

Corporate environmental performance and disclosure nexus: The role of Chief Sustainability Officer

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Abstract

Motivated by the view that integration of environmental management structures would lead to alignment of a firm's environmental performance with its disclosure practices, the study explores whether the presence of a Chief Sustainability Officer (CSO) in a firm would shape the corporate environmental performance—disclosure (P-D) nexus. We analyze data pertaining to a set of U.S. firms and find that the association between a firm's Greenhouse Gas (GHG) emissions and the extensiveness of its environmental disclosure is insignificant in firms with a CSO, while it is positively significant in firms without a similar officer. In additional analyses, we find that the association between a firm's GHG emissions and the extensiveness of its disclosure wanes into statistical insignificance for firms with board-level, standalone, environmental committees, while it is positively significant in firms without a similar committee. The findings imply that policymakers, regulators, and advocates of corporate environmental responsibility could use policies and campaigns that encourage appointment of CSOs and/or board-level standalone environmental committees to promote alignment of firms' environmental disclosure practices with their environmental performance.

Keywords: Corporate environmental governance; corporate carbon performance; corporate carbon disclosure; environmental committees; chief sustainability officer.

1. Introduction

Recent years have witnessed rising pressure on corporates to provide disclosure on their environmental performance (Bui, Houqe, & Zaman, 2020). Although environmental disclosures are broadly viewed as avenues through which firms demonstrate corporate environmental accountability to stakeholders (Bui et al., 2020), the theoretical literature proffers conflicting viewpoints regarding the relationship between corporate environmental performance and its environmental reporting practices. For instance, conjectures based on voluntary disclosure and signaling theories suggest that a firm with better environmental performance would have stronger incentives to provide more extensive environmental disclosures (Li, Richardson, & Thornton, 1997; Verrecchia, 1983). On the other hand, propositions anchored on stakeholder and legitimacy theories suggest that a firm could employ its environmental disclosures to “greenwash” and obfuscate its poor environmental performance; a firm with poor environmental performance would have a stronger incentive to provide a more extensive environmental disclosure (Adams, 2004; Gray, Kouhy, & Lavers, 1995; Hughes, Anderson, & Golden, 2001; Lemma, Feedman, Mlilo, & Park, 2019).

Just as in the theoretical prediction, prior empirical endeavors that explore the extent to which corporate environmental disclosures reflect firms’ environmental performance present mixed evidence. For example, some studies demonstrate a positive relationship between a firm’s environmental performance and its disclosure decisions (e.g., Al-Tuwaijri, Christensen, & Hughes, 2004; Clarkson, Li, Richardson, & Vasvari, 2008; Luo & Tang, 2014). Nonetheless, several other studies document an inverse relationship between the two variables (e.g., Cho, Freedman, & Patten, 2012; Clarkson, Li, Richardson, & Vasvari, 2011; Hassan & Romilly, 2018). The conflicting theoretical prediction and mixed empirical evidence suggest that the interaction between a firm’s environmental performance and its disclosure decisions is complex and is underpinned by several factors.

Drawing on the U.S. Security and Exchange Commission’s (SEC) interpretive release (2010), we conceptualize corporate environmental disclosure (*DISC*) as a measure of the extensiveness of corporate climate change disclosures on how climate change impacts a firm’s future financial condition or operating performance (Cong, Freedman, & Park, 2020). Although the SEC provides a mandatory list of items to be disclosed in a firm’s environmental disclosures, compliance varies (Cook, 2014; Freedman & Park, 2014; Hahn & Kühnen, 2013). In a recent study that explored voluntarily disclosure GHG related data obtained from the CDP,¹ Bui et al. (2020) demonstrate that the nexus between a firm’s environmental performance and its environmental disclosure (the P-D nexus, hereinafter) is shaped by board-level climate governance processes and structures. Bui et al’s (2020) study highlights the importance of [environmental] strategies and policies set at the board-level in shaping the interaction between a firm’s environmental reporting practices with its environmental performance.

Environmental strategies and policies established through climate governance structures at the board-level would require complementary organizational resources and

¹ Formerly known as the Carbon Disclosure Project.

capabilities, including employee skills and know-how, to ensure implementation (Hart, 1995; Russo & Fouts, 1997). Recent studies show that executives in charge of matters related to environmental sustainability serve as valuable human resource in the formulation and implementation of a firm's environmental strategies and policies and enhancing the firm's environmental performance and reputation (Dixon-Fowler, Ellstrand, & Johnson, 2017; Peters & Romi, 2014). We build on and extend both Peters and Romi's (2014) and Bui et al.'s (2020) studies and examine whether the presence of a Chief Sustainability Officer (CSO, hereafter)—an administrator charged specifically with environmental governance responsibilities—in a firm would reinforce or mitigate the alignment between the firm's environmental performance and its disclosure practice.

The motivation for our study stems from four main sources. First, pointing to the schism between firms' environmental policies and their actual environment performance (Hutchinson, 1996; Sæverud & Skjærseth, 2007), environmental management scholars have called for studies that focus on management processes and structures via which environmental strategies and policies are implemented (Dixon-Fowler et al., 2017). Our study responds to this call by investigating how the presence of a CSO in a firm would shape the *P-D* nexus. Second, the prior studies that explored the *P-D* nexus present inconclusive results. While some studies demonstrate a direct association (e.g., Luo & Tang, 2014), others report an inverse (e.g., Clarkson et al., 2008) or no (e.g., Wiseman, 1982) relationship between a firm's environmental undertakings and its disclosure practices. The inconclusive evidence highlights the complexity of the *P-D* nexus and suggest that there is a need for studies that explore the role of mediating or moderating factors on the association between the two variables. Our study explores this complex relationship by examining the role of the presence of a CSO in a firm in determining the relationship between a firm's environmental performance and the extensiveness of its environmental disclosures.

Third, prior studies examining the *P-D* nexus not only report conflicting findings but also are mostly based on voluntarily reported data (e.g., Bui et al., 2020). Thus, we attempt to bring additional insights by examining the role of the presence of a CSO or equivalent officer in a firm on the *P-D* nexus, using mandatorily reported data. Fourth, since environmental actions of a firm are deemed to be crucial to the sustainability of our planet (Addison, 2018; Baldini, Dal Maso, Liberatore, Mazzi, & Terzani, 2018), there still is a continuing and rising interest regarding the impact of corporate activities on climate change and the alignment of a firm's disclosure practices with its actual performance (Gillan, Koch, & Starks, 2021). Hence, our study contributed to the debate on the complex interaction involving a firm's environmental performance and its environmental disclosure.

