

Does the Voluntary Adoption of Corporate Governance Mechanisms Improve Environmental Risk Disclosures? Evidence from Greenhouse Gas Emission Accounting

Gary F. Peters · Andrea M. Romi

Received: 10 January 2013 / Accepted: 2 September 2013 / Published online: 1 November 2013
© Springer Science+Business Media Dordrecht 2013

Abstract Prior research suggests that voluntary environmental governance mechanisms operate to enhance a firm's environmental legitimacy as opposed to being a driver of proactive environmental performance activities. To understand how these mechanisms contribute to the firm's environmental legitimacy, we investigate whether environmental corporate governance characteristics are associated with voluntary environmental disclosure. We examine an increasingly important attribute of a firm's disclosure setting, namely the disclosure of greenhouse gas (GHG) information. GHG information represents proprietary non-financial information about the firm's exposure to environmental concerns and is related to the firm's operations and future profitability. Thus, we expect governance participants would view such information as a potentially important strategic device for managing stakeholders' demands for information concerning environmental risks. We find that the presence of an environmental committee and a Chief Sustainability Officer (CSO) is positively

associated with the likelihood of GHG disclosure and that CSOs are associated with disclosure transparency. Further analysis reveals that the likelihood of disclosure is associated with committee size, number of committee meetings, expertise of committee members and CSO, and overlap between the environmental committee and audit committee. Only expertise of the environmental committee members and the CSO are associated with GHG disclosure transparency, while larger committees tend to be associated with lower transparency. Our results are particularly important to those with interests in evaluating the potential role that corporate governance mechanisms play in responding to stakeholder concerns about environmental risks. Directors and officers who are considering appointment to similar governance positions, may wish to consider what attributes would make such governance positions more influential.

Keywords Corporate governance · Greenhouse gas disclosures · Corporate Sustainability Officer · Environmental committees

We appreciate the helpful comments from conference and workshop participants at the 2010 American Accounting Association Annual Conference, Portland State University's 5th International Conference on Business and Sustainability, Indiana University, Texas Christian University, Texas Tech University, the University of Utah, the University of Arkansas, and the University of Kansas.

G. F. Peters (✉)
Department of Accounting, Sam M. Walton College of Business,
University of Arkansas, Fayetteville, AR 72701-1201, USA
e-mail: peters@uark.edu

A. M. Romi
Department of Accounting, Rawls College of Business, Texas
Tech University, Box 42101, Lubbock, TX 79409-2101, USA
e-mail: Andrea.Romi@ttu.edu

Introduction

The last decade has witnessed increasing concerns from consumers, regulators, analysts, and markets about the impact of climate change risks on the financial results of company operations (Securities and Exchange Commission [SEC] 2010b). During this same period, there has also been an increase in the use of corporate governance mechanisms that encompass the monitoring of greenhouse gas (GHG) emissions and climate change risks, namely the creation of board committees and executive officer positions focused upon corporate sustainability and environmental concerns.

However, prior research suggests that such governance mechanisms do not fulfill the role of a proactive strategic driver of environmental activities (e.g., Rodrigue et al. 2013). In contrast, the mechanisms appear to serve more as monitors of management or the condition of the organization's environmental legitimacy. A key action used in responding to the condition of the organization's environmental legitimacy includes voluntary environmental disclosures (e.g., Cho et al. 2006; Chen and Roberts 2010; Bansal and Kistruck 2006; Bansal and Clelland 2004; Cormier et al. 2004). The primary purpose of this study is to examine the impact of voluntary environmental corporate governance mechanisms on the likelihood and transparency of voluntary GHG emission accounting disclosures.¹

Environmental issues represent an important component of an organization's governance objectives for enhancing their overall ethical climate. For example, Schwartz et al. (2005) argue that directors, grounded in ethical citizenship, have distinct responsibilities to engage in environmentally protective decisions. Despite the importance of this role, Prado and Garcia (2010) argue that the overall board of directors generally does not fulfill its monitoring role through the dissemination of carbon-related information. Rodrigue et al. (2013) provide evidence that suggests environmental governance mechanisms focus more on avoiding reputational and/or regulatory harm, as opposed to driving operational changes. Such roles could be viewed as simply symbolic in that they are more concerned with the portrayal of an environmentally responsible firm whether or not the firm takes responsible actions (Bansal and Kistruck 2006; Neu et al. 1998; Cho et al. 2012; Patten 2005). However, such roles not only reflect the reputations of the organizations, but also the reputations of individuals charged specifically with environmental governance responsibilities. So while the specific governance participant's ability to drive operational change decisions might be constrained, we conjecture they will still have incentives to promote greater levels of firm transparency. This creates a need to understand the specific attributes of these

specialized governance mechanisms and their impact on the firm's environmental mosaic.

Consistent with a focus on disclosure issues, Carcello (2009) and Vera-Munoz (2005) discuss how the characteristics of governance mechanisms are a factor in promoting the ethical climate of the firm through the enhancement of financial disclosure quality. The reasons for these disclosure relationships have been explored through various overlapping theoretical frameworks, including legitimacy theory, resource-based theory, stakeholder theory, and agency theory, among others. Analogous to the social responsibility disclosure findings of Branco and Rodrigues (2008), we assume that these theories, with a particular emphasis on the ethics-based attributes of stakeholder management and legitimacy theory, are linked in providing incentives for governance responsiveness to stakeholder demands for environmental information, namely GHG disclosures. Similar to prior financial disclosure literature, we also conjecture that the associations between voluntary corporate governance and GHG disclosures are not only contingent on the presence of governance mechanisms, but also upon the characteristics of the mechanisms specifically charged with environmental monitoring.

While GHG disclosures can be viewed as a means of pursuing environmental legitimacy, such environmental disclosures are not necessarily costless; moreover they represent demonstrative facts that may limit managerial flexibility in the future (Bansal and Kistruck 2006). In contrast to broad affirmative reports concerning sustainability activities, GHG disclosures can represent proprietary non-financial information about the firm's exposure to climate change risks, resulting from the firm's operations and related to future profitability over time (SEC 2010b). Climate change risks include increasing compliance or input costs from carbon-reducing regulation, increasing operating costs related to weather and threats to water supplies, altered consumer demand for products or services attributed to fluctuating weather patterns, and reputational and market value penalties from increasing GHG emissions (Coburn et al. 2011). Providing disclosures about these risks can create adverse consequences given they have the potential to affect a firm's cost of capital by providing information that might incite government agencies to investigate firms, invoke costly litigation, provide competitors with information about firm-specific sustainability strategies, and incite potentially negative attention from environmental advocacy groups. Given the potentially contentious and informative attributes of such information we argue that environmental governance participants will view GHG disclosures as a potentially important strategic device for meeting the environmental information demands of stake holders.

¹ For the purposes of the current study, we adopt the term "GHG emission accounting" from the CDPs Greenhouse Gas Emissions Questionnaire. From the CDP, GHG emission accounting includes information about emission and management of numerous items including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and other fluorinated gases (USEPA 2009). These gases are released as a result of manufacturing processes and the burning of fossil fuels. The terms *GHG emissions* and *carbon emissions* are used interchangeably in practice. In addition, "sustainability" refers to the corporate practice of creating long-term shareholder value by focusing corporate strategy around economic, environmental, and social endeavors which includes the management of GHG emissions.

We examine voluntary GHG disclosures among a set of US firms from 2002 through 2006.² Focusing on this particular timeframe ensures that more recent lobbying efforts with the US SEC and their subsequent interpretive guidance release, as well as the US Environmental Protection Agency's (EPA) GHG reporting regulations do not present confounding events affecting our results. We obtain voluntary GHG disclosures from the Carbon Disclosure Project's (CDP) GHG emissions questionnaire. The CDP is the leading global repository for comparative GHG emission information and provides a setting to explore a truly discretionary disclosure of information previously shown to impact firm value (Chapple et al. 2013; Matsumura et al. 2013; Griffin et al. 2010). Participation in the CDP questionnaire allows us to capture the firm's responsiveness to stakeholder demands for environmental information.

Results indicate the existence of an environmental committee and sustainability officers are associated with the likelihood of GHG disclosures, though only Chief Sustainability Officers (CSOs) are associated with increased disclosure transparency. Further analysis of specific governance characteristics, suggests the likelihood of disclosure is associated with committee size, number of committee meetings, expertise of committee members, overlap between the environmental committee and the audit committee, and CSO expertise. Only expertise of the environmental committee members and CSO are associated with greater GHG disclosure transparency, while larger committees tend to be associated with a lower disclosure transparency. Overall results indicate the more sustainability expertise of the corporate governance structure, the more extensive the disclosed information.

Our study adds to the disclosure literature's longstanding interest in the reporting of corporate environmental actions and strategic initiatives, as well as the increasing interest in environmental risk and GHG disclosures (e.g., Galbreath 2010; Berthelot et al. 2003; Bansal and Kistruck 2006, among others). Complementing Rodrigue et al. (2013) and similar studies, our study also responds to a call for additional corporate governance research related to environmental concerns and other aspects of firm risk (e.g., Brennan and Solomon 2008; Carcello et al. 2011). Analogous to the literature on audit committee characteristics and financial reporting outcomes, our study provides insights into the association between environmental transparency and the characteristics of voluntary environmental governance mechanisms. For example, our study highlights the importance of considering the

type of expertise held by governance representatives and their overlap with other governance areas. While firms might view the simple appointment of CSO positions and environmental committees as a means of managing the legitimacy of the firm's efforts to monitor exposure to environmental risks, we posit that the background of these individuals influences the effectiveness of these positions. The educational and experiential background of current CSOs in US firms range from sustainability to public relations and communications. Expertise in sustainability includes a fundamental understanding of GHG emissions and the significance of emissions in relation to operational and profitability risks to the firm. Consequently, sustainability experts are more likely to implement strategies that increase disclosures in order to positively differentiate their management abilities (Trueman 1986).

In addition to environmental expertise, our results suggest that experience with corporate disclosure, namely overlap with the audit committee, appears to draw the attention of environmental committees to disclosure issues. This is consistent with an expanding attention and sphere of influence by the audit committee into climate change and sustainability-related regulations. In particular, audit committees will be asked to integrate climate change and sustainability into enterprise wide risk assessment, focus on disclosures, evaluate the reporting systems and seek assurance of information (Ernst and Young [EY] 2010). Therefore, it is important to examine the overlap of the individuals on the environmental and audit committees, as the knowledge these individuals possess is likely complementary in relation to GHG disclosures.

The remainder of this paper is organized as follows. The next section describes the ethical context of voluntary environmental disclosures. The "GHG Reporting" section describes the strategic nature and source of disclosures utilized in the study. The "Voluntary Environmental Corporate Governance and Hypothesis Development" section provides our hypotheses development for the specific governance characteristics examined. We follow this section by describing our empirical research methods. Finally, we present the results of our study and provide concluding remarks.

Voluntary Environmental Disclosure Through an Ethical Lens

Information asymmetry between the managers and stakeholders of a firm create opportunities for voluntary disclosure decisions or actions to increase the transparency of the firm. This information asymmetry follows from management's private access to information about their own efforts or beliefs, yet unobservable to interested parties

² The sample includes all US firms in the FT500, comprised of 500 of the largest companies in the world based on market capitalization from 2002 until 2004, and the S&P 500 companies from 2005 and 2006.

outside the firm. Therefore, fundamentally, a firm's transparency is an important determinant of the ability of interested outside parties to efficiently determine the ways in which they will interact with the firm or its managers. As a result, the voluntary disclosure decision becomes a strategic response of the firm.

When examining these strategic responses, prior literature generally takes two broad theoretical approaches. The first approach views the decision primarily as a response to the economic pressures resulting from the economic relationships between the firm and its investors. In turn, the provision of voluntary disclosures generates context-specific costs and benefits from reducing the extent of information asymmetry between these two parties. The contextual costs of these disclosures include not only the cost of processing and reporting information, but also the proprietary costs that might occur as a result of the information being used against the firm by competitors, regulators, or other outside pressure groups. The benefits typically are viewed from the perspective of greater access to or lower costs of investment capital, which directly benefits the shareholders of the firm.³

A second approach, more common in the ethics-based literature, views disclosure decisions as a broader response to the demands that come from the various stakeholders including suppliers, customers, communities, as well as the firm's present and future investors.⁴ While the benefits and costs under this framework can also be economic in nature, an ethical component of this perspective derives from the need to weigh the conflicting interests among the stakeholders when economic obligations might not exist (i.e., decisions are voluntary). For example, under this ethical perspective Donaldson and Preston (1995) held that stakeholders exist as a result of their interests in the corporation (not because of the interests the company has in stakeholders) and that their interests merit consideration by the firm (see also Garriga and Mele (2004) for a discussion of normative stakeholder theory in relation to a firm's

response to corporate social responsibility, which includes environmental transparency).

This ethical balance is also a function of the firm's attempts to gain or protect access to resources that are important for the firm's survival, such as the legitimacy of the firm to operate within its social context, the ability to attract and retain employees, the ability to coordinate their activities with suppliers and consumers to create long-term innovations, as well as the internally motivated preferences of members within the firm to do the right thing, among others. Related to the disclosure decision, tension arises because these decisions are voluntary, are not necessarily subject to strict standards, and will not always benefit various stakeholders equally. For example, shareholders might focus on strategies targeting short-term gains, whereas environmental groups might focus more on actions that, while costly in the short-term, are primarily focused on the long-term benefit to the community (which may also benefit that firm as a member of that community). Likewise a manager's conviction to provide disclosures in response to do what she feels is the right thing to do, may come at the expense of immediate financial gains. Yet, the conviction is grounded in some greater sense of benefit to the natural environment in which the firm operates and benefits from.

These competing interests among the stakeholders generally create a condition in which a positive amount of transparency should result.⁵ We acknowledge that this does not necessarily equate to full environmental transparency being an ethically or morally optimal response (Bansal and Kistruck 2006). Moreover we note that disclosures can also take symbolic forms, which may or may not reflect the true position of the manager's beliefs or effort (e.g., Cho et al. 2010; Hopwood 2009). Nonetheless, over the past two decades there appears to be a distinct trend among firms to increase the extent of their environmental transparency (e.g., KPMG 2011). While this trend can be explained by the direct pressures applied by investor groups there also appears to be a growing consciousness of the long-term value and societal demands for greater environmental transparency (SEC 2010a, b). Following, Huang and Kung (2010) assert "environmental disclosure is a means by which firm can exhibit social responsibility." Despite the apparent voluntary increases in environmental transparency and its potential usefulness in exhibiting social responsibility, managers' disclosure choices remain tempered by the perceived proprietary and personal costs of these disclosures. A distinct overseer of the management group and potential reconciler of competing stakeholder group

³ From manager responsibility perspective this is also grounded in the early economic positions of Friedman's shareholder wealth maximization arguments (e.g., Friedman 1970). These views were also further developed from a finance perspective (e.g., Jensen and Meckling 1976), and analytical economics literature (e.g., Akerlof 1970; Verrechia 1983; Grossman 1981). See Cormier and Magnan (1999) for a summary of the theoretical drivers of an economic approach to environmental disclosures.

⁴ Broadly the theoretical frameworks under this view include Legitimacy Theory (e.g., Lindblom 1994)-related frameworks such as Stakeholder Theory (Freeman 1984), Institutional Theory (Meyer and Rowan 1977), Political Economy Theory (Tinker et al. 1991), among others. See Gray et al. (1995) for a review of social and environmental disclosure literature relying or building upon these frameworks.

⁵ We also note that economic theoretical explanations and stakeholder theoretical explanations for disclosure patterns need not be mutually exclusive (Dawkins and Fraas 2011).

interests and disclosure costs includes voluntary corporate governance mechanisms focused on environmental concerns.

Carcello (2009), in a financial reporting context, describes analogous corporate governance mechanisms as holding the ethical responsibility and potential for benefiting the common good (which transcends short-term economic costs) by enhancing the reporting environment of firms. Arjoon (2005) asserts “from an ethical dimension, at a fundamental level, the key issues of corporate governance involve questions concerning relationships and building trust (both within and outside the organization).” These questions flow from the inclusion of transparency, accountability, information flows, monitoring of manager actions, risk management, in addition to institutional compliance, and legal requirements. Following from the above discussion of ethical explanations for voluntary disclosure and the potential role of corporate governance in its promotion, we consider the specific roles that environmental committees and the presence of corporate sustainability officer have on the firm’s responsiveness to stakeholder demands for greater amounts of environmental transparency and concomitant environmental risk disclosures. The next section describes the environmental risk disclosure setting utilized in the paper (namely GHG reporting), followed by the development of hypotheses.

