The Influence of Countries' Climate Change-related Institutional Profile on Voluntary Environmental Disclosures

ABSTRACT. This paper analyzes how the regulative, normative and cultural dimensions of institutions exert pressure both on companies' decisions to voluntarily disclose environmental information and on the quality of the information disclosed. Prior research has focused on the influence of economic, disclosure and generic institutional determinants, while little attention has been paid to the analysis of the influence exerted by climate change-related institutional pillars. The results show that the three institutional pillars have different effects as regards both the decision to respond and the quality of disclosure. The regulative pillar positively influences the response decision, but does not influence disclosure quality. The normative pillar positively affects both the propensity of companies to disclose and the quality of the information reported. Meanwhile, the cultural pillar positively influences disclosure quality, but it has no effect on firms' decisions to disclose environmental information. This paper is the first to analyze whether the institutional profile of climate change in different countries influences voluntary environmental disclosures.

Keywords: environmental policy; corporate sustainability; climate change; carbon emissions; institutional theory

1. Introduction

Social concern regarding climate change and its consequences has developed into a relevant matter for organizations. In the case of the private sector, investors have increased their demands for information concerning impacts, risks and strategies related to climatic change (Luo, 2019). In 2000, a group of institutional investors created the Carbon Disclosure Project (hereinafter the CDP), whose annual reports have become an important part of companies' voluntary carbon reporting (Depoers et al., 2016; Kolk et al., 2008).

Previous studies have provided some evidence on the determinants of corporate carbon disclosures such as the CDP (Clarkson et al., 2008; Cotter & Najah, 2012; Jira & Toffel, 2013; Luo, 2019; Luo et al., 2012; Prado-Lorenzo et al., 2009; Rankin et al., 2011; Reid & Toffel, 2009; Stanny, 2013). They found that various factors affect corporate carbon reporting such as firms' characteristics (e.g. profitability, leverage, size), disclosure-related (e.g. corporate sustainability reports, firms' CDP participation), environment-related (e.g. carbon emissions, carbon-intensive industry), as well as country-level factors (e.g. the stringency of environmental regulations, common-law countries, presence of emissions trading schemes (hereinafter ETS), ratification of the Kyoto Protocol).

It has been argued that the institutional context plays a crucial role in moderating voluntary carbon disclosure (Hahn et al., 2015; Luo, 2019; Luo et al., 2012). However, the majority of previous studies have focused on a single dimension of institutions such as regulative (e.g. Rankin et al., 2011; Reid & Toffel, 2009), cultural (e.g. Luo & Tang, 2016), or on institutions as a whole (e.g. Luo et al., 2012). Moreover, these studies have used generic factors to measure institutional pressures, for example, the ratification of the Kyoto Protocol and the nature of the general legal system to proxy the regulatory dimension (Luo et al., 2012), or uncertainty avoidance, power distance or long-term orientation to proxy the cultural dimension of institutions (Luo & Tang, 2016). In this regard, this paper is innovative in that it

considers specific climate-related variables in order to measure the three institutional pillars (Hoffman, 1999; Phillips & Malhotra, 2008; Scott, 2014) as related to countries' institutional profiles of climate change (Kostova, 1997) in the field of voluntary carbon disclosures.

Perrault-Crawford and Clark-Williams (2010) suggested that countries' institutional contexts may be a key driver of voluntary carbon disclosures. Although they considered the three institutional pillars, their analyses cannot be extrapolated to other countries or industries since they only considered banking companies from two countries (France and the United States of America). They called for further empirical research that would move beyond institutional theory as a whole and consider a larger sample of countries and sectors.

Given that the impact of countries' institutional profile on corporate carbon reporting is understudied, this study explores whether countries' climate change-related institutional profiles affect corporate carbon disclosures via the CDP questionnaire. More specifically, this paper considers the three different institutional pressures (regulative, normative and cultural-cognitive) that have been identified from the perspective of New Institutional Sociology (hereinafter NIS). This perspective establishes that companies' decision to voluntarily disclose carbon information is not fundamentally the outcome of a rational decision-making process (Larrinaga-González, 2007). Instead, it may be influenced by pressures of the institutional context common to them (Grauel & Gotthardt, 2016; Scott, 2014).

This study uses a two-stage research approach. Firstly, it examines factors relating to the propensity of 2,327 firms to voluntarily disclose carbon information through the 2015 CDP questionnaire, specifically focusing on the influence of the three climate change-related institutional pillars. Secondly, it explores whether any relationships exist between the quality of carbon information and these three institutional pillars. The quality of carbon disclosure is measured by the CDP disclosure score (Ben-Amar & McIlkenny, 2014; Lemma et al., 2019), and CDP data has been used in several previous studies on voluntary carbon disclosure

(Giannarakis et al., 2017; Lemma et al., 2019; Luo et al., 2012; Luo & Tang, 2014; Reid & Toffel, 2009).

These analyses document three findings of interest. The first is that countries' climate-related regulation motivates firms to voluntarily participate in the CDP questionnaire, but that it is not related to the quality of carbon information reported. Secondly, we find that firms in countries with higher levels of climate-related normative pressures are more likely to participate in voluntary carbon reporting, as well as to disclose high-quality carbon information. And thirdly, countries' climate-related cultural contexts positively influence the quality of voluntary carbon disclosures. Conversely, the climate-related cultural pillar does not influence firms' decisions to voluntarily participate in the CDP.

This research contributes to the theoretical development of countries' institutional context and to the development of measurement instruments for the different institutional pillars, specifically those related to climate change. Firstly, this study expands on the NIS perspective in climate change matters since it carries out a more thorough examination of this theory than typically seen in previous studies (Cormier et al., 2005; Hahn et al., 2015; Luo, 2019; Luo et al., 2012). In this sense, this paper suggests that the features of a country's institutional context as reflected in its institutional profile may be used as a measure of the country-level pressures influencing companies' behavior related to climate change disclosures. Secondly, the institutional theory is further extended by the development of a theoretically-based method in order to represent the different institutional dimensions (Scott, 2014). Thirdly, it uses specific climate change-related measurements applied to all three institutional pillars of countries' institutional contexts (Scott, 2014). And finally, it considers all the firms included in the 2015 CDP report for each sample country, as opposed to previous studies which focus solely on larger companies (Borghei-Ghomi & Leung, 2013), or on those listed on specific indices such as S&P 500 (Freedman & Jaggi, 2005; Luo et al., 2012), or on companies

headquartered in a certain country (Brouhle & Harrington, 2010; Chu et al., 2012; Eleftheriadis & Anagnostopoulou, 2015).

The remainder of this paper is organized as follows: Section 2 presents the literature review and the testable hypotheses. A description of the research design is provided in Section 3, followed by the presentation of the results and subsequent discussion in Sections 4 and 5. Finally, our conclusions are covered in Section 6.

2. Literature review and hypothesis development

During the past decade, voluntary carbon disclosure has been the subject of considerable attention in the accounting literature. Previous research has explored this topic using different theoretical perspectives, which can be classified into three groups: economic-based theories; socio-political theories; and institutional theory (Hahn et al., 2015). Voluntary disclosure theory and signaling theory are the main theoretical anchors that can be identified within the group of economic-based theories (Verrecchia, 1983). These theories argue that companies will be more likely to disclose environmental information if the benefits and positive consequences outweigh the costs of doing so (Diamond & Verrecchia, 1991).

Economic-based theories suggest a positive association between environmental performance and climate change disclosures (Verrecchia, 1983). The underlying idea is that companies which dedicate resources to mitigating climate change will be interested in voluntarily sharing this information with their different stakeholders. Thus, these companies tend to disclose greater amounts of environmental information so as to distinguish themselves from less well-performing companies (Clarkson et al., 2008; Freedman & Jaggi, 2010).

