

Countries' regulatory context and voluntary carbon disclosures

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Abstract

Purpose - This study analyses the relationship between countries' regulatory context and voluntary carbon disclosures. To date, little attention has been paid to how specific climate change-related regulation influences companies' climate change disclosures, especially voluntary carbon reporting.

Design/methodology/approach – The New Institutional Sociology perspective has been adopted in order to examine the pressure of a country's climate change regulation on voluntary carbon reporting. This research uses Tobit regression to analyse data from 2,183 companies in 12 countries that were invited to respond to the CDP questionnaire in 2015.

Findings - The results show that countries' specific climate change-related regulation does influence both the participation of its companies in the CDP, and their quality, as measured by the CDP disclosure score.

Research limitations – The sample is restricted to 12 countries' regulatory environment. Thus, caution should be exercised when generalizing the results to other institutional contexts.

Practical implications – The results are of use to regulators and policymakers to better understand how specific climate change-related regulation influences voluntary carbon disclosure. Investors may also benefit from this research as it shows which institutional contexts present greater regulatory stringency, and how companies in more stringent environments take advantage of synergy to disclose high-quality carbon information.

Social implications – By linking regulatory and voluntary reporting, this study sheds light on how companies use voluntary carbon reporting to adapt to social expectations generated in their institutional context.

Originality/value – This is the first research that considers specific climate change-related regulation in the study of voluntary carbon disclosures.

1. Introduction

Climate change has led to an increase in concern over companies' levels of Greenhouse Gas emissions (hereinafter GHGs), and their contribution to global warming (Hahn *et al.*, 2015). As a result, companies find themselves under pressure from different stakeholders to report on their strategies for climate change, as well as on the risks and opportunities it entails (Freedman and Jaggi, 2010), so that said stakeholders may incorporate this information into their decision-making process (Luo *et al.*, 2013).

Many countries exert pressure on companies by establishing regulations that require them to measure and reduce their GHG emissions (Depoers *et al.*, 2016). In this sense, the Kyoto Protocol represented an important step forward since it established emissions reduction targets for the majority of industrialised countries (UN, 2018). Indeed, the Kyoto Protocol has been used in several previous studies to measure the influence of a country's regulatory context on companies' carbon reporting. However, no consistent results have been obtained: while certain authors have detected a positive relationship between the two (e.g. Freedman and Jaggi, 2005; Jira and Toffel, 2013; Prado *et al.*, 2009), others have not been able to find a significant relationship (e.g. Brouhle and Harrington, 2010; Luo *et al.*, 2012). In recent times, many countries have increased their environmental regulations in order to respond to the challenges of climate change, and they have passed specific laws for the reduction of GHG emissions (Nachmany *et al.*, 2015). This evolution towards greater specificity in climate change regulations together with the inconsistency of the results obtained in the previous literature have prompted the writing of this paper. In this sense, this research analyses the pressure exerted by a country's regulatory context on companies' carbon reporting strategies, taking into account whether they do or do not disclose information as well as the quality of the information disclosed.

In order to generate greater visibility to their emissions reductions targets and strategies, companies have fundamentally used two types of carbon reporting: mandatory and voluntary reporting (Borie, 2015). In terms of the latter, the Carbon Disclosure Project (hereinafter CDP) has become the main global standard for carbon disclosure. The CDP is an organisation founded by 35 institutional investors, and aims to provide support for better informed decision-making (Stanny and Ely, 2008). On an annual basis, the CDP sends a voluntary questionnaire to companies around the world, and then gathers and evaluates corporate data on emissions reduction targets and strategies, and awards scores accordingly. Furthermore, the CDP's annual reports, by country and by region, also include those companies that did not respond, declined to participate, or who did not make their response public (CDP, 2017).

Data from CDP reports has primarily been used in previous research to analyse the factors that may influence the voluntary carbon reporting (e.g. Ben-Amar and McIlkenny, 2014; Giannarakis *et al.*, 2017; Luo *et al.*, 2012; Luo *et al.*, 2013; Reid and Toffel, 2009), under different theoretical perspectives (Hahn *et al.*, 2015).