GHG Reporting

Prior environmental disclosure research exhibits great latitude in determining the type, level, and quality of disclosure to be examined.⁶ A key factor within disclosure theory is a firm’s ability to credibly disclose private information to stakeholders (Grossman 1981; Milgrom 1981). This creates a challenge in selecting a widely utilized and comparable environmental disclosure artifact. In an attempt to identify a comparable and credible signal of environmental outcomes, we examine GHG emission disclosures resulting from the CDP to draw inferences about the association between environmental corporate governance characteristics and the voluntary disclosure of environmental risk information.⁷ The CDPs process affords this opportunity by providing firms with the same questionnaire, the same advised methodology for measurement, and a credible repository for disclosure to the market.

⁶ Examples include Ingram and Frazier (1980), Wiseman (1982), Li et al. (1997), Al-Tuwaijri et al. (2004), Clarkson et al. (2008), Patten (2002), Cho et al. (2006, 2012), Cho and Patten (2007), Cormier et al. (2004, 2005), Prado and Garcia (2010), Huang and Kung (2010), Cormier and Magnan (1999), Rupley et al. (2012), among others.

⁷ Rankin et al. (2011) find the extent and credibility of GHG disclosures are greater for firms reporting through the CDP process.

The CDP is an independent not-for-profit organization established in 2002, to facilitate a dialogue between shareholders and corporations concerning a global corporate response to climate change (CDP 2007). This setting provides for comparability of discretionary disclosure of operational data among firms across time. The CDPs activities include a questionnaire process focusing directly on corporate GHG concerns. The CDPs questionnaire was developed by institutional investors, representing over \$55 trillion in assets, with the goal of creating a repository of GHG information for comparison and trend analysis. As a result of their efforts, the CDP is the benchmark for GHG disclosure methodology and the largest repository of GHG disclosures in the world.

The GHG information contained in the CDP questionnaire represents data relevant to the strategic roles and monitoring duties of governance participants. For example, the USEPA (2009) motivates their recent disclosure requirements by arguing that GHG emissions reveal information related to the efficiency of a firm’s business processes and “allow businesses to track their own emissions, compare them to similar facilities, and provide assistance in identifying cost effective ways to reduce emissions in the future”.⁸ Aligned with its potential monitoring value, GHG information represents costly measurement activities and proprietary costs (e.g., Chapple et al. 2013; Matsumura et al. 2013; Griffin et al. 2010). For example, disclosure potentially: impacts trading relationships with business partners and customers; invokes costly litigation; affects the cost of capital; provides competitors with information about firm-specific sustainability strategies; and provides ammunition for environmental advocacy groups or non-governmental organizations (NGOs) inciting negative attention (e.g., Zimmerman and Fong 2008; Kearney 2010; SEC 2010a).

Despite all of the potentially competitive costs associated with disclosure, stakeholder pressures on management to disclose GHG emissions continue to intensify. In a market where strong sustainability practices may be rewarded, corporate governance participants have incentives to respond with transparent environmental disclosures that reduce information asymmetry between managers and stakeholders, enhance the environmental legitimacy of the firm, and/or protect the reputations of the individuals charged with environmental governance (e.g., Huang and Kung 2010). Given the costly and informative attributes of such information we argue that environmental governance participants will perceive GHG reporting as a potentially

⁸ Examples of recent regulatory requirements include the EPAs Mandatory GHG Reporting Rule, issued on 22 September 2009, which requires major emitters and suppliers of fossil fuels to report GHG emissions beginning 2010 (USEPA 2009).

important strategic device for managing the firm's environmental reputation.

Voluntary Environmental Corporate Governance and Hypothesis Development

Environmental Committees

Prior research extensively investigates the role of governance structures, namely the role of the board of directors on the firm's reporting mosaic.⁹ Underlying many of these studies is the function of the board of directors in mitigating agency problems by reducing information asymmetry. It is important to note that such functions are constrained by the implicit costs of disclosing sensitive information. Thus, not all managers or corporate governance participants will necessarily engage in full disclosure. This creates an opportunity for effective corporate governance mechanisms to act as monitors of management activities and conduits for greater firm transparency.

The Deloitte Review recently addressed the role of corporate governance in relation to environmental concerns by indicating the need for climate change activities to be on corporate boards' radar screens (Wagner et al. 2009). They contend that the board has the ability to provide a perspective that may be lacking at the executive level. Because management is reluctant to provide environmental information representing risk to the firm, board oversight is particularly important in actively monitoring the climate change risks of the company as well as stakeholder information needs and the legitimacy of the firm's environmental reputation (Michals 2009; Gregg 2009; Ewing 2008). Results of prior research examining the impact of governance mechanisms on broader stakeholder issues, such as environmental concerns, are mixed. For example, prior literature establishes a link between management's strategic use of social reporting to create an image that may have little correlation with the firm's actual performance (e.g., Patten 2005; Deegan and Rankin 1996; Neu et al. 1998). Examining general characteristics of the overall board of directors, Prado and Garcia (2010) argue that the board as a whole generally remains unresponsive to the demands for greater environmental reporting. In contrast, using a Malaysian setting, Haniffa and Cooke (2005) find that corporate social disclosures have a significant

association with characteristics of the board of directors, including domination of the board by individuals with greater concern for social issues.

Current trends indicate that boards are now designating specific committees to address environmental issues from the perspectives of risks, strategic opportunities, and commitments to stakeholders (Michals 2009). Rodrigue et al. (2013) examine whether environmental committees on boards play a substantive versus symbolic role by examining several environmental performance proxies. They assert that these committees focus more on avoiding reputational and/or regulatory harm, as opposed to driving substantive operational changes. In contrast, Lam and Li (2008) find that having an environmental committee on the board is associated with a significant increase in environmental performance for high polluting firms. Analogous to an environmental setting, Cowen et al. (1987) find that firms with a corporate social responsibility committee are more likely to have a greater amount of human resource, but not environmental disclosures. Finally, Rankin et al. (2011) examine the relation between voluntary adoption of environmental committees and the probability of GHG disclosures in Australian firms, as well as the extent and credibility of that disclosure, and find no association. We aim to extend these studies by examining not only the existence of such environmental committees, but also the impact of their characteristics and overlap with other governance mechanisms in the organization.

In motivating our hypotheses, we assert that the environmental committee's role with respect to non-financial GHG disclosures is a corollary to the audit committee's role for insuring proper financial accounting disclosures. Similar to early regulatory regimes that did not explicitly prescribe audit committees or their specific composition, an environmental committee is voluntary, and its presence and design is one potential indicator of a corporation's commitment to environmental issues and transparency. Understanding that GHG information can be associated with negative market penalties and the release of proprietary information, it is important to determine whether committees will attempt to withhold proprietary information from the market or provide such disclosures to enhance the environmental transparency of the firm. While Rodrigue et al. (2013) did not document a positive association between environmental committees and environmental performance, they did observe based upon structured interviews with corporate directors, that the committee was charged with a key monitoring role whereby the overall board relied upon them to be a conduit of information regarding the environmental risks faced by the firm. Similar to the audit committee's role for enhancing the firm's financial reporting quality, we posit that the environmental committee will be positively

⁹ Examples include from the financial reporting literature includes: Forker (1992), Beasley (1996), Dechow et al. (1996), Klein (2002), Eng and Mak (2003), Abbott et al. (2004), Karamanou and Vafeas (2005), Farber (2005), Larcker et al. (2007), and Laksmana (2008). Examples from non-financial reporting practices includes: Haniffa and Cooke (2005), Prado et al. (2009), Rankin et al. (2011), among others discussed in the study.

associated with greater disclosure. We expect that environmental committees will take a more proactive interest in corporate environmental risks, and therefore will be more likely to respond to stakeholder demands for disclosures related to GHG emission information and will be associated with greater GHG disclosure transparency. This leads to the first set of hypotheses (in the alternative form):

Hypothesis 1a *Ceteris paribus*, firms with an environmental committee will be more likely to disclose GHG emission information.

Hypothesis 1b *Ceteris paribus*, firms with an environmental committee will exhibit greater levels of GHG disclosure transparency.

Sustainability Officers

While prior disclosure literature focuses primarily on the roles of the board and audit committees, less attention concentrates on the role of executive-level support in the form of *new* executive officer positions, outside of the primary role of the Chief Executive Officer (e.g., Cohen et al. 2008). Given the potentially costly nature of GHG disclosures, we argue that disclosure will be positively associated with credible executive-level support. Research suggests that the combined participation of top management support and other internal representatives are important factors in the firm's activities to monitor climate risk concerns (Hanna et al. 2000; Ramus and Steger 2000; Zutshi and Sohal 2004; Cordano and Frieze 2000; Egri and Herman 2000; Ewing 2008). An increasingly common manifestation of this executive knowledge and support includes the existence of CSOs (Rivenburgh 2010; Galbraith 2009; Deutsch 2007).¹⁰ Consistent with executive-level support, CSO responsibilities often include integrating various environmental concerns of external stakeholders, firm-wide strategy, and governance practices. Moreover, these positions often report directly to the Chief Executive Officer and the board, thus representing an influential internal stakeholder of the firm's resource commitments.

We expect sustainability officer positions will be associated with greater understanding of sustainability initiatives, advanced involvement in these initiatives, and greater effort and confidence in the collection and monitoring of GHG information. As a result we believe that such managers will be endowed with greater amounts of

GHG information, which in turn should result in greater disclosure. Complementary theories also suggest that this association is driven by attempts to signal greater managerial ability or enhance the legitimacy of the firm's ability to mitigate GHG risks to the organization's operations (e.g., Diamond 1985; Trueman 1986). Consequently, CSOs will also have more confidence in the development of a GHG reduction strategy and in the firm's response to the CDP questionnaire, making participation in GHG measurement and disclosure more likely. Similarly, we expect a sustainability position to be associated with greater GHG disclosure transparency. Thus, our second set of hypotheses is stated as follows (in the alternative form):

Hypothesis 2a *Ceteris paribus*, firms with a sustainability officer will be more likely to disclose GHG emission information.

Hypothesis 2b *Ceteris paribus*, firms with a sustainability officer will have greater GHG disclosure transparency.

Environmental Committee Size, Diligence, Expertise, Knowledge Spillover

Prior literature posits that the board of directors benefit from the attributes of the board members (e.g., Carcello 2009; Vera-Munoz 2005; Boyd 1990, among others). For example, as the expertise possessed by individuals in governance positions increases, it is more likely these individuals will be better equipped to assist the firm in meeting its strategic objectives, including mitigating environmental risks. In comparison, legitimacy theory posits that establishing committees *without* meaningful characteristics and concomitant influence are an attempt to merely create an image of the firm's responsiveness to risk regardless of its actual desire to improve certain performance outcomes. However, to the extent that firm's establish committees with stronger members we expect such committees to be associated with greater degrees of reporting given that their individual reputations will increase the weight of the benefits of disclosure (compared to the costs of disclosure). Therefore, we extend our primary hypotheses by investigating the relationship between specific environmental committee qualities and GHG disclosure. While little is known about the importance of environmental committee characteristics for environmental disclosure, investigations of audit committee characteristics have a strong presence in previous financial reporting literature and therefore guide our examination into environmental committee characteristics and risk disclosures (see also Carcello 2009; Vera-Munoz 2005).

Analogous to our environmental committee setting, Sommer (1991) suggests that simply having an audit committee as part of a firm's governance structure and

¹⁰ Although the CSO position is a relatively new position, the strategic influence of this executive position is also analogous with the impact and adoption of other strategically specialized executive positions that have evolved in the past, such as Chief Risk Officers and Chief Information Officers (e.g., Beasley et al. 2010; Pagach and Warr 2010; Feeny et al. 1992; Lubin and Esty 2010).

actually having an effective audit committee are two distinctly different things. Prior literature reveals certain audit committee characteristics are related to better financial reporting outcomes due to effective monitoring (e.g., Carcello 2009; Vera-Munoz 2005).¹¹ Two common characteristics include committee size and number of meetings. In general, these are viewed as a greater extent of authoritative influence and rigor of commitment (e.g., Kalbers and Fogarty 1993; DeZoort et al. 2002). Assuming the impact of these characteristics also applies to other board committees, we expect similar characteristics to impact the association between a firm's environmental committee and voluntary GHG disclosure. In general, the greater the board importance placed on environmental strategy and innovation, as evidenced by the size and activity of the committee, the greater the likelihood that firms will disclose their GHG responses.

We also expect the environmental committee's performance to be of greater influence when its members have more expertise. As an example, prior literature documents positive relationships between audit committee expertise and financial reporting quality. In general, these relationships exist due to the ability to interpret and influence issues of interest to the committee (Farber 2005; McDaniel et al. 2002; Abbott et al. 2004; Naiker and Sharma 2009). Similar to the existence of expertise on the audit committee, having an environmental committee member with appropriate expertise will better equip the committee to effectively evaluate environmentally innovative opportunities and strategies, including the involvement in and disclosure of GHG information.

One final committee characteristic that will potentially affect the probability of disclosure is the membership overlap between the environmental committee and the audit committee. As boards gain size and diversity of sub-committees, the monitoring role is disseminated among a broader set of knowledge/expertise. Moreover, the specific monitoring roles of specialized committees could complement each other when mitigating the complexity of firm problems (Carcello et al. 2011). GHG accounting is a measurement process that requires the accumulation and allocation of carbon emissions to the corporation, different geographical areas, different products, etc. As climate change and sustainability-related regulations increase in complexity, the audit committee insights may prove beneficial, as well as providing additional oversight (EY 2010). In particular, audit committees will be asked to integrate climate change and sustainability into enterprise wide risk assessment, focus

on the quality of disclosures, evaluate the reporting systems, and consider third party validation of reporting.

The audit committee could potentially possess financial reporting expertise that will spill over into the environmental committee's knowledge of the reporting issues. Specifically, knowledge of disclosure issues and operational risks from the audit committee may spill over to the environmental committee, which could attenuate apprehension concerning the measurement and disclosure of GHG information. Considering the benefits of reporting expertise to the environmental committee, firms with increased spillover from the audit committee to the environmental committee will have a greater understanding of the issues; hence increased motivation to signal their carbon initiatives by exhibiting increased GHG disclosure. This is also consistent with the generally expanding responsibilities of the audit committee for reviewing risks to the firm (Vera-Munoz 2005; Johnson 2010; Beasley et al. 2008). Given this potential relationship, we also examine whether the overlap between the environmental and audit committee will be associated with greater GHG disclosure and greater disclosure transparency.

Sustainability Officer Expertise

With the recent increase in corporate sustainability officer appointments, the question as to the appropriate expertise of these individuals to carry out their duties is of particular importance. Coinciding with the shift from reactive/compliance strategies to more proactive/innovative strategies, the background of sustainability executives is also expected to be distinctly different, with a divergence between officers possessing public relations expertise (reactive) and those with environmental and social expertise (proactive). While many sustainability officers were initially hired to 'spin' negative organizational sustainability behavior, such as large environmental fines (e.g., Exxon Valdez and British Petroleum's oil spills), in order to mitigate negative public impressions and litigation exposure, many firms now desire a more equitable mix of business and scientific knowledge to assist in key strategy decisions. CSOs with public relations expertise (reactive) would also presumably be the type of individuals associated with firms attempting "greenwashing" of a firm's environmental activities.¹² This divergence in expertise is likely to affect the participation in detailed GHG disclosures. A CSO with sustainability expertise is more likely to engage in

¹¹ The body of research on audit committee characteristics is particularly vast. Carcello (2009) and Vera-Munoz (2005) provide general overviews of the literature streams related to audit committee and their influence on the firm's disclosure environment.

¹² Greenwashing is a term used by many to describe the practice by individuals or organizations to mislead outside parties about an organization's environmental practices or the environmental advantages of a product or service provided. Greenwashing entails public emphasis on anecdotal examples of corporation's positive environmental expenditures without mention of their wrongdoings or specifics with respect to operational results or data.

sustainability initiatives aimed at carbon innovation and risk mitigation. Similarly, these CSOs are more likely to have measurements in place specific to the CDPs questions; hence they will be associated with greater disclosure transparency due to their information endowments and incentives to signal greater managerial ability (Diamond 1985; Trueman 1986; Verrechia 1990; Graham et al. 2005). In contrast, CSOs without prior sustainability experience are less likely to engage in rigorous sustainability initiatives and thus their GHG emission disclosures will be tempered by their reputational concerns, confidence in their information endowments, and threat of market penalties for releasing low quality information. Therefore, we also examine whether the officer's expertise will be associated with an increased propensity and transparency of GHG disclosure.