We analyze data pertaining to a set of U.S. firms, for years 2010 and 2011, to establish whether the presence of a CSO or equivalent officer in a firm would shape the nexus between a firm's environmental performance and its disclosure practice. We find that the association between a firm's Greenhouse Gas (GHG) emissions—an inverse measure of corporate environmental performance—and the extensiveness of its environmental disclosures is muted in firms with a CSO, while it is positively significant

in firms without a CSO. This finding suggests the presence of a CSO in a firm dampens the firm's proclivity to use environmental disclosures to "greenwash" or obfuscate poor environmental performance. It is also in sync with the view that the appointment of a senior manager responsible for corporate environmental issues in a firm improves information flow and strengthens the link between the firm's environmental strategies and implementation (Dixon-Fowler et al., 2017), which in turn weakens the potential misalignment between a firm's environmental performance and its disclosure practices.

In view of the call to reflect on the usefulness of board-level environmental committees (Walls, Berrone, & Phan, 2012), we carry out additional analyses to examine whether the existence of a standalone environmental committee on the board would shape the *P-D* nexus. We find that the association between a firm's environmental performance and its environmental reporting wanes into statistical insignificance for firms with boards that have standalone environmental committees, while it is positively significant in firms without such a committee. This finding suggests that the existence of a standalone environmental sub-committee on a firm's board structure curbs the firm's inclination toward using its environmental disclosures as mechanisms to disguise unfavorable environmental performance. It also suggests that presence of voluntary, board-level, standalone environmental committee in a firm is likely to strengthen the alignment between the firm's environmental strategies and its environmental performance. Taken together, our findings imply that policymakers, regulators, and advocates of corporate environmental responsibility could use policies and campaigns that encourage appointment of CSOs and/or environmental committees to promote alignment of a firm's environmental disclosure practices with its environmental performance.

The present study contributes to the literature on corporate environmental reporting in two ways. First, it presents evidence on how the appointment of a CSO or equivalent officer in a firm would influence the nexus between a firm's environmental performance and its environmental disclosure practices. This is a significant contribution as no prior study has examined the role of an executive officer in charge of a firm's environmental matters on the interaction between a firm's environmental performance and environmental reporting decisions. Second, most prior studies that explored the interplay between a firm's environmental performance and its environmental disclosures are based on voluntarily disclosed data (Bui et al., 2020; Cong et al., 2020). By examining the role of the presence of CSO in a firm on the interaction between a firm's environmental performance and its environmental disclosure decisions, using data obtained from the SEC (10K or 20-F forms) and EPA websites, the study presents additional insights regarding the role of a voluntarily established administrative structure on the *P-D* nexus in a mandated reporting setting. The remainder of the paper is organized as follows. Section 2 presents a review of key studies and construction of the hypothesis. Section 3 provides the empirical framework for the study. While section 4 presents the findings and discussions thereof, section 5 concludes the paper.

2. Hypothesis development

Recent years have witnessed a dramatic rise in corporate environmental reporting due to the rising demand for reliable and accurate corporate environmental information by

investors and other stakeholders (Clarkson, Overell, & Chapple, 2011). Developments within the regulatory and stakeholder space, demands for increased accountability, and competitive opportunities have made the integration of environmental issues into corporate strategic planning and decision making of crucial import (Braam, de Weerd, Hauck, & Huijbregts, 2016; Dixon-Fowler et al., 2017). Prior studies on the extent to which corporate environmental disclosures reflect a firm's actual environmental performance provide not only conflicting theoretical predictions (Gray et al., 1995; Verrecchia, 1983) but also inconclusive evidence (Clarkson, Overell, et al., 2011).

Stakeholder and legitimacy theories view corporate environmental disclosures as a firm's strategic responses to perceived outside pressure (Hahn, Reimsbach, & Schiemann, 2015). According to these theories, a firm could use corporate environmental disclosure as a strategic communication tool to change societal perceptions and expectations about the firm's environmental performance; for instance, firms with poorer environmental performance facing stronger stakeholder pressure and threatened legitimacy could use corporate environmental disclosures to deflect or nullify suspicion or doubt about their environmental activities (Lemma et al., 2019). These theories suggest that a firm could employ its environmental disclosures to "greenwash" and obfuscate its poorer environmental performance; thus, a firm with poor environmental performance would have a stronger incentive to provide a more extensive environmental disclosure (Adams, 2004; Gray et al., 1995; Hooghiemstra, 2000; Hughes et al., 2001).

Consistent with both stakeholder and legitimacy theories, several studies provide evidence that firms with poorer environmental performance are associated with more extensive environmental disclosures. For instance, in a study that examined a set of Canadian manufacturing companies, Bewley and Li, (2000) demonstrate that firms operating in pollution intensive industries are likely to provide more extensive environmental disclosures than is the case with firms operating outside pollution intensive industries. In a similar effort, based on analyses of the disclosure patterns of FTSE 100 U.K. companies, Campbell (2003) reports that firms operating in environmentally sensitive sectors provide more environmental information in their corporate disclosures than those in non-environmentally sensitive sectors. Likewise, many studies examine data drawn from firms operating in the U.S. and document evidence that the tendency to disclose more environmental information is associated with poorer environmental performance (Cho et al., 2012; Cho & Patten, 2007; He, Tang, & Wang, 2013). Evidence based on data drawn from firms operating in emerging or developing countries also corroborates conjectures based on stakeholder and legitimacy theories (e.g., Lemma et al., 2019; Lemma, Shabestari, Freedman, & Mlilo, 2020).

On the other hand, voluntary disclosure and signaling theories take the position that environmental performance would require a strategic choice to spend resources on environmental causes and firms with better environmental performance would want to differentiate themselves from companies with poorer environmental performance. According to these theories, achieving better environmental performance is costly and

cannot be easily imitated without putting in the required resources (Clarkson et al., 2008; Dye, 1985; Richardson, Welker, & Hutchinson, 1999; Verrecchia, 1983). Firms with stronger environmental performance would have stronger incentives to provide more extensive environmental disclosures than is the case for firms with poorer environmental record. Both voluntary disclosure and signaling theories suggest a positive association between corporate environmental performance and the extensiveness of its environmental disclosures (Clarkson et al., 2008; Li et al., 1997; Verrecchia, 1983).