Regarding socio-political theories, it is possible to classify two main theoretical frameworks, namely stakeholder theory and legitimacy theory. They differ from each other as regards their focus on actors. While stakeholder theory refers to the pressure exerted by

different stakeholders (e.g. investors, customers, governments) (Freeman, 1984), legitimacy theory focuses on the pressure from society in general (Guthrie & Parker, 1989; Patten, 1992). Both theories have been widely used to explain companies' voluntary carbon disclosures (Clarkson et al., 2008; Giannarakis et al., 2017; Luo et al., 2013).

In recent years, several authors have adopted institutional theory in order to analyze voluntary corporate carbon disclosure and to explain the reason why companies disclose environmental information (Haque & Ntim, 2018; Jira & Toffel, 2013; Luo et al., 2012; Q. Tang & Luo, 2016). According to the institutional perspective, organizations that incorporate socially legitimized elements in their formal structures maximize their legitimacy and future survival (Meyer & Rowan, 1977). Thus, besides economic-based factors, the success of organizations depends on accepting and following social norms established in their institutional environment (Tolbert & Zucker, 1996). Hence organizations that operate in highly institutionalized environments will obtain legitimacy by becoming isomorphic in these environments (DiMaggio & Powell, 1983).

In addition to being economically efficient, organizations need social power and institutional legitimacy in order to survive within a certain context (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). In this sense, DiMaggio and Powell (1983) highlighted the importance of the concept of institutional isomorphism for understanding the practices that pervade certain contexts. They stated that institutional isomorphism occurs via three mechanisms: coercive, normative and mimetic. Isomorphic pressures as identified by DiMaggio and Powell (1983) are related to the institutional pillars subsequently defined by Scott (2014). Scott designed an analytic framework of NIS theory and found that organizational behavior is influenced by three institutional pillars: regulative, normative and cultural-cognitive. These institutions provide a framework within which organizations must operate since they are under pressure from rules, norms and cultural beliefs that have been accepted and adopted in a specific environment.

The regulative pillar is related to coercive pressures. This institutional pillar encompasses rules and laws as along with enforcement mechanisms sanctioned by regulatory bodies, and which are used by organizations in selecting and interpreting information (DiMaggio & Powell, 1983). Therefore, governments play a fundamental role given their capacity to sanction rules. Qian and Burritt (2008) note that the regulative dimension of institutions creates the strongest incentive for companies to develop environmental actions, as well as imposing pressures upon them to do so.

Companies voluntarily disclose carbon information in order to be better positioned for future changes in regulation (Luo et al., 2012; Solomon & Lewis, 2002). Several previous studies use the signing of the Kyoto Protocol as a proxy for regulatory pressures. Although some authors reported no significant relationship between carbon disclosures and companies headquartered in a signatory country of the Kyoto Protocol (Luo et al., 2012; Q. Tang & Luo, 2016), the majority of these studies did find a positive and significant association between these variables (Freedman & Jaggi, 2005; Prado-Lorenzo et al., 2009). Similarly, in their study of voluntary environmental disclosures and the supply chain, Jira and Toffel (2013) found a positive and significant relationship between companies' disclosures and their belonging to Kyoto Protocol countries.

Moreover, some studies went further still and considered other GHG-related regulation such as regulations for specific polluting sectors or those related to ETS. Luo et al. (2013) demonstrated that voluntary carbon disclosures are positively associated with companies' belonging to a country with an established ETS. This result is similar to that reported by Kim and Lyon (2011) and Reid and Toffel (2009), who found that regulatory threats did have a positive influence on companies' actions with regard to voluntary disclosure of carbon emissions. Conversely, Rankin et al. (2011) did not find evidence that companies listed in the EU ETS are more likely to participate in voluntary GHG disclosure practices. Scholtens and

Kleinsmann (2011) found mixed evidence regarding regulatory determinants based on GHG-specific regulation. Although the findings of previous literature are ambiguous, it is possible to identify the predominance of a positive relationship between the regulatory context and voluntary carbon disclosures.

In addition to imposing mandatory rules on target companies, climate change-related regulation also contributes to the greater visibility of the climate change challenge within society. This leads to the generation of social expectations that may influence the behavior of both target and non-target companies. Regulation may also establish a set of requirements that the information disclosed must comply with, which in turn serves as a guarantee of the quality of said information. This would then suggest that companies headquartered in countries with more stringent levels of specific climate regulation will be more likely to voluntarily disclose carbon information compared to companies based in countries with lower levels of climate change regulation. Apart from influencing company participation, countries with high levels of climate change regulation may also exert pressure on the quality of the information reported. Therefore, the first hypotheses in this study may be established as follows:

H1a: Countries' climate-related regulative contexts positively influence companies' decisions to voluntarily disclose carbon information.

H1b: Countries' climate-related regulative contexts positively influence the quality of voluntary carbon disclosures.

The normative pillar of institutions refers to the social framework based on values – defined as conceptions of the preferred or the desirable – along with norms that specify the way in which actions should be undertaken in order to achieve organizational objectives (Scott, 2014). In this sense, it may be identified with "*the morally correct thing to do*" (Jones, 1999, p. 165). Thus, while the regulative pillar's basis of legitimacy is "legally sanctioned" and its basis of compliance is the "expediency" of avoiding sanctions, in the case of the normative

pillar, the basis of legitimacy is "morally governed" while the basis of compliance is "social obligation". Furthermore, Scott (2014) considers that the regulative pillar exhibits high values as regards the dimensions of obligation, precision and delegation, while values for these same dimensions in the case of the normative pillar are lower.

Normative pressures are related to the normative isomorphism identified by DiMaggio and Powell (1983). Therefore, companies may understand that the morally correct thing to do is to disclose information about the impact of their activities on climate change, with the CDP being the vehicle selected for this purpose. In this regard, the CDP serves as a self-regulatory framework for companies' normative behavior since there is no standardized global carbon report. In this way the CDP has created a common framework of rules that companies must adhere to if they wish to participate in the CDP questionnaire (Baldwin et al., 2012). More specifically, the normative expectations presented by the CDP establish how organizations are supposed to behave regarding climate change, and how they should report it. These expectations are also held by certain other notable actors, such as investors who support the CDP, and therefore are experienced by organizations as an external pressure.

In the field of voluntary carbon disclosure, research to date has not yet determined the effects of climate-related normative pressures on companies' voluntary carbon disclosures. Perrault-Crawford & Clark-Williams (2010) conducted a descriptive analysis which considered normative pressures measured as the participation of countries' organizations in the CDP along with corporate social reporting activities. However, they did not present an econometric association between these variables. Stanny (2013) examined voluntary carbon disclosures of US S&P 500 companies in the CDP, and concluded that the most relevant factor influencing companies' future disclosures was their previous disclosures. Thus it would seem that participating in the CDP questionnaire has become `the norm´ for larger listed companies. Moreover, companies' engagement in voluntary carbon disclosure seems to follow a rather

consistent pattern every year. It is necessary to highlight the fact that the information disclosed by companies to the CDP may vary between country-specific contexts (Perrault-Crawford & Clark-Williams, 2010). In this sense, the country-specific normative context may affect companies' decisions to voluntarily disclose carbon data, as well as generating higher-quality reporting. Consequently, this discussion leads to the following hypotheses:

H2a: Countries' climate-related normative contexts positively influence companies' decisions to voluntarily disclose carbon information.

H2b: Countries' climate-related normative contexts positively influence the quality of voluntary carbon disclosures.

The cultural-cognitive dimension of institutions is the main distinguishing feature of the NIS perspective (Hoffman, 1999; Phillips & Malhotra, 2008; Scott, 2014). This pillar refers to the socially shared conceptions and the common beliefs that create frameworks through which organizations interpret their environment and take action. According to Scott (2014), the basis of compliance of this pillar is the shared understanding that is taken for granted in a given context, while its basis of legitimacy is "culturally supported".

The cultural-cognitive pillar emphasizes that the internal interpretive processes upon which individuals and organizations rely for their decision-making – such as whether or not to disclose carbon information, for example – are configured and influenced by external cultural frameworks. Thus in this way, the belief systems and cultural frameworks which exist in countries put pressure on individual actors and organizations.