Sample and Regression Model

Sample

To examine the voluntary disclosure of GHG information, we use data available from the CDPs "Greenhouse Gas Emissions Questionnaire" from 2002 until 2006. This sample period is of particular interest because this was also the period of the initial firm adoption of environmental committees and officers. This particular timeframe ensures SEC lobbying to increase climate change disclosures and the subsequent interpretive guidance release are not confounding events affecting results. Most importantly, we acquired firm-specific GHG emission responses from the CDP for this period in order to evaluate the transparency of firm responses. Since, 2002 the CDP sends the GHG questionnaire to the largest corporations (based on market capitalization) in every country. Firms then decide whether to participate in providing information to the CDP and whether to disclose firm-specific GHG information to the public.¹³ Our sample includes all US firms in the FT500, composed of 500 of the largest companies in the world based on market capitalization from 2002 until 2004, and the S&P 500 companies from 2005 and 2006. Table 1 presents the sample attrition. We initially identify a sample of 1,620 firm year observations. We eliminate 47 firm year observations that lack compustat data, 174 observations in the banking/financing industry, 36 observations that lack the appropriate KLD Analytics data, 26 observations that lack available proxy information, 49 observations that lack governance information in Corporate Library, and 50 observations that lack at least two observations for a given industry in a given year, rendering a final sample of 1,238 firm year observations.

¹³ The CDP discloses the names of all firms they ask to participate in their project along with the firm's response choice.

Table 1 Sample selection 2002–2006

| | Firms |
|---|-------|
| All firm observations invited to participate in the Carbon Disclosure Project questionnaire | 1620 |
| Less | |
| Firm year observations without Compustat data available | (47) |
| Firm year observations in the finance/banking industry | (174) |
| Firm year observations without KLD Analytics data available | (36) |
| Firm year observations without Proxy information | (26) |
| Firm year observations without Corporate Library governance information | (49) |
| Firm year observations lacking at least two observations in an industry for a given year | (50) |
| Total firm year observations available | 1238 |

Regression Model

The empirical literature related to voluntary disclosure, firm characteristics, and corporate governance is vast. While we do not attempt to replicate any particular study's design, we do attempt to develop regression models that are generally reflective of disclosure determinants that have been found to be important in both the financial reporting and environmental reporting literature.¹⁴ We use the following regression model to test the associations between GHG disclosure and the existence of an environmental committee and a sustainability officer:

$$\begin{aligned}
 (\text{Disclosure})_{i,t} = & \beta_0 + \beta_1(\text{Environmental Committee})_{i,t-1} \\
 & + \beta_2(\text{CSO})_{i,t-1} + \beta_3\text{ENVST}_{i,t-1} \\
 & + \beta_4\text{PRIOR}_{i,t-1} + \beta_5\text{CROSSLIST}_{i,t-1} \\
 & + \beta_6\text{FOR_OP}_{i,t-1} + \beta_7\text{ENVINDEX}_{i,t-1} \\
 & + \beta_8\text{ESI}_{i,t-1} + \beta_9\text{CAPX}_{i,t-1} \\
 & + \beta_{10}\text{PPE_NEW}_{i,t-1} \\
 & + \beta_{11}\text{LITIGATION}_{i,t-1} + \beta_{12}\text{INSTOWN}_{i,t-1} \\
 & + \beta_{13}\text{TOBINSQ}_{i,t-1} + \beta_{14}\text{FINANCING}_{i,t-1} \\
 & + \beta_{15}\text{HERF}_{i,t-1} + \beta_{16}\text{LIQUIDITY}_{i,t-1} \\
 & + \beta_{17}\text{ROA}_{i,t-1} + \beta_{18}\text{SIZE}_{i,t-1} \\
 & + \beta_{19}\text{LEV}_{i,t-1} + \beta_{20}\text{YRCONTROLS}.
 \end{aligned}$$

¹⁴ Examples utilized to help select our regression design and control variables include, but are not limited to: Huang and Kung (2010), Clarkson and Li (2004), Lang et al. (2003), Clarkson et al. (2008), Cho and Patten (2007), Richardson et al. (2004), Lang et al. (1993), Branco and Rodrigues (2008), Stanny and Ely (2008), Peters and Romi (2013), among others.

Dependent Variables

Our dependent variable includes two disclosure measurements. We estimate a Probit regression by assigning the dependent variable (DISC) a value of 1 when a firm provides GHG disclosures, 0 otherwise. We also incorporate the CDPs own disclosure scoring methodology to assign each firm a disclosure transparency score (TRANSP). Beginning in 2010, the CDP developed a disclosure measurement, in conjunction with PriceWaterhouseCoopers, to determine how well corporations respond to the CDP questions.¹⁵ This taxonomy indicates a level of transparency based on the congruence between each firm's answer provided and the CDPs actual question being asked.¹⁶ TRANSP is our continuous dependent variable representing disclosure transparency as designated by the CDPs disclosure rating methodology. Because the analysis of disclosure transparency (TRANSP) may be subject to an endogenous selection mechanism, we incorporate Heckman's two-stage approach. The Heckman model allows us to control for the possibility of selection bias. Potential selection bias arises from the possibility that an omitted variable affecting the choice to disclose is also correlated with an omitted variable affecting the transparency of disclosures. See additional discussion of the procedure in the "Results" section.

Test Variables

The two variables of interest in evaluating the relationship between corporate governance and GHG disclosures are reflected in the environmental committee and CSO variables. We lag these variables because the request for participation and actual disclosure happen in different time periods. It is appropriate to analyze the influence of these variables during the actual period when managers make the disclosure decision. This technique also controls for possible endogenous relationships between the choice to hire a CSO, develop an environmental committee, and disclose

GHG emissions information.¹⁷ With respect to the presence of an environmental committee, we first code the existence of an environmental committee on the board of each firm (COMMITTEE) as a 1; otherwise as a 0. We search each proxy statement, Form DEF 14a, in SEC filings to determine whether the firm has any committee associated with environmental or sustainability-related matters. Titles for environmental committees include, but are not limited to: Public Policy Committee, Environmental Committee, Sustainability Committee, Corporate Social Responsibility Committee, Environmental Concerns Committee, and Social Welfare Committee. Committee responsibility descriptions, no matter the title, must mention responsibilities related to the environment or corporate sustainability practices.¹⁸

With respect to the CSO variable, we search each company by year to determine whether it has a CSO or equivalent position. Information about CSOs and their qualifications are collected from companies' Form 10-K, Lexis-Nexis, and broad internet searches. This position is not limited to a chief officer. Because of the extreme variance in the title associated with this position, we search using various key words (Rivenburgh 2010). Searches conducted included the following key words: Sustainability Officer, Environmental Officer, Environmental Director, Environmental Health and Safety Officer, Sustainability Vice President, Corporate Responsibility Officer, Responsibility Officer, and other variants of the same. Our CSO variable is then proxied by OFFICER, measured as a 1 if the organization employs a sustainability officer, 0 otherwise.

Environmental Committee and Sustainability Officer Characteristics

In subsequent tests, we substitute our environmental committee variable and CSO variable with the specific characteristics of these positions (summarized in Table 2, panel B, and described as follows). We measure COMMSZ as the number of individuals serving on the environmental committee. We also include COMMED, measured as the number of environmental committee members adjusted for the median number of committee members for all environmental committees in the sample. We evaluate the relationship between the diligence of the committee and GHG disclosure

¹⁵ The authors had several discussions with CDP and PriceWaterhouseCoopers representatives involved in grading firm disclosures about the methodology and its application.

¹⁶ The CDP questionnaire builds upon itself every year, asking firms to disclose greater detail about their GHG strategies, emissions, goals, etc. Because the basic questions remain unchanged with additional questions added each year, the scoring possibilities for each question each year were assigned accordingly. There was not, in accordance with the CDP disclosure measurement methodology, judgment used to determine how "environmentally well" a firm responded to a question. Instead, the firm was assigned an allotted score dependent upon the extent they answered each part of the question. Several individuals were involved in the scoring to ensure similarities in disclosure assignment.

¹⁷ See additional discussion in the results section regarding mitigation of endogeneity concerns.

¹⁸ Many firms choose not to develop a stand-alone committee to deal with these issues, but instead assign additional responsibilities to other standing committees. In addition to reading proxy statements for environmental committees, we also examined the responsibilities of standing committees to determine whether sustainability responsibilities were assigned to them. We found this on several occasions and the responsibilities were predominately assigned to the audit committee or the governance committee. On these occasions, firms were also assigned a 1 for COMMITTEE.

by incorporating a measurement for the number of meetings that the environmental committee held during the fiscal year (COMMET). We expect a positive relationship between environmental committee size and meetings and the likelihood of GHG disclosure as well as disclosure transparency.

We also anticipate greater expertise (COMEXP) with environmental issues to be associated with an increased likelihood of participation in and disclosure transparency of GHG information. Consistent with prior corporate governance literature (e.g., Abbott et al. 2004), we assign a value of 1 to COMEXP if there is an expert on the committee, 0 otherwise. Similar to Dixon-Fowler et al. (2010), we measure committee member expertise as a director currently or previously employed in an environmental governing agency, a NGO, or a director who also holds environmental directorships in other organizations. In addition, these individuals can be academics or scientists with research in, or work relating to, environmentally related disciplines.¹⁹ We also measure expertise on the committee using *COMXPRT*, which represents the ratio of sustainability experts assigned to the committee in relation to the total number of committee members.

In addition to committee members, we also evaluate the expertise of the CSO position similar to Peters and Romi (2013) and measure OFFEXP as 1 if the firm employs a sustainability officer and the officer has a background in environmental issues, evidenced by education (e.g., environmental sciences or an MBA in environmental affairs) or by experience (e.g., prior positions in an environmentally-related fields or disciplines).²⁰ We then create the variable

OFFNOEXP and measure this as a 1 if the firm has a sustainability officer, but the officer does not possess expertise in environmental issues (the remaining intercept captures the firms who do not employ a CSO position). The determination of expert for the officer is similar to the process we employ for the committee members, except that it focuses more on education and experience. We expect to find a positive relationship between OFFEXP and the likelihood and transparency of GHG disclosure.

Due to the diverse nature of sustainability (i.e., environmental, social, and economic), a diverse knowledge base is expected to assist in understanding and strategizing around sustainability initiatives. When members of the audit committee also serve on the environmental committee, the financial disclosure expertise is expected to spill over into the environmental committee. The combination of economic and sustainability knowledge possessed by these members will increase the understanding of disclosure issues and innovative participation in sustainability initiatives. We examine this relationship by including three different variables for committee overlap. We measure *COMOVLP* as the existence of an overlap between the audit committee and the environmental committee. We measure *COMNUOV* as the total number of overlaps between the two committees and *COMOVRT* as the ratio of overlaps to the total number of environmental committee members. We expect a positive relationship between overlap and the choice to measure and disclose GHG information. In addition, we expect a positive relationship between committee overlap and disclosure transparency.

Control Variables

As mentioned above, we utilized prior empirical disclosure literature to thoughtfully incorporate and adapt control variables that have been found to be important in both the financial reporting and environmental reporting literature (see footnote 11 for examples of prior studies utilized).²¹ We control for the relative environmental performance of the firm by including ENVST. We measure ENVST, using the total KLD Analytics environmental strength score.²²

¹⁹ An example from a director assigned to environmental committees with both Ashland, Inc., and International Paper includes the fact that this individual was the founder and Chairman Emeritus of The Conservation Fund, a NGO dedicated to conserving America's natural and historic heritage and a former president of The Nature Conservancy from 1973 to 1980.

²⁰ Two examples of CSO experts include Gene Kahn and Patricia Calkins. First, Gene Kahn, VP Global Sustainability Officer (later CSO) General Mills "dropped out of his graduate program in English at the University of Washington in 1972, leased some farmland near Rockport, Washington, and started figuring out how to raise food without pesticides, herbicides, or artificial fertilizers. He went on to create Cascadian Farm, one of the first organic food companies in the United States, which he and his business partners sold to General Mills in 2000. Kahn, the erstwhile hippie farmer and organic pioneer, has since become the big company's VP of sustainable development" (Fishman 2006). Second, Patricia A. Calkins VPEHS for Xerox, previously worked for AT&T on sustainability initiatives and environmental challenges, worked with the USEPA in developing market based voluntary sustainability programs and provided consulting services to corporations developing environmental leadership strategies, earned a master's degree in civil/environmental engineering, and serves as a member of the external advisory board for the University of Michigan's Center for Sustainable Systems. She also serves on several boards including the Central and Western New York Chapter of the Nature Conservancy and the Golisano Institute for Sustainability at the Rochester Institute of Technology (Xerox 2010).

²¹ We acknowledge that our selection of control variables is not an exhaustive inclusion of variables addressed in the vast body of prior disclosure literature. Since the objective of this study is not tied to replicating a specific study's design choices, we are limited in drawing exact inferences regarding our results compared to a specific prior study. Consistent with archival research designs, our study is also limited by variables that are unintentionally omitted which could be correlated with our variables of interest.

²² KLD Research and Analytics, Inc. provides an independent rating of corporate social responsibility for public firms. The specific environmental performance ratings are a measurement based on a binary system with 1 representing the existence of a specific environmental strength or weakness and 0 representing the absence

Table 2 Variable descriptions

Panel A: primary test variables

| | |
|------------|--|
| DISC | 1 if the firm discloses GHG disclosure response, 0 otherwise |
| TRANSP | Disclosure rating based on the CDP 2010 disclosure rating methodology |
| COMMITTEE | 1 if the firm's board committees includes an environmental committee, or environmental responsibilities assigned to a standing board sub-committee, 0 otherwise |
| OFFICER | 1 if the firm's management includes a sustainability officer, 0 otherwise |
| ENVST | A firm's total environmental strength score obtained from KLD Analytics, adjusted for industry median each year |
| PRIOR | The firm's cumulative number of previous disclosures |
| CROSSLIST | 1 if the firm is cross-listed on a foreign stock exchange, 0 otherwise |
| FOR_OP | 1 if the firm reports foreign income, 0 otherwise |
| ENVINDEX | Aggregate firm score for inclusion on three distinct sustainability indices |
| ESI | 1 if the firm belongs to any one of five environmentally sensitive industries (two-digit SIC codes of 13, 26, 28, 29, 33), 0 otherwise |
| CAPX | A firm's capital intensity measured as the ratio of total capital spending to total sales, adjusted for industry median each year |
| PPE_NEW | The newness of a firm's assets measured as the ratio of net PPE to gross PPE, adjusted for industry median each year |
| LITIGATION | 1 if the firm operates in any one of the high-litigation industries (SIC codes of 2833–2836, 3570–3577, 3600–3674, 5200–5961, and 7370), 0 otherwise |
| INSTOWN | 1 if the majority of the firm's ownership is institutional ownership, 0 otherwise |
| TOBINSQ | Growth measured as the market value of common equity plus book value of preferred stocks, book value of long term debt and current liabilities, divided by book value of total assets, adjusted by industry median each year |
| FINANCING | Amount of debt or equity capital raised by the firm during the year, scaled by total assets of that year and adjusted by industry median each year |
| HERF | A firm's level of competition measured as the sum of the squares of each individual firm's market share, multiplied by -1 |
| LIQUIDITY | The ratio of the number of shares traded in the year to the total shares outstanding at the end of the year, adjusted for industry medians each year |
| ROA | Return on assets measured as the ratio of income before extraordinary items to total assets at the beginning of each year, adjusted for industry medians each year |
| SIZE | Natural log of total sales, adjusted for industry medians each year |
| LEV | Ratio of total debt to total assets, adjusted for industry medians each year |

Panel B: environmental committee and sustainability officer characteristics

| | |
|----------|--|
| COMMSZ | The number of individuals serving on the environmental committee of the board of directors |
| COMMED | The number of the firm's environmental committee members adjusted for the median of all environmental committee members |
| COMMET | The number of meetings the environmental committee held during the fiscal year |
| COMEXP | 1 if the environmental committee includes a sustainability expert, 0 otherwise |
| COMXPRT | The ratio of experts to total environmental committee members |
| COMOVL | 1 if the environmental committee includes an individual whom also serves on the audit committee, 0 otherwise |
| COMNUOV | The number of overlaps between the environmental committee and the audit committee |
| COMOVRT | The ratio of overlapping members between the environmental and audit committees compared to the total members on the environmental committee |
| OFFEXP | 1 if the firm's sustainability officer is an expert, 0 otherwise |
| OFFNOEXP | 1 if the firm's sustainability officer is not an expert, 0 otherwise |

Footnote 22 continued

of a specific strength or weakness. The environmental rating for firm specific strengths includes the following: beneficial products and services, pollution prevention, recycling, alternative fuels, PPE and other environmental strengths. The environmental rating for concerns includes: hazardous waste, regulatory problems, ozone depleting chemicals, substantial emissions, agricultural chemicals, climate change and other environmental concerns.

We then adjust the raw environmental strength score by the industry medians each year, resulting in a firm's relative environmental strength. We chose the environmental measure in KLD because it most closely reflects similar activities to GHG measurement. We expect firms with greater environmental performance will attempt to signal their superiority by disclosing environmental information. In the case of GHG emissions, with a significant

stakeholder demand for climate change information, firms performing better environmentally will likely have GHG mitigating strategies in place and will reveal this information through greater amounts and transparency of GHG disclosure.