The New Institutional Sociology (hereinafter NIS) theory has been used in order to analyse the pressure of a country's climate change regulation on companies' response to demands for carbon disclosure. The theoretical perspective of NIS allows the institutional context within which it is developed to be introduced into the analysis of carbon reporting

(González and Zamora, 2016a; Perrault and Clark, 2010). Following this theory, the decision to disclose or not to disclose carbon information, and how to disclose it, is not necessarily the result of a rational decision-making process on the part of organizations that act independently (Larrinaga, 2010), but rather it may be conditioned by pressures of the institutional context of the country common to them (Grauel and Gotthardt, 2016), including regulatory pressures. Along these lines, Scott (2014) pointed out that organizations are deeply immersed in institutional contexts, which at the same time both facilitate and restrict said organizations' behaviour.

In line with these arguments, climate change regulations would imply the existence of a context that exerts higher levels of pressure on companies to take action and disclose information about themselves. Similarly, companies may choose to participate in voluntary carbon reporting in preparation for future regulatory changes (Luo *et al.*, 2012) which could also damage their legitimacy. Hence, this paper assumes that a country's regulatory context is positively associated with voluntary carbon reporting on the part of companies. Along with the pressure exerted by the regulatory context, this paper also considers other control variables, which are representative of the social and financial market pressures that influence companies' behaviour.

More specifically, this paper analyses whether a country's regulatory context influences companies' decisions on voluntary carbon reporting, and if it influences the quality of companies' responses to the CDP questionnaire. For this purpose, data was analysed from 2,183 companies, in 12 countries, who had been invited to respond to the CDP questionnaire in 2015. In contrast to previous research which relied on Logit models to study environmental information disclosure (Luo *et al.*, 2012, 2013; Reid and Toffel, 2009; Stanny and Ely, 2008), this paper uses the Tobit regression, since it allows both participation in the CDP questionnaire and the score obtained to be evaluated.

This paper contributes to the literature on voluntary carbon reporting in several ways. Firstly, it examines the pressure exerted by the regulatory context through specific climate change-related variables, in contrast to previous studies which consider general environmental regulation (e.g. Luo *et al.*, 2012; Rankin *et al.*, 2011; Reid and Toffel, 2009). Secondly, it takes into account the influence of regulatory pressure on all the companies included in the CDP 2015 report for each country or region, thus avoiding the bias of many previous studies which only considered the largest companies in the world as listed on principal indices (Borghei and Leung, 2013; González and Zamora, 2016b). In this respect, the majority of such studies are based on samples from Global 500 companies (e.g. Freedman and Jaggi, 2005; Luo *et al.*, 2012; Prado *et al.*, 2009; Tang and Luo, 2011), or concentrate on listed companies in a specific country (e.g. Brouhle and Harrington, 2010; Eleftheriadis and Anagnostopoulou, 2015), and do not consider the effect of the regulatory context on companies not included in said indices. Thirdly, given that the previous literature has not provided consistent results regarding the influence of a country's regulatory context on companies' decisions to participate in voluntary carbon reporting, this study's larger sample size – in terms of both companies and countries – may contribute to an increase in the consistency of the relationship between the factors under consideration.

The results show that the specific climate change regulation of a country does influence both the participation of its companies in the CDP questionnaire, and the quality of the information disclosed. Additionally, size and financial risk are positively and significantly related to climate change disclosure. These results have implications for regulators and policymakers in that they will be better able to understand how specific climate change-related regulation affects corporate carbon disclosure. Furthermore, the findings of this study are informative for investors as they show which institutional contexts present greater regulatory stringency, and how companies in more stringent environments take the advantage of synergy to voluntarily disclose high-quality carbon information. This paper provides a better understanding of the determinants that motivate firms' participation in voluntary carbon reporting, as well as the factors that affect the quality of the information disclosed.

The paper is structured as follows. The second section presents the theoretical framework and the factors that may influence voluntary carbon reporting. The third section details the methodology used, while the fourth section presents the descriptive analysis, the empirical results and the robustness analysis. Finally, the fifth section includes the main conclusions, as well as the possible implications for future research.