In line with the conjecture forwarded by voluntary disclosure and signaling theories, many previous studies find that firms with better environmental performance are associated with more extensive environmental disclosures. For example, Al-Tuwaijri et al. (2004), based on analyses of a cross-sectional data sourced from S&P 5000 U.S. firms, show that firm with “good” environmental performance are positively significantly associated with more extensive environmental disclosures. In a similar endeavor, Clarkson et al. (2008), using a sample of 191 firms from the five most polluting industries in the US, show that environmental performance is positively significantly associated with the level of discretionary environmental disclosures. In a similar vein, based on a sample of 474 U.S., U.K., and Australian firms, Luo and Tang (2014) report a positively significant association between the level of voluntary carbon disclosures and corporate carbon performance. Nevertheless, some studies report statistically insignificant associations between corporate environmental performance and its reporting practice (Freedman & Wasley, 1990; Wiseman, 1982).

The forgoing conflicting theoretical arguments coupled with mixed evidence on the *P-D* nexus suggest the relationship between the two variables is complex and, perhaps, requires non-linear, multifactor modelling. In this regard, Bui et al. (2020) demonstrate that board-level climate governance processes and structures form part of the complex relationship between corporate environmental performance and the extensiveness of voluntary environmental disclosures. In a related vein, prior studies show that corporate executives in charge of matters related to environmental sustainability serve as valuable human resource in the formulation and implementation of a firm’s environmental strategies and policies and enhancing the firm’s environmental performance and reputation (Dixon-Fowler et al., 2017; Peters & Romi, 2014). Thus, drawing on the argument that environmental strategies and policies established through climate governance structures at the board-level would require complementary organizational resources and capabilities to ensure implementation (Hart, 1995; Russo & Fouts, 1997), we posit that human resource at corporate management level would provide additional insights regarding our understanding of the *P-D* nexus. Specifically, we argue that the presence of a Chief Sustainability Officer or equivalent officer—an administrator charged specifically with environmental governance responsibilities—in a firm would reinforce or mitigate the alignment between the firm’s environmental performance and its disclosure practice. Therefore, we hypothesize as follows:

Hypothesis: The presence of Chief Sustainability Officer (CSO) in a firm would affect the association between corporate environmental performance and the extensiveness of a firm's environmental disclosures.

3. Empirical framework

3.1. Construction of the sample

For the most part of the first decade of the 2000, the disclosure of Greenhouse Gas (GHG) in the U.S. was voluntary. The discretionary nature of such disclosures casted a cloud over the faithfulness and completeness of disclosed data. After the promulgation of the Consolidated Appropriations Act of 2008, the U.S. environmental protection agency (EPA) issued the Mandatory Reporting of GHG Rule (74 FR 56260) with a view “to collect accurate and timely GHG data to inform future policy decisions.” This rule mandates that large emitters of GHG— facilities that emit 25,000 or more CO₂ Equivalent Metric Ton (Eq. t)—should provide annual reports on their GHG emissions and other relevant information, starting from 2010. As the EPA requires that reporting entities compute their GHG emissions in a specific way, the reported GHG emission numbers tend to be more accurate and straightforward, and thus, would mitigate the inconsistencies that have been observed in voluntarily reported figures (Wegener et al., 2019).

As the focus of our study is to examine the *P-D* nexus in a mandatory reporting setting, we target the first two years (2010 and 2011) during which both the EPA's mandatory reporting rule as well as the SEC's subsidiary disclosure requirements have become effective. Just as in Cong et al. (2020), we begin our exploration with *Fortune* 500 companies (as of the end of 2009) and narrow down the sample to firms operating in the ten (10) industries targeted by the European Union's Emissions Trading System (*EU ETS*). We reconstitute the ten (10) industries into six (6) groups so that we would have adequate number of observations in each industry (Cong et al., 2020). These six industry-groups include: the pulp and paper, chemicals, metals and mining, oil and gas, utilities, and the other industry-group. The processes resulted in a final sample of 136 unique firms.

3.2. Collection of Greenhouse Gas (GHG) data

We source the GHG emission and related data from the EPA's web-based interface called Facility Level Information on Greenhouse Gases Tool (FLIGHT), which provides an intuitive interface to an average user. However, as the FLIGHT system tends to provides insufficient information for the purpose of aggregating data at company level, as it relies keyword searches. For instance, suppose a user of FLIGHT wants to collect the GHG emissions of ExxonMobil and use the keywords “ExxonMobil,” “Exxon” and “Mobil” to search for the data. The FLIGHT system would provide data only for the facilities that have one of the three terms in their names. When we execute the search using the three keywords, the results we obtain do not include the Mobile Bay—Northwest Gulf Platform facility, although the facility's name contains the word “mobile,” which is very close to the keyword “Mobil.”

With a view to ensure that our aggregation process would not lead to omission of emission data pertaining to some facilities, we triangulate and cross-check our data by consulting multiple sources, using web scrapers written in Perl Programming Language, in a series of steps. First, to avoid omission of any facility, we search for all facility-year combinations in FLIGHT (2019a) and extract the URL link of each of the combinations. Second, we follow the URL link to access the reported data (FLIGHT, 2019c) and extract the CO₂. Eq.t. emission measures. Third, we use match the facilities identified with their parent companies. The matching procedure requires data from two sources: 1) Facility Registration System (FRS, 2019) administrated by the EPA; and 2) the subsidiary disclosures in annual financial reports, namely Exhibit-21 of 10-K or Exhibit-8 of 20-F, mandated by the SEC. After a primary match between the two sources, company websites and search engines are used to supplement and verify the data. Lastly, GHG emission quantities are aggregated by each parent company for each year. Each of the four steps was manually and independently reviewed and verified by two of the authors.

