guideline		
Disclosing firms: after G4	4.6547	−0.2298
Nondisclosing matched firms: after G4	4.5288	−0.2589
Difference (1)	0.1259**	0.0291
Disclosing firms: before G4	4.3824	−0.5213
Nondisclosing matched firms: before G4	4.4003	−0.2886
Difference (2)	−0.018	−0.2327***
Difference in earnings quality change after versus before G4 (1)–(2)	0.0859*	0.1948**
Panel B: Before and after the increase in the application level of guideline to prepare sustainability report		
Disclosing firms: after the increase in the application level	4.5896	−0.2196
Nondisclosing matched firms: after the increase in the application level	4.3295	−0.2774
Difference (1)	0.2601**	0.0578
Disclosing firms: before the increase in the application level	4.4046	−0.4787
Nondisclosing matched firms: before the increase in the application level	4.3669	−0.2260
Difference (2)	0.0376	−0.2528*
Difference in earnings quality change after versus before the		
Increase in the application level (1)–(2)	0.2225**	0.3107**

This table introduces the difference-in-difference test results of the relation between earnings quality and sustainability report. In the Panel A, we test the difference in earning quality for both disclosing and nondisclosing match firms before and after the release of G4 Guideline. Before the release of G4 Guideline (between 1999 and 2012), there are, respectively, 785 disclosing firm-year and 785 nondisclosing matched firm-year. After the release of G4 Guideline (between 2013 and 2015), there are, respectively, 602 disclosing firm-year and 602 nondisclosing matched firm-year. Then we compare the sample firm's average earnings quality before the release of G4 guideline to their average earnings quality after the release of G4 guideline. There are 182 sample firms that disclose sustainability reports in both pre-G4 and after-G4 period

In the Panel B, we test the difference in earnings quality for both disclosing and nondisclosing matched firms before and after the improvement in the application level of guideline in preparing sustainability report. There are in total 168 sample firm-year which experiences an improvement in the application level of guideline between 1999 and 2015. We compare their earnings quality in the year t that experience an improvement to their earnings quality in the year $(t - 1)$, one year immediately before the improvement

*,**,*** Respectively indicate that the mean difference is significant at 10, 5 and 1% level

the assured sustainability reports is associated with better innate earnings quality and better discretionary earnings quality. The OLS regression results are presented in the Table 6.[13] We find that both external assurance (coefficient = 0.5872, P value = 0.0350) and accounting firm assurance (coefficient = 0.6921, P value = 0.0498) are significantly and positively correlated with innate earnings quality. We do not find a significant correlation between the two alternative measurements of disclosure quality (external assurance and accounting firm assurance) and discretionary earnings quality suggesting that assurance on sustainability reports has no relation with discretionary earnings quality as assurance providers are more concerned with innate earnings quality. In conclusion, using alternative measurements of disclosure quality, we find a robust

conclusion that disclosure quality is positively correlated with innate earnings quality.

Conditional on Institutional Ownership and Sustainability Performance

In this section, we examine the relation between earnings quality and sustainability disclosure conditional on other factors such as corporate structure and sustainability performance. First, based on the agency theory, the institutional ownership can improve monitoring of managerial discretional behavior and advance the firm's performance attributes as reflected in financial reports. Thus, a stronger corporate governance structure, such as higher level institutional ownership, may increase both innate earnings quality and discretionary accrual quality. Since the effect of corporate structure on earnings quality is directly viewed, there is a possibility that sustainability disclosure is released by management due to the pressure from institutional owners. Under this assumption, the

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[13] When we use these two alternative measurements of disclosure quality, we only run OLS tests and don't conduct DID tests, because the external assurance is not an exogenous factor. In contrast, the release of G4 guideline (DIS_Q1) and the GRI guideline application level (DIS_Q2) are both exogenous factors outside the firms.

sustainability disclosure is viewed as a mechanism to alleviate the agency problem between owners and management, and thus its association with earnings quality may be significantly conditional on the corporate governance including institutional owners.

Second, prior research suggest that better sustainability performance is associated with better stock market performance and financial performance (Ameer and Othman 2012; Eccles et al. 2014). On the one hand, better sustainability performance is associated with a firm's operations and reputation and thus may increase the innate earnings quality. On the other hand, better sustainability performance may encourage management to shift its focus from short-term earnings to long-term sustainable performance and thus may also increase the discretionary accrual quality. Therefore, one question is raised, whether the relation between earnings quality and sustainability disclosure is related on sustainability performance. According to the signaling theory, firms with better sustainability performance are more likely to signal this good news to the public through the sustainability report to distinguish themselves from other firms with worse sustainability performance (Hummel and Schlick 2016). Therefore, there is a possibility that the higher innate earnings quality or lower discretionary accrual quality is not directly caused by the issuance of the sustainability report but is induced by the prior-year sustainability performance.