There are a total of 429 unique firms in the sample, rendering an average of 2.89 out of 5 years of participation per firm. In order to control for multiple year inclusion by one firm, we include a variable to account for a prior initial decision to offer GHG disclosure, in addition to rendering robust standard error estimates by clustering on each firm to correct for dependence among the repeated observations (Petersen 2009).²³ We control for prior CDP disclosure by including a variable measured as the cumulative occurrences of prior disclosure (PRIOR) during the sample period. A firm having already disclosed is likely to have the minimal information needed and willingness to respond to the questionnaire in future periods (Stanny 2013). For specification purposes, we do not include the instance of prior GHG disclosures (PRIOR) in the second stage of our Heckman regression for disclosure transparency (TRANSP). While we expect prior initial choices to disclose GHG information to be associated with a current choice to disclose (Heckman first-stage model), we do not posit an expected relation between prior choices to disclose and current levels of disclosure transparency (Heckman second-stage model).

We also control for firms cross-listed on foreign stock exchanges that face wider visibility and greater scrutiny by a broader set of investors and regulators. The CDP process includes a global sample of firms asked to participate, and US firms that are cross-listed may face greater scrutiny and greater pressures to participate and disclose GHG information.²⁴ CROSSLIST controls for firms that are cross-listed on international exchanges, and we expect a positive relationship with the level and transparency of GHG disclosure. CROSSLIST is assigned a value of 1 if the firm is cross-listed on one of the top six stock exchanges in the world, as measured by domestic market capitalization, and 0 otherwise. We also include FOR_OP as a variable indicating a firm's operations overseas. Because the CDP asks

specific questions regarding a firm's strategy as it relates to EU trading schemes and operations in Kyoto Protocol Annex B countries, we control for companies that might have operations in these particular jurisdictions. FOR_OP is measured as a 1 if the firm reports income from foreign operations, 0 otherwise. We expect FOR_OP to be positively related to disclosure.

Dye (2001) argues that the presence of sophisticated investors increases disclosure by firms. ENVINDEX is a control variable measuring the level of firm exposure to environmentally informed stakeholders, or sophisticated investors, as proxied by the firm's presence on environmental or sustainability indices. The greater the firm visibility on sustainability indices, the greater the likelihood those firms will be strategically responsive to environmentally informed stakeholders.²⁵ We assign a 1 for each listing on each index, 0 otherwise. The value range a firm receives for ENVINDEX is between 0 and 3. The greater the value for ENVINDEX, the greater the firm's environmentally responsible intensity and the greater the expectation they will disclose their GHG information with the CDP. Similarly, we expect firms with a greater ENVINDEX value to have more transparent disclosures.

A potentially confounding factor in examining the relationship between firm-specific characteristics and GHG disclosures is the political and social pressures within environmentally sensitive industries. Following prior environmental disclosure literature, we include ESI to control for firms included in environmentally sensitive industries (ESI). ESI is a dichotomous variable with a value of 1 if the firm belongs to any one of the ESIs, 0 otherwise. Similar to Patten (2002) and Cho and Patten (2007), the ESI firms are defined as firms belonging to industries with two-digit SIC codes: OIL = 13 (oil exploration), PAPER = 26 (paper), CHEMICAL = 28 (chemical and allied products), PETROLEUM = 29 (petroleum refining) or METALS = 33 (metals). Verrechia (1983) argues that firms will not disclose information if the proprietary costs are greater than the expected benefits. Inclusion in any one

²³ Although firm-specific GHG disclosure policies might remain constant across years, we do not find this to be the case. Many times firms chose a disclosure strategy, only to change to a non-disclosure strategy the next year. In contrast, governance structures do remain more consistent, but, as indicated in Table 5, out of 429 unique firms, only 89 have CSOs and 75 have a sustainability committee. Because of the timing of our sample, it was extremely rare for firms to have either of these in place in 2002, making it possible to examine the effects of these relationships since their inception.

²⁴ It is also important to note that many other countries already have mandatory carbon disclosures or carbon markets where cross-listed firms would be expected to compete (although participation with CDP disclosure guidelines remains voluntary).

²⁵ We create an aggregate measure of ENVINDEX by searching for each firm on three separate indices: the Dow Jones Sustainability World Index (DJSWI), the Domini 400 Social Index (DSI) and the FTSE 4Good Index (FTSE4). The DJSI was created in 1999 and is the first global index tracking the financial performance of sustainability focused firms. This index encompasses the top 10 % of the world's largest 2,500 companies in the Dow Jones Global Total Stock Market Index in terms of economic, environmental and social criteria. Firm analysis and ranking is updated annually. The DSI began in May of 1990 as an index of US equities that was the first benchmark created to measure the impacts of environmental, social and governance factors on investment portfolios. Finally, the FTSE4 is an index that measures the economic performance of firms that meet specific responsibility standards, while encouraging investment in those companies. Specifically, firms are recognized for their environmentally and socially responsible activities.

of these industries creates a greater external expectation and tolerance of negative environmental activities, decreasing the tolerance for nondisclosure. This, in turn, decreases the cost of disclosure. We expect each of these control variables to exhibit a positive association with the likelihood that a firm discloses its CDP responses.

Additional confounding characteristics that may motivate firms to disclose GHG information relates to firm investment in innovations that assist in driving down GHG levels. Prior environmental literature has controlled for these innovative investments by examining the age of a firm's property, plant and equipment and the level of capital expenditures. Firms investing in newer and better GHG emitting technologies are more likely to desire differentiation through disclosure of this information to stakeholders. Similarly, firms with greater capital expenditures are more likely invested in GHG innovative technologies and would desire to signal this strategy. We control for the age of a firm's equipment by including PPE_NEW, measured as the ratio of net PPE divided by gross PPE. We also control for capital intensity of a firm by including CAPX, measured as the ratio of a firm's capital spending divided by their total sales. Each of these variables is adjusted for the industry median per year.

Skinner (1997) posits that firms facing higher levels of litigation risk are more likely to offer information in an attempt to mitigate potential lawsuits. We include LITIGATION to control for a firm's litigation risk. LITIGATION equals 1 if a firm operates in any one of the high litigation industries (SIC codes 2833–2836, 3570–3577, 3600–3674, 5200–5961, and 7370), 0 otherwise (Francis et al. 1994; Matsumoto 2002). Because GHG is considered a potential risk to operations from climate change, those firms in industries of high litigation risk are more likely to voluntarily disclose GHG information.

The CDP was formulated in response to institutional shareholder requests for firm-specific GHG information. Because of the substantial investment, institutional shareholders have an incentive to monitor management behavior in response to firm-specific risks from climate change. Extant literature indicates institutional shareholders play a vital role in corporate governance through the monitoring of management (Shleifer and Vishny 1986). We include INSTOWN and assign a value of 1 if the firm is majority owned by institutional investors and expect a positive relationship between institutional ownership and disclosure. We obtain institutional ownership data from the Corporate Library.

We control for the growth opportunities of the firm by including TOBINSQ. In growth periods, firms have fewer discretionary resources to contribute towards the measurement and reporting of GHG information, decreasing the motivation for disclosure. Similarly, these firms are less

likely to have the funds to place towards the development of new committees and appointment of new officers unless it is truly their competitive strategy. However, these same growth firms face a greater amount of information asymmetry, which would increase the motivation for management to disclose GHG information to signal differentiation to potential investors. TOBINSQ is measured as the market value of common equity plus book value of preferred stocks, book value of long-term debt and current liabilities, divided by book value of total assets. We then adjust the raw score by industry median each year. We do not predict the direction of the growth and disclosure relationship. We include FINANCING to control for the external financing needs of the firm prior to disclosure. FINANCING is measured as the sale of common and preferred shares of stock minus the purchase of common and preferred shares of stock, plus the long-term debt issuance minus the long-term debt issuance, adjusted for the industry median for each year.

From an economic theory perspective, perfectly competitive markets differentiate firms-based solely upon price. In contrast, industry concentrations create opportunities for firm differentiation, abnormal profits, and competitive advantages (Harris 1998). As such, disclosure choices give managers opportunities to manage their own public image among competitors, regulators, and consumers within the industries. This is also consistent with Narver's (1971) supposition that environmental disclosure choices signal management's attempts for positive differentiation and market gain to the product markets. Therefore, we expect firms in more concentrated industries to face greater incentives to disclose GHG information. We include the Herfindahl index (HERF) representing the measure of industry concentration, where higher values of HERF indicate greater industry concentration (Harris 1998). Following the related hypothesis, we expect managers of companies involved in higher concentration (i.e., less competitive) industries are more likely to disclose GHG information.

In addition to the firm's differentiation benefits from voluntary disclosure, management also has particular interest in the personal benefits of increasing the liquidity of their stock price in order to issue equities or sell shares of their firm stock obtained as part of their compensation plans. We control for the liquidity of a firm's stock by including LIQUIDITY and measure it as the ratio of the number of shares traded in the year to the total shares outstanding at the end of the year, adjusted for industry medians by year. Firms with greater financial performance are likely to have the available resources to participate and report GHG information. Accordingly, we control for firm performance by including ROA, measured as the income before extraordinary items, divided by total assets at the

beginning of each year and adjusted for the industry median by year. We also include SIZE, calculated as the natural log of total sales adjusted for industry medians each year, to control for the size of the firm. Larger firms are likely to draw greater attention from stakeholders and have greater amounts of free resources to invest in capital-intensive projects; therefore, we expect a positive relationship between firm size and GHG disclosure.

As a firm's level of debt increases, the market monitoring mechanism requires greater amounts of information. This information demand creates a greater incentive for managers to voluntarily disclose information. Therefore, we include a firm's leverage (LEV), as measured by total debt divided by total assets adjusted for industry each year, and expect it to be positively associated with a firm's overall disclosure strategy (Leftwich et al. 1981). Finally, we include, but do not provide tabulated results for, control variables for each year of the CDP in our sample YR02, YR03, YR04, and YR05 to control for systematic year effects.

Results

Descriptive Statistics

Table 3 presents descriptive statistics related to the CDP sample. Panel A includes the general characteristics and Panel B provides the characteristics of the environmental committees and CSOs in the sample. The disclosure rate for the entire sample period is approximately 44 %, with the average transparency of disclosure (of the firms disclosing) at a 47 % rating. Approximately 18 % of the firms utilized an environmental committee (COMMITTEE), while 21 % of firms employed a sustainability officer. Environmental performance for the firms in this sample is also quite low, with a range of 0–4; the average environmental strength rating is 0.396.²⁶ A small number of firms had disclosed GHG information with the CDP in previous years, with a range between 0 and 4 and a mean value of only 0.517. The CDP sample also exhibits a small number of cross-listed firms, with a mean value of only 0.121. Almost two-thirds of our sample report foreign income (0.656). On average, firms are listed on at least one out of three possible sustainability indices and are not likely to belong to an environmentally sensitive industry (0.204). Similarly, it appears most firms do not operate in high-litigation industries (mean = 0.291) and have less debt (0.218). Institutional ownership appears to be pervasive among CDP firms (mean = 0.905). The average firm size

is reflective of the CDP requesting participation from the largest firms in each country.

Panel B provides a breakdown of the committee and officer characteristics. On average, committees contain 4.8 members. The mean number of meetings is 3.3. Approximately 9 % of firms had committees with members possessing sustainability expertise. The percentage of committee experts ranged from 0 to 75 % with a mean of 10 %. Approximately 13 % had committees that included overlapping members with the audit committee. The average number of member overlaps per committee is 1.7. The average percentage of overlap between the environmental and audit committee members is 15 %. Approximately 12 % of firms chose to hire officers with sustainability expertise.

As previously discussed, the composition of the CDPs respondent list varies slightly from year to year. Table 4 presents the annual sample size and the associated disclosure rates. A breakdown of specific firm responses, including an indication of the rate of disclosure for each response, is included. In 2002, the disclosure rate is 22 %, increasing to 58 % by 2004. This is indicative of the initial years of the project. The addition of many new firms unfamiliar with the GHG measurement process in 2005 brings the disclosure rate down to 40 %, followed by an increase in 2006 to 53 %. Of the total disclosures made over the sample period, the majority of the firms answered the questionnaire in full as opposed to providing a smaller set of information. Approximately 40 % of firms chose to refrain from any type of response (i.e., declined to participate or provided no response).

Table 5 indicates the timing of environmental committee implementation and CSO hiring in relation to GHG disclosure and in relation to one another. It is fairly common for firms to hire a CSO and develop a committee prior to the decision to disclose. In the sample, a CSO was hired 68 times before disclosure, as opposed to 21 times where the company disclosed GHG information prior to hiring the CSO. Similarly, firms developed environmental committees 71 times before disclosing GHG information and only four times after disclosure. The table also indicates that, when these firms have both an officer and a committee and they are not developed or hired during the same year, it appears firms are more likely to establish the committee prior to hiring a CSO. Sharing these governance structures is rare. Most firms, during our sample period, only have one or the other.

Univariate Results

Table 6 presents the univariate results and indicates there is a significant difference between the number of environmental committees and sustainability officers in firms that

²⁶ All industry adjusted independent variables are presented in raw form in the descriptive statistics.

Table 3 Descriptive statistics

| Variables | <i>N</i> | Mean | Median | Max | Min | Std dev |
|---|----------|----------|----------|--------|--------|---------|
| Panel A: main model variables | | | | | | |
| DISC | 1238 | 0.443 | 0 | 1 | 0 | 0.497 |
| TRANSP | 549 | 0.466 | 0.52 | 0.98 | 0.00 | 0.277 |
| COMMITTEE | 1238 | 0.179 | 0 | 1 | 0 | 0.384 |
| OFFICER | 1238 | 0.210 | 0 | 1 | 0 | 0.407 |
| ENVST | 1238 | 0.396 | 0 | 4 | 0 | 0.775 |
| PRIOR | 1238 | 0.517 | 0 | 4 | 0 | 0.928 |
| CROSSLIST | 1238 | 0.121 | 0 | 1 | 0 | 0.326 |
| FOR_OP | 1238 | 0.656 | 1 | 1 | 0 | 0.475 |
| ENVINDEX | 1238 | 0.961 | 1 | 3 | 0 | 0.815 |
| ESI | 1238 | 0.204 | 0 | 1 | 0 | 0.404 |
| CAPX | 1238 | 0.070 | 0.042 | 1.191 | 0 | 0.091 |
| PPE_NEW | 1238 | 0.516 | 0.513 | 1.773 | 0 | 0.165 |
| LITIGATION | 1238 | 0.291 | 0 | 1 | 0 | 0.454 |
| INSTOWN | 1238 | 0.905 | 1 | 1 | 0 | 0.294 |
| TOBINSQ | 1238 | 3.161 | 1.577 | 98.394 | 0.105 | 6.252 |
| FINANCING | 1238 | -211.732 | -221.500 | 58.723 | -7.712 | 3.673 |
| HERF | 1238 | -0.057 | -0.037 | -0.010 | -0.382 | 0.064 |
| LIQUIDITY | 1238 | 1.966 | 1.494 | 18.900 | 0.542 | 1.500 |
| ROA | 1238 | 0.066 | 0.064 | 0.503 | -0.136 | 0.073 |
| SIZE | 1238 | 9.181 | 9.193 | 12.754 | 6.743 | 1.165 |
| LEV | 1238 | 0.218 | 0.209 | 0.892 | 0 | 0.157 |
| Panel B: corporate governance characteristics | | | | | | |
| COMMSZ | 222 | 4.770 | 5 | 9 | 1 | 1.384 |
| COMMED | 222 | 0.770 | 1 | 5 | -3 | 1.387 |
| COMMET | 222 | 3.266 | 3 | 10 | 1 | 1.351 |
| COMEXP | 1238 | 0.093 | 0 | 1 | 0 | 0.290 |
| COMXPRT | 222 | 0.104 | 0 | 0.75 | 0 | 0.153 |
| COMOVLP | 1238 | 0.129 | 0 | 1 | 0 | 0.338 |
| COMNUOV | 222 | 1.658 | 1 | 7 | 0 | 1.492 |
| COMOVRT | 222 | 0.153 | 0.167 | 1.00 | 0 | 0.120 |
| OFFEXP | 1238 | 0.118 | 0 | 1 | 0 | 0.323 |
| OFFNOEXP | 1238 | 0.084 | 0 | 1 | 0 | 0.289 |

All industry adjusted independent variables are presented in raw form for descriptive statistics. All continuous corporate governance characteristic variable descriptive statistics are presented for the sample of those firms that have environmental committees only

disclose versus those that do not disclose GHG information with the CDP. Both environmental committees and sustainability officers are significantly more common among disclosing firms. Disclosing firms also have significantly better environmental performance than non-disclosing firms. Firms disclosing GHG information are significantly more likely to have participated and disclosed before, are more likely cross-listed, have foreign operations, are on sustainability indices, and are larger. Disclosing firms are also more likely to belong to an environmentally sensitive industry and less likely to belong to a high-risk litigation industry. Disclosers appear to exhibit majority ownership

by institutional shareholders. Disclosing firms are statistically more likely to establish more active and diligent committees and appoint executive officers with greater environmental expertise. Table 7 presents the Pearson correlations.²⁷

²⁷ With the significance associated with some of the independent variables in our analysis, there is the possibility of incorrect inferences due to multicollinearity. All independent variables are evaluated for multicollinearity and variance inflation factors are below the stringent logistic regression threshold of 2 (well below the regression threshold of 10).