Hoffman (1999) highlighted that the cognitive aspects of institutions are the most entrenched because they form taken-for-granted beliefs and are resistant to change. According to Hoffman (1999, p. 364), "unfortunately, the presence of cognitive institutions is extremely difficult to measure", as has also been highlighted by other authors (e.g. Larrinaga-González, 2007). However, in his study regarding the evolution of environmentalism in the U.S. chemical

industry, Hoffman (1999, p. 364) identified the cultural-cognitive pillar of institutions with "a new mindset" in which the chemical industry was considered to be part of the solution to environmental problems, and not as a problem for the environment, as was the case in previous periods. In this sense, it can be argued that a new mindset is emerging in relation to climate change. While climate change was hardly considered to be a problem by society during the 1980s, social concern and awareness has been on the increase since the 2000s, thus recognizing the problem and its anthropogenic nature, along with its serious repercussions for future generations and the need for organizations to take mitigating action. Social awareness has advanced from ignorance to the shared belief that climate change is a problem that requires the intervention of organizations at the global level. This in turn is putting pressure on organizations, who have thus started to provide carbon reporting as a means of responding to said pressure. Therefore, just as it is taken for granted that organizations must report on their activities and their economic and financial situation through their annual accounts, with no questions raised as to their necessity, the same may occur with the provision of information related to the impact of organizations' climate change activities, and it may also become a taken-for-granted practice in the future.

With regard to the relationship between countries' climate-related cultural pressures and voluntary carbon disclosures, little research has been carried out. In fact, certain authors have focused rather more on descriptive analyses and have not established a significant relationship with these variables (Perrault-Crawford & Clark-Williams, 2010). Conversely, other authors have examined voluntary carbon disclosures and national cultural values using an econometric analysis (Luo & Tang, 2016). However, they approximated national cultural values by culture indices that are rather generalist in nature (e.g. the Hofstede measure (Hofstede et al., 2010) or the Global Leadership Organizational Behavior Effectiveness (GLOBE) measure (House et al., 2004)), and therefore did not take into consideration specific

national cultural values regarding climate change. In this sense, previous studies have not examined the influence of specific countries' climate change awareness on voluntary carbon disclosures. To fill this gap in research, this paper considers countries' cultural pressures related to climate change in the study of voluntary carbon disclosures, by considering countries' mindsets concerning climate change, which is then reflected in climate change-related social awareness and concerns in each of the different countries.

It would appear that companies headquartered in countries with high levels of climate change awareness will be more likely to disclose carbon-related information, given that such are the patterns followed in these countries. Therefore, the climate-related cultural context of countries may influence the decisions of companies in said countries to voluntarily disclose carbon information, as well as the quality of the information reported. Consequently, the following hypotheses may be established:

H3a: Countries' climate-related cultural contexts positively influence companies' decisions to voluntarily disclose carbon information.

H3b: Countries' climate-related cultural contexts positively influence the quality of voluntary carbon disclosures.

3. Methodology

3.1. Sample

The sample was initially based on 3,106 firms listed in the 2015 CDP reports from those countries with data available regarding their climate-related institutional context. The countries considered are Australia, Canada, France, Germany, India, Indonesia, Italy, Japan, South Africa, South Korea, Turkey, the United Kingdom, and the United States of America. This study considers a single year of data (2015) due to the availability of data regarding countries' climate change-related institutional profile. More specifically, the variable used to measure

countries' climate change-related cultural pressures was available for 2015 only (Stokes et al., 2015). In line with Luo et al. (2012), financial companies (608) were subsequently identified and eliminated. Companies which were duplicated in the CDP reports (8); firms which were classified as SA (See Another – refers to another firm's response) in the 2015 CDP report, e.g. because these firms were a subsidiary or had undergone a merger during the 2015 CDP report submission process (30); and companies with missing financial data (133) were also eliminated from the sample (Luo et al., 2012). The final sample is thus composed of 2,327 companies from 13 countries, operating in the following sectors, according to the Global Industry Classification Standard (GICS): Consumer Discretionary; Consumer Staples; Energy; Health Care; Industrials; Information Technology; Materials; Telecommunication Services; Utilities.

3.2. Sources

Companies' response status and the CDP score were collected by hand from the 2015 CDP report for each sample country, which may be found on the CDP website. The majority of CDP reports for each country provide a list detailing companies that responded to the CDP, as well as those that decided not to respond, declined to participate, or that did not publish the questionnaire. However, the 2015 CDP climate report for Hong Kong and South East Asia, which includes Indonesian companies, only provides details of the companies that did respond to the questionnaire. Therefore, in order to obtain a consistent sample for the case of Indonesia, we also checked the CDP web database to find out which Indonesian companies did not respond, declined to participate, or that not publish the questionnaire. CDP is perhaps the most prominent voluntary mechanism used by global companies for disclosing carbon emissions (S. Tang & Demeritt, 2018). Its data has been used in several papers concerning voluntary carbon disclosures (e.g. Ben-Amar & McIlkenny, 2014; Kolk et al., 2008; Lemma et al., 2019; Luo, 2019; Matisoff et al., 2013).

Data regarding countries' institutional context was obtained from different sources. Firstly, regulatory pressures related to climate change were measured using the Environmental Policy Stringency Index (hereinafter EPSI) provided by the OECD (Organization for Economic Co-operation and Development) (OECD, 2019). Secondly, normative pressures were estimated by using the information included in the 2014 CDP climate reports for each sample country. Finally, data concerning countries' cultural context was obtained by hand from the Pew Research Center's 2015 Global Attitudes Survey (Stokes et al., 2015).

Financial data required to calculate the control variables was collected from Datastream. Since the CDP requests companies to provide emissions and accounting data for the preceding year (Luo et al., 2012; Stanny, 2013), financial data was retrieved for the previous fiscal year.

3.3. Theoretical models

Given that this study examines the influence of countries' climate-related institutional contexts on both the propensity for firms to voluntarily disclose carbon information and the quality of the information reported, two models are proposed (Bouten et al., 2012; Rankin et al., 2011). The initial model considers the decision of companies to voluntarily disclose carbon information through the CDP questionnaire, hence a binary-choice Probit model is used (1). Model 1 is tested for the whole sample of 2,327 firms. In this model, the dependent variable (DisCDP) is a dichotomous variable of CDP participation which is equal to 1 if the company voluntarily responded to the 2015 CDP questionnaire and made the response public, and 0 otherwise. Both responding and publication decisions are considered in the same model since the majority of sample firms that responded to the 2015 CDP climate survey made their response public. Model 1, which comprises a binary measure of the probability of participation, is as follows:

$$DisCDP = \beta_0 + \beta_1 Regulative + \beta_2 Normative + \beta_3 Cultural + \beta_4 Size +$$

$$\beta_5 Risk + \beta_6 TobinQ + \beta_7 ROA + \beta_8 Lev + \beta_9 DisCDP_{t-1} + \beta_{10-17} Sector + \varepsilon \quad (1)$$

Our study's second model explores the relationship between climate-related institutional pillars and the quality of voluntary carbon disclosures (as measured by the 2015 CDP disclosure score). Hence, this model comprises a more complex measure of the dependent variable that captures the quality of the information reported to the CDP survey by those companies which voluntarily disclose their carbon data.

Most of the companies in the sample that replied to the 2015 CDP survey received a high CDP disclosure score. As shown in Table 1, more than 72 per cent of the responding firms (852 out of 1,170 firms) obtained a CDP score equal or greater than 85 points in the 2015 CDP climate program. Therefore, it would appear that those companies that decided to respond to the CDP survey also decided to disclose high-quality carbon information. In this case, the 2015 CDP disclosure score is skewed to the right and does not illustrate a positive result for a normal distribution. Thus, instead of using an Ordinary Least Squares (OLS) regression, we perform a Probit model where the dependent variable is equal to 1 if the company obtained a CDP disclosure score greater than 93.5 (the median score of responding firms), and 0 otherwise (Q. Tang & Luo, 2011).