2. Literature review and hypotheses development

According to Hahn *et al.* (2015), three main groups of theories can be identified to explain the voluntary disclosure of GHG emissions on the part of companies: socio-political theories of disclosure; economic theories of disclosure; and institutional theory. Within the group of socio-political theories, stakeholder theory and legitimacy theory (Clarkson *et al.*, 2008) may be highlighted. The first of these argues that companies are subject to pressure from different stakeholders (e.g. suppliers, customers, investors, governments, etc.), all of whom may have different expectations and interests (Freeman, 1984); company managers may respond to this pressure and manage their relationships with stakeholders through voluntary carbon reporting. With regard to legitimacy theory, this maintains that companies operate in society based on a social contract (Guthrie and Parker, 1989; Patten, 1992), whereby they agree to carry out socially desirable actions in exchange for the approval of their actions and objectives (Brown and Deegan, 1998; Giannarakis *et al.*, 2017). In this way, companies are able to use the CDP questionnaire as a reporting vehicle, in order to increase their legitimacy and avoid social scrutiny (Stanny, 2013). Several studies have used socio-political theories to explain the factors that influence carbon reporting (e.g. Freedman and Jaggi, 2005; Luo *et al.*, 2012, 2013; Prado *et al.*, 2009), and all agree that company size has a positive influence on the decision to voluntarily disclose environmental information. This result is consistent with the argument of socio-political theories, which uphold that larger companies are subject to greater social scrutiny, hence they will be more likely to voluntarily disclose environmental information.

For their part, economic theories of disclosure (Verrecchia, 1983) suggest that companies' carbon reporting is based on a cost-benefit analysis. Hence, companies will voluntarily disclose environmental information if the cost of doing so is lower than the positive consequences generated by doing so (Diamond and Verrecchia, 1991). This group of theories includes the voluntary disclosure theory, which predicts the positive impact of voluntarily disclosed information on financial performance (Verrecchia, 1983).

According to this theory, companies that dedicate resources to improving their environmental performance are interested in having investors know about this information so they may in turn assess the former's behaviour. These companies, therefore, will be more likely to disclose a greater amount of environmental information, thereby also making it more difficult for less well-performing companies to simulate their behaviour (Clarkson *et al.*, 2008; Freedman and Jaggi, 2010).

Signalling theory, which also falls within the group of economic theories of disclosure, maintains that companies that control their emissions are able to achieve a competitive advantage, but that they also bear higher costs (Dawkins and Fraas, 2011; Denicolò, 2008). These companies would signal their decisions to the government by means of voluntary information disclosure. The underlying idea is that the regulator will see that the current cost of complying with regulation is low, thereby leading to stricter levels of regulation which competitors are less able to comply with but which are attainable by those companies that do voluntarily disclose information (Brouhle and Harrington, 2010; Luo, 2017).

Finally, institutional theory argues that companies base their decisions for voluntary carbon reporting not only on economic aspects, but also because they are forced to so by pressure from the institutional context (Bansal and Roth, 2000; Hahn *et al.*, 2015). DiMaggio and Powell (1983) identified isomorphism as the process by which an organization tends to resemble others in its same context. Consequently, organizations that share a particular institutional context are subject to the same institutional pressures, thus facilitating isomorphism. There are three isomorphic processes which make organizations so similar to each other: coercive, normative and mimetic. Specifically, coercive isomorphism results from both formal and informal pressures exerted on certain organizations that they depend on, as well as from shared expectations within the society in which the organizations operate. Similarly, Boxenbaum & Jonsson (2008) viewed these three isomorphic processes as topographical directions from which they emerged within an organizational field. They stated that while regulatory pressures stem from institutions that are in a higher position, such as governments, normative and mimetic pressures come from peer organizations that are positioned at the same level.