3.3. Assessment of climate change disclosure quality

As global climate change is considered the most pressing environmental concern of our time (Tavakolifar et al., 2021, Lemma et al., 2021), this study focuses on corporate climate change disclosure as a proxy of firms' environmental disclosure. More specifically, we adopt disclosure extensiveness as a key characteristic of corporate climate change disclosure quality as more extensive disclosure would provide more relevant information decision-making. Taking cue from prior studies (Cong et al., 2020, Freedman and Park, 2014, Freedman et al., 2015), we systematically assess the extensiveness of climate change disclosures included in a firm's 10-K or 20-F filings, using nineteen (19) disclosure items outlined in SEC's (2010) interpretive release as yardsticks. The nineteen (19) disclosure items cover a gamut of issues including regulatory risks associated with existing and future legislations, the impact of cap-and-trade allowances, impact of climate change related policies, reputational risks associated with climate change issues, and many others (Cong et al., 2020).² Since we assign equal weight to each of the nineteen (19) items, the maximum possible score for the resulting aggregate measure of climate disclosure quality is nineteen (19) and the minimum possible score is zero (0).

3.4. Establishing the presence of chief sustainability officer

Since there are no existing databases that provide readily available information on CSO (Peters and Romi, 2014, Wiengarten et al., 2017, Strand, 2013), we collect CSO information by searching into various public documents and/or news articles which are available in the public domain, to establish the presence or absence of CSO or equivalent officer as part of a firm's top management. Using the Factiva search engine and key words such as "Environmental w/10 Officer," "Sustainability w/10 Officer", "Responsibility w/10 Officer", "Environmental w/10 President", "Sustainability w/10 President", or "Responsibility w/10 President," we establish whether a firm has a CSO or equivalent officer. Furthermore, pursuant to Strand (2013), we include the term "Chief

² An elaborate discussion of the nineteen (19) items and the determination of the composite measure of climate change disclosure quality can be found in Cong et al. (2020).

Ethics Officer” in our CSO or equivalent officer search, as firms’ discretionary climate change disclosure would depend on their commitment to ethical decisions. Once again, we triangulate and cross-check our data source by searching proxy statements, Form DEF 14a, in SEC filings to determine whether the firm has a CSO or equivalent officer among its top executive officers. The whole process resulted in identification of 71 (76) firms which had a CSO or equivalent position out of the 136 firms in our sample, for the years 2010 (2011).

3.5. Model Specifications

We first establish the association between a firm’s environmental performance (*CEP*), proxied by the logarithm of the amount of GHG emissions of the firm, and the quality of its environmental disclosures (*DISC*), using the following Ordinary Least Squares (OLS) regression model (Cong et al., 2020; Lemma et al., 2019):

$$DISC_{i,t} = \beta_0 + \beta_1 CEP_{i,t} + \beta_2 F_{SIZE}_{i,t} + \beta_3 LEVER_{i,t} + \beta_4 PRFT_{i,t} + \beta_5 INDUST_{i,t} + \varepsilon \dots(1)$$

where the dependent variable, *DISC*, is a proxy of the quality of environmental disclosure of a firm, which is computed using the process described in Section 3.3. Higher (lower) scores of the disclosure index (*DISC*) indicate better (poorer) quality of environmental disclosures by a firm. Our research variable, *CEP*, is an inverse proxy of a firm’s environmental performance and is computed as the logarithm of the quantity of a firm’s GHG emission. Higher (lower) values of the corporate environmental performance (*CEP*) variable show the firm has poorer (better) environmental performance.

We control for several factors in our model with a view to isolate the effect of *CEP* on *DISC* from the effect of other firm-level attributes on a firm’s environmental disclosure decisions. For instance, we control for firm size (*F_SIZE*) as it encapsulates numerous factors including financial resources, political costs, and information asymmetry (Lemma et al., 2018) that incentivize corporate environmental disclosures (Shan and Taylor, 2014, Stanny and Ely, 2008). We also control for level of firm leverage (*LEVER*), as creditors in more leveraged firms tend to require more information to monitor the behavior of such firms (Leftwich et al., 1981). More profitable firms may want to signal their superior earnings quality and that they could easily afford the expenditures required to produce and disclose corporate environmental information to investors (Stanny & Ely, 2008); thus, we control for firm-level profit (*PRFT*). Finally, firms in different industries are subject to varying levels of regulatory and other stakeholder pressure (Tavakolifar et al., 2021); thus, we control for industry effects (*INDUST*) in our model.

After establishing the association between a firm’s environmental performance (*CEP*) and its environmental disclosure quality (*DISC*), we examine whether the association is reinforced or mitigated by the presence of a CSO in the firm. We accomplish this by re-estimating the model expressed in equation (1) for sub-samples of firms with and without a CSO or equivalent officer. We then investigate if the regression coefficients of

the *CEP* variable vary between the regression estimates for the two sub-samples, using the *t-test* show below:

$$t = \frac{\beta_1 - \varphi_1}{\sqrt{s_{\beta_1}^2 + s_{\varphi_1}^2}} \sim T(n_1 + n_2 - 4) \quad \dots\dots (2)$$