[Insert here Table 1]

Model 2 is based on a subsample of a total of 1,170 firms from across the sample countries that responded to and published the 2015 CDP report. If we solely consider firms which decided to participate in the 2015 CDP, then sample selection bias is introduced into the proposed model as a result of self-selection bias (Breen, 1996). In line with Heckman (1979), in order to correct for sample selection bias, this study calculates and includes the Heckman correction factor (Lambda) in Model 2. Therefore, Model 2 is as follows:

$$CDPscore = \beta_0 + \beta_1 Regulative + \beta_2 Normative + \beta_3 Cultural + \beta_4 Size +$$

$$\beta_5 Risk + \beta_6 TobinQ + \beta_7 ROA + \beta_8 Lev + \beta_9 DisCDP_{t-1} + \beta_{10} Lambda +$$

$$\beta_{11-18} Sector + \varepsilon \quad (2)$$

Three country-level independent variables were included in Models 1 and 2, representing the different dimensions of countries' institutional context related to climate change. Specifically, this paper includes Regulative, Normative and Cultural variables as illustrative of the influence of countries' institutional pressures related to climate change. In addition, six firm-level control variables were also included in both models: Size, Risk, TobinQ, Lev (Leverage), ROA (Return on Assets) and $DisCDP_{t-1}$ (dummy variable of firms' CDP participation in the previous year). These factors were introduced into the models since they have been found to be associated with voluntary carbon reporting (Hahn et al., 2015; Stanny, 2013; Wegener et al., 2013). Furthermore, dummy variables for each sector GICS (Global Industry Classification Standard) were introduced in order to control the fixed effects of each.

3.4. Variables

Table 2 shows the variables included in this study.

[Insert here Table 2]

The dependent variables are DisCDP (Model 1) and CDPscore (Model 2). DisCDP (Model 1) is a dichotomous variable of CDP participation which is equal to 1 if the company voluntarily participates and publishes the 2015 CDP questionnaire, and 0 otherwise. CDPscore (Model 2) is an indicator variable that is equal to 1 if the company obtained a CDP disclosure score not lower than 93.5 points, and 0 otherwise. The CDP disclosure score is ranked from 0 to 100, with 100 being the maximum value of the scale. It evaluates the quality, comprehensiveness and completeness of firms' response to the CDP questionnaire. Thus a high

CDP disclosure score indicates that a firm reported high-quality and comprehensive information regarding the measurement and management of its carbon emissions, and its climate change strategies and risk management (CDP, 2015). The CDP requires participating companies to follow its guidelines when responding to the questionnaire. This facilitates the comparison of CDP data across firms, countries and industries (Luo et al., 2012). In recent years, several scholars have used the CDP score to measure firms' participation in voluntary carbon reporting (Cotter & Najah, 2012; Luo et al., 2012; Stanny, 2013), as well as the quality of the information reported (Ben-Amar & McIlkenny, 2014; Lemma et al., 2019; Luo, 2019; Mateo-Márquez et al., 2020). Hahn et al. (2015) point out that the CDP disclosure score provides a comprehensive measure of the quality of information reported by companies, as well as highlighting that it captures the quality of carbon information more objectively than self-created indices such as content analysis.

Three country-level independent variables were included in order to test this study's hypotheses: (1) the Regulative variable which refers to countries' regulatory pressures related to climate change. It is based on the EPSI index, prepared by the OECD, and measures the regulatory stringency of each country's environment-related policies (Botta & Koźluk, 2014; OECD, 2019). Previous studies have used this index to measure countries' environmental pressures (Andersson, 2018; Mateo-Márquez et al., 2020; Rosati & Faria, 2019). The EPSI index has a range of values from 0 (not stringent) to 6 (the highest level of stringency); (2) the Normative variable has been incorporated in the model as representative of countries' normative pressures related to climate change. This variable has been introduced since the higher the percentage of companies participating in the CDP in a given country, the more widespread the CDP questionnaire will be in that country, and thus the greater the pressure on companies in that country to voluntarily respond to the CDP. Therefore, companies may respond to the CDP because it is the morally right thing to do in that context (Scott, 2014), and

also because their failure to participate can be made public, thereby damaging their legitimacy. The Normative variable is calculated as the number of firms in a given country that responded and published their response in the previous year divided by the total number of firms that were included in the CDP report for that country in the previous year; (3) the Cultural variable reflects the cultural-cognitive dimension of institutions. In order to measure countries' cultural influences related to climate change, this paper uses a climate change concern index elaborated by the Pew Research Center, based on a global survey regarding levels of public concern about climate change. This index is ranked from 3 to 12, with 3 representing the lowest level of concern about climate change, and 12 the highest level of concern (Stokes et al., 2015). Data from the Pew Research Center has been used in previous studies to explain cross-national variations in climate change public opinion (Ergun & Rivas, 2019; Lewis et al., 2019).

Six variables were included as a control for company performance (Size, Risk, TobinQ, Lev, ROA and DisCDP$_{t-1}$). The Size variable is included because larger companies are subject to greater social scrutiny (Wegener et al., 2013), hence these companies are more likely to participate in voluntary carbon reporting in order to adapt to social expectations, as well as to avoid legitimacy problems (Cho & Patten, 2007; Solomon & Lewis, 2002).

Previous studies point out that environmental disclosures are positively related to company risk (Cormier et al., 2005; Q. Tang & Luo, 2011). Therefore, companies with higher levels of business risk will disclose voluntary carbon information in order to make it easier for investors to estimate the performance of said companies more accurately. Risk refers to a company's beta, which is based on 23 to 35 consecutive end-of-month price percentage changes and their relativity to the local market index. Likewise, it is expected that firms with a higher TobinQ will be more likely to participate in the CDP questionnaire (Luo et al., 2012; Wegener, 2010). TobinQ reflects companies' future growth projections. A company with a superior TobinQ will identify the need to address the impacts of climate change on its

operations, thus being more likely to participate in the CDP questionnaire. However, many empirical studies did not find a conclusive association between TobinQ and voluntary carbon disclosures (González-González & Zamora-Ramírez, 2016b; Luo et al., 2012; Wegener et al., 2013). In this study, TobinQ is measured by the sum of the firms' market capitalization plus the book value of preferred stock plus the book value of long-term and current liabilities, divided by the book value of total assets (Clarkson et al., 2008).

Highly leveraged companies are more likely to be subject to greater pressure from investors and creditors. Therefore, these companies will be more likely to voluntarily disclose carbon information in order to respond to the demands of their investors and to enhance their financial flexibility (Stanny & Ely, 2008). Thus this study includes the Lev variable, which represents companies' total debt to total assets ratio. Highly profitable companies are in a better position to bear the cost of reducing carbon emissions (Bewley & Li, 2000; Stanny & Ely, 2008). Therefore, the ROA variable is also included in this study. Stanny (2013) found that firms' prior CDP disclosure is the most significant factor influencing its future voluntary carbon disclosure behavior. Hence, the variable $DisCDP_{t-1}$ is introduced in order to control for prior disclosure behavior with respect to CDP participation.

4. Empirical results

4.1. Breakdown of climate-related institutional profile by country

Table 3 shows the distribution of countries' climate-related institutional context and firms by selected countries. It also presents statistics corresponding to firms' responses to the CDP as well as the average CDP disclosure score by country.

[Insert here Table 3]

As can be seen in Table 3, Japanese firms constitute the largest group. The second largest group contains companies from the United States of America, followed by firms

headquartered in the United Kingdom and France. Together they account for more than 50 per cent of the sample. Countries with a higher response rate to the 2015 CDP questionnaire are South Africa, the United Kingdom and the United States, with response rates of 83.87, 78.54 and 68.7 per cent respectively. In average terms, the 2015 CDP disclosure score is higher in South Korea, South Africa and India, all receiving a score greater than 90 points. Although these countries do not have high levels of regulative pressures, they do present a significant degree of concern regarding climate change, as shown by the climate change index in the fourth column of Table 3.

