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Article

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Abstract

Although stakeholder theory is widely accepted in environmental disclosure research, empirical evidence about the role of stakeholders in firms' disclosure is still scarce. The authors address this issue for a setting of carbon disclosure. Our international sample comprises the Carbon Disclosure Project (CDP) Global 500, S&P 500, and FTSE 350 reports from 2008 to 2011, resulting in a total of 1,120 firms with 3,631 firm-year observations. The authors apply Tobit regressions to analyze the relationship between carbon disclosure and the relevance of the following stakeholder groups: government, general public, media, employees, and customers. Our results confirm that in addition to carbon performance, all stakeholders are associated with carbon disclosure. Only one stakeholder group (government) acts as a moderator for the relationship between carbon performance and carbon disclosure. Furthermore, the authors find that carbon performance but not the affiliation to a carbon-intensive industry acts as a moderator between stakeholder relevance and carbon disclosure.

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carbon disclosure, carbon performance, climate change, stakeholder theory, corporate social responsibility (CSR), sustainability reporting

The impacts of climate change have created a substantial demand on firms regarding their carbon disclosure. Various groups of non-financial stakeholders, such as governments, the general public, the media, employees, and customers as well as financial market participants, ask for information about a firm's efforts to address climate-change risks. The motivation behind this request for carbon disclosure is manifold. For example, *governments* evaluate whether mandatory carbon disclosure is necessary and seek input on prospective legislation. Furthermore, given increased environmental sensitivity, *employees* and *customers* have also started to pay attention to firms' disclosed carbon performance for better-informed decision-making.

This investigation builds on more than three decades of research on the determinants of corporate environmental disclosure (Cormier & Magnan, 2003; De Villiers & van Staden, 2011; Hughes, Anderson, & Golden, 2001; Ingram & Frazier, 1980; Patten, 1991), which we adopt to climate change, and thereby to the carbon disclosure context. Often it is argued that a firm's motivation to voluntarily disclose carbon or more general environmental information originates—at least in part—from stakeholder pressure (Clarkson, Li, Richardson, & Vasvari, 2008; Patten, 2002; Reid & Toffel, 2009; Stanny, 2013). Stakeholders demand to be informed about a firm's performance and related activities and can pressure firms to disclose such information (Clarkson, 1995). However, the relevance of different stakeholder groups is not reflected in most empirical analyses with a few exceptions (Perez-Batres, Doh, Miller, & Pisani, 2012; Sprengel & Busch, 2011). Prior literature focuses on the relationship between environmental disclosure and environmental performance and often applies only financial market-oriented control variables and financial stakeholders. It is argued that this limitation is one reason for the inconsistent results regarding these relationships (Orlitzky, Schmidt, & Rynes, 2003; Wood & Jones, 1995). We elucidate this important issue by including different non-financial stakeholder groups in the empirical model as independent variables and as interaction terms and by answering two research questions:

Research Question 1: Which non-financial stakeholder groups are relevant for a firm's carbon disclosure?
Research Question 2: How do the relevant non-financial stakeholders moderate the relationship between carbon performance and carbon disclosure?

A widely used disclosure medium in the climate-change context is the Carbon Disclosure Project (CDP). The CDP is an organization headquartered in the United Kingdom that works with shareholders and corporations to disclose greenhouse gas (GHG) emissions (which are referred to as carbon performance in the remainder of this article). The CDP sends questionnaires regarding corporate carbon management and performance to the world's largest firms and encourages them to disclose their climate-change-related information by answering the questionnaire and legitimizing its publication via the CDP. With the focus on carbon disclosure, we choose a narrow field of environmental disclosure. However, the issue of climate change is very prominent in politics and the media because researchers proclaim that it has already transgressed its planetary boundaries (Rockström et al., 2009). Thus, the issue of carbon performance is one of the most important fields of disclosure for firms, shareholders, and other stakeholders (Busch & Hoffmann, 2011).

In this study, the authors consider the government, the general public, the media, employees, and customers as non-financial stakeholder groups. We compare a model with and without stakeholder variables. We then additionally apply interaction models to assess whether the stakeholders act as moderators for the relationship between carbon performance and carbon disclosure. We also investigate the differences between good and poor carbon performers and between firms from carbon-intensive and non-carbon-intensive industries. Our research builds on a worldwide sample from the three major CDP reports (Global 500, S&P 500, and FTSE 350) and covers the years 2008 to 2011, resulting in a total sample of 3,631 observations.

This study contributes to the literature on environmental disclosure in several ways. First, we analyze the relationship between carbon performance and carbon disclosure. Second, we expand current literature (Luo, Lan, & Tang, 2012; Stanny, 2013; Stanny & Ely, 2008) which is focusing on investors by analyzing the relationship between the relevance of a variety of non-financial stakeholder groups and carbon disclosure. Third, we explore whether the relevance of stakeholder groups for a firm moderates the relationship between carbon performance and carbon disclosure. Fourth, using a large cross-sectional sample of firms, we investigate whether there is a difference in carbon disclosure behavior between good and poor carbon performers and between carbon-intensive and non-carbon-intensive industries (Reid & Toffel, 2009). Therefore, we can expand current literature which is focused on environmental (carbon) intensive firms. In addition, the international CDP sample (similar to Luo et al., 2012) allows us to explore the relationship of country-specific stakeholder variables with carbon disclosure and thus to expand current literature which is dominated by samples of U.S. firms.

The remainder of the article is structured as follows. The next section contains a literature review on the theoretical foundations of the relationship between carbon disclosure and carbon performance, followed by the development of our hypotheses. Thereafter, we explain our research design and provide some information and descriptive statistics about our sample. Finally, we present and discuss our results and draw conclusions.

Literature Review and Theoretical Considerations

Stakeholder Theory and Stakeholder Relevance

The relationship between carbon performance and carbon disclosure is an important issue because stakeholders (such as the government, the general public, the media, employees, and customers) are increasingly interested in the carbon performance of firms given that planetary boundaries, perceived as resource scarcity, have emerged as an issue. Therefore, it is useful for a firm to be held accountable to the relevant stakeholders who have a stake in knowing how the resources entrusted to a firm are used (Schaltegger & Burritt, 2000) to obtain a "contract to continue its operations" (Deegan, 2002, p. 293). The degree to which managers give priority to competing stakeholder claims is termed *stakeholder salience* (Mitchell, Agle, & Wood, 1997). Firms are dependent on the external stakeholders who control the resources critical to corporate performance (Pfeffer & Salancik, 1978). In fact, it is the dependence of firms on climate-change actors (external stakeholders) for resources that gives those actors leverage over a firm (Frooman, 1999). Organizations could not survive if they were not responsive to the demands of the groups in their environments, who are thus enabled to influence organizational outcomes (Pfeffer & Salancik, 1978).

Stakeholder theory, as a very flexible socio-political concept, emerged with different interpretations distinguishing between managerial, legal, and ethical approaches (Fassin, 2009). Building on the managerial view, "[b]usiness can be understood as a set of relationships among groups that have a stake in the activities that make up the business. Business is about how [stakeholders] interact and create value" (Freeman, Harrison, & Wicks, 2007, p. 3). In a broad stakeholder definition, "Any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984, p. 25) holds a stake in the firm. Narrow views, however, account for limited organizational resources, time, and attention as well as the managers' patience in addressing stakeholders and their claims (Mitchell et al., 1997). Over time, various different stakeholder classifications emerged, for instance, primary versus secondary stakeholders (Clarkson, 1995),

normative versus derivative versus dormant stakeholders (Phillips, 2003), or urgent and/or powerful and/or legitimate stakeholders (Mitchell et al., 1997).

The salience of stakeholders can arise from stakeholders with powerful, urgent, and/or legitimate claims. The number of attributes held by stakeholders coincides with the level of pressure that they can exert with respect to their stakes (Mitchell et al., 1997). Wood (1991) argues that social responsiveness approaches may indeed characterize various organizational responses to social pressure. In this context, stakeholder salience helps to explain "to whom and to what managers actually pay attention" (Mitchell et al., 1997, p. 854). This definition was further specified to the "attention, time and priority managers accord to the stakeholder's environmental demands" (Gago & Antolin, 2004, p. 68). Eesley and Lenox (2006, p. 765f) defined salience "in terms of whether firms are likely to respond to stakeholder requests for action and by proposing that power, legitimacy, and urgency arise out of the nature of stakeholder–request–firm triplets." Neville, Bell, and Whitwell (2011, p. 369) define stakeholder salience as "the prioritization of stakeholder claims by managers based on their perception of the degree of power of the stakeholder and the degree of moral legitimacy and urgency of the claim." These notions build on the assumption that managers have incentives to consider particular stakeholders. Carbon disclosure is a way of satisfying salient stakeholders and reflects an adaptive management approach to address a dynamic, multidimensional environment, and an ability to meet social pressure and respond to societal needs (Hackston & Milne, 1996). To take into account the specific context of disclosure, we define "stakeholder relevance" as the measurable influence of a specific stakeholder group on the decisions of the firm.