To conduct our tests, first, we use the institutional ownership, which is the percentage of firm's shares owned by the institutional investors at the period end, to measure the corporate structure. We divide the sample into two subgroups, the subgroup with high institutional ownership (which is greater than the sample median), and the subgroup with low institutional ownership (which is smaller than the sample median). We, respectively, run the Eqs. (3) and (4) under either high or low institutional ownership. Second, we use four measures from the KLD database to construct the sustainability performance. The first measure is the ESG scores which are the sum of net scores of the firm's environmental, social, and governance performance. The second measure is CSR/ESG scores, which are the sum of net scores of the firm's community, diversity, employee, environmental, product and humanity performance. The third measure is the CGOV scores which are derived from the firm's corporate governance performance. The final measure is the ENV score which specifically indicates the firm's environmental performance. In our test, we alternatively interact our interesting variable, issuance of sustainability (disclose), with the four measures of 1-year lag sustainability performance and investigate whether the prior-year sustainability performance influences the relation between earnings quality and sustainability disclosure.

Table 6 Alternative measurements of disclosure quality

	Dependent variable = IEQ			
	Coefficient	P value	Coefficient	P value
Intercept	6.0104	0.0074	4.2781	0.2934
Ext_Assure	0.5872	0.0350		
Acct_Assure			0.6921	0.0498
NOA	0.7195	0.0738	1.0361	0.1017
Ret_Vol	−6.5472	0.0490	−16.3312	0.0487
Analyst	0.0029	0.7600	−0.0041	0.8462
Earn_Vol	−2.0800	0.0204	−0.2755	0.0095
Manager	5.9703	0.2470	9.4927	0.0563
SIZE	0.2865	0.0183	0.3816	0.0288
ROA	1.9338	0.0044	2.5598	0.2881
BTM	−0.5740	0.0248	−0.3173	0.0797
Cycle	0.1310	0.7247	−1.8240	0.0656
Current	−1.6990	0.1101	−2.0058	0.2182
LEV	−1.8174	0.0288	1.1955	0.2525
Year fixed effect	Yes		Yes	
Industry fixed effect	Yes		Yes	
Adjusted R^2	0.7627		0.9190	
Observations	104		50	

This table illustrates the relation between innate earnings quality and alternative measurements of disclosure quality. In the first column, to alternatively measure disclosure quality, we use the dummy variable, Ext_Assure, whether the disclosing firms obtain external assurance for their sustainability report. The sample size is 104 which includes 52 disclosing firms which obtain external assurance and 52 nondisclosing matched firms

In the second column, to alternatively measure disclosure quality, we use the dummy variable, Acct_Assure, whether the disclosing firms obtain external assurance from accounting firms for their sustainability report. The sample size is 50 which includes 25 disclosing firms which obtain external assurance from accounting firms and 25 nondisclosing matched firms. All other variables are explained in the "Appendix"

Table 7 shows the effect of these additional factors.[14] Panel A illustrates whether the relation between earnings quality and sustainability disclosure is conditional on the institutional ownership. We find that the issuance of the sustainability report is positively associated with innate earnings quality (coefficient = 0.2805, P value <0.0001) when the institutional ownership is high and there is also a significant and positive correlation between innate earnings quality and sustainability disclosure when the institutional ownership is low (coefficient = 0.2709, P value <0.0001). In contrast, we find that the issuance of the sustainability report is negatively associated with discretionary earnings quality (coefficient = −0.4608, P value = 0.0003) when institutional

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[14] The sample sizes are reduced after merging with institutional ownership data from Thomson Reuters 13-F filings and sustainability performance data from KLD database.

Table 7 The relation between sustainability report and earnings quality conditional on corporate structure and sustainability performance