In terms of climate-related regulatory pressures, countries with higher levels of climate-related regulatory stringency are the United Kingdom, France, Canada and Italy. These countries have an EPSI index greater than 3.25 points. It is of note that they all have a carbon pricing instrument in place at the national or sub-national level (Kossoy et al., 2015). As shown in the third column of Table 3, more than 60 per cent of companies from South Africa, the United Kingdom and the United States of America participated in the CDP survey the previous year. This reflects the higher level of normative pressures with respect to climate change in these countries, especially in South Africa (80 per cent). In relation to the cultural dimension of institutions, South Korea, Japan, Italy and India have a score greater than 10 points in the climate change concern survey, which would suggest that society in these countries believes global climate change to be a serious problem. It can be seen from the data in Table 3 that companies headquartered in countries with high cultural-cognitive pressures are more likely to disclose high-quality carbon information, as evidenced by the high mean of their CDP disclosure scores.

4.2. Descriptive statistics and correlation analysis

Table 4 reports the descriptive statistics for both dependent and independent variables. More

specifically, it details the mean, standard deviation, minimum, percentiles (25, 50 and 75) and maximum for each of the variables introduced in the study. All continuous independent variables are winsorized at the 1st and 99th percentiles. In regards to regulative pressures, the mean is 2.96 and the maximum value is 3.83, which is somewhat below the highest degree of stringency (6) (Botta & Koźluk, 2014). With regard to the Normative variable, the mean is 0.51 which demonstrates that, on average, more than 50 per cent of companies in the selected countries responded to and published the CDP questionnaire in the previous year. Cultural-cognitive pressures related to climate change are rather high - over 9.49 points - for half of the sample firms. However, there is relatively little variation in this variable between each sample country, given that the minimum value is 8.75 and the maximum is 10.77. As shown in Panels B and C, responding companies present a greater mean in terms of Size, Risk, and Lev than non-responding companies. In addition, on average 83 per cent of disclosing companies replied to and published their response to the 2014 CDP questionnaire.

[Insert here Table 4]

Table 5 presents the distribution of firms by sector. As can be seen, in every sector the majority of companies responded to the 2015 CDP survey and made their response public. Consumer Discretionary, Industrials and Materials are the three sectors with the highest number of companies in the CDP report. Utilities has the highest mean of CDP (93.36). Telecommunication Services, Information Technology and Materials are the three sectors with the highest response rates.

[Insert here Table 5]

Table 6 reports both Spearman and Pearson correlation coefficients in the upper and lower triangles respectively. As shown in Table 6, cross-correlations among pairs of independent variables do not indicate problems of multicollinearity. In addition, the variance

inflation factor of each independent variable is less than 3, which suggests that multicollinearity should not be an issue.

[Insert here Table 6]

4.3. Regression analyses

Table 7 reports the results for both the response decision model (Model 1) and the disclosure quality model (Model 2). The likelihood ratio chi-square of Model 1 is 1,758.28, significant at $p < .01$, which indicates that the model as a whole fits significantly. This model is applied to the whole sample of 2,327 firms and was able to distinguish those sample firms that voluntarily disclosed carbon data through the CDP from those that did not. Table 7 also shows that Model 1 correctly predicted the outcome of the response decision for more than 88 per cent of sample firms.

Model 2 examines the disclosure quality and is applied to a subsample of companies that responded the CDP climate report and made their response public (1,170 companies). Model 2 is significant overall (Chi-square = 281.32, $p < .01$). As shown in Table 7, Model 2 correctly predicted the outcome of disclosure quality for 69.66 per cent of sample firms. The Lambda variable, which represents the inverse Mill's ratio, is introduced as an additional independent variable in Model 2 to account for selectivity bias in the sample. As shown in Model 2 of Table 7, the estimated coefficient of Lambda is not significant, suggesting that there is no noteworthy sample selection problem.

[Insert here Table 7]

The Regulative variable shows a positive and significant relationship with companies' decisions to voluntarily disclose carbon information (0.153, $p < .05$; Model 1). This result supports hypothesis H1a, thus indicating that countries' regulative context related to climate change positively influences companies' decisions to voluntarily participate in the CDP

questionnaire in said countries. On average, the Regulative variable has an impact consisting of a 6 per cent increase in the probability of responding for each unit increase in the value of this variable. Contrary to our expectations (as regards hypothesis H1b), we find that countries' regulative pressures are not significantly associated with the quality of disclosures (Model 2).

The estimated coefficient of the Normative variable is significantly positive at the maximum level for the response decision (2.188, p < .01), as well as for the disclosure quality (1.841, p < .01). This finding supports both hypotheses H2a and H2b, indicating that firms' propensity to disclose and the quality of the information reported both increase in line with countries' climate-related normative pressures.

The Cultural variable is not significantly associated with firms' decisions to participate in the CDP survey (Model 1). This result does not support the hypothesis that countries' climate-related cultural contexts positively influence companies' decisions to voluntarily disclose carbon data (H3a). In the disclosure quality model, the coefficient of the Cultural variable is positive and significant at the maximum level (0.576, p < .01). This result provides support for hypothesis H3b, which states that countries' cultural-cognitive pressures positive and significantly influence the quality of the information disclosed.

Regarding the control variables, the coefficient for Size is positive and significant both in Models 1 and 2, suggesting that larger firms tend to respond to the CDP questionnaire, as well as to provide high-quality data. TobinQ presents a positive and significant coefficient in Model 2, which indicates that companies with high future growth expectations tend to disclose high-quality carbon information to allow investors and creditors to better determine their value. However, TobinQ is not associated with firms' decisions to voluntarily disclose carbon data. In addition, responding to the CDP questionnaire in year t-1 (measured by DisCDPt-1) positively and significantly influences both firms' decisions to respond to the CDP in year t

and the quality of the information reported in that year. The coefficients for Risk, ROA and Lev are not significant for either Model 1 or Model 2.

4.4. Robustness checks

This paper formulates four additional sensitivity analyses in order to determine whether the results of this study are valid. Firstly, in Models 1 and 2, the measurement for countries' regulatory pressures was replaced by a variable taken from the study carried out by Nachmany et al. (2015), which considers the number of climate change-related regulation that a country has enacted. The results (not reported) are consistent with those reported in Table 7. Secondly, in order to test whether our results are robust to winsorization (which resulted in a change of 2 per cent as regards the original observations), we reran Models 1 and 2 using unwinsorized data. The statistic results (not tabulated) are consistent with the findings presented in Table 7. Thirdly, instead of using eight sector dummies to control for sector effects, we performed Model 1 and Model 2 considering only one single dummy variable to control for carbon-intensive industries (see Table 8). We therefore included the Carbon-intense variable in the models, with a value equal to 1 if a company operates in the Materials, Energy or Utilities sectors, and 0 otherwise (Q. Tang & Luo, 2011). The significance and the signs of independent variables are similar to those reported in Table 7. Similarly, coefficients of control variables do not present significant value variations except for Risk, TobinQ, Lev and $DisCDP_{t-1}$. Additionally, we find that firms in carbon-intensive sectors are more likely to disclose high-quality carbon information, possibly because carbon-intensive firms are more exposed to address future carbon-related costs and liabilities (Q. Tang & Luo, 2011).

[Insert here Table 8]

Fourthly, given that data for Indonesian companies was obtained from two sources (the CDP report and the CDP web database), we ran additional regressions in order to analyze its

influence. The results of these additional tests (not tabulated) do not change the inferences drawn for the main results. Finally, simple two-stage ordinary least square regressions were formulated separately (not reported). The coefficients of the variables presented similar signs and significance. No significant values were found in the residuals for each of the companies in the t test at 95 per cent, which may be indicative of the existence of uncommon values.