Table 4 Breakdown of disclosure sample by year

| Years | N | Disclose | Percent of sample by year disclosure | Answered questionnaire-permission to disclose granted | Answered questionnaire-permission to disclose denied | Provided information-permission to disclose granted | Provided information-permission to disclose denied | Declined to participate | No response |
|-------------------------------------|------|----------|--------------------------------------|---|--|---|--|-------------------------|-------------|
| 2002 | 151 | 33 | 0.22 | 33 | 15 | 0 | 18 | 41 | 44 |
| 2003 | 161 | 69 | 0.43 | 62 | 10 | 7 | 14 | 37 | 31 |
| 2004 | 161 | 94 | 0.58 | 86 | 16 | 8 | 14 | 16 | 21 |
| 2005 | 382 | 151 | 0.40 | 126 | 55 | 25 | 13 | 18 | 145 |
| 2006 | 383 | 202 | 0.53 | 185 | 46 | 17 | 4 | 48 | 83 |
| Total | 1238 | | | 492 | 142 | 57 | 63 | 160 | 324 |
| Percent of each response to total N | | | | 39.7 | 11.5 | 4.6 | 5.1 | 12.9 | 26.2 |

Table 5 Evaluation of the timing between CSO hire and environmental committee development and the relation of these corporate governance structures to the timing of GHG disclosures

| N = 1238 | OFFICER | COMMITTEE |
|--|---------|-----------|
| Total | 260 | 222 |
| Unique | 89 | 75 |
| In comparison to disclosure timing | | |
| Before disclosure | 68 | 71 |
| After disclosure | 21 | 4 |
| In comparison to development of officer/committee counterpart position (if within same firm) | | |
| Before | 2 | 5 |
| After | 5 | 2 |

Multivariate Results

Column A of Table 8 presents the results of the Probit regression of DISC. Column B presents the Heckman two-stage regression of TRANSP for those firms that choose to disclose GHG information ($n = 549$). As discussed in the “Methodology” section, we follow a two-stage Heckman approach by including the inverse Mills ratio or IMR (resulting from the initial Probit model as specified in Column A), in the second stage (as reported in Column B), to control for potential selection bias.

In support of Hypothesis 1a, firms with an environmental committee (COMMITTEE) are more likely to disclose their GHG emission accounting ($p \leq 0.05$). However, once the decision has been made to participate in disclosure, having a COMMITTEE does not appear to influence disclosure transparency (TRANSP). The association between the presence of a CSO (OFFICER) and the likelihood of disclosure is marginally significant ($p \leq 0.10$). However, once disclosure is made, the presence of a CSO is positively associated with disclosure transparency at traditionally significant levels ($p \leq 0.05$). In both cases the positive incentives and monitoring pressure to disclose GHG emission accounting appears to outweigh the proprietary costs of disclosure. These results confirm a positive association between GHG disclosures and firms with environmental governance mechanisms. Results also support public claims that increased executive-level support strengthens a firm’s commitment to disclosure transparency.

We offer a brief summary of the control variables significant at conventional levels. Firms with greater environmental performance (ENVST) are significantly more likely to disclose GHG emission information and provide more transparent disclosures. Firms previously participating in CDP disclosure (PRIOR) are also more likely to disclose in the current year. Cross-listed firms (CROSSLIST) are significantly more likely to disclose GHG

Table 6 Univariate results

| Variables | Disclose (<i>N</i> = 549) Mean | Non-disclose (<i>N</i> = 689) Mean | <i>t</i> stat for differences |
|------------|---------------------------------------|---|-------------------------------|
| COMMITTEE | 0.2750 | 0.1030 | −8.03*** |
| OFFICER | 0.3315 | 0.1132 | −9.71*** |
| ENVST | 0.6594 | 0.1858 | −11.21*** |
| PRIOR | 1.0237 | 0.1132 | −19.64*** |
| CROSSLIST | 0.2040 | 0.0552 | −8.18*** |
| FOR_OP | 0.7013 | 0.6197 | −3.01*** |
| ENVINDEX | 1.0055 | 0.9260 | −1.54 |
| ESI | 0.2696 | 0.1524 | −5.13*** |
| CAPX | 0.0812 | 0.0601 | −4.05*** |
| PPE_NEW | 0.5246 | 0.5083 | −1.72* |
| LITIGATION | 0.2532 | 0.3208 | 2.61*** |
| INSTOWN | 0.9235 | 0.8897 | −2.01** |
| TOBINSQ | 2.6529 | 3.5652 | 2.57*** |
| FINANCING | −177.20 | −239.25 | −0.30 |
| HERF | 0.0481 | 0.0637 | 4.32*** |
| LIQUIDITY | 1.7345 | 2.1418 | 4.83*** |
| ROA | 0.0640 | 0.0681 | 1.00 |
| SIZE | 26,966 | 14,385 | −6.37*** |
| LEV | 0.2368 | 0.2029 | −3.80*** |
| COMMSZ | 1.3188 | 0.4862 | −7.75*** |
| COMMED | 0.2188 | 0.0740 | −3.87*** |
| COMMET | 0.9107 | 0.3266 | −7.58*** |
| COMEXP | 0.1384 | 0.0566 | −4.97*** |
| COMXPRT | 0.0302 | 0.0093 | −4.82*** |
| COMOVLP | 0.1967 | 0.0754 | −6.37*** |
| COMNUOV | 0.4481 | 0.1771 | −5.34*** |
| COMOVRT | 0.0422 | 0.0158 | −6.00*** |
| OFFEXP | 0.2113 | 0.0435 | −9.40*** |
| OFFNOEXP | 0.1202 | 0.0697 | −3.07*** |

***, **, * Significance at the 1, 5, and 10 % levels, respectively. One-tailed when signed differences are expected

information as well; however, being listed on foreign exchanges appears to actually be marginally associated with reduced disclosure transparency ($p \leq 0.10$). This result may indicate that US firms cross-listed on foreign exchanges respond to the traditionally greater demands for sustainability-related disclosure exhibited by foreign stakeholders; however they temper the transparency of their disclosures in response to the norms in the US markets. In contrast, once the disclosure decision has been made, those firms who voluntarily chose to participate in disclosure in the absence of foreign exchange pressure also chose to provide more transparent disclosures. Firms in environmentally sensitive industries (ESI) are more likely to disclose information and it is more transparent. Firms in high litigation industries (LITIGATION) and firms with strong financial performance (ROA) appear to be less likely to disclose GHG emissions, but once they choose disclosure they exhibit greater transparency. Although

firms majority owned by institutional shareholders are not more likely to disclose GHG emissions, those that do disclose do so with significantly less transparency. Larger firms (SIZE) and firms operating in industries with greater concentration (HERF) are associated with greater levels of voluntary GHG disclosure.

Table 9 provides further analysis of association between disclosure and the specific characteristics of the environmental committees. Columns 1–8 represent the results when the COMMITTEE variable is replaced with the individual committee characteristics (COMMSZ, COMMED, COMMET, COMEXP, COMXPRT, COMOVLP, COMNUOV, and COMOVRT). The size and activity of the committee are associated with an increased likelihood of the firm's management to measure and report GHG information (COMMSZ ≤ 0.05 , COMMED ≤ 0.10 and COMMET ≤ 0.05). The size and activity of the committee create a greater knowledge base and a more diligent

Table 7 Correlation coefficients for GHG disclosure ($N = 1,238$)

| | DISC | TRANSP | COMMITTEE | OFFICER | ENVST | PRIOR | CROSSLIST | FOR_OP | ENVINDEX |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| TRANSP | 0.783*** | | | | | | | | |
| COMMITTEE | 0.223*** | 0.274*** | | | | | | | |
| OFFICER | 0.263*** | 0.357*** | 0.260*** | | | | | | |
| ENVST | 0.304*** | 0.404*** | 0.338*** | 0.351*** | | | | | |
| PRIOR | 0.487*** | 0.556*** | 0.232*** | 0.341*** | 0.448*** | | | | |
| CROSSLIST | 0.227*** | 0.258*** | 0.265*** | 0.343*** | 0.152*** | 0.263*** | | | |
| FOR_OP | 0.085*** | 0.099*** | 0.117*** | 0.131*** | 0.206*** | 0.120*** | 0.160*** | | |
| ENVINDEX | 0.044 | 0.048* | 0.006 | 0.158*** | 0.130*** | 0.100*** | 0.021 | 0.103*** | |
| ESI | 0.144*** | 0.216*** | 0.233*** | 0.157*** | 0.181*** | 0.156*** | 0.125*** | 0.224*** | 0.011 |
| CAPX | 0.039 | 0.040 | -0.027 | -0.005 | 0.034 | 0.012 | 0.013 | 0.009 | 0.044 |
| PPE_NEW | -0.002* | -0.015 | -0.092*** | -0.030 | -0.034 | 0.024 | 0.049* | 0.047* | 0.037 |
| LITIGATION | -0.074*** | -0.025 | -0.142*** | 0.063* | -0.008 | -0.041 | -0.042 | 0.074*** | 0.156*** |
| INSTOWN | 0.057** | 0.027 | 0.001 | 0.067** | 0.070*** | 0.086*** | 0.036 | 0.072*** | 0.029 |
| TOBINSQ | -0.078** | -0.052* | -0.092*** | -0.063* | -0.087*** | -0.076*** | -0.069** | 0.027 | 0.002 |
| FINANCING | 0.003 | -0.010 | 0.028 | -0.034 | 0.008 | -0.052* | 0.050* | -0.024 | -0.089*** |
| HERF | 0.122*** | 0.134*** | 0.013 | 0.039 | 0.084*** | 0.095*** | 0.032 | 0.072*** | 0.006 |
| LIQUIDITY | -0.111*** | -0.111*** | -0.076*** | -0.106*** | -0.062** | -0.126*** | -0.133*** | 0.025 | -0.042 |
| ROA | -0.016 | -0.004 | -0.032 | 0.036 | -0.021 | 0.030 | 0.048* | -0.003 | 0.029 |
| SIZE | 0.286*** | 0.323*** | 0.258*** | 0.346*** | 0.317*** | 0.387*** | 0.372*** | 0.126*** | 0.154*** |
| LEV | -0.006 | -0.004 | 0.043 | 0.035 | 0.051* | -0.030 | 0.056** | 0.001 | -0.054* |

| | ESI | CAPX | PPE_NEW | LITIGATION | INSTOWN | TOBINSQ | FINANCING | HERF | LIQUIDITY | ROA | SIZE |
|------------|-----------|-----------|----------|------------|-----------|-----------|-----------|---------|-----------|-----------|---------|
| TRANSP | | | | | | | | | | | |
| COMMITTEE | | | | | | | | | | | |
| OFFICER | | | | | | | | | | | |
| ENVST | | | | | | | | | | | |
| PRIOR | | | | | | | | | | | |
| CROSSLIST | | | | | | | | | | | |
| FOR_OP | | | | | | | | | | | |
| ENVINDEX | | | | | | | | | | | |
| ESI | | | | | | | | | | | |
| CAPX | 0.109*** | | | | | | | | | | |
| PPE_NEW | -0.008 | -0.155*** | | | | | | | | | |
| LITIGATION | 0.073*** | 0.030 | 0.131*** | | | | | | | | |
| INSTOWN | 0.103*** | -0.000 | 0.036 | 0.044 | | | | | | | |
| TOBINSQ | 0.055** | -0.004 | 0.011 | 0.009 | -0.014 | | | | | | |
| FINANCING | -0.032 | 0.097 | 0.091*** | -0.064** | -0.019 | 0.012 | | | | | |
| HERF | 0.200*** | 0.062** | 0.002 | -0.184*** | -0.031 | 0.050* | 0.003 | | | | |
| LIQUIDITY | 0.013 | 0.079*** | 0.111*** | 0.111*** | -0.018 | 0.129*** | 0.050* | 0.039 | | | |
| ROA | -0.019 | -0.024 | 0.006 | -0.051 | 0.125 | 0.175 | -0.059 | -0.042 | -0.079 | | |
| SIZE | -0.032 | -0.043 | 0.026 | 0.016 | -0.012 | -0.225*** | -0.060** | -0.050* | -0.367*** | -0.002 | |
| LEV | -0.084*** | 0.029 | 0.009 | -0.081*** | -0.107*** | -0.017 | 0.199*** | 0.021 | -0.031 | -0.234*** | 0.062** |

***, **, * Significance at the 1, 5, and 10 % levels, respectively

monitoring effect that is associated with better GHG measurement and reporting performance. The presence of an overall sustainability expert on the environmental committee (COMEXP) is not associated with greater disclosure when we merely count the number of experts represented on the committee. However, when we measure expertise using a ratio of experts to total members (COMXPRT), we do find a significant relationship

($p \leq 0.05$). Greater expertise on the environmental committee increases the likelihood of GHG disclosure, especially when that expertise dominates participation.

Table 9 also reveals the results from analyzing the effects of the knowledge spillover from the audit committee and environmental committee overlap. Due to the knowledge required to understand both the complexities of corporate disclosure and the implementation of

Table 8 Regression results

| Variables | Column A | | Column B | |
|---------------|--------------|---------|-----------------|----------|
| | DISC: Probit | | TRANSP: Heckman | |
| | Coefficient | z | Coefficient | t |
| COMMITTEE | 0.256 | 1.90** | 0.028 | 0.72 |
| OFFICER | 0.239 | 1.63* | 0.061 | 1.94** |
| ENVST | 0.167 | 2.12** | 0.031 | 2.16** |
| PRIOR | 0.820 | 9.15*** | | |
| CROSSLIST | 0.398 | 2.25*** | -0.530 | -1.35* |
| FOR_OP | -0.031 | -0.32 | -0.026 | -0.77 |
| ENVINDEX | -0.038 | -0.70 | -0.015 | -1.04 |
| ESI | 0.162 | 1.29* | 0.059 | 1.60* |
| CAPX | 0.603 | 1.12 | 0.087 | 0.42 |
| PPE_NEW | -0.038 | -0.12 | -0.081 | -0.66 |
| LITIGATION | -0.128 | -1.27* | 0.062 | 1.89** |
| INSTOWN | 0.048 | 0.34 | -0.069 | -1.81** |
| TOBINSQ | 0.003 | 0.44 | 0.000 | 0.24 |
| FINANCING | 0.000 | 1.26* | 0.000 | 0.62 |
| HERF | 1.560 | 2.25*** | -0.011 | -0.04 |
| LIQUIDITY | -0.008 | -0.20 | 0.007 | 0.60 |
| ROA | -0.889 | -1.37* | 0.279 | 1.46* |
| SIZE | 0.169 | 2.64*** | -0.003 | -0.16 |
| LEV | -0.287 | -0.83 | 0.065 | 0.57 |
| IMR | | | -0.219 | -6.03*** |
| Year effects | Included | | Included | |
| N | 1238 | | N | 549 |
| Wald χ^2 | 242.38 | | F | 9.78 |
| p value | 0.0000 | | p value | 0.0000 |
| Pseudo R^2 | 0.27 | | R^2 | 0.27 |

GHG disclosure determinants

$$\begin{aligned}
 (\text{GHG disclosure})_{i,t} = & \beta_0 + \beta_1 \text{COMMITTEE}_{i,t-1} + \beta_2 \text{OFFICER}_{i,t-1} + \beta_3 \text{ENVST}_{i,t-1} + \beta_4 \text{PRIOR}_{i,t-1} \\
 & + \beta_5 \text{CROSSLIST}_{i,t-1} + \beta_6 \text{ENVINDEX}_{i,t-1} + \beta_7 \text{ESI}_{i,t-1} + \beta_8 \text{CAPX}_{i,t-1} + \beta_9 \text{PPE_NEW}_{i,t-1} \\
 & + \beta_{10} \text{LITIGATION}_{i,t-1} + \beta_{11} \text{INSTOWN}_{i,t-1} + \beta_{12} \text{TOBINSQ}_{i,t-1} + \beta_{13} \text{FINANCING}_{i,t-1} \\
 & + \beta_{14} \text{HERF}_{i,t-1} + \beta_{15} \text{LIQUIDITY}_{i,t-1} + \beta_{16} \text{ROA}_{i,t-1} + \beta_{17} \text{SIZE}_{i,t-1} + \beta_{18} \text{LEV}_{i,t-1}
 \end{aligned}$$

Note Column A presents the Cross-Sectional Probit Regression where the dependent variable (DISC) is the likelihood of disclosures. Column B presents the Heckman two-stage regressions where the dependent variable is the extent of disclosure transparency (TRANSP). Robust standard error estimates are used by clustering on each firm

***, **, * Significance at the 1, 5, and 10 % levels, respectively. One-tailed when signed differences are expected

sustainability strategies, we anticipate firms with greater overlap between the audit committee and the environmental committee will have greater monitoring abilities. In turn, this should lead to a higher likelihood GHG measurement and disclosure. The overlap between the committees is associated with greater sustainability attentiveness where GHG disclosure is concerned. All three variables representing overlap (*COMOVL*, *COMNUOV*, and *COMOVRT*) are positively associated with GHG disclosure. All control variable relationships are similar to the main analysis. In addition, the existence of a sustainability officer remains positively significant throughout this entire analysis.