	Institutional ownership = high				Institutional ownership = low			
	Dependent = IEQ		Dependent = DEQ		Dependent = IEQ		Dependent = DEQ	
	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value
Panel A: The relation between sustainability disclosure and earnings quality under high/low institutional ownership								
Intercept	4.7680	<0.0001	−0.5293	0.0169	4.0520	<0.0001	0.0974	0.5223
Disclose	0.2805	<0.0001	0.0452	0.4313	0.2709	<0.0001	−0.4608	0.0003
NOA	0.0413	0.0015	0.0094	0.7688	0.0277	0.0133	0.0658	0.0085
Ret_Vol	−2.7073	<0.0001	−0.5584	0.0090	−2.1216	<0.0001	−0.0003	0.9984
Analyst	0.0072	<0.0001	0.0089	<0.0001	0.0002	0.8523	0.0084	<0.0001
Earn_Vol	−1.4721	<0.0001	0.0318	0.7915	−0.6125	<0.0001	−0.6353	<0.0001
Manager	2.0469	<0.0001	−1.6417	<0.0001	2.8249	<0.0001	0.1945	0.7181
SIZE	0.0938	<0.0001	0.0502	<0.0001	0.1552	<0.0001	0.0737	<0.0001
ROA	1.0053	<0.0001	1.3354	<0.0001	0.4377	<0.0001	0.4358	<0.0001
BTM	−0.0414	0.0003	0.0300	0.1417	0.0057	0.2002	−0.0371	0.0001
Cycle	−0.1100	<0.0001	−0.1489	<0.0001	−0.1138	<0.0001	−0.1067	<0.0001
Current	−1.0242	<0.0001	0.2867	0.0016	−0.6384	<0.0001	0.0619	0.3634
LEV	−0.0241	0.4573	−0.0420	0.5438	−0.0706	0.0040	−0.0269	0.6036
Year fixed effect	Yes		Yes		Yes		Yes	
Industry fixed effect	Yes		Yes		Yes		Yes	
Adjusted R^2	0.6733		0.3484		0.5876		0.3149	
Observations	17,550		17,550		17,550		17,550	
	Dependent variable = IEQ							
	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value
Panel B: The interaction between prior-year sustainability performance and current year sustainability report								
Intercept	5.4282	<0.0001	5.4147	<0.0001	5.4239	<0.0001	5.4020	<0.0001
Disclose	0.1453	<0.0001	0.2346	<0.0001	0.1230	0.0003	0.2588	<0.0001
Disclose * ESG	−0.0256	0.0002						
ESG	0.0067	0.0393						
Disclose * ENV			−0.0301	0.0899				
ENV			0.0123	0.2299				
Disclose * CSR					−0.0289	<0.0001		
CSR					0.0105	0.0022		
Disclose * CGOV							−0.0203	0.0335
CGOV							0.0239	0.0206
NOA	0.0010	0.9470	0.0007	0.9608	0.0011	0.9385	0.0015	0.9154
Ret_Vol	−3.3537	<0.0001	−3.3015	<0.0001	−3.3685	<0.0001	−3.3051	<0.0001
Analyst	0.0038	<0.0001	0.0043	<0.0001	0.0036	0.0001	0.0042	<0.0001
Earn_Vol	−1.5869	<0.0001	−1.5890	<0.0001	−1.5868	<0.0001	−1.5874	<0.0001
Manager	1.2984	<0.0001	1.3748	<0.0001	1.2728	<0.0001	1.3622	<0.0001
SIZE	0.0259	0.0003	0.0263	0.0003	0.0272	0.0001	0.0293	<0.0001
ROA	0.9553	<0.0001	0.9506	<0.0001	0.9555	<0.0001	0.9452	<0.0001
BTM	0.0081	0.5099	0.0086	0.4827	0.0077	0.5325	0.0079	0.5211
Cycle	−0.1413	<0.0001	−0.1427	<0.0001	−0.1414	<0.0001	−0.1439	<0.0001
Current	−1.0322	<0.0001	−1.0309	<0.0001	−1.0304	<0.0001	−1.0266	<0.0001
Leverage	−0.1386	0.0009	−0.1403	0.0008	−0.1371	0.0010	−0.1386	0.0009
Year fixed effect	Yes		Yes		Yes		Yes	
Industry fixed effect	Yes		Yes		Yes		Yes	
Adjusted R^2	0.5713		0.5692		0.5721		0.5693	