5. Discussion

Our research has shown that countries' regulative pillar as related to climate change does influence firms' decisions to voluntarily disclose carbon information. Thus, firms headquartered in countries characterized by having strict climate-related regulations are more likely to voluntarily disclose carbon information. Thus we find that besides imposing binding rules on target companies, climate-related regulations further the creation of social expectations regarding corporate voluntary carbon disclosure behavior, which may affect both target and non-target companies. Hence, climate-related regulations may create stimulus that influence companies to voluntarily disclose carbon information. The results of the Regulative variable are consistent with previous studies (Freedman & Jaggi, 2005; Jira & Toffel, 2013; Luo et al., 2012), despite being focused on generic environmental regulations. This result is also consistent with the findings of Mateo-Marquez et al. (2020), who concluded that regulative pressures related to climate change positively influence voluntary carbon disclosures. However, they examined the response decision and the level of disclosure together using a Tobit model, thus making it difficult to disaggregate the effect of regulative pressures on firms' decisions to voluntarily disclose carbon data.

However, although climate-related regulations are established in most of the sample countries (Kossoy et al., 2015; Nachmany et al., 2015), they are not proving effective enough to motivate companies to voluntarily disclose high-quality carbon information. Therefore, the

regulative pillar of institutions is not motivating organizations to make an "extra effort" (González-González & Zamora-Ramírez, 2016a; Hess & Warren, 2008) in order to disclose high-quality and comprehensive carbon information through a voluntary mechanism. This could be because this pillar is based on coercive mechanisms which reinforce regulative rules, which in turn have a lower impact as regards motivating companies to disclose high-quality carbon information through the CDP survey.

We find that countries' climate-related normative pressures positively influence both firms' propensity to disclose carbon data and the quality of disclosure. Therefore, the greater the dissemination of the CDP questionnaire in a given country, as evidenced by the number of responding companies, the greater the normative pressure on companies to both participate in the CDP and report high-quality carbon information. Consistent with NIS theory, these companies will disclose carbon information to the CDP because they believe that it is the morally right thing to do in this context, which in turn helps them to protect their legitimacy (Scott, 2014).

Contrary to our expectations, we find that countries' cultural pillar as related to climate change is not associated with companies' decisions to voluntarily disclose carbon information. This could be affected by the fact that the cultural-cognitive pillar is based on those more subtle aspects of social reality (Scott, 2014), since it includes socially shared beliefs and meanings that are taken for granted in a given country, without raising the possibility of there being other options (Phillips & Malhotra, 2008). In the case of climate change, such beliefs and meanings are not necessarily firmly consolidated in society (e.g. certain significantly influential world powers, such as the United States of America and China, still continue to question the existence of climate change), but rather they are in the process of construction by society since climate change is still an emerging institutional field (Kolk et al., 2008; Wittneben et al., 2012), which may serve to reduce the pressure exerted by this pillar. In this regard, Hoffman (1997) observed

that institutional pillars form a continuum or sequence which moves from the conscious to the unconscious, from the legally-enforced (the regulative pillar) to the taken-for-granted (the cultural-cognitive pillar), via the socially and morally correct (the normative pillar). Hoffman's (1999) study on the institutional evolution of environmentalism in the U.S. chemical industry demonstrated this sequence by showing that regulative and normative pillars were already exerting pressure prior to the development of the cultural-cognitive pillar. This argument may explain the results of our study: in the case of climate change, the regulative and normative pillars are the first to be constituted and as such they are able to put pressure on companies to voluntarily disclose information concerning carbon emissions. Hence our results confirm hypotheses H1a and H2a. However, hypothesis H3a is not supported, justified by the fact that the cultural-cognitive pillar takes longer to develop and therefore, in the early stages, its capacity to exert pressure on the companies of a given country to disclose carbon information is lower.

Consistent with hypothesis H3b, the results show that the quality of voluntary carbon disclosures is positively influenced by countries' climate-related cultural contexts. Therefore, firms headquartered in countries with high levels of climate change awareness will be more likely to voluntarily disclose high-quality information, given that such are the patterns followed in these countries (Scott, 2014). Thus, the greater the concern regarding climate change in a given country, the more internalized the problem of climate change in said country's society will be. Thus, cognitive schemes related to climate change in said country's society will be more widespread and shared to a greater degree in order to obtain improved consideration and interpretation as regards the problem of climate change. This in turn leads to greater cultural-cognitive pressures on companies in said country to adopt measures to address climate change which, in this case, implies greater pressure for them to provide high-quality carbon information to the CDP.

Taken together, the results suggest that the significant factors related to the response decision differ from the significant factors related to disclosure quality. Therefore, this study provides evidence against analyzing companies' decisions to voluntarily disclose carbon information and the quality of their disclosures together. This is in contrast to the prior literature on voluntary carbon disclosure which uses a Tobit model in order to explain both aspects (e.g. González-González & Zamora-Ramírez, 2016b; Guenther et al., 2016; Mateo-Márquez et al., 2020).

6. Conclusions

This paper examines the influence of countries' climate-related institutional profile on both the decision of companies to voluntarily disclose carbon information and on the quality of the information disclosed from the theoretical perspective of New Institutional Sociology. The sample comprises 2,327 companies from 13 countries that were listed on the 2015 CDP climate report for each country. This paper uses a Heckman two-step approach to model firms' participation in the CDP climate survey and the quality of carbon information reported.

Regarding the response decision, this study finds that the climate-related regulative pillar positively influences companies' propensity to voluntarily disclose carbon information. Similarly, firms in countries with a higher degree of climate change-related normative pressures are more likely to participate in voluntary carbon reporting. These results are consistent with NIS theory. However, contrary to our expectations, we find that climate-related cultural-cognitive pressures are not significantly related to firms' decisions to voluntarily disclose carbon information. This may be due to the fact that the cultural-cognitive pillar is underpinned by beliefs and meanings shared by society, which take longer to form and to become consolidated. People and organizations take longer to internalize and incorporate them

into their behavior and, therefore, to be able to put pressure on the behavior of companies regarding disclosing their carbon information through a voluntary instrument such as CDP.

The results of this study also show that companies in countries with a higher degree of climate change-related normative pressures tend to participate in voluntary carbon reporting, disclosing high-quality carbon information. Similarly, this study demonstrates that companies headquartered in countries characterized by higher levels of concern regarding climate change are more likely to provide high-quality information. However, it also finds that countries' climate-related regulative pillar is not significantly associated with the quality of disclosures. Therefore, in a more highly-regulated context, organizations may perceive that they only need to participate in the CDP in order to conform to said context and to protect their legitimacy. However, they do not feel obliged to provide a high-quality response, which may be conditioned by the fact that participation and disclosure in the CDP are voluntary.

The main theoretical implication of this research relates to the filling in of the knowledge gap as regards the influence of climate-related institutional pillars on voluntary carbon disclosures. In particular, this paper contributes to the previous literature in several ways: it links countries' institutional contexts to the decision of firms that operate in said countries to voluntarily disclose carbon information (Grauel & Gotthardt, 2016); it uses specific climate-related measurements for the regulative, normative and cultural-cognitive dimensions of countries' institutional context (Kostova, 1997; Scott, 2014); it considers the three institutional pillars related to climate change in the same regression; and it provides empirical evidence that companies' decisions to voluntarily disclose carbon information and the quality of the information disclosed should be examined separately because it is possible that they are influenced by different factors.

The findings of this study have several practical implications. Firstly, the results suggest that countries' climate-related institutional profile serves to significantly explain companies'

carbon disclosure behavior, implying that managers cater to national conceptions (rules, norms and expectations) when making their reporting decisions. By communicating a company's conformity with the pressures exerted by the institutional pillars, through instruments such as the CDP, managers are able to influence the public perception of various institutional actors, which in turn may positively affect the legitimacy and reputation of the company. Furthermore, companies can exert power while participating in the configuration of a country's climate change institutional profile in order to shape the profile in their own interests (Wittneben et al., 2012). Thus, for example, companies can form connections with other companies or industry associations, and even with environmental organizations, in order to exert influence on a country's climate change regulation, on the social expectations regarding the behavior expected of companies, as well as on the meanings assigned to various aspects of climate change (e.g. carbon performance, measurement of carbon emissions, green technologies, cleaner production). In this way, companies are able to influence the pressures exerted by institutional pillars so as to promote their own interests.