Table 10 continues the analysis shown in Table 9 by examining the association between the transparency of GHG disclosures and the same independent committee and officer activity and expertise variables. Similar to the previous analysis, the CSO variable remains significant. The only environmental committee characteristic variables that appear to motivate increased disclosure transparency are those associated with expertise on the committee. Both the existence of environmental expertise on the environmental committee and the ratio of environmental experts in relation to the total size of the committee significantly influence GHG disclosure transparency (*COMEXP* and

Table 9 Probit regression results

| Variables | (1) COMMSZ | (2) COMMED | (3) COMMET | (4) COMEXP | (5) COMXPRT | (6) COMOVL | (7) COMNUOV | (8) COMNUOV |
|------------|---------------|---------------|---------------|---------------|----------------|---------------|----------------|----------------|
| COMMITTEE | 0.052** | 0.096* | 0.061** | 0.166 | 1.090** | 0.246* | 0.097** | 1.152** |
| OFFICER | 1.95 | 1.27 | 1.76 | 0.89 | 1.63 | 1.56 | 1.95 | 1.95 |
| ENVST | 0.241** | 0.260** | 0.241** | 0.245** | 0.251** | 0.254** | 0.261** | 0.254** |
| PRIOR | 1.64 | 1.79 | 1.66 | 1.69 | 1.73 | 1.74 | 1.79 | 1.73 |
| CROSSLIST | 0.171** | 0.191** | 0.172** | 0.184** | 0.173** | 0.180** | 0.184** | 0.180** |
| FOR_OP | 2.17 | 2.43 | 2.18 | 2.36 | 2.20 | 2.33 | 2.37 | 2.32 |
| ENVINDEX | 0.820** | 0.821** | 0.820** | 0.824** | 0.827** | 0.819** | 0.820** | 0.819** |
| ESI | 0.391** | 0.410** | 0.413** | 0.433** | 0.415** | 0.407** | 0.408** | 0.416** |
| CAPX | 2.20 | 2.34 | 2.35 | 2.51 | 2.40 | 2.32 | 2.35 | 2.39 |
| PPE_NEW | -0.028 | -0.025 | -0.030 | -0.031 | -0.039 | -0.027 | -0.024 | -0.030 |
| LITIGATION | -0.29 | -0.26 | -0.31 | -0.32 | -0.41 | -0.28 | -0.25 | -0.31 |
| INSTOWN | -0.038 | -0.039 | -0.037 | -0.040 | -0.034 | -0.037 | -0.034 | -0.036 |
| TOBINSQ | -0.69 | -0.72 | -0.67 | -0.74 | -0.73 | -0.67 | -0.63 | -0.65 |
| FINANCING | 0.159* | 0.190* | 0.174* | 0.185* | 0.185* | 0.175* | 0.171* | 0.181* |
| HERF | 1.26 | 1.50 | 1.39 | 1.45 | 1.46 | 1.39 | 1.36 | 1.44 |
| LIQUIDITY | 0.622 | 0.606 | 0.584 | 0.591 | 0.602 | 0.562 | 0.586 | 0.539 |
| ROA | 1.15 | 1.11 | 1.08 | 1.08 | 1.10 | 1.04 | 1.08 | 1.01 |
| SIZE | -0.031 | -0.070 | -0.067 | -0.104 | -0.129 | -0.052 | -0.064 | -0.058 |
| | -0.10 | -0.22 | -0.20 | -0.32 | -0.40 | -0.16 | -0.20 | -0.18 |
| | -0.125 | -0.142* | -0.130* | -0.137* | -0.130* | -0.140* | -0.138* | -0.143* |
| | -1.25 | -1.44 | -1.29 | -1.36 | -1.30 | -1.41 | -1.39 | -1.44 |
| | 0.056 | 0.054 | 0.044 | 0.045 | 0.040 | 0.015 | 0.054 | 0.045 |
| | 0.39 | 0.39 | 0.32 | 0.32 | 0.29 | 0.37 | 0.38 | 0.32 |
| | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 |
| | 0.41 | 0.29 | 0.41 | 0.36 | 0.39 | 0.41 | 0.36 | 0.43 |
| | 0.000 | 0.000 | 0.00* | 0.000* | 0.000* | 0.000* | 0.000 | 0.000 |
| | 1.21 | 1.17 | 1.32 | 1.29 | 1.28 | 1.26 | 1.23 | 1.28 |
| | 1.556** | 1.470** | 1.55** | 1.532** | 1.54** | 1.497** | 1.546** | 1.494** |
| | 2.24 | 2.14 | 2.24 | 2.22 | 2.25 | 2.16 | 2.23 | 2.15 |
| | -0.010 | -0.008 | -0.007 | -0.006 | -0.007 | -0.008 | -0.010 | -0.006 |
| | -0.24 | -0.21 | -0.17 | -0.15 | -0.18 | -0.19 | -0.25 | -0.16 |
| | -0.890* | -0.900* | -0.881* | -0.919* | -0.872* | -0.914* | -0.891* | -0.915* |
| | -1.37 | -1.39 | -1.36 | -1.42 | -1.35 | -1.42 | -1.38 | -1.42 |
| | 0.168** | 0.175** | 0.172** | 0.176** | 0.178** | 0.170** | 0.166** | 0.171** |
| | 2.63 | 2.75 | 2.69 | 2.76 | 2.79 | 2.66 | 2.60 | 2.68 |

Table 9 continued

| Variables | (1) COMMSZ | (2) COMMED | (3) COMMET | (4) COMEXP | (5) COMXPRT | (6) COMOVLP | (7) COMNUOV | (8) COMNUOV |
|-----------------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|
| LEV | -0.280 | -0.265 | -0.277 | -0.269 | -0.300 | -0.291 | -0.268 | -0.299 |
| | -0.80 | -0.76 | -0.80 | -0.78 | -0.86 | -0.83 | -0.77 | -0.85 |
| Year effects | Included | Included | Included | Included | Included | Included | Included | Included |
| N | 1238 | 1238 | 1238 | 1238 | 1238 | 1238 | 1238 | 1238 |
| Wald χ^2 | 243.8 | 244.3 | 243.5 | 240.9 | 245.6 | 240.8 | 241.2 | 239.5 |
| p value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Pseudo R ² | 27.12 | 26.97 | 27.04 | 26.92 | 27.04 | 27.05 | 27.10 | 27.10 |

GHG disclosure likelihood and environmental committee characteristics

$$(DISC)_{i,t} = \beta_0 + \beta_1(\text{committee characteristic})_{i,t-1} + \beta_2\text{OFFICER}_{i,t-1} + \beta_3\text{ENVST}_{i,t-1} + \beta_4\text{PRIOR}_{i,t-1} + \beta_5\text{CROSSLIST}_{i,t-1} + \beta_6\text{ENVINDEX}_{i,t-1} + \beta_7\text{ESI}_{i,t-1} + \beta_8\text{CAPX}_{i,t-1} + \beta_9\text{PPE_NEW}_{i,t-1} + \beta_{10}\text{LITIGATION}_{i,t-1} + \beta_{11}\text{INSTOWN}_{i,t-1} + \beta_{12}\text{TOBINSQ}_{i,t-1} + \beta_{13}\text{FINANCING}_{i,t-1} + \beta_{14}\text{HERF}_{i,t-1} + \beta_{15}\text{LIQUIDITY}_{i,t-1} + \beta_{16}\text{ROA}_{i,t-1} + \beta_{17}\text{SIZE}_{i,t-1} + \beta_{18}\text{LEV}_{i,t-1}$$

Note Columns 1–8 represent the results when (COMMITTEE) is replaced with the different committee characteristics measured as COMMSZ, COMMED, COMMET, COMEXP, COMXPRT, COMOVLP, COMNUOV, and COMOVRT. Robust standard error estimates are used by clustering on each firm

***, **, * Significance at the 1, 5, and 10 % levels, respectively. One-tailed when signed differences are expected

COMXPRT ≤ 0.01). In sharp contrast to expectations, among firms that disclose GHG emissions, those with larger environmental committees exhibit a significantly negative relationship with disclosure transparency (COMMED ≤ 0.10). All control variable relationships are similar to the main analysis.

Table 11 reveals sustainability expertise is also an important attribute of sustainability officers. Firms employing sustainability officers with expertise (OFFEXP) are significantly more likely to disclose GHG information ($p \leq 0.01$), and that information is statistically of greater transparency ($p \leq 0.01$), compared to the condition where no CSO is employed. In contrast, the presence of a CSO that does not possess expertise in sustainability is not significantly associated with disclosure or transparency compared to the condition where a firm does not employ a CSO. In other words, firms hiring CSOs lacking expertise are not different from firms that choose not employ a sustainability officer. These results appear to support anecdotal evidence suggesting firms with experienced sustainability officers are more inclined towards a proactive corporate sustainability strategy, which likely includes GHG reporting. The results also indicate that in the presence of an expert sustainability officer, having an environmental committee continues to be a factor in GHG disclosure ($p \leq 0.01$). It is important to note that throughout each of our analyses, firm size has a significant influence in the decision to disclose, but does not affect disclosure transparency.

Limitations and Sensitivity Analysis

This study is an initial attempt to examine the monitoring importance of environmental corporate governance characteristics as exhibited by their association with GHG emission disclosures. To our knowledge, this is one of the first studies to consider the specific characteristics of environmental committees and sustainability officers on environmental disclosures. While we view this as an important contribution, similar to extant corporate governance research, our findings are subject to limitations. To address these issues, we incorporate specific research designs to mitigate certain concerns. First, we recognize that there are likely other possible ways to identify or measure such governance characteristics. We attempt to design the governance variables in ways that are consistent with prior governance research. To date, there are no resources available to identify every CSO-related position, environmental committees or similar positions with different names. There are possible oversights in the identification of CSOs and environmental committees, although we were careful to follow prior corporate governance literature for common archival coding procedures.

Table 10 Heckman regression results

| Variables | (1) COMMSZ | (2) COMMED | (3) COMMET | (4) COMEXP | (5) COMXPRT | (6) COMOVLPL | (7) COMNUOV | (8) COMOVRT |
|------------|---------------|---------------|---------------|---------------|----------------|-----------------|----------------|----------------|
| COMMITTEE | 0.001 | -0.021* | -0.002 | 0.107*** | 0.299*** | -0.014 | -0.013 | 0.038 |
| OFFICER | 0.08 | -1.38 | -0.16 | 2.62 | 2.68 | -0.34 | -0.84 | 0.28 |
| | 0.061** | 0.062** | 0.061** | 0.048** | 0.052** | 0.060** | 0.059** | 0.061** |
| ENVST | 1.94 | 2.02 | 1.94 | 1.49 | 1.66 | 1.95 | 1.90 | 1.96 |
| | 0.032*** | 0.034*** | 0.033*** | 0.029** | 0.029*** | 0.033*** | 0.033*** | 0.033*** |
| CROSSLIST | 2.24 | 2.34 | 2.28 | 1.99 | 1.97 | 2.28 | 2.27 | 2.24 |
| | -0.050* | -0.043 | -0.049 | -0.062* | -0.057* | -0.048 | -0.047 | -0.050* |
| FOR_OP | -1.28 | -1.12 | -1.25 | -1.57 | -1.44 | -1.24 | -1.20 | -1.27 |
| | -0.025 | -0.025 | -0.024 | -0.028 | -0.028 | -0.025 | -0.026 | -0.025 |
| ENVINDEX | -0.74 | -0.75 | -0.72 | -0.84 | -0.84 | -0.73 | -0.76 | -0.74 |
| | -0.015 | -0.016 | -0.016 | -0.013 | -0.015 | -0.016 | -0.017 | -0.015 |
| ESI | -1.08 | -1.17 | -1.09 | -0.84 | -1.04 | -1.10 | -1.17 | -1.07 |
| | 0.063** | 0.068** | 0.064** | 0.047* | 0.056* | 0.066** | 0.069** | 0.063*** |
| CAPX | 1.71 | 1.87 | 1.80 | 1.30 | 1.53 | 1.80 | 1.88 | 1.73 |
| | 0.078 | 0.051 | 0.074 | 0.128 | 0.103 | 0.072 | 0.067 | 0.078 |
| PPE_NEW | 0.37 | 0.24 | 0.35 | 0.72 | 0.50 | 0.34 | 0.32 | 0.37 |
| | -0.088 | -0.102 | -0.091 | -0.110 | -0.102 | -0.0909 | -0.093 | -0.887 |
| LITIGATION | -0.72 | -0.85 | -0.75 | -1.91 | -0.85 | -0.76 | -0.78 | -0.74 |
| | 0.056** | 0.051** | 0.054** | 0.080*** | 0.072*** | 0.054** | 0.053** | 0.056** |
| INSTOWN | 1.75 | 1.73 | 1.73 | 2.45 | 2.31 | 1.78 | 1.77 | 1.85 |
| | -0.071** | -0.079** | -0.072** | -0.061** | -0.067** | -0.072** | -0.076** | -0.071** |
| TOBINSQ | -1.88 | -2.07 | -1.92 | -1.62 | -1.74 | -1.94 | -2.06 | -1.86 |
| | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| FINANCING | 0.19 | 0.30 | 0.18 | 0.25 | 0.32 | 0.18 | 0.20 | 0.21 |
| | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 |
| HERF | -0.60 | -0.50 | -0.59 | -0.18 | -0.41 | -0.60 | -0.60 | -0.59 |
| | -0.038 | -0.086 | -0.050 | 0.073 | 0.015 | -0.050 | -0.066 | -0.039 |
| LIQUIDITY | -0.15 | -0.34 | -0.20 | 0.28 | 0.06 | -0.20 | -0.26 | -0.16 |
| | 0.008 | 0.009 | 0.009 | 0.007 | 0.006 | 0.009 | 0.010 | 0.009 |
| ROA | 0.67 | 0.75 | 0.70 | 0.57 | 0.53 | 0.70 | 0.77 | 0.68 |
| | 0.281* | 0.275* | 0.281* | 0.260* | 0.289* | 0.285* | 0.284* | 0.279* |
| SIZE | 1.47 | 1.45 | 1.47 | 1.39 | 1.50 | 1.49 | 1.49 | 1.46 |
| | -0.002 | -0.002 | -0.002 | -0.003 | -0.003 | -0.002 | -0.001 | -0.002 |
| LEV | -0.11 | -0.10 | -0.09 | -0.16 | -0.14 | -0.09 | -0.04 | -0.11 |
| | 0.064 | 0.066 | 0.063 | 0.060 | 0.050 | 0.064 | 0.063 | 0.065 |
| IMR | 0.56 | 0.58 | 0.55 | 0.53 | 0.43 | 0.56 | 0.55 | 0.57 |
| | -0.223*** | -0.226*** | -0.223*** | -0.223*** | -0.225*** | -0.226*** | -0.229*** | -0.223*** |
| | -6.29 | -6.52 | -6.33 | -6.29 | -6.45 | -6.36 | -6.54 | -6.18 |

Table 10 continued

| Variables | (1) COMMSZ | (2) COMMED | (3) COMMET | (4) COMEXP | (5) COMXPRT | (6) COMOVLP | (7) COMNUOV | (8) COMOVRT |
|-----------------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|
| Year effects | Included | Included | Included | Included | Included | Included | Included | Included |
| <i>N</i> | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 |
| <i>F</i> | 9.71 | 10.34 | 10.02 | 10.11 | 10.61 | 9.71 | 9.91 | 9.67 |
| <i>p</i> value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| <i>R</i> ² | 27.11 | 27.49 | 27.12 | 28.45 | 28.03 | 27.14 | 27.34 | 27.13 |

GHG disclosure transparency and environmental committee characteristics

$$\begin{aligned}
 (\text{TRANSP})_{i,t} = & \beta_0 + \beta_1(\text{committee characteristic})_{i,t-1} + \beta_2\text{OFFICER}_{i,t-1} + \beta_3\text{ENVST}_{i,t-1} + \beta_4\text{CROSSLIST}_{i,t-1} + \beta_5\text{ENVINDEX}_{i,t-1} + \beta_6\text{ESI}_{i,t-1} \\
 & + \beta_7\text{CAPX}_{i,t-1} + \beta_8\text{PPE_NEW}_{i,t-1} + \beta_9\text{LITIGATION}_{i,t-1} + \beta_{10}\text{INSTOWN}_{i,t-1} + \beta_{11}\text{TOBINSQ}_{i,t-1} + \beta_{12}\text{FINANCING}_{i,t-1} + \beta_{13}\text{HERF}_{i,t-1} \\
 & + \beta_{14}\text{LIQUIDITY}_{i,t-1} + \beta_{15}\text{ROA}_{i,t-1} + \beta_{16}\text{SIZE}_{i,t-1} + \beta_{17}\text{LEV}_{i,t-1}
 \end{aligned}$$

Note Columns 1–8 represent the results when (COMMITTEE) is replaced with the different committee characteristics measured as COMMSZ, COMMED, COMMET, COMEXP, COMXPRT, COMOVLP, COMNUOV, and COMOVRT. Robust standard error estimates are used by clustering on each firm

***, **, * Significance at the 1, 5, and 10 % levels, respectively. One-tailed when signed differences are expected

We believe we were conservative in our inclusion of CSOs and environmental committees. Moreover, to the extent we have not included unobservable CSO-related positions or environmental committees, our tests should bias us away from our findings.