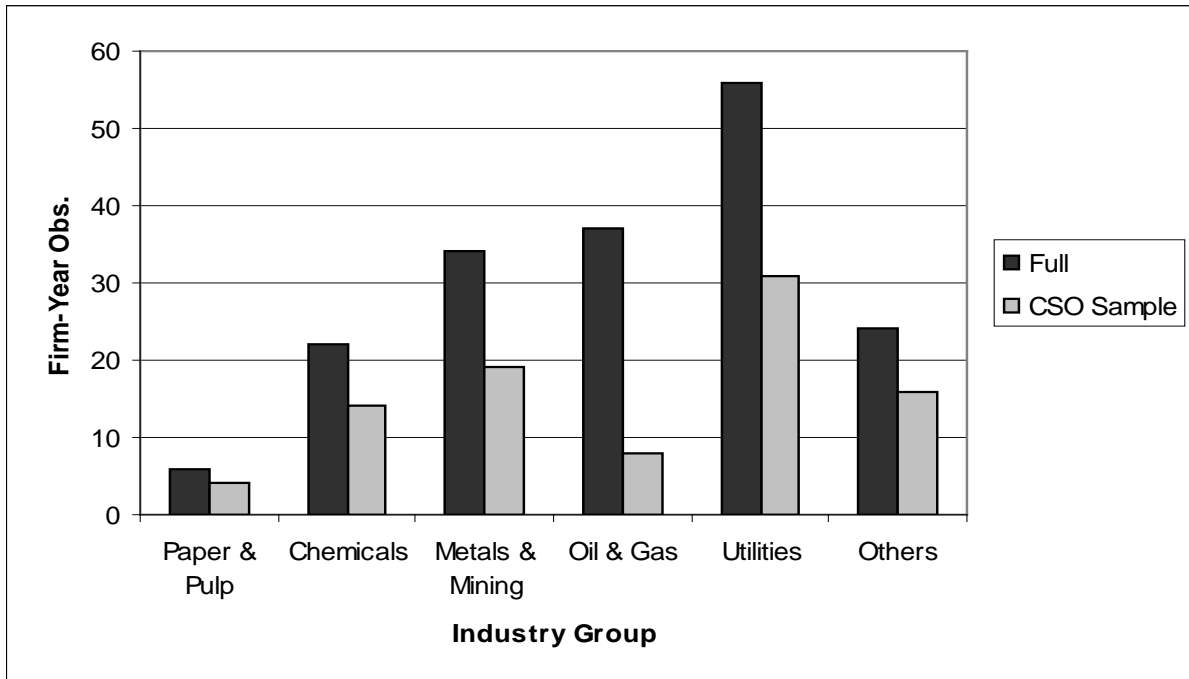
where *t* denotes the *t-statistic*, β_1 and s_{β_1} denote the estimated coefficient and corresponding standard error of the *CEP* variable for the sub-sample of firms with a CSO or equivalent officer, and φ_1 and s_{φ_1} denote the estimated coefficient and standard error of the *CEP* variable for the sub-sample of firms without a CSO or equivalent officer.

4. Results and discussions

4.1. Preliminary results

Figure 1 depicts the industry-group distribution of sample firm-year observations. Firms operating in the Utilities industry-group dominate our sample while those drawn from the Paper & Pulp industry-group constitute the lowest number of firms in the sample. Out of the total 159 firm-year observations, 98 firm-year observations have a CSO or equivalent position. As shown in Panel A of Figure 1, the proportion of firm-year observations with a CSO or equivalent position varies between industry groups. Specifically, a very high proportion of firms operating in the Paper & Pulp, Chemicals, Metals & Mining and Others had a CSO or equivalent position during the sample years. On the other hand, a relatively smaller proportion of firms operating in the Oil & Gas and Utilities industries had a CSO or equivalent position.

Figure 1: Industrial distribution of sample firms
Panel A: Industrial distribution of sample firms with CSO positions



Panel B: Industrial distribution of sample firms with environmental committees

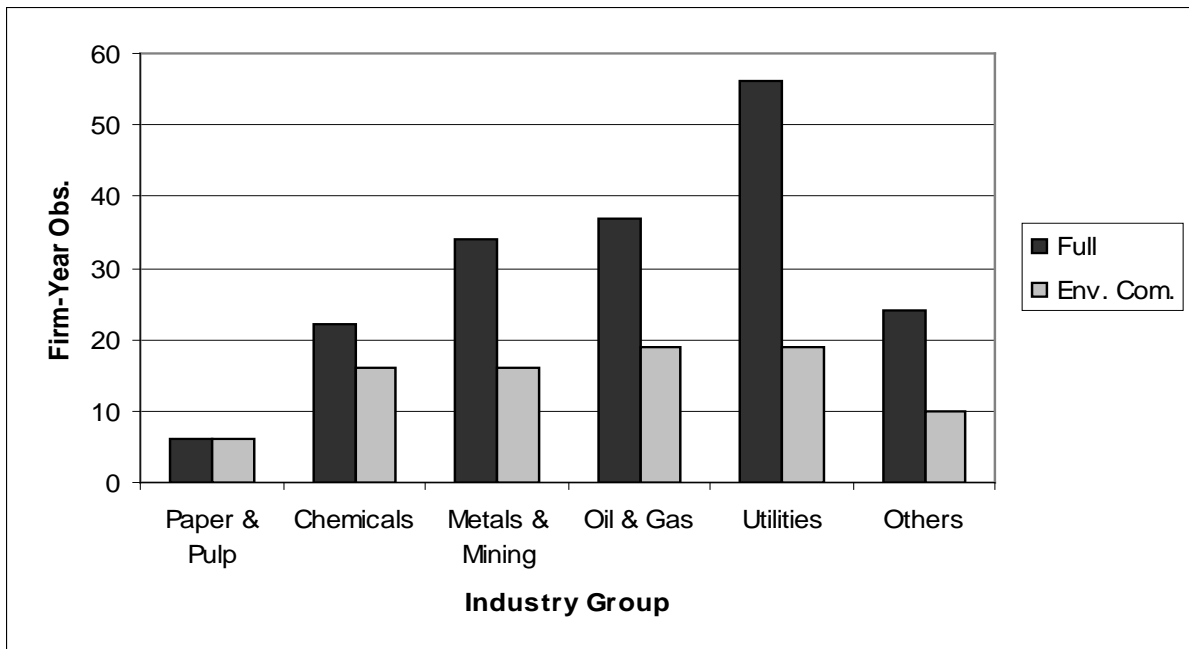


Table 1 (Panel A of) presents descriptive statistics and tests of differences for all the variables used in the OLS regression model. The mean (median) score of our dependent variable, *DISC*, is 2.90 (2.50); a typical firm in our sample discloses less than three (3) items out of the total nineteen (19) listed in SEC's interpretive release (2010). The average score of the *DISC* variable highlights the long journey that firms in our sample would have to trek toward improving the quality of environmental disclosures; they could improve the score up to a maximum of 19.00. The table also indicates that the mean (median) environmental disclosure score (*DISC*) for firms with a CSO or equivalent position is 3.07 (3.00), indicating that firms with a CSO or equivalent position disclosed *circa* 3 items out of a total 19 items listed on SEC's interpretive release (2010). Furthermore, the *p-value* of test of differences in median scores show that there is a marginally significant difference in the quality of environmental disclosures between firms with and without a CSO or equivalent position. This finding provides a tentative support to the proposition that there would be a discernable change in the quality of corporate environmental disclosure stemming from the appointment of a CSO or equivalent officer in the firm. Nevertheless, we should think through this finding with some circumspection as the univariate analysis disregards the role of control variables in determining how the existence of a CSO or equivalent officer in a firm interacts with its environmental reporting practice.