Various groups of stakeholders, such as the government, the general public, the media, employees, and customers ask for information about a firm's efforts to manage climate-change impacts. The motivation behind a request for disclosure is manifold. *Governments* evaluate whether mandatory disclosure is necessary and seek input on prospective legislation. For example, the European Commission (2011, p. 15) released a commitment to "present a legislative proposal on the transparency of the social and environmental information provided by companies in all sectors" (Single Market Act, SEC, (2011), p. 467). Through these serious attempts to mandate disclosure but without any obligatory disclosure regulation, the specific stakeholder government has an enormous stake in environmental (carbon) disclosure (Clarkson, 1995; Huang & Kung, 2010; Patten, 2002; Wilmshurst & Frost, 2000). Given increased sensitivity regarding climate change, *employees* have also started to pay attention to a firm's disclosed carbon performance (Baron, 2009; Huang & Kung, 2010). Moreover, many *customers'* conscience

regarding climate change has obliged companies to adopt pertinent policies and to report their carbon performance (Moneva & Llena, 2000; Munilla & Miles, 2005). In addition, the *general public* is interested in the carbon performance of businesses and can pressure the government to put in place new regulations or to intensify the existing ones (O'Dwyer, 2002; Weaver, Trevino, & Cochran, 1999). Private parties, either individually or through a non-governmental organization (NGO), may sue companies for harmful climate behavior (Konar & Cohen, 1997). The general public requires carbon-related information (Jenkins & Yakovleva, 2006). If an organization cannot justify its continued operation by reporting on its carbon performance, the community may revoke its license to continue operations (Deegan & Gordon, 1996). Pressure from the general public to reduce emissions can be expected to have an influence on any company that has a substantial stake in the community. Finally, as a consequence of increased public awareness, the *media* have discovered climate change as a topic that captures public attention (Baron, 2009; Clarkson, 1995). Through its priming and framing effects, the media coverage directly influences audience attention (Dawkins & Fraas, 2011; Entman, 2006). The increased media coverage of climate science signals a shift in public opinion and public attitudes toward carbon-intensive businesses (Dawkins & Fraas, 2011). However, despite the stakeholders' need for carbon information, the relevant studies on the relationship between carbon performance and carbon disclosure have only selectively included stakeholders in their analyses of environmental (carbon) disclosure and environmental (carbon) performance (Clarkson et al., 2008; Huang & Kung, 2010; Prado-Lorenzo & Garcia-Sanchez, 2010), whereas stakeholders are a common antecedent, moderator or mediator variable in the related research field on the relationship between corporate environmental performance and corporate financial performance (Guenther & Hoppe, 2014).

Corporate Environmental Performance and Disclosure

Scholars have found positive, negative, and insignificant relationships between environmental (and more recently carbon) performance and environmental (carbon) disclosure. Table 1 highlights these relationships. It also gives an overview of about previous literature in terms of geographical scope, investigated industry sectors as well as use of performance variables and disclosure variables. Furthermore, Table 1 shows that the existing studies often focus on only one country (predominantly the United States). An exception is a study by Prado-Lorenzo and Garcia-Sanchez (2010), who use a global sample of 283 firms from 28 countries. These authors investigate predominantly carbon-intensive industries from a few selected sectors for which data are

Table 1. Studies Investigating the Environmental (Carbon) Performance–Disclosure Relationship.

Reference, journal, sample, geographical scope	Sectors	Relation performance/ disclosure	Stakeholder inclusion/(variable)	Environmental performance variable	Disclosure medium/ (disclosure measure, self-defined: yes/no)
Iatridis (2013), *Emerging Markets Revenue, N* = 529, Malaysia	Environmentally intensive industries	Positive	Media (Janis Fadner coefficient)	Hazardous waste, initiative to reduce waste	(Clarkson, Li, Richardson, & Vasvari, 2008 checklist, no)
Zeng, Xu, Yin, and Tam (2012), *J Bus Ethics, N* = 2,361, China	Manufacturing companies	Positive	Regulatory pressure (dummies: government owned company, environmentally sensitive industry	Dummy environmentally sensitive industry	Annual reports (10-point checklist, yes)
Cho, Guidry, Hageman, and Patten (2012), AOS, *N* = 92, United States	Environmentally intensive industries	Negative	Media (Newsweek environmental reputation score)	Environmental Impact Score Trucost	Annual report, 10-K report, CSR Report (Clarkson et al., 2008 checklist, no)
De Villiers and van Staden (2011), JAPP, *N* = 129, United States	Cross-sectional	Negative	Creditor (leverage ratio, equity/ debt raised in fiscal year)	KLD, TRI	Annual report and websites (word count, yes)
Dawkins and Fraas (2011), *J Bus Ethics, N* = 344, United States	Cross-sectional	Positive	Media visibility (Google News Archive)	Ceres, KLD, Trucost	Ceres questionnaire (No vs. incomplete vs. full disclosure, yes)
Prado-Lorenzo and Garcia-Sanchez (2010), *J Bus Ethics, N* = 283, Global	Cross-sectional (excluding finance and insurance industries)	Positive	Stakeholder orientation (code-law vs. common law country), legal enforcement (strength of legal infrastructure), public pressure (NCRI), board (percentage women; independent members, CEO = Chairman), creditor (indebtedness)	GHG emissions	CDP questionnaire (CDLI Score, no)
Clarkson et al. (2008), AOS, *N* = 191, United States	Environmentally intensive industries	Positive	Media (Janis Fadner coefficient), creditor (leverage ratio, equity/ debt raised in fiscal year)	TRI, toxic waste recycling percentage	Environment report, web disclosures (95-point checklist, yes)

(continued)

Table 1. (continued)

Reference, journal, sample, geographical scope	Sectors	Relation performance/ disclosure	Stakeholder inclusion/(variable)	Environmental performance variable	Disclosure medium/ (disclosure measure, self-defined: yes/no)
Cho and Patten (2007), AOS, *N* = 100, United States	Cross-sectional	Negative	—	KLD	10-K report (8 point checklist, yes)
Al-Tuwaijri, Christensen, and Hughes (2004), AOS, *N* = 198, United States	Environmentally intensive industries	Positive	Public visibility (WSJ news)	Toxic waste recycling percentage	10-K report (4-point checklist, yes)
Patten (2002), AOS, *N* = 131, United States	Four environmentally intensive industries	Negative	—	TRI	Annual report (8-point checklist, yes)
Hughes, Anderson, and Golden (2001), JAPP, *N* = 51, United States	Cross-sectional	Negative	—	Ranking from U.S. CEP	Annual report (4-point checklist, yes)
Freedman and Wasley (1990), APIA, *N* = 50, United States	Four environmentally intensive industries	Insignificant	—	Ranking from U.S. CEP	Annual report and 10-K report (4-point checklist, yes)
Wiseman (1982), AOS, *N* = 26, United States	Three environmentally intensive industries	Insignificant	—	Ranking from U.S. CEP	Annual report (4-point checklist, yes)
Ingram and Frazier (1980), JAR, *N* = 40, United States	Four environmentally intensive industries	Insignificant	—	Ranking from U.S. CEP	Annual report (4-point checklist, yes)

Note. The studies by Huang and Kung (2010) and Stanny (2013) are not reported because neither study measures an environmental performance variable. Variables for stakeholder inclusion are only reported if stakeholder variables are explicitly addressed in the studies. Thus, control variables, especially financial controls such as RoA, RoE, or Tobin's Q are not reported. The table shows the measures as applied in the respective studies, regardless of whether the variables capture stakeholder relevance or not. *J Bus Ethics* = *Journal of Business Ethics*; AOS = *Accounting, Organizations and Society*; CSR = corporate social responsibility; JAPP = *Journal of Accounting and Public Policy*; KLD = Kinder Lydenberg & Domini; TRI = Toxic Release Inventory; NCRI = National Corporate Responsibility Index; GHG = greenhouse gas; CDP = Carbon Disclosure Project; CDLI = Carbon Disclosure Leadership Index; WSJ = *Wall Street Journal*; CEP = U.S. council of economic priorities; APIA = *Advances in Public Interest Accounting*; JAR = *Journal of Accounting Research*.

accessible. Five studies (Cho & Patten, 2007; Dawkins & Fraas, 2011; De Villiers & van Staden, 2011; Hughes et al., 2001; Prado-Lorenzo & Garcia-Sanchez, 2010) have a wider scope of industries.