Although normative and mimetic pressures may be important factors influencing voluntary carbon reporting, this paper is focused on coercive isomorphism for the following reasons: (1) it has been extensively considered in the literature on voluntary carbon reporting, although it has concentrated on general environmental regulation (Freedman and Jaggi, 2010; Jira and Toffel, 2013; Luo *et al.*, 2012; Prado *et al.*, 2009) and thus has not taken into account the specific problem of climate change-related regulation; (2) the coercive dimension exerts a more obvious and direct pressure on organizations in general (DiMaggio and Powell, 1983; Scott, 2014), and on their environmental behaviour in particular (Bebbington and Larrinaga, 2008; Qian and Burritt, 2008), thereby facilitating its measurement; and (3) an important aspect of coercive isomorphism is that it is the authority and capacity to sanction on the part of the actor on which organizations depend that exerts the pressure (Scott, 2014), with the state being the main actor in this case, as considered in this paper.

More specifically, this paper focuses on the specific state-centric view of the regulatory dimension, that is regulation that occurs through legal instruments promulgated by the government. This study adopts the state-centric approach because: (1) the crucial role of the state in promoting coercive isomorphism through this type of regulation has been predominantly considered in the NIS literature (Scott, 2014); (2) the legal instruments promulgated by the state offer a common legal environment for organizations (DiMaggio and Powell, 1983) which operate in a particular country, which is aligned with the objective of this paper; (3) governmental support has played a key role in promoting climate change-related regulation (Nachmany *et al.*, 2015); (4) the second commitment period of the Kyoto Protocol is currently in force, which is based on more centralized regulation (UNFCCC, 2019); and (5) many countries worldwide are now improving and expanding mandatory reporting requirements so as to incorporate more stringent disclosures on social and environmental information (Nachmany *et al.*, 2015; Noronha *et al.*, 2013).

According to the NIS perspective, it is regulatory pressure in particular – among all other institutional pressures – that displays the greatest coercive power, since it is based on laws and regulations that must be complied with; on the overseeing of compliance on the part of companies; and on the imposition of sanctions in the case of non-compliance (DiMaggio and Powell, 1983; Scott, 2014). Thus, institutions' regulatory context creates a legal framework in order to influence organizations' behaviour, e.g. companies within certain sectors are required to disclose their carbon emissions as consequence of implementing an emissions trading scheme. However, according to the arguments of the institutional pillars (Järvenpää, 2009; Scott, 2014), climate change regulation generates social expectations that may affect the performance of both companies subject to regulation, and those that are not. Apart from the requirements of the regulatory framework, adapting to these social expectations can lead companies to voluntarily disclose carbon information through a widely accepted mechanism such as the CDP. In this regard, NIS predicts that the higher the number of adopters of a particular practice, the wider the social acceptance and the greater the legitimacy that it contributes (Deephouse and Suchman, 2008).

In accordance with NIS, organizational legitimacy is a key consequence of institutional isomorphism (Deephouse, 1996). Therefore, organizations that adapt to the pressures exerted by the regulatory pillar of their country's institutional context obtain legitimacy, understood as the degree of cultural support received by an organization (Meyer and Scott, 1992). Legitimacy is a key concept in the NIS perspective, although its consideration is different from that stated by legitimacy theory. While the latter focuses on the concept of legitimacy as the ability of organizations to alter the perceptions of other actors (e.g. regulators or public opinion), NIS focuses on the organizations' compliance with the institutions in their environment, which reflect external expectations concerning what behaviours are acceptable (Deegan, 2002). In this regard, Scott (2014) highlighted the fact that organizational legitimacy derives from the organizations' conformity with institutions.

Larrinaga (2010) argued that while legitimacy theory is useful for determining in the short term why an organization is disclosing environmental information, NIS is useful for explaining why certain sustainability reporting practices become common within a

particular context. Perrault and Clark (2010) pointed out that the environmental and social reporting carried out by companies to respond to coercive regulatory pressures entails several drawbacks. In particular, they indicated that it usually leads to an increase in the amount of information disclosed, but not in the quality of the information. Furthermore, the information is used to justify the company's behaviour socially for the sole purpose of recovering legitimacy. They thus concluded that more mandatory information may not be necessary as it is already provided voluntarily. Although voluntary reporting also receives criticism, Perrault and Clark (2010), concluded that it is showing more promise in terms of changing undesirable corporate behaviour.