Endogeneity could potentially affect our regression results. There is the possibility that our findings may be affected by an unobservable omitted variable representing the firm’s overall sustainability strategy. If our results are driven by this omitted variable and not by our corporate governance characteristics, estimations will produce biased and inconsistent results. This potential limitation is analogous to the challenges faced in prior audit committee/financial-reporting research, whereby the firm may adopt an overall financial-reporting strategy that not only determines the quality of financial reports, but also the specific appointment of audit committee members. Despite the limitation, Beasley et al. (2009) find that audit committee members can serve as active and incremental components in financial reporting process. Likewise, we hold that individual environmental committees could also serve as incremental governance mechanisms affecting voluntary environmental disclosures. We test for endogeneity between the disclosure decision and the decision to hire a CSO and/or create an environmental committee. Results of the Durbin–Wu–Hausman test indicate endogeneity does not appear to affect the interpretation of our results.²⁸ In addition, we incorporate lagged independent variables. As such, our variables capture whether the prior existence of environmental committee and sustainability officer is associated with future period disclosures.

We also acknowledge that our primary dependent variable also suffers from limitations, common to the voluntary disclosure of environmental or social performance of the firm. In contrast to audited financial statements which much prescribe to specific measurement and reporting standards, our GHG disclosure remains voluntary, not subject to binding standards, and could be influenced by conditions such as a bias or lack of understanding by a primary survey responder. Despite these inherent limitations of the dependent variable, the strength of our inferences is bolstered by the fact that we are not aware of prior literature that shows a positive association between our

²⁸ The models included in the Durbin–Wu–Hausman test are taken from prior literature and are as follows: (1) COMMITTEE = $f(\text{OFFICER}, \text{ESI}, \text{ENVST}, \text{LEV}, \text{SIZE}, \text{OUTSIDE})$, with all variables as defined in the current paper besides OUTSIDE representing the proportion of outside directors, (2) OFFICER = $f(\text{COMMITTEE}, \text{ENVST}, \text{ESI}, \text{SIZE}, \text{LITIGATION}, \text{ROA}, \text{FINANCING}, \text{CEONOTCHAIR}, \text{INSTOWN}, \text{CROSSLIST})$, with all variables as defined in the current paper besides CEONOTCHAIR, controlling for CEO duality and representing a 1 if the CEO is not the chair of the board. Results indicate logistic regression is consistent and that endogeneity does not appear to present a problem.

Table 11 Regression results

| Variables | Column A | | Column B | |
|-----------------------|--------------|---------|-----------------|----------|
| | DISC: Probit | | TRANSP: Heckman | |
| | Coefficient | z | Coefficient | t |
| COMMITTEE | 0.308 | 2.33*** | 0.034 | 0.85 |
| OFFEXP | 0.601 | 3.38*** | 0.084 | 2.33*** |
| OFFNOEXP | -0.204 | -1.05 | 0.020 | 0.41 |
| ENVST | 0.156 | 1.96** | 0.031 | 2.14** |
| PRIOR | 0.800 | 8.87*** | | |
| CROSSLIST | 0.429 | 2.46*** | -0.048 | -1.20 |
| FOR_OP | -0.042 | -0.44 | -0.024 | -0.71 |
| ENVINDEX | -0.045 | -0.82 | -0.017 | -1.19 |
| ESI | 0.198 | 1.58* | 0.059 | 1.62** |
| CAPX | 0.564 | 1.04 | 0.089 | 0.44 |
| PPE_NEW | -0.118 | -0.37 | -0.829 | -0.69 |
| LITIGATION | -0.175 | -1.74** | 0.052 | 1.52* |
| INSTOWN | 0.007 | 0.05 | -0.073 | -1.88** |
| TOBINSQ | 0.003 | 0.52 | 0.001 | 0.35 |
| FINANCING | 0.000 | 1.26* | -0.000 | -0.58 |
| HERF | 1.278 | 1.91** | -0.056 | -0.22 |
| LIQUIDITY | -0.009 | -0.21 | 0.009 | 0.68 |
| ROA | -0.772 | -1.17 | 0.289 | 1.50* |
| SIZE | 0.181 | 2.77*** | -0.002 | -0.10 |
| LEV | -0.194 | -0.56 | 0.086 | 0.73 |
| IMR | | | -0.217 | -5.93*** |
| Year effects | Included | | Included | |
| N | 1238 | | N | 549 |
| Wald χ^2 | 238.00 | | F | 9.86 |
| p value | 0.0000 | | p value | 0.0000 |
| Pseudo R ² | 0.28 | | R ² | 0.27 |

GHG disclosure and sustainability officer expertise

$$\begin{aligned}
 (\text{GHG disclosure})_{i,t} = & \beta_0 + \beta_1 \text{COMMITTEE}_{i,t-1} + \beta_2 \text{OFFICEREXP}_{i,t-1} + \beta_3 \text{OFFICERNOEXP}_{i,t-1} + \beta_4 \text{ENVST}_{i,t-1} \\
 & + \beta_5 \text{PRIOR}_{i,t-1} + \beta_6 \text{CROSSLIST}_{i,t-1} + \beta_7 \text{FOR_OP}_{i,t-1} + \beta_8 \text{ENVINDEX}_{i,t-1} + \beta_9 \text{ESI}_{i,t-1} \\
 & + \beta_{10} \text{CAPX}_{i,t-1} + \beta_{11} \text{PPE_NEW}_{i,t-1} + \beta_{12} \text{LITIGATION}_{i,t-1} + \beta_{13} \text{INSTOWN}_{i,t-1} \\
 & + \beta_{14} \text{TOBINSQ}_{i,t-1} + \beta_{15} \text{FINANCING}_{i,t-1} + \beta_{16} \text{HERF}_{i,t-1} + \beta_{17} \text{LIQUIDITY}_{i,t-1} \\
 & + \beta_{18} \text{ROA}_{i,t-1} + \beta_{19} \text{SIZE}_{i,t-1} + \beta_{20} \text{LEV}_{i,t-1}
 \end{aligned}$$

Note Column A presents the Cross-Sectional Probit Regression where the dependent variable (DISC) is the likelihood of disclosures. Column B presents the Heckman two-stage regressions where the dependent variable is the extent of disclosure transparency (TRANSP). Robust standard error estimates are used by clustering on each firm

***, **, * Significance at the 1, 5, and 10 % levels, respectively. One-tailed when signed differences are expected

variables of interest and the extent of preparer bias or lack of understanding. To affect our inferences we note that a lack of understanding on the part of the preparer would need to be positively associated with the presence of our corporate governance measures.

Similarly, we note that disclosure literature asserts that some disclosures can also take symbolic forms. These symbolic forms can be either a reflection of the true beliefs

of management (even when the significance of certain firm-specific performance gains do not parallel such beliefs) or may simply be forms of impression management that do not reflect management’s beliefs. Unfortunately, our tests are unable to distinguish between these two conditions. However, we note that the nature of the disclosure studied should on average guard against such manipulative disclosure behavior. The measurement and reporting nature of

the GHG disclosures potentially binds management to an objective benchmark in which future performance could be measured. This disciplinary attribute applies across all of the firms in our sample. Likewise, we are unaware of prior literature that explicitly documents a positive association between our corporate governance measures and untruthful disclosures. In contrast, Peters and Romi (2012) document a positive association between the presence of environmental committees and the choice to engage assurance services as part of the development of corporate sustainability reports.

Conclusion

Our study answers the call from prior literature to investigate the effects of other types of corporate governance on alternative forms of corporate reporting (Carcello 2009; Carcello et al. 2011). Regulators increasingly express concern over corporate exposure to environmental risks to operations and the reporting of such information (i.e., Canadian Institute of Chartered Accountings [CICA] 2003; U.S. General Accounting Office [USGAO] 2004; SEC 2010b; International Auditing and Assurance Standards Board 2007). Likewise, firms are increasingly establishing environmental committees and corporate sustainability officer positions. Our study investigates the association between these governance mechanisms and voluntary environmental disclosures by investigating whether these corporate governance characteristics are associated with an increased likelihood and transparency of voluntary disclosure of GHG information.

Using a sample of firms participating in the CDP from 2002 through 2006, we find that GHG disclosure and disclosure transparency are positively associated with the presence of environmental committees on boards of directors and corporate sustainability officers (CSOs). Results indicate that the existence of a sustainability officer is associated with the likelihood and transparency of GHG disclosures. Additional environmental characteristics associated with the probability of disclosure are committee size, number of committee meetings, expertise of committee members, overlap between the environmental committee and the audit committee, and CSO expertise. Only expertise of the environmental committee members and CSO expertise are associated with greater GHG disclosure transparency, while larger committees tend to be associated with lower disclosure transparency. This evidence is also consistent with the overall rigor or composite design of the environmental committee influencing voluntary disclosure and the firm's environmental transparency.

Overall, our findings document a positive association between voluntary environmental governance mechanisms

and disclosures related to the environmental risks of the firm. Although firms may adopt environmental governance mechanisms simply as a means to manipulate public perception of the firm's environmental citizenship, regardless of the firm's actual environmental performance (Rodríguez et al. 2013; Branco and Rodrigues 2008) these governance mechanisms are associated with specific and costly risk disclosure of outcomes generated by the firm's operations. Such disclosures may also discipline the firm's environmental strategies over time since the disclosures create accountable benchmarks. Under the legitimacy theory framework of Chen and Roberts (2010), this suggests that while governance practices might be adopted to simply adapt to social norms, over time such actions can evolve into means to compete for vital stakeholder resources, consistent with resource dependency theory. Future research may wish to consider the longer-term impact of these governance practices and their impact on the firm's ability to compete for stakeholder resources in an environmentally sensitive setting.

Future research may also wish to consider how the adoption of voluntary environmental governance mechanisms relate to and facilitate other informal "environmental organizational citizenship behaviors" that promote the greening of the corporation (Boiral 2009; Boiral and Paillé 2012). While governance practices and environmental citizenship behaviors may not be sufficient to resolve a firm's environmental concerns, Boiral (2009) argues that such initiatives represent important cogs in an overall system. This creates a need to understand how management practices, formal governance structures, and environmental citizenship behaviors work together to impact environmental performance and guide environmental initiatives. For example, based upon discussions with CSOs, future research could help promote an understanding of how the CSO position could facilitate voluntary behaviors within the organization.

Acknowledgments We gratefully acknowledge Teri Lombardi Yohn and Daniel Beneish for their helpful comments.

References

- Abbott, L. J., Parker, S., & Peters, G. F. (2004). Audit committee characteristics and restatements. *Auditing: A Journal of Practice and Theory*, 23, 69–87.
- Akerlof, G. (1970). The market for lemons: Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 90, 629–650.
- Al-Tuwaijri, S. A., Christensen, T. E., & Hughes, K. E., I. I. (2004). The relations among environmental disclosure, environmental performance, and economic performance: A simultaneous equations approach. *Accounting, Organizations and Society*, 29, 447–471.
- Arjoon, S. (2005). Corporate governance: An ethical perspective. *Journal of Business Ethics*, 61, 343–352.

- Bansal, P., & Clelland, I. (2004). Talking trash: Legitimacy, impression management and unsystematic risk in the context of the natural environment. *Academy of Management Journal*, 47(1), 93–103.
- Bansal, P., & Kistruck, G. (2006). Seeing is (not) believing: Managing the impression of the firm's commitment to the natural environment. *Journal of Business Ethics*, 67(2), 165–180.
- Beasley, M. S. (1996). An empirical analysis of the relation between the board of director composition and financial statement fraud. *The Accounting Review*, 71, 443–465.
- Beasley, M. S., Branson, B. C., & Hancock, B. V. (2008, April). Rising expectations: Audit committee oversight of enterprise risk management. *Journal of Accountancy*, 44–51.
- Beasley, M. S., Carcello, J. V., Hermanson, D. R., & Neal, T. L. (2009). The audit committee oversight process. *Contemporary Accounting Research*, 26(1), 65–122.
- Beasley, M., Pagach, D., & Warr, R. (2010). Information conveyed in hiring announcements of senior executives overseeing enterprise-wide risk management processes. *Journal of Accounting, Auditing, and Finance*, 23, 311–323.
- Berthelot, S., Cormier, D., & Magnan, M. (2003). Environmental disclosure research: Review and synthesis. *Journal of Accounting Literature*, 22, 1–44.
- Boiral, O. (2009). Greening the corporation through organization citizenship behaviors. *Journal of Business Ethics*, 87, 221–236.
- Boiral, O., & Paillé, P. (2012). Organizational citizenship behavior for the environment: Measurement and validation. *Journal of Business Ethics*, 109(4), 431–445.
- Boyd, B. (1990). Corporate linkages and organizational environment: A test of the resource dependence model. *Strategic Management Journal*, 11, 419–430.
- Branco, M. C., & Rodrigues, L. L. (2008). Factor influencing social responsibility disclosure by Portuguese Companies. *Journal of Business Ethics*, 83, 685–701.
- Brennan, N. M., & Solomon, J. F. (2008). Corporate governance, accountability and mechanisms of accountability: An overview. *Accounting, Auditing, and Accountability Journal*, 21(7), 885–906.
- Canadian Institute of Chartered Accountings (CICA). (2003). *CICA practice guide: Engagements to audit GHG emissions information*. Toronto, ON: Canadian Institute of Chartered Accountings.
- Carbon Disclosure Project (CDP). (2007). *What we do*. Retrieved July 23, 2007, from <https://www.cdproject.net/en-US/WhatWeDo/Pages/overview.aspx>.
- Carcello, J. V. (2009). Governance and the common good. *Journal of Business Ethics*, 89, 11–18.
- Carcello, J. V., Hermanson, D. R., & Ye, Z. (2011). Corporate governance research in accounting and auditing: Insights, practices, implications, and future research. *Auditing: A Journal of Practice and Theory*, 30(3), 1–31.
- Chapple, L., Clarkson, P. M., & Gold, D. L. (2013). The cost of carbon: Capital market effects of the proposed Emission Trading Scheme (ETS). *Abacus*, 49(1), 1–33.
- Chen, J. C., & Roberts, R. W. (2010). Toward a more coherent understanding of the organization–society relationship: A theoretical consideration for social and environmental accounting research. *Journal of Business Ethics*, 97, 651–665.
- Cho, C. H., Freedman, M., & Patten, D. M. (2012). Corporate disclosure of environmental capital expenditures: A test of alternative theories. *Accounting, Auditing and Accountability*, 25(3), 486–507.
- Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society*, 32, 639–647.
- Cho, C. H., Patten, D. M., & Roberts, R. W. (2006). Corporate political strategy: An examination of the relation between political expenditures, environmental performance, and environmental disclosure. *Journal of Business and Ethics*, 67, 139–154.
- Cho, C. H., Roberts, R. W., & Patten, D. M. (2010). The language of US corporate environmental disclosure. *Accounting, Organizations and Society*, 35, 431–443.
- Clarkson, P. M., & Li, Y. (2004). The market valuation of environmental capital expenditures by pulp and paper companies. *The Accounting Review*, 79, 329–353.
- Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, 33, 303–327.
- Coburn, J., Donahue, S. H., & Jayanti, S. (2011). *Disclosing climate risks and opportunities in SEC filings: A guide for corporate executives, attorneys and directors*. Boston, MA: Ceres.
- Cohen, J. R., Krishnamoorthy, G., & Wright, A. M. (2008). Form versus substance: The implications for auditing practice and research alternative perspectives on corporate governance. *Auditing: A Journal of Practice and Theory*, 27, 181–198.
- Cordano, M., & Frieze, I. H. (2000). Pollution reduction preferences of US environmental managers: Applying Ajzen's theory of planned behavior. *Academy of Management Journal*, 43, 627–641.
- Cormier, D., Gordon, I. M., & Magnan, M. (2004). Corporate environmental disclosure: Contrasting management's perceptions with reality. *Journal of Business Ethics*, 49(2), 143–165.
- Cormier, D., & Magnan, M. (1999). Corporate environmental disclosure strategies: Determinants, costs and benefits. *Journal of Accounting, Auditing, and Finance*, 14, 429–451.
- Cormier, D., Magnan, M., & Velthoven, B. V. (2005). Environmental disclosure quality in large german companies: Economic incentives, public pressures or institutional conditions? *European Accounting Review*, 14(1), 3–39.
- Cowen, S. S., Ferreri, L. B., & Parker, L. D. (1987). The impact of corporate characteristics on social responsibility disclosure: A typology and frequency-based analysis. *Accounting, Organizations and Society*, 12, 111–122.
- Dawkins, C. E., & Fraas, J. W. (2011). Erratum to: Beyond acclamations and excuses: Environmental performance, voluntary environmental disclosure and the role of visibility. *Journal of Business Ethics*, 99, 383–397.
- Dechow, P. M., Sloan, R. G., & Sweeney, A. P. (1996). Causes and consequences of earnings manipulation: An analysis of firms subject to enforcement actions by the SEC. *Contemporary Accounting Research*, 13, 1–36.
- Deegan, C., & Rankin, M. (1996). Do Australian companies report environmental news objectively? An analysis of environmental disclosures by firms prosecuted successfully by the Environmental Protection Agency. *Accounting, Auditing and Accountability Journal*, 9, 50–67.
- Deutsch, C. H. (2007). Companies giving green an office. *The New York Times*. Retrieved July 3, 2007, from www.nytimes.com/2007/07/03/business/03sustain.html.
- DeZoort, F. T., Hermanson, D. R., Archambeault, D. S., & Reed, S. A. (2002). Audit committee effectiveness: A synthesis of the empirical audit committee literature. *Journal of Accounting Literature*, 21, 38–75.
- Diamond, D. W. (1985). Optimal release of information by firms. *Journal of Finance*, 40(4), 1071–1094.
- Dixon-Fowler, H. R., Ellstrand, A. E., & Johnson, J. (2010). The role of environmental committees in corporate environmental performance. In *Presented at the 2010 Academy of Management Annual Meeting*, Montreal, Canada. Working Paper. University of Arkansas.
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review*, 20(1), 65–91.