In general, the KLD Social Ratings Database and Toxic Release Inventory (TRI) or the rankings from the U.S. Council on Economic Priorities are used in the reviewed studies to measure environmental performance (Table 1). GHG emissions are addressed only in the study by Prado-Lorenzo and Garcia-Sanchez (2010). For environmental disclosure, most studies analyze the non-discretionary media for disclosure, such as annual or 10-K reports, using a code-book-based content analysis. Dawkins and Fraas (2011), however, analyze discretionary environmental disclosure using Ceres data and a measure for the type of response to the Ceres questionnaire. Prado-Lorenzo and Garcia-Sanchez (2010) use the Carbon Disclosure Leadership Index (CDLI) score from the CDP. Sample sizes vary between 26 firms for Wiseman (1982) to 344 for Dawkins and Fraas (2011), with small sample sizes for older studies and larger sample sizes in the more recent studies. We expand the current empirical studies by using a large, global, and cross-sectional sample, by including a variety of stakeholder groups with different measures for stakeholder relevance and by using an objective measure for carbon disclosure delivered by a third party, the CDP. Busch and Hoffmann (2011) argue that in empirical research, an issue must be material for a firm to find a relationship with disclosure. They conclude that climate change is perceived to be such an issue because of the public and political attention. Following this position, we see a benefit in analyzing the relationship between stakeholder relevance and carbon disclosure.

For the field of carbon disclosure and in light of the relevance of climate change as a material business issue, we expect that low emissions and thus a better carbon performance is associated with more carbon disclosure (Al-Tuwaijri, Christensen, & Hughes, 2004; Clarkson et al., 2008). Thus, we formulate the following hypothesis:

Hypotheses 1 (H1): A firm's carbon performance is positively associated with its carbon disclosure.

Concerning stakeholder inclusion, most studies presented in Table 1 only address stakeholder impact in general and explicitly address mostly measures for shareholders and creditors. Specific stakeholders, such as the media or the general public, are addressed by only some authors (Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Dawkins & Fraas, 2011; Prado-Lorenzo & Garcia-Sanchez, 2010).

Huang and Kung (2010) address a wider range of stakeholders; however, their study is limited to Taiwanese carbon-intensive industries and does not include environmental performance. For the measurement of stakeholder groups, Huang and Kung (2010) apply firm-specific data as available from the financial statements. We widen the scope by analyzing a global sample of both carbon-intensive industries and non-carbon-intensive industries. Furthermore, we integrate a wider range of non-financial stakeholders and we hypothesize the following:

Hypotheses 2 (H2): The relevance of a firm's stakeholders is positively associated with a firm's carbon disclosure.

In addition to the direct relationship, we also investigate whether stakeholder relevance acts as a moderator for the relationship between carbon performance and carbon disclosure as analyzed by H1. Thus, we formulate the following:

Hypotheses 3 (H3): The relevance of a firm's stakeholders acts a moderator for the relationship between carbon performance and carbon disclosure.

Firms with poor carbon performance might not only be inclined to disclose less carbon-related information. It is also possible that the relationships between stakeholder relevance variables and carbon disclosure are weaker for these firms. For example, a firm with poor carbon performance might prefer not to disclose this information in a country with strong GHG politics because it is afraid that disclosure might lead to more carbon-related regulation or other public pressure. Furthermore, our sample consists of firms from carbon-intensive and non-carbon-intensive industries. It is likely that firms that are not active in carbon-intensive industries have a different motivation for carbon-related disclosure. A different motivation would lead to different relationships between stakeholder relevance and carbon disclosure, and thus we follow studies analyzing industry effects like Baird, Geylani, and Roberts (2012) and hypothesize that industry might have a moderating effect on disclosure. Thus, we hypothesize the following:

Hypotheses 4a (H4a): Carbon performance acts as a moderator for the relationship between carbon disclosure and the relevance of the stakeholder groups for the firm.
Hypotheses 4b (H4b): Industry affiliation acts as a moderator for the relationship between carbon disclosure and the relevance of the stakeholder groups for the firm.

Background on the CDP

To disclose carbon information to the interested parties, the CDP asks firms worldwide to disclose information about their efforts to mitigate GHG emissions and to adapt to climate change. This initiative involves a new form of disclosure, as firms are required to answer a structured questionnaire about their carbon performance instead of applying a set of rules to an environmental or a sustainability report, as under the Global Reporting Initiative (GRI; 2013a, 2013b). When firms respond to a questionnaire, it becomes more obvious when they choose not to disclose information, because they choose not to answer a question. Thus, the CDP provides a voluntary disclosure setting with little discretion (Luo et al., 2012), meaning that the firms cannot easily distract from poor carbon performance. The CDP assesses the firm responses in a qualitative and quantitative way. As a third party and being distinct from the disclosing firm and the information-seeking stakeholders, the CDP provides an appropriate measure for carbon disclosure.

By drawing on the CDP, this article investigates the effectiveness of an initiative that seeks to better link sustainability challenges and financial markets. The CDP represents 722 institutional investors and creditors, including the world's largest banks (such as BNP Paribas, Deutsche Bank, Barclays Bank, and JPMorgan Chase & Co.), with a combined US$87 trillion under management (CDP, 2013). The CDP seeks information from firms on their sustainability performance to disclose it to various stakeholders and, above all, to the financial markets. Several actors in sustainable investment such as Triodos Bank partner with the CDP (Triodos, 2013). Behind the Dow Jones Sustainability Index, CDP is the second best known sustainability rating and ranking and is regarded to be the best in terms of credibility across sustainability experts (SustainAbility, 2012). Thus, the CDP information is available for making contemporary sustainable investment decisions. Many firms also participate in the CDP to attract capital from sustainability oriented investors. For example, Siemens explicitly mentions its participation in the CDP and the awarded disclosure score on its webpage on Socially Responsible Investment (Siemens, 2015).

Furthermore, in comparison with other actors in the field of sustainable investment, the CDP explicitly targets climate change, which represents a clear constraint on all carbon-intensive industries due to the transgression of the planetary boundaries and a unique opportunity for the renewable energy sector. Our contribution focuses on climate change as a major issue in sustainability investment and the financial markets. This consideration is deeply needed given the somewhat paradoxical situation that despite the interest of several

stakeholders, such as equity market participants or governments, in ecological sustainability, global CO_2 emissions are increasing (Intergovernmental Panel on Climate Change, 2013).

Research Design

The authors apply a regression model to estimate the carbon disclosure score by using as independent variables the carbon performance, the relevance of the stakeholder groups and control variables. The dependent variable is the Carbon Disclosure score. In the following, we describe all variables in the regression models in detail. Note that we structure the variables according to the non-financial stakeholder groups government, general public, media, employees, and customers. Shareholders and creditors are also stakeholder groups, but they are regarded as control variables because we focus on non-financial stakeholder groups. All financial measures are derived from Thomson Reuters Datastream Worldscope, and we indicate other data sources in the following variable descriptions.

Carbon Disclosure Score

As a measure of carbon disclosure, we apply the CDP *carbon disclosure score*. The disclosure score measures whether and how well a firm responds to each question from the CDP questionnaire. The measure is publicly available and scores the four sections of the CDP questionnaire: (a) risk and opportunities; (b) emission accounting, verification, and trading; (c) performance; and (d) governance. A firm is awarded points if it reports its GHG emissions, but the actual amount of emissions does not affect the score (CDP, 2008). Hence, the disclosure score solely measures disclosure, not performance. The scoring accounts for sector-specific issues and includes standalone questions that apply to all firms, as well as lead questions that are the first in a series of questions and solicit a yes or no answer. The disclosure score ranges from 0 (no answers given) to 100 (complete disclosure). For the firms that choose not to answer the CDP questionnaire, we apply a disclosure score of 0. This decision is in accordance with the prior literature (Clarkson et al., 2008).

Although CDP disclosure is applied in empirical environmental disclosure studies (Luo et al., 2012; Prado-Lorenzo & Garcia-Sanchez, 2010; Reid & Toffel, 2009; Stanny, 2013), the earlier CDP disclosures were criticized because the CDP questionnaire was subject to considerable changes during the early years (2003-2006), and sustainability professionals had some doubts about the provided information (Kolk, Levy, & Pinkse, 2008). The CDP

further developed the climate-change questionnaire to improve the reliability of the data. Therefore, we start analyzing the CDP reports in 2008, after which point any changes in the questionnaire were less substantial. Furthermore, in a survey by Globescan and SustainAbility in June 2012 with 850 sustainability professionals responding from 70 countries, the CDP leadership index achieved the highest credibility for all included sustainability ratings and rankings (SustainAbility, 2012). This result confirms that the CDP is not only of interest to recent empirical research but could considerably improve its credibility for sustainability professionals.