The previous literature also offers several reasons as to why companies may choose to voluntarily disclose environmental information, especially carbon information, such as: to obtain legitimacy; to improve the company's reputation; to attract investment funds; to adapt to future regulatory changes; and to take advantage of synergies with existing environmental information systems (Deegan, 2002; Grauel and Gotthardt, 2016; Larrinaga, 2010; Ott *et al.*, 2017; Perrault and Clark, 2010). From the NIS perspective, voluntary carbon reporting via the CDP is a vehicle for companies (both subject and not subject to mandatory carbon reporting) to adapt to the social expectations of their environment. These expectations encompass what society expects from companies. Thus, companies tend to incorporate these expectations into their operations, and furthermore, over time, expectations tend to become moral obligations (Järvenpää, 2009). Companies' adaptation to social expectations allows them to obtain legitimacy from both regulatory bodies (legally authorised bodies that have authority over organizations), and public opinion (which has the role of establishing the norms of social acceptability) (Deephouse, 1996). Moreover, in the case of the CDP, this initiative was launched by institutional investors, who themselves are actors that can provide financial resources, and above all, they occupy a position that allows companies to confer legitimacy (Deephouse, 1996).

It is possible to identify countries' regulatory context as the laws and norms that they have established in relation to climate change. Thus, the role of governments is fundamental given their capacity to establish laws and regulations, thereby incentivizing companies to reduce their GHG (Stoddart *et al.*, 2012). Townshend *et al.* (2013) pointed out that national climate change-related regulation is of vital importance for implementing international agreements, as well as for increasing confidence for future international commitments given that experience at the national level may increase the likelihood of attaining international pledges.

Many governments use a carbon pricing instrument to internalize the external costs of carbon emissions, as well as to reduce GHG emissions to the atmosphere (Metcalf and Weisbach, 2009). Two main mechanisms can be used to set a price on carbon emissions: carbon tax and the GHG emissions trading scheme (hereinafter ETS). With regard to carbon tax instruments, governments place an explicit price on carbon emissions by establishing a tax rate, i.e. a price per tonne of CO₂ emitted, as well as by specifying those companies or industries subject to said tax (Haite, 2018). In this sense, targeted subjects can choose between reducing their emissions or paying for them. Therefore, the GHG emission reduction depends on the decision taken by the targeted subjects. An ETS instrument sets a limit on carbon emissions by selected subjects, and issues allowances in quantities approximately equal to the limit. Emission rights are tradable, and their price

is determined by supply and demand (Chevallier, 2013). ETS differs from carbon tax in that the carbon price of emissions is not predefined whereas the GHG emission reduction outcome is (World Bank, 2018).

Apart from implementing carbon pricing instruments, governments can require mandatory reporting of companies' GHG emissions. For instance, the Australian government promulgated the National Greenhouse and Energy Reporting (hereinafter NGER) Act in 2008, which requires the reporting of GHG emissions on the part of specific organizations. This was a challenge for many companies, since they had to be mandatorily accountable for their GHG emissions. Thus, the promulgation of the NGER Act led to the emergence of many accounting implications for both organizations and the government. In this sense, the NGER Act facilitates carbon reporting and GHG emissions assurance; it provides engagement with stakeholders; it offers a tool with which to manage risks arising from climate change; it facilitates the implementation of carbon management accounting; it makes available data about GHG emissions; and is extremely useful for developing a carbon pricing mechanism (Lodhia, 2011). Four years later, Australia implemented a system which put a price on carbon emissions, but it was abolished in 2015 (Jotzo and Mazouz, 2015). In this study's sample, all the countries possess a climate change regulatory framework. However, it is difficult to measure the level of seriousness of a given country based solely on the number of laws related to climate change disclosures, since while some rules are broad and integrative, others are very narrow in scope (Townshend *et al.*, 2013).

With specific regard to carbon emissions, institutional theory establishes that companies opt for voluntary carbon reporting in order to better position themselves vis-à-vis future regulatory changes (Luo *et al.*, 2012), thus avoiding possible sanctions and adapting to their institutional context (Scott, 2014). In order to measure the regulatory pressure exerted by different countries, the previous literature has utilised the signing of the Kyoto Protocol. While certain studies have found a positive and significant relationship between carbon reporting and companies belonging to a country that has ratified the Kyoto Protocol (e.g. Freedman and Jaggi, 2005 y 2010; Jira and Toffel, 2013; Prado *et al.*, 2009), others have not detected a significant relationship between these two factors (Luo *et al.*, 2012), which means, therefore, that the results obtained in the previous literature are not consistent.