Table 1: Descriptive Statistics

Panel A: Comparison between firms with and without a CSO or equivalent position

	Full Sample		Firm-year obs. with CSO		Firm-year obs. without CSO		Diff. btw the two groups	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
<i>DISC</i>	2.90	2.50	3.07	3.00	2.72	2.00	0.34	1.00 *
<i>CEP</i>	14.70	14.75	15.04	15.19	14.35	14.36	0.69 **	0.83 **
<i>CEP_A</i>	1.47	1.49	1.47	1.52	1.46	1.45	0.01	0.07 *
<i>F_SIZE</i>	10.10	10.14	10.27	10.22	9.93	9.72	0.34 **	0.50 **
<i>LEVER</i>	0.65	0.68	0.68	0.69	0.61	0.66	0.06 ***	0.03 **
<i>PRFT</i>	0.05	0.04	0.04	0.04	0.05	0.04	-0.01	0.00

Panel B: Comparison between firms with and without board-level environmental committees

	Firm-year obs. with Env. Comm.		Firm-year obs. without Env. Comm.		Diff. btw the two groups	
	Mean	Median	Mean	Median	Mean	Median
<i>DISC</i>	2.87	2.00	2.92	3.00	-0.05	-1.00
<i>CEP</i>	14.97	15.08	14.45	14.19	0.52	0.89
<i>CEP_A</i>	1.49	1.49	1.44	1.52	0.05	-0.03
<i>F_SIZE</i>	10.15	10.01	10.06	10.23	0.09	-0.22
<i>LEVER</i>	0.65	0.67	0.64	0.68	0.01	-0.01
<i>PRFT</i>	0.05	0.05	0.04	0.04	0.01	0.02

This table presents: (1) the mean (median) values of each variable used in the study for all firms and firms with and without a CSO or equivalent officer and results of tests of difference in the mean (median) values of variables computed for firms with and without a CSO or equivalent officer (Panel A); and (2) the mean (median) values of each variable used in the study for firms with and without a board-level, standalone, environmental committee and results of tests of difference in the mean (median) values of variables computed for firms with and without a board-level, standalone, environmental committee (Panel B). *DISC* is the climate change disclosure score determined through the content analysis process described in section 3.3. *CEP* is a reverse proxy of corporate environmental performance computed as the logarithm of the quantity of a firm's GHG emissions. *F_SIZE* is a proxy for firm size and computed as the logarithm of total asset. *CEP_A* an alternative proxy for corporate environmental performance and is computed as the ratio of *CEP* to *F_SIZE*. *LEVER* is a measuring of gearing and computed as the ratio of total liabilities to total asset. *PRFT* is a proxy for firm-level profitability and computed as the ratio of net income to total asset. Tests of differences in the mean (median) values are carried out using *t-test* (*Wilcoxon rank-sum test*). ***, **, * represent two-tailed significance levels at 1%, 5% and 10%, respectively.

The table also show that the difference in mean (median) value of the corporate environmental performance (*CEP*) variable, between firms with and without a CSO or equivalent officer, is statistically significant (*p-values* <0.05). This observation proffers a preliminary support for the conjecture that the presence of a CSO or equivalent officer in a firm would have a significant effect on the firm's environmental performance. Once again, we should not read too much into this preliminary finding as the effect of variables other than the presence/absence of a CSO or equivalent officer has not been accounted for. Furthermore, we observe the mean (median) value the firm size (*F_SIZE*) variable is significantly higher for firms with a CSO or equivalent officer relative to those without such an officer. This finding suggests that firms with a CSO or equivalent officer are bigger in size compared to those without a similar officer as part of their executive leadership. We note significant (insignificant) difference in the *LEVER* (*PRFT*) variable between firms with a CSO or equivalent officer and those that do not have such an officer in their top management.³

Table 2 presents the Spearman pairwise correlation coefficients of all the variables included in the study. It shows that the corporate environmental disclosure (*DISC*) variable is significantly positively (*p-value* < 0.01) correlated with the corporate environmental performance variable (*CEP*), providing a tentative support to arguments based on legitimacy and stakeholder theories which suggest that firms would employ their environmental reporting as a strategic communication tool to change societal perceptions and expectations. But, again, we must take this tentative finding with some measure of caution as correlational associations do not account for the effects of control variables. We also observe a positively (negatively) significant correlation between the firm size (firm-level profitability) and corporate environmental disclosures (*DISC*) variables. As is to be expected, we observe statistically significant correlations between several other variables in our model. In untabulated results we note that the variance

³ A discussion on the significant difference in the mean (median) value of the *CEP_A* variable is presented in section 4.3.

inflation factor (*VIF*) statistics for all the variables are less than 10, which confirms that multicollinearity is not a concern in our model.

Table 2: Correlation matrix

	<i>CEP</i>	<i>CEP_A</i>	<i>F_SIZE</i>	<i>LEVER</i>	<i>PRFT</i>
<i>DISC</i>	0.42 ***	0.29 ***	0.22 ***	0.07	-0.30 ***
<i>CEP</i>		0.78 ***	0.22 ***	0.07	-0.24 ***
<i>CEP_A</i>			-0.38 ***	0.20 ***	-0.33 ***
<i>F_SIZE</i>				-0.17 **	0.13 *
<i>LEVER</i>					-0.38 ***

This table presents the Spearman pairwise correlation coefficients (and the corresponding *p-values*) for each of the variables included in the study. The definition of all the variables is as in Table 1. ***, **, * represent two-tailed significance levels at 1%, 5% and 10%, respectively.

4.2. Regression results

The primary aim of this study is to examine if the presence of a CSO or equivalent officer in the executive team of a firm affects the association between a firm's environmental performance and its environmental disclosure practice. Table 3 presents summaries of estimation results of the OLS model expressed in equation (1). It provides results of regressing *DISC* on *CEP* and control variables for all firms (Column 1), for firms with a CSO or equivalent officer (Column 2), and for firms without a CSO or equivalent officer (Column 3). Overall, the models are well specified; the *F-statistic* of all the models is significant (at the 1% or 5% level). The *R-square* of the models span between 11% and 28%.