Carbon Performance

As explained above, we hypothesize from recent literature (Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Dawkins & Fraas, 2011; Prado-Lorenzo & Garcia-Sanchez, 2010) and argue that carbon performance is positively associated with carbon disclosure. Accordingly, we measure *carbon performance* as the value of the estimated CO_2 emissions (Scope 1 and Scope 2) divided by total assets in the year prior to the CDP disclosure. The values are derived from Thomson Reuters Asset4 and Worldscope. To account for different levels of CO_2 emissions among different industries, we *z*-standardize the value by year and industry, based on the Industry Classification Benchmark (ICB) supersectors.[1] Note that we apply the negative sign to this measure for easier interpretation and comparison with other studies (Clarkson et al., 2008). Therefore, the measure of carbon performance is high when carbon performance is good (when CO_2 emissions are low) and vice versa.

Government

GHG politics captures one environmental dimension of the stakeholder government. It is measured as the perception of a country's national and international climate politics as provided by Germanwatch for the year prior to the CDP disclosure. Germanwatch is an organization concerned with environmental and social issues, and it publishes an index of climate protection. One of the dimensions of this index evaluates the climate protection oriented policies of approximately 50 countries based on answers to a questionnaire by climate-change experts. GHG politics is the negative value of the score provided by Germanwatch and ranges from −5 (very poor GHG politics) to −1 (very good GHG politics). We expect that countries with good GHG politics are more successful in motivating firms to improve their carbon disclosure. Kolk and Perego (2010) as well as Chen and Bouvain (2009) argue that a country's institutional setting and its arrangements regarding environmental

issues have an influence on the reporting behavior of firms. We follow the prior literature by assuming that a firm's home country is of primary importance to its disclosure behavior (Freedman & Jaggi, 2005; Luo et al., 2012). Freedman and Jaggi (2005) show that a firm's disclosure decision is more strongly connected to its home country than to the countries in which it operates.

General Public

The relevance of the stakeholder group *general public* is measured by an indicator that captures how the general public can make its needs heard and accounted for by the government (Kaufmann, Kraay, & Mastruzzi, 2011). This variable is measured using the Voice and Accountability measure as provided by the World Governance Index (WGI) for the year prior to the CDP disclosure.[2] The WGI provides dimensions of governance measured for over 200 countries. Voice and accountability captures the ability of people to influence politics. Climate change is an issue that is discussed intensely in the media and by many interest groups. Accordingly, the ability of the general public to make itself heard and to influence judicial processes is important to firms' disclosure decisions and should be positively associated with carbon disclosure.

Media

The relevance of *media* is measured by the sum of all controversies faced by a firm as reported in Thomson Reuters Asset4 for the year prior to the CDP disclosure.[3] The media pays more attention to firms with controversies regardless of the reason for their occurrence. Such firms face the threat of protests or boycotts from customers and interest groups or even legal actions against the firm. Reid and Toffel (2009) show that the firms facing threats of regulation or the attention of activist groups (because they have been targeted by stakeholder actions on environmental issues) tend to increase their carbon disclosure. By engaging in carbon disclosure, firms can respond to public pressure and the media and report on their initiatives toward higher carbon performance. In addition, increased carbon disclosure might serve the purpose of deflecting attention from controversies in other areas.

Employees

The relevance of *employees* to the firm is measured as the workforce/employee quality score of the firm obtained from the Thomson Reuters

Asset4 Database in the year prior to the CDP disclosure. Firms with a stronger employee orientation and which react on their employees as stakeholders obtain a higher score. Employees are an important interest group of firms; they directly influence firm performance through their productivity and their wages and salaries. Employees also provide indirect influence through labor unions and recruitment. Labor unions influence the development of wages and salaries and, accordingly, a firm's profitability and value (Abowd, 1989). Furthermore, unionized labor is demonstrated as being related to financial risks due to the influence of unions on labor costs (Hansson, 2004; Rosett, 2001). If there is a public understanding that GHG emissions should be lowered, then this pressure might also be executed through labor unions. Thus, a firm's basis for negotiations should be improved when it discloses information about its efforts to lower GHG emissions. In addition, prospective employees are concerned with more than just the current financial performance of a firm and might also consider information regarding a firm's carbon performance (Grolleau, Mzoughi, & Pekovic, 2012; Ilinitch, Soderstrom, & Thomas, 1998). Hence, providing such information might be helpful in attracting potential new employees. As a result, a firm that is concerned with its employees will also increase its carbon disclosure, both to attract new employees and to improve its relationships with current employees and labor unions.

Customers

The variable *customers* captures the relevance of customers for the firm and is measured by the client management score obtained from Thomson Reuters Asset4 in the year prior to the CDP disclosure. The client management score is an aggregate measure that considers different dimensions of customer orientation via different sources. For example, it includes, among others, the dimensions of brand value, customer satisfaction, and innovative activities. A high score indicates a high customer orientation and thus a reaction of the firm on the relevance of this stakeholder group. Customers pay attention to a firm's environmental disclosure (Ilinitch et al., 1998). Accordingly, firms use their carbon disclosure as a marketing tool to attract new customers and retain existing customers.

Control Variables

We follow previous studies and choose variables in a similar way. *Financial performance* is the return on equity (RoE), measured as the net income divided by the book value of the firm's common equity in the year prior to the

CDP disclosure.[4] This measure captures a firm's performance from the shareholders' perspective. RoE also captures the resources that a firm has available to cover, among others, expenditures for carbon disclosure. Therefore, a firm with higher profits also has more resources to spend on quantity and quality of carbon disclosure (Brammer & Pavelin, 2006).

Leverage is measured by a firm's total debt capital divided by total assets in the year prior to the CDP disclosure.[5] It has been argued that leverage influences firms' disclosure decisions (Clarkson et al., 2008; Leftwich, Watts, & Zimmerman, 1981) because firms with high leverage are more dependent on creditors and experience higher monitoring costs.

Volatility is measured by the stock price volatility based on the standard deviation of the market-adjusted monthly stock returns (Clarkson et al., 2008; Lim, 2001) in the year prior to the CDP disclosure.[6] High volatility indicates a high level of information asymmetry, which negatively influences the cost of capital. Therefore, firms are motivated to voluntarily disclose information to lower information asymmetry and the cost of capital (Healy & Palepu, 2001).

Size is the firm size and is measured by the common logarithm of total assets in the year prior to the CDP disclosure. Leuz and Wysocki (2008) note that large firms tend to disclose more information than small firms. We include firm size to account for this effect. Firm size is also a widely accepted control variable in voluntary disclosure studies (Botosan, 1997; Clarkson, Kao, & Richardson, 1999; Jones, 2007).

The variable *capital investment* is calculated as capital expenditures divided by total sales revenue in the year prior to the CDP disclosure. Firms with relatively high capital investments should have newer equipment. Clarkson et al. (2008) argue that newer equipment will be more state of the art and thus helps to improve carbon performance.[7] Therefore, firms with newer equipment are more inclined to increase disclosure to inform about their investment activities and the positive effects on carbon performance.

Code law captures the legal dimension of the stakeholder government. It is a dichotomous variable that equals 1 when the country's legal system is based on code law and zero otherwise. There is a stronger political influence on accounting in code-law countries than in common-law countries. Accordingly, code-law countries are observed to motivate stakeholder-oriented disclosure, such as carbon disclosure, while shareholder-oriented disclosure is prevalent for common-law countries (Ball, Kothari, & Robin, 2000; Luo et al., 2012; Prado-Lorenzo & Garcia-Sanchez, 2010). However, as regulations for stakeholder-oriented disclosure are tighter in code-law countries, firms might refrain from voluntary disclosure as much information is already publicly and mandatorily available. Code-law countries are

countries with a German, French, or Scandinavian legal origin. Common-law countries have an English legal origin (La Porta, Lopez-de-Silanes, & Shleifer, 2008) and therefore mainly comprise English-speaking countries (Australia, Canada, United Kingdom, and United States). Thus, we expect code-law countries to be associated with lower carbon disclosure.

The variable *signatories* represents institutional ownership and is measured as the percentage of shares held by institutional owners in the year prior to the CDP disclosure. An empirical study by Bushee and Noe (2000) finds a positive relationship between institutional ownership and higher levels of disclosure. Furthermore, the CDP's signatories are institutional investors who may demand that the firms in which they invest increase their CDP disclosure. This effect has been empirically verified by Reid and Toffel (2009).