Studies that consider other specific GHG regulations such as the ETS, or specific regulations for some of the more polluting sectors, do not achieve consistent results either (Brouhle and Harrington, 2010; Kim and Lyon, 2011; Luo *et al.*, 2012; Rankin *et al.*, 2011; Reid and Toffel, 2009; Scholtens and Kleinsmann, 2011). Thus, for example, for a sample of Global 500 companies, Luo *et al.* (2012) found a positive and significant relationship between a company's carbon reporting and their belonging to a country that had established an ETS. However, Rankin *et al.* (2011) concluded that companies' participation in the European Union ETS had no impact on the decision of said companies as to the disclosure of their GHG emissions.

Given the inconsistency of the results obtained in the previous literature, this paper studies the influence of different countries' regulatory institutional context on voluntary carbon reporting, using variables which are representative of policies and regulations specifically

related to the fight against climate change. Furthermore, unlike previous studies (e.g. Freedman and Jaggi, 2005; Luo, 2017), which are based on larger companies or on listed companies in a specific country (e.g. Brouhle and Harrington, 2010; Eleftheriadis and Anagnostopoulou, 2015), this study considers the influence of different countries' regulatory environment on all of the companies that appear in CDP climate reports for each country/region.

Although response to the CDP questionnaire is on a wholly voluntary basis, it may be expected that companies which belong to countries with established specific climate change regulations will adapt and make investments to control and reduce their GHG emissions, with the aim of avoiding possible sanctions or loss of legitimacy (Cho and Patten, 2007). This in turn could result in increased participation in the CDP along with an improvement in the score obtained by companies in those countries. Therefore, the following hypotheses are proposed:

H1. The regulatory context of a country positively and significantly influences the participation of companies in said country in the CDP questionnaire.

H2. The regulatory context of a country positively and significantly influences the level of disclosure of companies in said country that have responded to the CDP questionnaire.

3. Methodology

3.1 Sample

The initial sample was based on 2,905 companies included in the 2015 CDP reports from those countries for which we possess data regarding their regulatory context (Australia, Canada, France, India, Indonesia, Italy, Japan, South Africa, South Korea, Turkey, the United Kingdom, and the United States of America). Subsequently, 580 companies identified as belonging to the financial sector were eliminated from the sample, as recommended by Luo *et al.* (2012). Similarly, the following were also eliminated: 8 companies duplicated in the CDP reports; 21 S.A. companies (due to their being a subsidiary or having merged during the CDP report submission process), as recommended by Luo *et al.* (2012); and a further 113 companies whose financial data was not available in Datastream. Thus, the final sample includes 2,183 companies from 12 countries that operate in different sectors (GICS).

3.2 Sources

Data from the dependent variable (CDP) was manually extracted from the 2015 CDP reports, which are available on the organisation's website. In the case of Indonesia, data for companies that did not respond, declined to participate, or that did not publish the questionnaire was collected from the CDP web database, since the CDP climate report for *Hong Kong and South East Asia edition* only included companies that did respond to the questionnaire. The 2015 CDP questionnaire consists of several modules: Introduction; Corporate Governance; Risks and Opportunities; Accounting and Verification of GHG Emissions; Energy Use; and Emissions Trading (CDP, 2015). Similarly, CDP reports have a standard format that facilitates comparison between companies and sectors (Luo *et al.*, 2012). Several investigations related to carbon disclosure have used data from the CDP (e.g. Kolk *et al.*, 2008; Luo *et al.*, 2012; Reid and Toffel, 2009; Stanny and Ely, 2008).

The Environmental Policy Stringency Index (EPSI) prepared by the OECD (Organisation for Economic Co-operation and Development), which measures the stringency of every country's specific environmental policy primarily related to climate and air pollution (OECD, 2017), has been used as an approximation for measuring regulatory pressure. The data was obtained from the OECD database, as available on its website.