- Dye, R. A. (2001). An evaluation of 'Essays on Disclosure' and the disclosure literature in accounting. *Journal of Accounting and Economics*, 32, 181–235.
- Egri, C. P., & Herman, S. (2000). Leadership in the North American environmental sector: Values, leadership styles, and contexts of environmental leaders and their organizations. *Academy of Management Journal*, 43, 571–604.
- Eng, L. L., & Mak, Y. T. (2003). Corporate governance and voluntary disclosure. *Journal of Accounting and Public Policy*, 22, 325–345.
- Ernst and Young (EY). (2010, April). Regulatory change is driving audit committee agendas. *Insights for North American Audit Committee Members Newsletter*.
- Ewing, K. A. (2008, August). Global warming: The director's perspective. In *NACD-directors monthly* (pp. 11–13). Washington, DC: National Association of Corporate Directors.
- Farber, D. B. (2005). Restoring trust after fraud: Does corporate governance matter? *The Accounting Review*, 80, 539–561.
- Feeny, D. F., Edwards, B. R., & Simpson, K. M. (1992). Understanding the CEO/CIO relationship. *MIS Quarterly*, 16, 435–448.
- Fishman, C. (2006). A farming fairy tale: Imagine that you could wave a wand and make all our food organic. Retrieved January 5, 2009, from <http://www.fastcompany.com/56671/farming-fairy-tale>.
- Forker, J. J. (1992). Corporate governance and disclosure quality. *Accounting and Business Research*, 22, 111–124.
- Francis, J., Philbrick, D., & Schipper, K. (1994). Shareholder litigation and corporate disclosures. *Journal of Accounting Research*, 32, 137–164.
- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Boston, MA: Pitman.
- Friedman, M. (1970, September 13). The social responsibility of business is to increase profits. *New York Times Magazine*, 32–33, 122, 126.
- Galbraith, K. (2009). Companies add chief sustainability officers. *New York Times*. Retrieved March 2, 2009, from <http://green.blogs.nytimes.com/2009/03/02/companies-add-chief-sustainability-officers>.
- Galbreath, J. (2010). Corporate governance practices that address climate change: An exploratory study. *Business Strategy and the Environment*, 19, 335–350.
- Garriga, E., & Mele, D. (2004). Corporate social responsibility theories: Mapping the territory. *Journal of Business Ethics*, 53, 51–71.
- Graham, J. R., Harvey, C. R., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, 40(1–3), 3–73.
- Gray, R., Kouhy, R., & Lavers, S. (1995). Corporate social and environmental reporting: A review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing and Accountability Journal*, 8(2), 47–77.
- Gregg, D. (2009). Carbon footprints gain ground as governance issue. *Puget Sound Business Journal*. Retrieved July 11, 2009, from <http://orlando.bizjournals.com/seattle/stories/2009/04/27/focus9.html>.
- Griffin, P. A., Lont, D. H., & Sun, Y. (2010). The relevance to investors of greenhouse gas emission disclosures. Working Paper. Davis, CA: University of California.
- Grossman, S. J. (1981). The informational role of warranties and private disclosure about product quality. *Journal of Law and Economics*, 24, 460–483.
- Haniffa, R. M., & Cooke, T. E. (2005). The impact of culture and governance on corporate social reporting. *Journal of Accounting and Public Policy*, 24, 391–430.
- Hanna, M. D., Newman, W. R., & Johnson, P. (2000). Linking operational and environmental improvement through employee involvement. *International Journal of Operations and Production Management*, 20, 148–165.
- Harris, M. S. (1998). The association between competition and managers' business segment reporting decisions. *Journal of Accounting Research*, 36, 111–128.
- Hopwood, A. (2009). Accounting and the environment. *Accounting, Organizations and Society*, 34, 433–439.
- Huang, C. L., & Kung, F. H. (2010). Drivers of environmental disclosure and stakeholder expectation: Evidence from Taiwan. *Journal of Business Ethics*, 96, 435–451.
- Ingram, R. W., & Frazier, K. B. (1980). Environmental performance and corporate disclosure. *Journal of Accounting Research*, 18, 614–622.
- International Auditing and Assurance Standards Board (IAASB). (2007). *Approved project proposal: Assurance engagements on carbon emissions information*. New York: International Auditing and Assurance Standards Board.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency cost, and ownership structure. *Journal of Financial Economics*, 3, 305–360.
- Johnson, S. (2010, February 22). Who's minding risk? *CFO Magazine*.
- Kalbers, L., & Fogarty, T. (1993). Audit committee effectiveness: An empirical investigation of the contribution of power. *Auditing: A Journal of Practice and Theory*, 12, 24–49.
- Karamanou, I., & Vafeas, N. (2005). The association between corporate boards, audit committees, and management earnings forecasts: An empirical analysis. *Journal of Accounting Research*, 43, 453–486.
- Kearney, A. T. (2010). Carbon management becomes key part of corporate supply chain strategy for major global companies. Retrieved February 1, 2010, from <http://www.marketwire.com>.
- Klein, A. (2002). Audit committee, board of director characteristics, and earnings management. *Journal of Accounting and Economics*, 33, 375–400.
- KPMG. (2011). *KPMG international survey of corporate responsibility reporting 2011*. Amsterdam, North Holland: KPMG.
- Laksmana, I. (2008). Corporate board governance and voluntary disclosure of executive compensation practices. *Contemporary Accounting Research*, 25, 1147–1182.
- Lam, K., & Li, Y. (2008). Does corporate governance matter? The case of environmental and social responsibility committees on the board. Working Paper. Toronto, ON: University of Toronto.
- Lang, M., Lins, K., & Miller, D. (2003). ADRS, analysts, and accuracy: Does cross-listing in the United States improve a firm's information environment and increase market value? *Journal of Accounting Research*, 31, 317–345.
- Lang, M., Lins, K., Miller, D., & Lundholm, R. (1993). Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of Accounting Research*, 31, 246–271.
- Larcker, D. F., Richardson, S. A., & Tuna, I. (2007). Corporate governance, accounting outcomes, and organizational performance. *The Accounting Review*, 82, 963–1008.
- Leftwich, R. W., Watts, R. L., Zimmermann, L., Burton, J. C., & Schipper, K. (1981). Voluntary corporate disclosure: The case of interim reporting/discussion. *Journal of Accounting Research*, 19(Suppl), 50–77.
- Li, Y., Richardson, G. D., & Thornton, D. B. (1997). Corporate disclosure of environmental liability information: Theory and evidence. *Contemporary Accounting Research*, 14, 435–474.
- Lindblom, C. K. (1994). *The implications of organizational legitimacy for corporate social performance and disclosure*. In Presented at Critical Perspectives on Accounting Conference, New York.
- Lubin, D. A., & Esty, D. C. (2010). The sustainability imperative. *Harvard Business Review*, 88(5), 42–50.

- Matsumoto, D. A. (2002). Management's incentives to avoid negative earnings surprises. *The Accounting Review*, 77, 483–514.
- Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2013). Firm-value effects of carbon emissions and carbon disclosures. *The Accounting Review* (forthcoming).
- McDaniel, L., Martin, R. D., & Maines, L. A. (2002). Evaluation financial reporting quality: The effects of financial expertise vs. financial literacy. *The Accounting Review*, 77(Suppl), 139–167.
- Meyer, J. W., & Rowan, B. (1977). Institutional organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340–363.
- Michals, G. (2009). The boardroom's climate is changing: More companies are designating specific committees for environmental issues to help inform the board of potential problems. *Directorship Boardroom Intelligence*. Retrieved December 23, 2009, from <http://www.directorship.com/environmental-board-room/>.
- Milgrom, P. (1981). Good news and bad news: Representation theorems and applications. *Bell Journal of Economics*, 12, 380–391.
- Naiker, V., & Sharma, D. S. (2009). Former audit partners on the audit committee and internal control deficiencies. *The Accounting Review*, 84, 559–587.
- Narver, J. C. (1971). Rational management response to external effects. *Academy of Management Journal*, 14, 99–115.
- Neu, D., Warsame, H., & Pedwell, K. (1998). Managing public impressions: Environmental disclosures in annual reports. *Accounting, Organizations and Society*, 23, 265–282.
- Pagach, D., & Warr, R. S. (2010, April 10). The effects of enterprise risk management on firm performance. Working Paper. Available at SSRN: <http://ssrn.com/abstract=1155218>.
- Patten, D. M. (2002). The relation between environmental performance and environmental disclosure. *Accounting, Organizations and Society*, 27, 763–773.
- Patten, D. M. (2005). The accuracy of financial report projections of future environmental capital expenditures: A research note. *Accounting, Organizations and Society*, 30(5), 457–468.
- Peters, G. F., & Romi, A. M. (2012). The association between sustainability governance characteristics and the assurance of corporate sustainability reports. Working Paper. Texas Tech University.
- Peters, G. F., & Romi, A. M. (2013). Discretionary compliance with mandatory environmental disclosures: Evidence from SEC filings. *Journal of Accounting and Public Policy*, 32(4), 213–236.
- Peters, G. F., Romi, A. M., & Sanchez, J. M. (2013). Corporate sustainability officers and environmental performance: Symbolic legitimation or authentic leadership. Working Paper, Texas Tech University.
- Petersen, M. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, 22(1), 246–276.
- Prado, J. M., & Garcia, I. M. (2010). The role of the board of directors in disseminating relevant information on greenhouse gases. *Journal of Business Ethics*, 97(3), 391–424.
- Prado, J. M., Rodriguez, L., Gallego, I., & Garcia, I. M. (2009). Factors influencing the disclosure of greenhouse gas emissions in companies worldwide. *Management Decision*, 47(7), 1133–1157.
- Ramus, C. A., & Steger, U. (2000). The roles of supervisory support behaviors and environmental policy in employee 'ecoinitiatives' at leading-edge European companies. *Academy of Management Journal*, 43, 605–626.
- Rankin, M., Windsor, C., & Wahyuni, D. (2011). An investigation of voluntary corporate greenhouse gas emissions reporting in a market governance system: Australian evidence. *Accounting, Auditing and Accountability Journal*, 24, 1037–1070.
- Richardson, S., Teoh, S. H., & Wysocki, P. (2004). The walkdown to beatable analysts' forecasts: The role of equity issuance and inside trading incentives. *Contemporary Accounting Research*, 21, 885–924.
- Rivenburgh, D. (2010). Sustainability executive positions on the rise. *Strategic Imperatives*. Retrieved April 10, 2010, from <http://strategic-imperatives.com/node/54>.
- Rodrigue, M., Magnan, M., & Cho, C. H. (2013). Is environmental governance substantive or symbolic? An empirical investigation. *Journal of Business Ethics*, 114(1), 107–129.
- Ruple, K., Brown, D., & Marshall, S. (2012). Governance, media, and the quality of environmental disclosure. *Journal of Accounting and Public Policy*, 31(6), 610–640.
- Schwartz, M. S., Dunfee, T. W., & Kline, M. J. (2005). Tone at the top: An ethics code for directors? *Journal of Business Ethics*, 58(1–3), 79–100.
- Securities and Exchange Commission (SEC). (2010a). *SEC issues interpretive guidance on disclosure related to business or legal developments regarding climate change*. Washington, DC: SEC. Retrieved January 27, 2010, from <http://www.sec.gov/news/press/2010/2010-15.htm>.
- Securities and Exchange Commission (SEC). (2010b). Speech by SEC Chairman: Statement before the Open Commission Meeting on Disclosure Related to Business or Legislative Events on the Issue of Climate Change. Washington, DC: SEC. Retrieved January 27, 2010, from <http://www.sec.gov/news/speech/2010/spch012710mls-climate.htm>.
- Shleifer, A., & Vishny, R. W. (1986). Large shareholders and corporate control. *Journal of Political Economy*, 94, 461–489.
- Skinner, D. J. (1997). Earnings disclosure and stockholder lawsuits. *Journal of Accounting and Economics*, 23, 249–282.
- Sommer, A., Jr. (1991). Auditing audit committees: An educational opportunity for auditors. *Accounting Horizons*, 5, 91–93.
- Stanny, E. (2013). Voluntary disclosure of emissions by US firms. *Business Strategy and the Environment*, 22(3), 145–158.
- Stanny, E., & Ely, K. (2008). Corporate environmental disclosures about the effects of climate change. *Corporate Social Responsibility and Environmental Management*, 15, 338–348.
- Tinker, A., Neimark, M., & Lehman, C. (1991). Falling down the hole in the middle of the road: Political quietism in corporate social reporting. *Accounting, Auditing, and Accountability Journal*, 4, 28–54.
- Trueman, B. (1986). Why do managers voluntarily release earnings forecasts? *Journal of Accounting and Economics*, 8, 53–71.
- United States Environmental Protection Agency (USEPA). (2009). *Final mandatory reporting of greenhouse gases rule*. Washington, DC: USEPA. <http://www.epa.gov/climatechange/emissions/ggulemaking.html>.
- U.S. General Accounting Office (USGAO). (2004). *Environmental Disclosure: SEC should explore ways to improve tracking and transparency of information*. Washington, DC: General Accounting Office (GAO-04-808).
- Vera-Munoz, S. C. (2005). Corporate Governance Reforms: Redefined expectations of audit committee responsibilities and effectiveness. *Journal of Business Ethics*, 62, 115–127.
- Verrechia, R. E. (1983). Discretionary disclosure. *Journal of Accounting and Economics*, 5, 179–194.
- Verrechia, R. E. (1990). Information quality and discretionary disclosure. *Journal of Accounting and Economics*, 12, 365–380.
- Wagner, S., Hespeneide, E., & Pavlovsky, K. (2009). The responsible and sustainable board. *Deloitte Review Issue*, 4, 59–71.
- Wiseman, J. (1982). An evaluation of environmental disclosures made in corporate annual reports. *Accounting, Organizations and Society*, 7, 53–64.

- Xerox. (2010). *Patricia A. Calkins biography*. Retrieved February 17, 2010, from http://www.xerox.com/downloads/usa/en/t/TL_bio_Patricia_Calkins.pdf.
- Zimmerman, A., & Fong, M. (2008, October 22). Chinese suppliers face new Wal-Mart mandates. *The Wall Street Journal*.
- Zutshi, A., & Sohal, A. S. (2004). Adoption and maintenance of environmental management systems: Critical success factors. *Management of Environmental Quality: An International Journal*, *15*, 399–419.