Table 3: Ordinary least squares (OLS) regression results

	Exp. sign	Full Sample	Firms with CSO	Firms without CSO
<i>Intercept</i>		-2.54 [-1.34]	-0.29 [-0.10]	-2.57 [-0.84]
<i>CEP</i>	+/-	0.22 *** [2.97]	0.04 [0.41]	0.32 ** [2.62]
<i>F_SIZE</i>	+	0.26 * [1.80]	0.32 [1.62]	0.17 [0.73]
<i>LEVER</i>	+	-0.31 [-0.31]	-1.07 [-0.86]	-0.76 [-0.38]
<i>PRFT</i>	+	-8.23 ** [-2.31]	-6.53 [-1.41]	-9.99 * [-1.68]
<i>Industry fixed effect</i>		Yes	Yes	Yes
<i>Year fixed effect</i>		Yes	Yes	Yes
<i>N=Num. of Obs.</i>		178	91	87

Adjusted R²	0.19	0.28	0.11
F-value	8.03 ***	6.92 ***	2.78 **

This table presents the results from OLS regression analyses. The definition of all the variables is as in Table 1. The significance levels are based on *t*-statistic (presented in parentheses). ***, **, * represent two-tailed significance levels at 1%, 5% and 10%, respectively.

Table 3 (Column 1) reports a positively significant (*p-value* <0.05) association between the *CEP* and *DISC* variables; firms with higher levels of GHG emissions tend to provide more extensive environmental disclosures. This finding suggests that firms with poorer environmental performance would provide more extensive environmental disclosures. It is in line with propositions supported by the stakeholder and legitimacy theory which suggest that firms with poor environmental record tend to provide more extensive environmental disclosures with a view to “greenwash” their poor environmental performance (Adams, 2004; Gray, Kouhy, & Lavers, 1995; Hughes, Anderson, & Golden, 2001; Lemma, Freedman, Mlilo, & Park, 2019). Nevertheless, it is in contrast with the conjecture supported by voluntary disclosure and signaling theories which suggests that firms with better environmental performance would have stronger incentives to provide more extensive environmental disclosures (Li, Richardson, & Thornton, 1997; Verrecchia, 1983). While our finding is qualitatively similar with those of Cho, Freedman, and Patten (2012), Clarkson, Li, Richardson, & Vasvari (2011), and Hassan and Romilly (2018), it stands in contrast to those reported in Al-Tuwaijri, Christensen, and Hughes (2004), Clarkson, Li, Richardson, & Vasvari (2008).

We bifurcate the sample into firms with and without a CSO or equivalent officer to examine whether the relationship between a firm’s environmental performance and its disclosure practice varies between the sub-samples (see columns 2 and 3, Table 3). The results show that the association between the corporate environmental performance (*CEP*) and a firm’s disclosure quality (*DISC*) variables is insignificant for firms which a CSO or equivalent officer and that it is positively significant (*p-value* <0.05) for those without a similar officer. Stated differently, firms with a CSO or equivalent officer do not seem to be using their environmental disclosures for the purpose of signaling superior environmental performance nor for the purpose of earning legitimacy; firms without such an officer tend to use environmental disclosures to earn legitimacy or respond to stakeholder pressures. It appears that the positively significant association between the *CEP* and *DISC* variables in the full sample is driven primarily by firms with a CSO or equivalent officer.

We further examine the results reported in Table 3 (Columns 2 and 3) to check whether there is a statistically significant difference in the coefficient of the corporate environmental performance (*CEP*) variable for firms with and without a CSO or equivalent officer. We observe that coefficient and standard error estimates for the model with (without) a CSO or equivalent officer are 0.02 and 0.10 (0.40 and 0.19), respectively. Also, the firm-year observations for the model with (without) a CSO or equivalent officer were 91 (52). Using the slope difference formula in equation (2), we compute the *t-statistic* to be 1.77. Imposing a one-tail test indicates that difference in the

coefficient of the CEP variable between firms with CSO or equivalent officer and those without such an officer is significant (p -value <0.05). Taken together, these findings suggest that the presence of a CSO or equivalent officer in a firm deters the firm from using its environmental reporting as a mechanism for “greenwashing” its poor performance. The findings also suggest that the appointment of a senior manager responsible for corporate environmental issues in a firm improves information flow and strengthens the link between the firm’s environmental strategies and implementation (Dixon-Fowler et al., 2017), which in turn weakens the potential misalignment between a firm’s environmental performance and its disclosure practices.

4.3. Robustness Check

The corporate environmental performance (*CEP*) variable employed in the main regression analysis, logarithm of the quantity of a firm’s GHG emissions, measures the magnitude of a firm’s GHG emissions than the intensity of its GHG emissions. However, it would not capture the intensity of a firm’s GHG emissions (Hoffman & Bush, 2008; Bush, 2010). To address this concern, we deflate the quantity of a firm’s GHG emissions by firm size and use as an alternative measure of corporate environmental performance (*CEP_A*). Results of univariate analyses indicate there is a marginal difference (p -value < 0.1) in median value of the alternative corporate environmental performance (*CEP_A*) variable between firms with and without a CSO or equivalent officer (see Table 1, Panel A).

Table 4 reports a summary of the regression results based on the alternative measure of corporate environmental performance (*CEP_A*). We observe that the *CEP_A* variable is a strongly associated with environmental disclosure score (*DISC*) when we include all firms in our sample into the regression. The table further shows that the *CEP_A* variable loads insignificantly (positively significantly) for firms with (without) a CSO or equivalent officer. Unlike the results in the main analyses for all firms, we note a stronger association between firm size (*F_SIZE*) and the quality of a firm’s environmental disclosures (*DISC*). Overall, the earlier finding that the presence of a CSO or equivalent officer in a firm would discourage the firm from using its environmental disclosure for the purpose of “greenwashing” poor environmental performance is confirmed.