Table 7 continued

	Dependent variable = IEQ							
	Coefficient	*P* value	Coefficient	*P* value	Coefficient	*P* value	Coefficient	*P* value
Observations	11,520		11,520		11,520		11,520	
Panel C: The interaction between prior-year sustainability performance and current year sustainability report								
Intercept	−0.6693	0.0021	−0.6812	0.0017	−0.6780	0.0018	−0.6786	0.0018
Disclose	−0.0970	0.0157	−0.1275	0.0530	−0.0860	0.0223	−0.1214	0.0385
Disclose * ESG	0.0188	0.1103						
ESG	−0.0134	0.0461						
Disclose * ENV			−0.0088	0.7995				
ENV			−0.0117	0.5695				
Disclose * CSR					0.0197	0.1198		
CSR					−0.0139	0.0516		
Disclose * CGOV							0.0176	0.7740
CGOV							−0.0128	0.5705
NOA	0.0091	0.7852	0.0086	0.7983	0.0086	0.7961	0.0084	0.8017
Ret_Vol	−0.5021	0.0373	−0.4809	0.0287	−0.5041	0.0372	−0.4685	0.0495
Analyst	0.0059	0.0030	0.0058	0.0032	0.0060	0.0026	0.0056	0.0047
Earn_Vol	−0.3251	0.0352	−0.3272	0.0345	−0.3253	0.0350	−0.3261	0.0353
Manager	−1.2964	0.0017	−1.2834	0.0019	−1.3038	0.0016	−1.2520	0.0024
SIZE	−0.0060	0.7017	−0.0064	0.6842	−0.0043	0.7852	−0.0073	0.6462
ROA	1.2907	<0.0001	1.2947	<0.0001	1.2936	<0.0001	1.2932	<0.0001
BTM	−0.0487	0.0707	−0.0497	0.0649	−0.0487	0.0711	−0.0498	0.0647
Cycle	−0.2166	<0.0001	−0.2184	<0.0001	−0.2161	<0.0001	−0.2179	<0.0001
Current	0.2357	0.0192	0.2289	0.0228	0.2367	0.0186	0.2295	0.0224
Leverage	−0.0192	0.8193	−0.0114	0.8916	−0.0196	0.8159	−0.0137	0.8703
Year fixed effect	Yes		Yes		Yes		Yes	
Industry fixed effect	Yes		Yes		Yes		Yes	
Adjusted R^2	0.3954		0.3952		0.3954		0.3952	
Observations	11,520		11,520		11,520		11,520	

This table introduces how institutional ownership and the prior-year sustainability performance will influence the relation between earnings quality and sustainability report. In the Panel A, we test whether institutional ownership affects the relation between earnings quality and sustainability report. In the first two columns, we run the tests when the institutional ownership is high, and in the last two columns we run the tests when the institutional ownership is low. In the Panel B and C, we test whether prior-year sustainability performance influences the relation between earnings quality and sustainability report, and the dependent variables are innate earnings quality and discretionary earnings quality, respectively. In each column, the sustainability performance is proxied by environmental, social and governance scores (ESG), environmental scores (ENV), corporate social responsibility scores (CSR), and corporate governance scores (CGOV). All other variables are explained in the "Appendix". All the *P* values are presented after clustering standard errors at the firm-level and year-level

ownership is low and there is no significant correlation between discretionary earnings quality and sustainability disclosure when the institutional ownership is high. This suggests that the drawbacks of sustainability disclosure may be affected by the firm's corporate structure proxied by institutional ownership; however, the benefits of sustainability disclosure may not be affected by the firm's corporate structure. Specifically, the higher institutional ownership will encourage the higher level of monitoring and alleviate the agency problem caused by managerial discretion, and thus it will mitigate the negative relation between discretionary earnings quality and sustainability disclosure. However, the

higher innate earnings quality brought by sustainability disclosure will not be significantly different under higher or lower institutional ownership.

Panel B illustrates whether the relation between innate earnings quality and sustainability disclosure is influenced by the previous sustainability performance measured by four different KLD scores. By alternatively using 1-year lag scores of ESG, environmental performance, corporate social responsibility, and corporate governance, and to interact with sustainability disclosure, we find that innate earnings quality is still positively associated with the sustainability report. However, this positive relation between

innate earnings quality and sustainability disclosure is reduced by better previous ESG performance (coefficient = −0.0256, P value = 0.0002), firm's environmental performance (coefficient = −0.0301, P value = 0.0899), corporate social responsibility performance (coefficient = −0.0289, P value <0.0001), and corporate governance performance (coefficient = −0.0203, P value = 0.0335).This suggests that better innate earnings quality is at least partially attributed to better prior-year sustainability performance which leads to the sustainability disclosure due to the signaling theory.

Panel C shows whether the relation between discretionary earnings quality and sustainability disclosure is influenced by the previous sustainability performance. The results indicate a negative relation between discretionary earnings quality and sustainability disclosure after we control for the firm's prior-year sustainability performance. This negative relation is not influenced by sustainability performance since all the four interaction terms are statistically insignificant. This suggests that managerial discretionary choices arising from sustainability disclosure do not reduce even though firms perform well in sustainability in the prior year.