Meanwhile, the financial data necessary for the calculation of the control variables was extracted from the Datastream database. In line with Stanny (2013) and Luo *et al.* (2012), financial data from the end of fiscal year 2014 was used given that the CDP questions companies on carbon data for the preceding year. Thus, the 2015 CDP report contains emissions data related to the period from 1st January to 31st December 2014.

3.3 Theoretical model

The decision of companies to voluntarily participate in carbon reporting is a function that includes several pressures [1]:

$$\text{Environmental disclosure} = f(\text{social pressure, financial market pressure and regulatory pressure}) \quad [1]$$

The econometric model used is as follows [2]:

$$\text{CDP} = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{Beta} + \beta_3 \text{TobinQ} + \beta_4 \text{Leverage} + \beta_5 \text{Profitability} + \beta_6 \text{EPSI} + \beta_7 \text{ETS} + \beta_{8-16} \text{Sector} + \beta_{17-28} \text{Country} + \varepsilon \quad [2]$$

The following control variables were introduced into the model: size, beta, TobinQ, leverage and profitability. These variables have been widely contrasted in previous studies and have demonstrated a high level of explanatory power with regard to voluntary carbon reporting. Following on from the abovementioned model, the EPSI and ETS variables were included as representative of the influence of different countries' regulatory context, with the aim of testing this study's target hypothesis. In addition, dummy variables for each sector (GICS) and country were created in order to control the fixed effects of each.

Regression was estimated using the Tobit model, since the dependent variable has a restricted range of values (the score received by the companies that responded to the 2015 CDP questionnaire ranged in value from 0 to 100). Tobit model regressions were estimated according to maximum likelihood, since the use of linear models was not appropriate in this case because the coefficients would have been biased and inconsistent (Wooldridge, 2015). The Tobit regression has been used in previous studies to analyse factors that influence companies' carbon reporting (e.g. Clarkson *et al.*, 2008; Cormier *et al.*, 2005; González and Zamora, 2016b).

3.4 Variables

Table 1 summarises the variables introduced in the model.

[Insert here Table 1]

The dependent variable (CDP) reflects the companies' 2015 CDP disclosure score. The CDP disclosure score measures the quality, comprehensiveness and completeness of the companies' response to the questionnaire. In addition, it reflects the companies' internal

management, carbon strategies and corporate transparency with respect to climate change. Therefore, firms with high levels of transparency regarding their climate change-related strategies will have a higher CDP disclosure score than those companies with lower levels of transparency (Lemma *et al.*, 2019). Responding companies must follow the CDP guidelines when reporting climate change information to the CDP, e.g. managers cannot modify the structure of the CDP questionnaire. Thus, CDP carbon information can be compared across companies, countries and sectors, since the information provided is consistent for all participating companies (Luo *et al.*, 2012, 2018). In line with these arguments, several previous studies support the use of the CDP disclosure score to measure companies' participation in the CDP, as well as the quality of their response (Cotter & Najah, 2012; Lemma *et al.*, 2019; Tang & Luo, 2016). In fact, apart from being of interest in recent empirical studies, the CDP disclosure score has high levels of credibility for sustainability experts (Luo, 2017). The dependent variable (CDP) is equal to the score obtained in the CDP questionnaire if the company in question answered the questionnaire and published the score. On the contrary, i.e. in the case of a company that did not respond to the questionnaire, declined to participate, or did not publish the questionnaire, the dependent variable CDP takes a value of zero.

EPSI. This variable approximates the regulatory pressure of countries. As mentioned above, this index is prepared by the OECD and measures the stringency of each country's specific environmental policy, thus allowing for comparison among them. In this way, it evaluates and incorporates a series of environmental policy instruments, primarily related to climate and air pollution (Botta and Koźluk, 2014). More specifically, stringency should be understood as the degree to which environmental policies place an explicit or implicit price on pollution or behaviour that is damaging to the environment (OECD, 2017). *EPSI* adopts a range of values from 0 (not stringent) to 6 (highest degree of stringency).