Year-control dummy variables capture time-specific effects that affect all firms; for example, there might be a lower carbon disclosure level in the aftermath of the financial crisis. *Industry-control* denotes industry dummy variables that capture industry-specific effects. These control variables are defined according to the industry classification of CDP (as reported in Table 1).

Because firms can choose not to respond to the CDP, we apply Tobit regressions. Therefore, we account for the character of the dependent variable carbon disclosure score as being cut off at 0 for the case of non-disclosure. We analyze the determinants of the carbon disclosure score using the following model "All stake":

$$\begin{aligned}\text{Disclosure Score}_{it} = {} & \beta_0 + \beta_1 \text{Carbon Performance}_{it} + \beta_2 \text{GHG politics}_{it} + \\ & \beta_3 \text{General public}_{it} + \beta_4 \text{Media}_{it} + \beta_5 \text{Employees}_{it} + \\ & \beta_6 \text{Customers}_{it} + \beta_7 \text{Financial Performance}_{it} + \\ & \beta_8 \text{Leverage}_{it} + \beta_9 \text{Volatility}_{it} + \beta_{10} \text{Size}_{it} + \\ & \beta_{11} \text{Capital Investment}_{it} + \beta_{12} \text{Code Law}_{it} + \\ & \beta_{13} \text{Signatories}_{it} + \text{Year} - \text{Controls}_t + \\ & \text{Industry} - \text{Controls}_i + \varepsilon,\end{aligned}$$

where subscript *i* denotes firms and *t* denotes years.

H1 is supported if the coefficient β_1 is significant and positive, whereas H2 is confirmed for a specific stakeholder group if its respective coefficient (β_2 through β_6) is significant. We also estimate a model "No stake" without the stakeholder variables (GHG politics, general public, media, employees, and customers) to analyze whether this change leads to distorted results for carbon performance due to the omitted variable problem.

To test H3, we introduce interaction terms for each stakeholder variable. For each stakeholder variable, we estimate the following Tobit regression:

$$\begin{aligned}\text{Disclosure Score}_{it} = {} & \gamma_0 + \gamma_1 \text{Carbon Performance}_{it} + \gamma_2 \text{Interaction}_{it} + \\ & \gamma_3 \left(\text{Interaction}_{it} \times \text{Carbon Performance}_{it}\right) + \\ & \gamma_4 \text{Financial Performance}_{it} + \gamma_5 \text{Leverage}_{it} + \\ & \gamma_6 \text{Volatility}_{it} + \gamma_7 \text{Size}_{it} + \gamma_8 \text{Capital Investment}_{it} + \\ & \gamma_9 \text{Code law}_{it} + \gamma_{10} \text{Signatories}_{it} + \text{Year} - \text{Controls}_t + \\ & \text{Industry} - \text{Controls}_i + \varepsilon,\end{aligned}$$

where Interaction is a binary variable of the analyzed stakeholder group. Therefore, for GHG politics, general public, employees, and customers, we apply a median split for the total sample. For the interaction variable observations above (below), the median values are coded with 1 (0). The interactions variable for Media is 1 if the firm has at least one controversy for the year prior to the CDP disclosure and 0 otherwise. We apply this Tobit regression for each single stakeholder group separately. If γ_3 is significant, then H3 is supported for the respective stakeholder group.

In H4a and H4b, we focus on moderating effects of carbon performance and carbon-intensive industries on the results of the ALL STAKE model. We analyze three models. The first two models apply either carbon performance or carbon-intensive industry as a binary interaction variable. The third model is a combination in which we apply both interaction variables. To convert carbon performance into a binary variable, we apply a median split within each industry (on the ICB subsector level) and year. Firms above the median are good carbon performers, and we assign a value of 1 to the carbon performance interaction variable. All other observations are classified as poor (or below median) carbon performance, and we assign a value of 0. The definition of carbon-intensive industries is based on the CDP's definition (CDP, 2008).[8] Carbon-intensive industries are chemicals and pharmaceuticals; construction and building products; manufacturing; oil and gas; raw materials, mining, paper, and packaging; transport and logistics; and utilities. Non-carbon-intensive industries are financial services; hospitality, leisure, and business services; retail and consumer; technology; and media and telecoms.

Sample Description

The study sample comprises all firms that are included in the CDP Global 500, S&P 500, or FTSE 350 reports from 2008 to 2011 and for which all

necessary financial and environmental data are available in the Thomson Reuters Worldscope and Asset4 databases. The sample consists of a total of 1,120 firms with 3,631 firm-year observations. Table 2 presents the sample composition by country, industry, and year. Due to the inclusion of CDP's S&P 500 and FTSE 350 reports, our sample is biased toward U.S. and U.K. firms. Table 2 also reports the mean disclosure score. Germany (71.22) and Australia (66.50) show high disclosure scores, whereas China (13.03) and India (23.33) rank very low. For industries, the mean disclosure score ranges from 34.02 for the Energy sector to 54.96 for Consumer Staples. The yearly analysis reveals that from 2008 to 2011, the number of observations (629-1,050) and the mean disclosure score (42.83-44.65) have increased, with a low of 41.54 in 2009.

For countries, the table provides details for the 12 most comprehensive countries. All other countries are consolidated into "Other." These countries are as follows (in order of decreasing number of observations): Russian Federation, the Netherlands, Italy, South Korea, Sweden, Singapore, South Africa, Norway, Indonesia, Belgium, Denmark, Turkey, Finland, Malaysia, Mexico, Portugal, Thailand, Luxembourg, Poland, Austria, Czech Republic, Greece, and Morocco.

Descriptive statistics for all variables are reported in Table 3.

Disclosure score is the carbon disclosure score as assigned by the CDP. Theoretically, the score ranges from 0 (no response or no answers provided) to 100 (complete disclosure). CARBON PERFORMANCE is reported as the negative value of Scope 1 and Scope 2 emissions divided by net sales (in further analysis, this variable is z-standardized by year and industry). We use the negative value for the better interpretation of results as good carbon performers have low CO2 emissions relative to net sales and industry. Thus, using negation, good performers have high values for CARBON PERFORMANCE. GHG POLITICS is the negative value of the score provided by Germanwatch and ranges from −5 (very poor GHG politics) to −1 (very good GHG politics). GENERAL PUBLIC is the voice and accountability measure from the World Government Index and ranges from 0 (very poor) to 100 (very good). MEDIA is the sum of controversies a firm has faced from the Datastream Asset4 Database. EMPLOYEES and CUSTOMERS are scores from the Datastream Asset4 Database and range from 0 (very poor) to 100 (very good). FINANCIAL PERFORMANCE is net income divided by the book value of equity. LEVERAGE is total debt capital/total assets. VOLATILITY is the standard deviation of market-adjusted monthly returns over 12 months. SIZE is the common logarithm of total assets. CAPITAL INVESTMENT is capital investments divided by total sales. CODE LAW is a binary variable, which is 0 for common-law countries (countries with a

Table 2. Industry and Continent Affiliation of Sample Firms.

			Disclosure score−Descriptive statistics		
	Observations	Relative proportion	*M*	*SD*	Median
Country					
USA	1,509	41.56%	44.33	34.10	53
United Kingdom	884	24.35%	45.53	31.88	57
Japan	218	6.00%	37.15	33.01	43
China	137	3.77%	13.03	27.80	0
France	113	3.11%	56.47	32.05	64
Canada	96	2.64%	45.86	31.97	59
Germany	77	2.12%	71.22	26.71	78
Spain	49	1.35%	50.82	39.03	66
Australia	48	1.32%	66.50	25.93	72
Switzerland	48	1.32%	58.54	33.20	68.5
India	46	1.27%	23.33	33.13	0
Brazil	43	1.18%	46.09	34.44	57
Other	363	10.00%	31.27	36.36	0
Industry					
Consumer discretionary	511	14.07%	40.91	33.97	51
Consumer staples	278	7.66%	54.96	30.89	63
Energy	307	8.45%	34.02	33.90	33
Financials	755	20.79%	39.08	35.51	50
Health care	237	6.53%	47.09	32.32	55
Industrials	493	13.58%	41.84	33.09	52
Information technology	358	9.86%	45.46	34.01	54.5
Materials	291	8.01%	50.40	33.97	59
Telecommunications	147	4.05%	38.16	35.75	44
Utilities	254	7.00%	46.17	36.79	55.5
Year					
2008	629	17.32%	42.83	30.02	53
2009	937	25.81%	41.54	32.85	50
2010	1,015	27.95%	42.81	34.82	54
2011	1,050	28.92%	44.65	37.98	58
Total	3,631	100.00%	43.02	34.51	53

Note. The table provides an overview of the sample composition by country, industry (following ICB classification), and year. Descriptive statistics show the number of observations, the relative number of observations in percent of total observations, the mean, standard deviation (*SD*), and median of the disclosure score.