Conclusions

We investigate the relationship between voluntary sustainability disclosure and earnings quality by examining whether sustainability disclosure quantity/quality is a substitute or a complement to earnings quality. Following Moon Jr. (2014), we classify earnings quality into innate earnings quality and discretionary earnings quality and, respectively, investigate their relationships to sustainability disclosure. We construct two measures of sustainability disclosures in our main tests, sustainability disclosure quantity as a proxy for whether the firm issues sustainability reports and sustainability disclosure quality of whether and how the firm using the GRI guidelines in the preparation and assurance of sustainability reports. Specifically, we constructed sustainability disclosure quality as the application level of the GRI guideline in preparing sustainability disclosure, an advanced version of the GRI guideline (such as G4) and level and type of assurance on sustainability reports.

We perform both DID tests and OLS regression and find that sustainability disclosure quantity is positively correlated with innate earnings quality and negatively correlated with discretionary earnings quality. Moreover, DID tests suggest that sustainability disclosure quality can significantly influence the relation between earnings quality and sustainability disclosure quantity. We find that the positive correlation between sustainability disclosure quantity and innate earnings quality is more pronounced when sustainability disclosure quality is high, and the negative correlation between sustainability disclosure quantity and discretionary earnings quality is less pronounced when sustainability disclosure quality is high. Finally, further tests suggest that the relation between earnings quality and sustainability disclosure is moderated by certain factors. Specifically, the positive relation between innate earnings quality and sustainability disclosure quantity tends to mitigate if firms did well in prior-year sustainability performance. Results suggest that the negative relation between discretionary earnings quality and sustainability disclosure quantity tends to mitigate if the institutional ownership is high.

Our paper contributes to the accounting literature by providing new evidence for the long-time argument regarding the relation between voluntary disclosure and earnings quality, both of which intended to improve usefulness, reliability, and trustworthiness of corporate reporting. Different from most prior studies, we examine the link between innate earnings quality and voluntary disclosure and the relation between discretionary earnings quality and voluntary disclosure and find that the quantity and quality of sustainability disclosure can both complement and substitute for earnings quality aimed at curtailing unethical earnings manipulation and opportunistic managerial behavior. Moreover, our research suggests that sustainability disclosure quality, corporate structure and prior sustainability performance play essential roles in explaining the effect of voluntary sustainability disclosure quantity on earnings quality. Therefore, our paper has policy implications for standard setters and other organizations (e.g., GRI, IIRC, SASB) to continue improving the framework and guidance to help firms prepare high-quality sustainability reports. Our results suggest that firms pay more attention to disclosure quality when trying to increase disclosure quantity to provide more useful and reliable information to their stakeholders.

Appendix: Variable Definition

Disclose = a dummy variable equals to 1, if the firm releases a sustainability report: zero otherwise.
DIS_Q1 = a dummy variable which is equal to 1, if the firm prepare the sustainability report; zero otherwise.
DIS_Q2 = the application level of GRI framework in preparing the sustainability report.

EQ = the earnings quality measured as the standard deviation of the residuals obtained from the modified Dechow and Dichev model during the 5-year period prior to the sample year.

IEQ = the predicted value from the regression of earnings quality on inherent firm traits.

DEQ = the residual from the regression of earnings quality on inherent firm traits.

CFVOL = the standard deviation of cash flows scaled by total assets over the previous 5 year window.

SALEVOL = the standard deviation of sales scaled by total assets over the previous 5 year window.

OPCYCLE = the natural logarithm of operating cycle.

NEG = the frequency of negative earnings realizations during the previous 5 years.

INT = intangible (the sum of R&D expenditures and advertisement expenditures) scaled by total assets.

INTDUM = a dummy variable equals to 1, if research and development or advertising expenditure is the missing value; zero otherwise.

CAP = capital expenditures scaled by total assets.

NOA = a dummy variable which is equal to 1 if firm net operating assets at the beginning year scaled by beginning sales are above the median of corresponding industry's net operating assets; zero otherwise.

Ret_Vol = the standard deviation of monthly raw return over the 60 months prior to the sample period.

Earn_Vol = the standard deviation of earnings over the 5 year prior to the sample period.

Analyst = the number of financial analysts following during the sample period.

Manager = the percentage of shares owned by executives.

Cycle = the firm operating cycle measured by the accounts receivable cycle plus inventory cycle and minus the accounts payable cycle.

SIZE = natural logarithm of firm total assets.

BTM = book-to-market ratio at the beginning period.

ROA = return on assets.

Current = current assets to total assets ratio.

LEV = total liabilities to total assets ratio.

Inst_Owner = the percentage of firm's shares owned by the institutional investors at the period end.

ESG = The overall net scores of corporate environmental, social and governance performance from the KLD database.

ENV = the number of corporate environmental strengths minus the number of corporate environmental concerns.

CSR = the number of corporate social strengths minus the number of corporate social concerns.

CGOV = the number of corporate governance strengths minus the number of corporate governance concerns.

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