Secondly, the results are of use to regulators so as to better understand the effects of climate change-related rules on voluntary corporate carbon disclosure, as well as to develop policies aimed at supporting corporate carbon reporting. Thirdly, investors, shareholders and other stakeholders can benefit from this research as it demonstrates which climate change-related institutional context exerts more pressure on companies to voluntarily disclose carbon information, as companies in those countries will be more likely to participate in the CDP, as well as to disclose high-quality information. This will help them to develop country-specific strategies and investment plans. Finally, this paper provides scholars and practitioners specific climate-related measures for the three dimensions of institutions, and helps them to accumulate and apply knowledge regarding the development of the NIS perspective in the study of voluntary corporate carbon disclosure.

However, this study has certain limitations. First, it only considered countries' institutional profiles related to climate change, thus caution should be exercised when generalizing the findings to others institutional profiles related to other environmental issues (Kostova, 1997). Second, the study period was relatively short compared with previous studies on voluntary carbon reporting (e.g. Lemma et al., 2019; Luo, 2019; Stanny, 2013); however, the multinational design, with 13 countries including 2,327 companies, helped compensate for this limitation. As regards future research, countries' institutional context has been posited as a factor which influences investors' perceptions (Bell et al., 2014). Carbon disclosure has proved to constitute valuable information for financial investors (Griffin et al., 2017). In this sense, further research might analyze whether the value relevance of voluntary carbon disclosure for market investors is influenced by countries' institutional environment.

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Range	N	Percentage (%)	Mean	Minimum	Median	Maximum
0 < = 2015 CDP score < 30	31	2.65	16.48	2.00	11.00	28.00
30 < = 2015 CDP score < 50	50	4.27	39.26	30.00	38.00	49.00
50 < = 2015 CDP score < 70	87	7.44	61.06	50.00	61.00	69.00
70 < = 2015 CDP score < 85	150	12.82	77.66	70.00	78.00	84.00
2015 CDP score > = 85	852	72.82	95.26	85.00	96.00	100.00
Sample Total	1,170	100.00	85.98	2.00	93.50	100.00

Table 1. Distribution of the 2015 CDP disclosure score.

Dependent variables			
DisCDP	A dichotomous variable of CDP participation which is equal to 1 if the firm responded the 2015 CDP questionnaire and made the response public, and 0 otherwise.		
CDPscore	An indicator variable that is equal to 1 if the firm obtained a CDP score not lower than 93.5 points, and 0 otherwise.		

Independent variables			
	Description	*References*	*Expected sign*
Regulative	Based on the EPS index, which measures the stringency of each country's specific environmental policy. It has a range of values from 0 (not stringent) to 6 (the highest degree of stringency).	Botta & Koźluk (2014)	+
Normative	Percentage of companies that responded to the CDP questionnaire in the previous year in a given country.	Stanny (2013)	+
Cultural	Based on an index that reflects countries' climate change concern. It is ranked from 3 to 12, with 3 indicating the lowest level of concern with regard to climate change, and 12 the highest level of concern.	Stokes et al. (2015)	+

Control variables		
Size	Natural logarithm of total revenues.	Cotter & Najah (2012), Matisoff (2013)
Risk	Beta (systematic risk).	González & Zamora (2016b), Luo et al. (2012), Q. Tang & Luo (2011)
TobinQ	Proxy of TobinQ, calculated as the market capitalization of the company plus preferred shares, book value of long-term debt, and current liabilities, divided by book value of total assets at the end of fiscal year 2014.	Clarkson et al. (2008), González & Zamora (2016b), Luo et al. (2012)
Lev	Total debt divided by total assets at the end of fiscal year 2014.	Borghei & Leung (2012), González & Zamora (2016b), Luo et al. (2012), Stanny & Ely (2008)
ROA	Return on assets. Calculated by earnings before interest and taxes divided by total assets at the end of fiscal year 2014.	Penman (2007), Subramanyam & Wild, (2009)
DisCDP$_{t-1}$	Dummy variable which is equal to 1 if firm disclosed the previous CDP, and 0 otherwise.	Stanny (2013), Stanny & Ely (2008)
Lambda	Heckman correction factor which accounts for selectivity bias in the sample.	Breen (1996), Heckman (1979)

Table 2. Variables used in the study.

Country	Regulative	Normative	Cultural	Total firms	R N	R %	CDP Score
Australia	3.17	39.00	8.75	179	63	35.20	81.48
Canada	3.28	59.50	9.45	134	79	58.96	84.56
France	3.58	39.20	9.94	210	77	36.67	86.73
Germany	3.06	44.08	9.49	144	76	52.78	74.83
India	1.82	29.50	10.77	142	30	21.13	93.07
Indonesia	1.08	20.00	9.21	40	4	10.00	53.00
Italy	3.28	53.00	10.12	69	36	52.17	86.00
Japan	3.17	46.60	10.11	397	206	51.89	89.23
South Africa	0.71	80.00	9.44	62	52	83.87	94.60
South Korea	3.07	34.80	10.03	207	45	21.74	94.62
Turkey	1.92	41.00	9.28	89	27	30.34	77.89
United Kingdom	3.83	70.86	8.78	261	205	78.54	84.49
United States	2.69	69.00	8.78	393	270	68.70	86.42
Total				2,327	1,170	50.28	85.98

Table 3. Distribution of countries' climate change-related institutional context and firms by countries. Regulative = regulative pillar, measured by the EPSI index. Normative = normative pillar, represented by the percentage of companies that participated in the CDP in the previous year in a given country. Cultural = cultural-cognitive pillar, measured by an index that reflects countries' climate change concern. R = responding companies. The percentage is determined by dividing the number of companies (N) by total firms (fifth column) in the country. CDP score is the average 2015 CDP disclosure score by country, which is calculated using the total CDP disclosure score of responding firms divided by total number of responding firms (N) in the country.

Panel A: Whole sample (i.e., non-responding firms included as zeros)								
Variable	N	Mean	St Dev.	Min.	P25	Median	P75	Max.
DisCDP	2,327	0.50	0.50	0.00	0.00	1.00	1.00	1.00
CDPscore	2,327	0.25	0.43	0.00	0.00	0.00	1.00	1.00
Regulative	2,327	2.96	0.69	0.71	2.69	3.17	3.28	3.83
Normative	2,327	0.51	0.15	0.20	0.39	0.47	0.69	0.80
Cultural	2,327	9.51	0.64	8.75	8.78	9.49	10.11	10.77
Size	2,327	14.72	1.81	7.94	13.69	14.81	15.91	18.60
Risk	2,327	0.91	0.42	0.05	0.64	0.87	1.13	2.31
TobinQ	2,327	1.89	1.56	0.48	0.99	1.37	2.15	9.81
ROA	2,327	0.08	0.09	-0.28	0.04	0.07	0.12	0.37
Lev	2,327	0.24	0.17	0.00	0.10	0.22	0.35	0.73
DisCDP$_{t-1}$	2,327	0.45	0.50	0.00	0.00	0.00	1.00	1.00
Panel B: Responding firms								
DisCDP	1,170	1.00	0.00	1.00	1.00	1.00	1.00	1.00
CDPscore	1,170	0.50	0.50	0.00	0.00	0.50	1.00	1.00
Regulative	1,170	3.02	0.70	0.71	2.69	3.17	3.28	3.83
Normative	1,170	0.56	0.14	0.20	0.44	0.60	0.69	0.80
Cultural	1,170	9.36	0.61	8.75	8.78	9.44	10.03	10.77
Size	1,170	15.45	1.58	7.94	14.46	15.51	16.55	18.60
Risk	1,170	0.96	0.41	0.05	0.67	0.92	1.18	2.31
TobinQ	1,170	1.74	1.25	0.48	1.02	1.34	2.03	9.81
ROA	1,170	0.08	0.08	-0.28	0.04	0.07	0.12	0.37
Lev	1,170	0.25	0.15	0.00	0.14	0.24	0.35	0.73
DisCDP$_{t-1}$	1,170	0.83	0.38	0.00	1.00	1.00	1.00	1.00
Panel C: Non-responding firms								
DisCDP	1,157	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CDPscore	1,157	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Regulative	1,157	2.90	0.67	0.71	2.69	3.17	3.17	3.83
Normative	1,157	0.45	0.13	0.20	0.35	0.41	0.47	0.80
Cultural	1,157	9.66	0.64	8.75	8.78	9.94	10.11	10.77
Size	1,157	13.99	1.73	7.94	13.11	14.11	15.04	18.60
Risk	1,157	0.86	0.42	0.05	0.60	0.82	1.07	2.31
TobinQ	1,157	2.05	1.82	0.48	0.98	1.41	2.32	9.81
ROA	1,157	0.08	0.10	-0.28	0.04	0.07	0.12	0.37
Lev	1,157	0.22	0.18	0.00	0.06	0.21	0.34	0.73
DisCDP$_{t-1}$	1,157	0.07	0.25	0.00	0.00	0.00	0.00	1.00