Table 3. Descriptive Statistics.

	M	*SD*	10%	Median	90%
Dependent variable					
Disclosure score	43.02	34.51	0	53	85
Independent variable					
Carbon performance	−0.48	1.42	−1.06	−0.04	−0.004
Stakeholders					
GHG politics	−3.60	0.96	−4.90	−3.85	−2.26
General public	82.41	19.37	63.98	86.73	92.89
Media	1.19	2.93	0	0	4
Employees	63.52	26.44	23.21	70.00	93.65
Customers	61.20	28.45	17.00	64.61	96.06
Controls					
Financial performance	0.16	0.22	0.00	0.14	0.34
Leverage	0.24	0.16	0.02	0.22	0.46
Volatility	8.50	5.09	4.55	7.31	13.25
Size	16.63	1.72	14.48	16.55	18.81
Capital investment	0.10	0.16	0.01	0.04	0.23
Code law	0.27	0.44	0	0	1
Signatories	7.33	8.88	0	5	20

Note. The table reports descriptive statistics of the dependent variable disclosure score and all independent variables.

British legal origin) and 1 for code-law countries. SIGNATORIES is (shares held by institutional investors / total shares) × 100. All independent variables are measured in the year prior to the DISCLOSURE SCORE.

Results and Discussion

Table 4 shows the correlation table for the Bravais-Pearson coefficients for the dependent and independent variables. Interestingly, the carbon disclosure score is significantly correlated with all variables except for GHG politics and financial performance. The strongest correlations between variables are −0.38 (between General public and Code law) and +0.43 (between Size and Code law). Hence, we expect no problems from multicollinearity.[9]

Table 5 reports the results of the basic model (ALL STAKE) compared with a model without stakeholder variables (NO STAKE). Furthermore, to analyze whether the stakeholder variables are a moderator for the relationship between the carbon disclosure score and carbon performance, we apply interaction models for each of the five stakeholder variables.

Table 4. Correlations Table.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) DISCLOSURE SCORE	1												
(2) CARBON PERFORMANCE	−.04**	1											
(3) GHG POLITICS	.01	−.03*	1										
(4) GENERAL PUBLIC	.27***	−.01	−.04**	1									
(5) MEDIA	.25***	−.03	−.10***	.08***	1								
(6) EMPLOYEES	.19***	.04**	.16***	−.03*	−.01	1							
(7) CUSTOMERS	.22***	.02	.05***	.07***	−.04**	.29***	1						
(8) FINANCIAL PERFORMANCE	.02	−.01	.04**	−.04**	.010	.08***	.03*	1					
(9) LEVERAGE	.03**	.09***	−.05***	.10***	−.04**	−.04**	.08***	−.02	1				
(10) VOLATILITY	−.16***	−.03*	.010	.01	−.07***	−.09***	−.08***	−.19***	.08***	1			
(11) SIZE	.24***	−.04**	−.14***	−.16***	.31***	.18***	.27***	−.14***	.10***	−.09***	1		
(12) CAPITAL INVESTMENT	−.08***	.18***	.04**	−.04**	−.05***	.00	−.07***	−.11***	.20***	.08***	−.06***	1	
(13) CODE LAW	−.07***	−.03*	.22***	−.38***	−.07***	.15***	.20***	−.02	.03*	−.05***	.43***	.00	1
(14) SIGNATORIES	−.06***	.02	−.09***	.19***	−.10***	−.06***	−.09***	−.04**	.02	.15***	−.34***	−.34***	−.06***

Note. The table contains Bravais-Pearson correlations of the dependent variable (DISCLOSURE SCORE) and all independent variables.
*$p < .1$. **$p < .05$. ***$p < .01$.

Table 5. Basic Model and Shareholder Interactions.

			INTERACTION MODELS				
Variables	NO STAKE	ALL STAKE	(1)	(2)	(3)	(4)	(5)
CARBON PERFORMANCE	3.951*** (4.49)	2.794*** (3.43)	0.984 (0.68)	2.722** (2.30)	3.715*** (3.70)	4.471*** (3.62)	4.139*** (3.68)
Stakeholder variables[a]							
(1) GHG POLITICS		5.393*** (6.04)	15.123*** (7.72)				
(2) GENERAL PUBLIC		0.686*** (13.94)		23.827*** (14.71)			
(3) MEDIA		1.566*** (5.61)			9.979*** (5.35)		
(4) EMPLOYEES		0.206*** (6.77)				12.463*** (7.84)	
(5) CUSTOMERS		0.191*** (6.62)					14.614*** (9.00)
Interactions							
w/CARBON PERFORMANCE			4.339** (4.41)	1.129 (0.67)	0.950 (0.47)	−0.867 (−0.50)	−0.660 (−0.37)
Control variables							
FINANCIAL PERFORMANCE	−0.875 (−0.22)	−2.458 (−0.67)	−1.274 (−0.33)	−0.858 (−0.23)	−1.325 (−0.34)	−3.642 (−0.94)	−2.270 (−0.59)
LEVERAGE	3.013 (0.56)	−1.223 (−0.24)	5.080 (0.96)	4.819 (0.93)	4.097 (0.77)	4.678 (0.88)	1.027 (0.19)
VOLATILITY	−1.534*** (−8.02)	−1.391*** (−7.77)	−1.562*** (−8.23)	−1.581*** (−8.52)	−1.524*** (−8.01)	−1.496*** (−7.89)	−1.518*** (−8.03)
SIZE	12.015*** (19.84)	9.841*** (14.45)	13.017*** (21.09)	13.491*** (22.55)	10.481*** (15.80)	11.606*** (19.30)	11.012*** (18.16)
CAPITAL INVESTMENT	3.118 (0.52)	2.152 (0.39)	1.127 (0.19)	−1.609 (−0.28)	3.435 (0.58)	1.218 (0.21)	2.588 (0.44)
CODE LAW	−27.371*** (−13.29)	−21.464*** (−9.76)	−32.253*** (−15.01)	−29.852*** (−14.82)	−24.446*** (−11.55)	−28.533*** (−13.90)	−29.139*** (−14.19)
SIGNATORIES	0.050 (0.51)	−0.015 (−0.16)	0.083 (0.85)	0.089 (0.94)	0.036 (0.37)	0.024 (0.24)	0.052 (0.53)
Intercept	−152.53*** (−13.61)	−183.7*** (−15.20)	−182.75*** (−15.39)	−182.67*** (−16.45)	−131.55*** (−11.18)	−152.48*** (−13.73)	−142.73*** (−12.85)
Observations	3,631	3,631	3,631	3,631	3,631	3,631	3,631
Chi-square (*p* value)	666.20 (0.000)	1,136.76 (0.000)	732.89 (0.000)	882.24 (0.000)	695.33 (0.000)	727.56 (0.000)	746.82 (0.000)
Log likelihood	−13,610.87	−13,375.59	−13,688.52	−13,502.85	−13,596.30	−13.580.19	−13,570.56

Note. This table reports results of the Tobit models with the disclosure score as the dependent variable and independent variables as identified in the first column. The models are "NO STAKE" which does not contain stakeholder variables and "ALL STAKE" which contains all stakeholder variables, but no interaction terms; "Interaction Models" contain the interaction term for one stakeholder variable and its interactions with CARBON PERFORMANCE. The Interaction Models are numbered (1) for good versus poor GHG politics, (2) for high versus. low influence of the general public of the people in political processes, (3) for firms with controversies versus firms without controversies, (4) for high versus low employee orientation, and (5) for high versus low customer orientation. The table reports the slope coefficient and the *t*-value (in parenthesis).

[a]For the model "ALL STAKE," the stakeholder variables are continuous variables as presented in Table 3 and defined in "Research Design" section. For the interaction models, the stakeholder variables are binary variables where 1 (0) indicates a high (low) degree of stakeholder orientation based on a median split. The exception is MEDIA, which is 1 for firms with one or more controversies and 0 for firms without any controversies.

*$p < .1$. **$p < .05$. ***$p < .01$.