Table 4: Ordinary least squares (OLS) regression results

	Exp. sign	Full Sample	Firms with CSO	Firms without CSO
<i>Intercept</i>		-5.67 ** [-2.21]	-0.93 [-0.25]	-6.89 * [-1.68]
<i>CEP_A</i>	+/-	2.12 *** [2.93]	0.45 [0.43]	2.91 ** [2.47]
<i>F_SIZE</i>	+	0.59 *** [3.53]	0.38 * [1.67]	0.65 ** [2.35]
<i>LEVER</i>	+	-0.37 [-0.36]	-1.06 [-0.85]	-0.93 [-0.46]
<i>PRFT</i>	+	-8.50 ** [-2.40]	-6.46 [-1.38]	-10.80 * [-1.81]
<i>Industry fixed effect</i>		Yes	Yes	Yes
<i>Year fixed effect</i>		Yes	Yes	Yes
<i>N=Num. of Obs.</i>		178	91	87
<i>Adjusted R²</i>		0.19	0.28	0.10
<i>F-value</i>		7.98 ***	6.93 ***	2.64 **

This table presents the results from OLS regression analyses. The definition of all the variables is as in Table 1. The significance levels are based on *t*-statistic (presented in parentheses). ***, **, * represent two-tailed significance levels at 1%, 5% and 10%, respectively.

4.4. Additional analyses

Bui et al. (2020) demonstrate that board-level environmental committee is associated with the alignment between a firm's environmental performance and its environmental reporting practice, using a voluntarily reported data. With a view to ascertain whether a similar relationship would be observed in a mandatory reporting setting, we investigate the role played by board-level environmental committees in shaping the interaction between corporate environmental performance with its reporting practice.

We determine the presence or absence of a standalone board-level environmental committee for each firm in our sample, by searching through the proxy statements filed with SEC. As there is a high variation in the title of a board-level environmental committee, we employed multiple keywords including "Environmental and Social Responsibility Committee", "Environmental, Health & Safety Committee", "Sustainability Committee", and "Public Policy Committee". Through the search process, we were able to establish that 80 of the 159 firm-year observations had a standalone environmental committee during the study period. The industry-by-industry distribution of proportion of firms with board-level environmental committees appears to follow a broadly similar pattern as the proportion of firms with a CSO or equivalent officer (see Figure 1—Panel B).

Results of univariate analyses show that there is no statistically significant difference neither in the corporate environmental performance (*CEP*) nor in the quality of environmental disclosure (*DISC*) variable between firms with and without board level environmental committee (see Table 1—Panel B). Nonetheless, the regression results reported in Table 5 demonstrate that the association between the corporate environmental performance (*CEP*) and a firm's disclosure quality (*DISC*) variables is insignificant for firms which a board-level environmental committee and that it is positively significant (*p-value* <0.01) for those without a similar committee. Taken together, firms with a standalone board-level environmental committee do not seem to be using their environmental disclosures for the purpose of signaling superior environmental performance nor for the purpose of earning legitimacy; firms without such a committee tend to use environmental disclosures to earn legitimacy or respond to stakeholder pressures. These results are consistent with those reported in Bui et al. (2020).

Table 5: Ordinary least squares (OLS) regression results

	Exp. sign	Firms with Environmental Committee		Firms without Environmental Committee	
		(1)	(2)	(1)	(2)
<i>Intercept</i>		0.76 [0.22]	-0.74 [-0.14]	-5.99 *** [-2.73]	-10.54 *** [-3.75]
<i>CEP</i>	+/-	0.10 [0.65]		0.31 *** [4.02]	
<i>CEP_A</i>	+/-		0.99 [0.68]		3.10 *** [3.99]
<i>F_SIZE</i>	+	0.19 [0.88]	0.35 [1.19]	0.41 ** [2.21]	0.85 *** [4.31]
<i>LEVER</i>	+	-1.95 [-1.09]	-2.01 [-1.14]	1.40 [1.28]	1.44 [1.31]
<i>PRFT</i>	+	-9.36 [-1.43]	-9.66 [-1.49]	-6.05 [-1.63]	-5.82 [-1.56]
<i>Industry effects</i>		Yes	Yes	Yes	Yes
<i>Year fixed effect</i>		Yes	Yes	Yes	Yes
<i>N=Num. of Obs.</i>		86	86	92	92
<i>Adjusted R²</i>		0.11	0.11	0.35	0.34
<i>F-value</i>		2.68 **	2.69 **	8.99 ***	8.94 ***

This table presents the results from OLS regression analyses. The definition of all the variables is as in Table 1. The significance levels are based on *t*-statistic (presented in parentheses). ***, **, * represent two-tailed significance levels at 1%, 5% and 10%, respectively.

5. Conclusion

This study aims to assess whether the presence of a CSO or equivalent officer in a firm would shape the interaction between a firm's environmental performance and its environmental disclosure practice. Using a mandatorily reported data pertaining to a set of U.S. firms, we demonstrate that the presence of a CSO or equivalent officer in a firm deters the firm from using its environmental reporting as a mechanism for "greenwashing" its poor performance. We also show that board-level standalone environmental committee in the governance structure of a firm promotes the alignment of a firm's environmental disclosure practices with its environmental performance. Taken together, the appointment of a CSO or equivalent officer within the executive team or a standalone board-level environmental committee has the potential to transform the interaction between the firm's environmental performance and the quality of its environmental disclosures.

Our findings have implications to researchers, policymakers, regulators, and other stakeholders. First, it advances researchers understanding of the complex, corporate environmental performance—disclosure nexus, by examining the role of CSO in shaping the nexus, using a mandatory reporting setting. Second, the findings of the study imply that policymakers and regulators activities should consider actions that promote the appointment of a CSO or equivalent officer or board-level standalone environmental committee as these governance structures appear to enhance the congruence between a firm's environmental performance with its reporting practice. Third, environmental activists and other stakeholders could exert pressures on regulatory and policy making agencies to direct such agencies to focus on actions that induce firms into appointing a CSO or equivalent officer or board-level standalone committee that specialized on environmental issues.

The findings of this study should be considered with caution as they are based on limited data due to unavailability of commercial databases that provide information on CSO of companies. Furthermore, prior studies suggest that the interaction between corporate environmental performance and a firm's environmental reporting practices are sensitive to institutional contexts (Luo, 2019). Thus, cross-country studies that control for relevant institutional variables could bring additional insights regarding the role of CSO or other environmental governance structures in shaping the complex relationship between a firm's environmental performance and its environmental disclosure practices. Finally, studies that focus on the role of the attributes of a CSO or equivalent officer on the corporate environmental performance-disclosure nexus would advance our understanding regarding the relationship between the two variables.

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