Table 4. Descriptive statistics. Panel A presents descriptive statistics for the whole sample, while Panel B and C report the same statistics for a subsample of responding firms and non-responding firms, respectively. N = Number of firms. P25 and P75 are the 25th and the 75th percentiles of the variables, respectively. All variables are defined in Table 2.

Sector	DisCDP = 0		DisCDP = 1		Total	Average CDP score
	Number of firms	Percentage (%)	Number of firms	Percentage (%)		
Consumer Discretionary	286	56.86	217	43.14	503	83.56
Consumer Staples	98	47.34	109	52.66	207	92.06
Energy	105	57.69	77	42.31	182	86.13
Health Care	124	62.31	75	37.69	199	81.43
Industrials	225	45.55	269	54.45	494	84.40
Information Technology	104	41.43	147	58.57	251	84.64
Materials	136	42.63	183	57.37	319	88.10
Telecommunication Services	17	32.69	35	67.31	52	85.89
Utilities	62	51.67	58	48.33	120	93.36
Total	1,157	49.72	1,170	50.28	2,327	85.98

Table 5. Distribution of companies by sectors. The average CDP score is the sum of the total CDP disclosure score of sample companies that replied the CDP survey divided by total number of responding firms in the sector.

Variables	1	2	3	4	5	6	7	8	9	10	11
1. DisCDP	1	0.58***	0.09***	0.38***	-0.17***	0.43***	0.13***	-0.03	0.01	0.10***	0.76***
2. CDPscore	0.58***	1	0.01	0.21***	-0.01	0.45***	0.08***	-0.04**	-0.02	0.12***	0.53***
3. Regulative	0.08***	-0.01	1	0.22***	-0.05**	-0.12***	-0.15***	-0.15***	-0.19***	-0.05**	0.03
4. Normative	0.37***	0.21***	0.11***	1	-0.42***	0.29***	0.02	0.12***	0.10***	0.05**	0.30***
5. Cultural	-0.22***	-0.05**	-0.13***	-0.64***	1	-0.02	-0.01	-0.12***	-0.10***	-0.08***	-0.14***
6. Size	0.40***	0.42***	0.01	0.29***	-0.06**	1	0.24***	-0.14***	-0.02	0.25***	0.43***
7. Risk	0.11***	0.07***	-0.06**	0.06***	-0.04*	0.17***	1	-0.08***	-0.06***	0.06**	0.13***
8. TobinQ	-0.09***	-0.07***	-0.20***	0.04*	-0.04	-0.19***	-0.06**	1	0.62***	-0.19***	-0.03
9. ROA	0.02	-0.01	-0.17***	0.12***	-0.04*	0.12***	-0.07**	0.47***	1	-0.25***	0.01
10. Lev	0.07***	0.10***	-0.04*	0.05**	-0.08***	0.22***	0.07**	-0.19***	-0.20***	1	0.11***
11. DisCDP$_{t-1}$	0.76***	0.53***	0.04*	0.30***	-0.17***	0.40***	0.11**	-0.11***	0.03	0.08***	1

Table 6. Correlation matrix. Pearson (Spearman) correlation coefficients are presented below (above) the diagonal. *, **, *** represent coefficients significant at the 0.1, 0.05 and 0.01 levels respectively (two-tailed). All variables are defined in Table 2.

	Model 1 - Response decision			Model 2 – Disclosure quality			
Variables	Predicted sign	Coeff.	z-stat	Marginal effects	Predicted sign	Coeff.	z-stat	Marginal effects
Regulative	+	0.153**	2.54	0.06**	+	-0.036	-0.54	-0.014
Normative	+	2.188***	6.42	0.868***	+	1.841***	3.45	0.734***
Cultural	+	-0.116	-1.49	-0.046	+	0.576***	5.73	0.229***
Size		0.143***	5.54	0.057***		0.381***	10.40	0.152***
Risk		0.004	0.04	0.001		-0.149	-1.36	-0.059
TobinQ		-0.024	-0.78	-0.009		0.076*	1.71	0.03*
ROA		0.176	0.34	0.069		-0.98	-1.46	-0.39
Lev		-0.166	-0.69	-0.066		0.368	1.32	0.146
DisCDP$_{t-1}$		2.273***	28.44	0.733***		1.248**	2.37	0.429**
Lambda		-	-	-		0.644	1.49	0.257
Constant		-3.566***	-3.96	-		-13.641***	-7.79	-
Chi-square		1,758.28***				281.32***		
Log likelihood		-733.776				-670.321		
Pseudo R2		0.5451				0.1734		
% Correctly predicted		88.10%				69.66%		
Number of observations		2,327				1,170		
Control of sector effects		yes				yes		

Table 7. Probit regressions. *, **, *** coefficients are significant at the 0.1, 0.05 and 0.01 levels respectively (two-tailed). All variables are described in Table 2.

Variables	Model (1) - Response decision				Model (2) - Disclosure quality			
	Predicted sign	Coeff.	z-stat	Marginal effects	Predicted sign	Coeff.	z-stat	Marginal effects
Regulative	+	0.154***	2.6	0.061***	+	-0.06	-0.89	-0.024
Normative	+	2.145***	6.39	0.851***	+	1.553***	2.75	0.619***
Cultural	+	-0.093	-1.22	-0.037	+	0.587***	5.88	0.234***
Size		0.129***	5.11	0.051***		0.357***	9.89	0.142***
Risk		0.059	0.66	0.023		-0.231**	-2.30	-0.092**
TobinQ		-0.028	-0.94	-0.011		0.067	1.55	0.026
ROA		0.262	0.52	0.104		-0.851	-1.29	-0.339
Lev		-0.291	-1.27	-0.115		0.47*	1.75	0.187*
DisCDP$_{t-1}$		2.281***	29.06	0.735***		0.902	1.44	0.331
Carbon-intense		0	0	0		0.172*	1.81	0.068*
Lambda		-	-	-		0.325	0.64	0.129
Constant		-3.439***	-3.89	-		-12.592***	-6.76	-
Chi-square		1726.06***				260.11***		
Log likelihood		-749.885				-680.927		
Pseudo R2		0.5351				0.1604		
% Correctly predicted		87.88%				69.40%		
Number of observations		2,327				1,170		

Table 8. Robust regressions. *, **, *** coefficients are significant at the 0.1, 0.05 and 0.01 levels respectively (two-tailed). All variables are described in Table 2.