Table 5 indicates that the carbon disclosure score is positively associated ($p < .01$) with carbon performance for both the NO STAKE and the ALL STAKE model. This relationship means that lower emissions intensity in relation to the industry average (better carbon performance) is associated with higher carbon disclosure. Our results confirm the results of previous studies on the association of environmental (carbon) disclosure with environmental (carbon) performance (Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Dawkins & Fraas, 2011; Prado-Lorenzo & Garcia-Sanchez, 2010) and thus support H1. Our results show that signs and significances for the association between carbon performance and carbon disclosure do not change when stakeholder variables are added to the model. This lack of change is evidence that the omitted variable problem, which occurs when a study does not include important independent variables in the research design, does not lead to different conclusions in relation to the previous studies.

Results of the ALL STAKE model clearly show that all stakeholder variables are associated with the carbon disclosure score with high significance levels ($p < .01$). We find that firms headquartered in countries with stronger GHG politics and more potential for the general public to influence the regulatory process (measured as higher general public) disclose more carbon-related information. This finding means, in general, that the institutional setting is significantly associated with the carbon disclosure score, confirming the previous results of Kolk and Perego (2010) and Chen and Bouvain (2009) for other environmental issues. In addition, we confirm the results of Freedman and Jaggi (2005) and Luo et al. (2012) that the country where a firm is headquartered is also related to carbon disclosure.

Furthermore, the firms that experience more media pressure are likely to increase their carbon-related disclosure. In addition, we show that employees and customers as stakeholders are positively associated with the carbon disclosure score of firms, representing two stakeholder groups that had not been analyzed, to our best knowledge, in the empirical literature on carbon disclosure to date.

Interestingly, the sign and significance of carbon performance remains stable when comparing the NO STAKE and the ALL STAKE models. However, the model fit increases considerably when analyzing the chi-square from 666.20 (NO STAKE) to 1,136.76 (ALL STAKE) which means that the inclusion of stakeholder variables better explains the carbon disclosure score. Therefore, the stakeholder variables should be included in the future carbon disclosure research. All control variables are robust for all models shown in Table 5. To sum up, the results support our H2.

Next, we analyze the possible moderating effects of the stakeholder variables. Note, that for the purpose of the interaction model, the stakeholder

variables are calculated as binary variables, thus differentiating between high and low stakeholder relevance. The interaction models show, again, that all stakeholder variables are significant. This means that results of the ALL STAKE model are robust to different calculations of the stakeholder variables. We find a moderating effect supporting our H3 only for GHG politics. We find that in countries with weak GHG politics (GHG politics binary = 0), there is no significant relationship between the carbon disclosure score and carbon performance (coefficient: 0.984). However, in countries with strong GHG politics, there is a considerably stronger positive relationship between the carbon disclosure score and carbon performance (coefficient: 5.323 = 0.984 + 4.339). We interpret this result to mean that in countries with strong GHG politics, the firms are not only directly motivated to increase their carbon disclosure (coefficient: 15.123, $p < .01$) but also have additional incentives to further increase their disclosure activities if their carbon performance is good.

For all other stakeholder variables (general public, media, employees, and customers), we find no significant changes in the coefficients of the carbon disclosure score between high and low stakeholder relevance: There is no significance for the relevant interaction term in Table 5. This result means that carbon performance and stakeholder relevance are both significantly associated with the carbon disclosure score, but independent of one another. In summary, H3 is supported only for GHG politics.

The results of testing the moderating effect of industry affiliation and carbon performance on the association between carbon disclosure score and stakeholder relevance are summarized in Table 6.

The results support the notion that carbon performance acts as a moderator for stakeholder variables. We find that the good carbon performers generally show a higher disclosure score (coefficient: 40.728, p value < .01), which is consistent with the positive and significant results of the analysis in Table 5. Furthermore, we find that the good carbon performers show a stronger relationship between the carbon disclosure score and GHG politics and weaker relationships between the carbon disclosure score and general public as well as employees. However, although there are some moderating effects, the general signs of the relationships are unchanged. For example, for poor carbon performers, the coefficient of GHG politics is 4.226 ($p < .01$) and for good carbon performers it is 7.482 (4.226 + 3.256). This result shows again that good carbon performance is an enforcing moderator for the country-specific relationship between GHG politics and the carbon disclosure score. For poor carbon performers, the general public variable has a coefficient of 0.792 ($p < .01$), and for good carbon performers, the coefficient is 0.519 (0.792 − 0.273). For employee orientation, poor carbon performers show a coefficient of

Table 6. Results of Carbon Performance and Carbon Industry Interactions.

Variables	Carbon performance	Carbon-intensive industries	Carbon performance and carbon-intensive industries
CARBON PERFORMANCE		2.395 (2.13)**	
Stakeholder variables			
GHG POLITICS	4.226 (3.54)***	5.193 (4.49)***	3.149 (1.98)**
GENERAL PUBLIC	0.792 (12.95)***	0.756 (12.01)***	0.954 (11.56)***
MEDIA	1.764 (4.79)***	1.544 (4.44)***	1.766 (3.86)***
EMPLOYEES	0.274 (6.35)***	0.228 (5.54)***	0.296 (4.92)***
CUSTOMERS	0.164 (4.14)***	0.166 (4.33)***	0.155 (2.80)***
Interaction variables			
CARBON PERFORMANCE	40.728 (3.57)***		70.331 (4.62)***
CARBON INDUSTRY		18.603 (1.28)	44.458 (2.58)**
BOTH			−69.303 (−2.99)***
Interaction with CARBON PERFORMANCE			
GHG POLITICS	3.256 (2.07)**		5.181 (2.42)**
GENERAL PUBLIC	−0.273 (−2.84)***		−0.532 (−4.18)***
MEDIA	−0.413 (−0.85)		−0.428 (−0.67)
EMPLOYEES	−0.143 (−2.41)**		−0.133 (−1.65)*
CUSTOMERS	0.056 (1.02)		0.025 (0.34)
Interaction with CARBON INDUSTRIES			
CARBON PERFORMANCE		0.829 (0.51)	
GHG POLITICS		0.465 (0.29)	2.531 (1.14)
GENERAL PUBLIC		−0.172 (−1.84)*	−0.384 (−3.23)***
MEDIA		0.065 (0.13)	0.031 (0.04)
EMPLOYEES		−0.051 (−0.85)	−0.043 (−0.49)
CUSTOMERS		0.057 (1.03)	0.026 (0.33)
Interaction with CARBON PERFORMANCE AND CARBON INDUSTRIES			
GHG POLITICS			−4.427 (−1.41)
GENERAL PUBLIC			0.619 (3.14)***
MEDIA			0.015 (0.02)
EMPLOYEES			−0.042 (−0.35)
CUSTOMERS			0.069 (0.62)
Control variables			
FINANCIAL PERFORMANCE	−2.391 (−0.62)	−2.314 (−0.63)	−1.997 (−0.54)
LEVERAGE	−1.134 (−0.22)	−1.963 (−0.39)	−2.030 (−0.40)
VOLATILITY	−1.384 (−7.72)***	−1.391 (−7.75)***	−1.391 (−7.72)***
SIZE	9.874 (14.47)***	9.879 (14.43)***	9.920 (14.47)***

(continued)

Table 6. (continued)

Variables	Carbon performance	Carbon-intensive industries	Carbon performance and carbon-intensive industries
CAPITAL INVESTMENT	0.765 (0.14)	2.991 (0.53)	1.850 (0.33)
CODE LAW	−20.597 (−9.26)***	−21.499 (−9.77)***	−20.485 (−9.20)***
SIGNATORIES	−0.037 (−0.40)	−0.012 (−0.13)	−0.026 (−0.28)
Intercept	−200.135 (−15.41)***	−193.622 (−12.46)***	−221.312 (−13.06)***
Observations	3,631	3,631	3,631
Chi-square (*p* value)	1,142.55 (0.000)	1,141.81 (0.000)	1,160.30 (0.000)
Log-likelihood	−13,372.69	−13,373.07	−13,363.82

Note. This table reports the results of Tobit models with interaction terms for CARBON PERFORMANCE and CARBON INDUSTRY. Therefore, CARBON PERFORMANCE is a binary variable in the models "Carbon Performance" and "Carbon Performance and Carbon Industries." We apply a median split per year and ICB Subsector for Carbon Performance. This variable is 1 for good carbon performers (lower 50% of GHG emissions divided by net sales) and 0 otherwise. CARBON INDUSTRY is 1 for carbon-intensive industries as defined by CDP (chemicals and pharmaceuticals; construction and building products; manufacturing; oil and gas; raw materials, mining, paper, and packaging; transport and logistics; and utilities) and 0 otherwise. The table reports the slope coefficient and the *t*-value (in parenthesis).
*$p < 0$. **$p < .05$. ***$p < .01$.

0.274 ($p < .01$), while good carbon performers show a coefficient of 0.131 (0.274 − 0.143). This result means that carbon disclosure is driven by the general public and employees, but the effect is weaker when carbon performance is good. Thus, poor carbon performers disclose more if they are employee oriented or if the general public has a stronger influence on political processes.

Analyzing the moderation effects of belonging to carbon-intense industries, we find that firms with a good carbon performance in the same type of industry disclose more (coefficient: 2.395 and $p < .05$).[10] For the carbon industry itself, we do not find a significant direct effect, and the moderating effect does only concern one stakeholder variable on a low level of significance ($p < .1$): general public. Thus, carbon disclosure appears to be driven rather by the firm-specific carbon performance relative to the industry and not by its industry affiliation. The general finding that carbon-intensive versus non-carbon-intensive industries deliver largely similar results is consistent with Reid and Toffel (2009) who also analyze a moderating effect of a firm's industry affiliation with carbon disclosure and only found weak evidence.

The combination of both the carbon performance and the carbon industry interaction variables shows an additional moderating effect. General public is moderated by carbon performance and carbon-intensive industries as well as

the combination of both, with negative signs for the single interaction terms. Looking on the coefficients for the interactions terms for general public, there appears to be a trade-off between general public and carbon performance or carbon-intensive industry concerning the relationship with the carbon disclosure score. Furthermore, we find that the effect of good carbon performance is larger (70.331, $p < .01$) than the effect of industry affiliation (44.458, $p < .05$). In addition, firms with a good carbon performance from a carbon-intensive industry also tend to disclose more information than the poor carbon performers from non-carbon-intensive industries (coefficient: 45.486 = 70.331 + 44.458 − 69.303) but less than the good carbon performers from non-carbon industries (coefficient: 70.331, $p < .01$). Thus, we find a joint effect of both carbon performance and carbon industry which partially supports H4a and H4b.

Overall, we find that the direct and moderating effects of carbon performance are stronger and more pronounced for the carbon-intensive industries. Interestingly, whether we analyze carbon-intensive or non-carbon-intensive industries appears to have no influence on the inferences from stakeholder variables. Of course, this result is specific to our CDP setting. However, it is worthwhile analyzing other environmental disclosure settings because the scope of inferences and analyses can be widened considerably when researchers do not need to focus on specific industries for environmental disclosure research.

Conclusion

Stakeholder theory is often mentioned in the motivation of empirical carbon disclosure studies. However, analyzing literature that studies the relationship between environmental disclosure and environmental performance reveals that generally shareholder relevance is analyzed while non-financial stakeholder groups are often ignored. Thus, this study contributes to the literature by expanding the scope of the current empirical studies to include measures for non-financial stakeholder groups and especially to include employees and customers.

The results support a direct positive relationship between carbon disclosure and the relevance of all stakeholder groups analyzed: governmental GHG politics, the general public, the media, employees, and customers. This positive relationship means that these stakeholder groups are regarded as relevant stakeholders to whom the firms react by disclosing their climate change related efforts. This result is strong and consistent across different models and measurements. However, our results also show that the significances and signs of the relationship between carbon disclosure and carbon performance

do not change if the stakeholder variables are not considered. This absence of change is evidence that the omitted variable problem, which occurs when a study fails to include important independent variables in its research design, does not necessarily lead to different conclusions in relation to the previous studies. However, this finding is based on the specific setting of CDP. It is uncertain whether this result is transferable to other environmental disclosure settings (such as settings with more discretionary potential) or even sustainability disclosure settings. Therefore, the authors recommend for future research that researchers include a variety of stakeholder variables because the extended ALL STAKE model better explains carbon disclosure.

The authors also analyze the extent to which stakeholders act as moderators of the relationship between the carbon disclosure and carbon performance, and find that only GHG politics acts as a moderator. Generally, in countries with strong GHG politics, we find a stronger relationship between the carbon disclosure score and carbon performance. This reveals that governments have direct and indirect influence on a firm's carbon reporting behavior. The other stakeholder variables for media, employees, and customers appear to be directly related to the carbon disclosure score. Furthermore, we show that the effects of all stakeholder variables add up to a total effect on climate disclosure, but so far seem to be rather exchangeable. Future research might explore multiplicative associations between stakeholder variables.

Furthermore, in an extension to the previous literature, we look at a cross-section of industries and investigate the differences between carbon-intensive and non-carbon-intensive industries regarding stakeholder relevance. In general, we find that firm-specific carbon performance better explains carbon disclosure compared to industry affiliation. Finally, we expand the current literature focusing predominantly on the United States by using an international sample of firms for our measures. This expansion allows us to more thoroughly explore and confirm the importance of country-specific stakeholder groups such as the government and the general public for carbon disclosure.

Our study confronts both data and methodological limitations. Not all country-specific data, such as TRI and KLD for the United States, can be applied for an international sample such as ours. However, our setting of climate change is global by nature and in the focus of recent empirical research (Luo et al., 2012; Reid & Toffel, 2009; Stanny, 2013). Results of our study are only transferable to climate-change issues. We identified climate change to be in the focus of current public debate and, therefore, to be of special interest to firms and stakeholders. It may also be interesting to expand our study to the wider field of environmental performance or sustainability in general. However, the data for environmental and sustainability performance

is at least partially industry-specific, currently unavailable for a large sample on a global scale, and much more complex than that for climate-change issues.

The representatives of stakeholder groups such as government, the general public, the media, employees, and customers can use our findings as an indication that they are regarded as relevant stakeholders in terms of their claims on the disclosure on climate-change-related information. For regulators, our findings demonstrate that a stringent climate-change policy, despite its unquestioned usefulness for the carbon performance of firms, has a positive relationship with carbon disclosure. This study is potentially of interest to public-policy makers who may consider introducing (further) regulation in this important area. Accordingly, the results of our study improve the understanding of the country-specific attributes and the stakeholder relevance variables that have significant relationships with carbon disclosure. Firms and analysts must be aware that in addition to carbon and financial performance, also non-financial stakeholders need to be considered as relevant drivers of carbon disclosure.

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Notes

1. *Z*-standardization means that for each firm, the authors calculate $-(CO_2\text{-ratio}_{it} - CO_2\text{-average}_{it}) / CO_2\text{-std.deviation}_{jt}$, where $CO_2\text{-ratio}_{it}$ is firm *i*'s estimated CO_2 emissions divided by total assets in year *t*; $CO_2\text{-average}_{jt}$ is the mean of all CO_2 ratios of firm *i*'s corresponding industry *j* in year *t*; and $CO_2\text{-std.deviation}_{jt}$ is the standard deviation of all CO_2 ratios of firm *i*'s corresponding industry *j* in year *t*.
2. Current data are available online at www.govindicators.org. Other governance indicators are "Political Stability," "No Violence," "Government Effectiveness," "Regulatory Quality," "Rule of Law," and "Control of Corruption." All indicators are highly correlated with each other. Therefore, only one indicator should be used in the empirical models to avoid problems of multicollinearity. However, when we apply any other governance indicator, the results are qualitatively similar.
3. The measure covers all controversies as summarized by Asset4. Specifically, these are controversies regarding accounting, anti-competition, biodiversity, business ethics, child labor, consumers, critical countries, diversity and opportunity,

employee health and safety, environment, freedom of association, general shareholder rights, human rights, indigenous people, insider dealings, intellectual property, management compensation, product impact media, product responsibility, public health, social exclusion, spills and pollution, tax fraud, wages, and working conditions.

4. Alternative measures such as return on assets, return on sales, and Tobin's Q lead to qualitatively similar results.
5. An alternative calculation (total debt divided by book value of equity) leads to qualitatively similar results.
6. Alternatively, we applied a beta calculated on a weekly basis for the 1 year prior to the Carbon Disclosure Project (CDP) disclosure and based on a worldwide market index. The results are qualitatively similar to our measure of volatility.
7. Clarkson, Li, Richardson, and Vasvari (2008) analyze and refer to environmental performance. However, the same argument is true for carbon performance.
8. Note that this classification is provided by the CDP and does not directly relate to any industry classification system. However, as this classification was specifically assigned to the CDP reports up to 2008, it is best suited for the analysis. Following the ICB industry classification of Datastream, carbon-intensive ICB sectors corresponding to these of CDP are oil and gas, basic materials, industrials, health care, and utilities. The results do not change considerably when we apply the ICB structure instead of the CDP classification.
9. In further unreported results, the condition number does not exceed the critical value in any of the reported models. The condition number shows a maximum of 5.66 for the stakeholder interaction models and a maximum of 26.55 for the interaction models of carbon performance and carbon industry.
10. Note that for this analysis, carbon performance is again a continuous variable, whereas carbon industry is binary.

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