ETS. The implementation of an ETS involves the creation of a regulatory framework for carbon accounting, trading, reporting and assurance. Thus, the presence of an ETS provides strong evidence that a country is on a path to a low-carbon economy (Luo, 2017). Companies belonging to a country that has implemented an ETS are under pressure to measure, trade, report and verify their carbon emissions. Therefore, these companies are better positioned to participate in the CDP questionnaire and to disclose higher quality information on GHG emissions than companies headquartered in a country that does not possess an ETS. They can also benefit from synergy, since they are subject to greater carbon regulatory stringency in their country. Previous studies have considered the establishment of an ETS to analyse voluntary carbon disclosures (Luo, 2017; Luo *et al.*, 2012; Tang and Luo, 2016). They highlighted the fact that companies headquartered in countries that have implemented an ETS are more likely to voluntarily disclose their carbon emissions. Thus, this study predicts that firms in countries with an ETS are more likely to respond to the CDP questionnaire and disclose high-quality information.

Previous studies have found that social and financial markets pressures influence voluntary carbon disclosures, so this study includes five variables (size, beta, TobinQ, leverage and profitability) to control those pressures. Hahn *et al.* (2015) pointed out that it is difficult to compare the results of control variables in previous research, since they include different sets of control variables in their models. Therefore, this study addresses

this issue by considering a set of control variables that are commonly used in studies on voluntary carbon disclosure, which it may be helpful for future comparisons.

Size. Legitimacy theory argues that larger companies are subject to greater social pressure. Thus said companies will be willing to participate in higher levels of carbon reporting in order to demonstrate their compliance with social expectations and to prevent their legitimacy from being threatened (Cho and Patten, 2007; Solomon and Lewis, 2002). Size has been used as a control variable in several previous studies related to environmental disclosure (Cormier *et al.*, 2005; Liu and Anbumozhi, 2009; Martínez *et al.*, 2015; Matisoff 2013), and they all agree that there is a positive and significant relationship between size and carbon reporting. It is therefore expected that company size will have a positive effect, both on the participation of companies in the CDP as well as on the score they obtain. The natural logarithm of total revenues is used to measure company size (Cotter and Najah, 2012; Matisoff, 2013).

Beta. The previous literature confirms that there is a positive and significant relationship between a company's volatility or risk and environmental information disclosure (Cormier *et al.*, 2005). According to stakeholder theory, companies with a higher level of business risk are more likely to participate in carbon reporting in order to allow investors to evaluate this information more accurately (Tang and Luo, 2011). Previous research has used this variable as an approximation of companies' business risk (Cormier *et al.*, 2005; Tang and Luo, 2011). Luo *et al.* (2012) included companies' Beta in their model as a control variable. The Beta used in this study is based on 23 to 35 consecutive end-of-month price percentage changes, and their relativity to the local market index.

TobinQ. This variable is used as an approximation of companies' future growth expectations (Luo *et al.*, 2012). Companies with a higher TobinQ will be more likely to disclose more information in order to reduce information asymmetries. Thus, investors will better able to calculate the market value of these companies and their intangible assets (Stanny and Ely, 2008). The previous literature does not establish a conclusive relationship between environmental disclosure and TobinQ. Many studies do not find a significant relationship between both variables (González and Zamora, 2016b; Luo *et al.*, 2012; Tang and Luo, 2011; Wegener *et al.*, 2013). In this study, TobinQ was calculated as the sum of the company's market value plus preferred shares plus the book value of long-term debt and current liabilities, divided by the book value of the total assets (Clarkson *et al.*, 2008). TobinQ is expected to have a positive and significant influence on voluntary carbon reporting (Tang and Luo, 2011).

Leverage. Companies with higher levels of leverage will be subject to greater pressure from investors and creditors. Hence these firms will be willing to participate in carbon reporting in order to respond to the demands of the aforementioned stakeholders and to improve their financial flexibility (Stanny and Ely, 2008). With regard to the influence of leverage on environmental disclosure, empirical studies have not achieved consistent results. Some authors have not found a significant relationship between companies' leverage and their level of environmental disclosure (e.g. Freedman and Jaggi, 2005; Prado *et al.*, 2009; Stanny and Ely, 2008). Andrikopoulos and Krikilani (2013) analysed the environmental disclosures of companies listed on the Copenhagen Stock Exchange and found a negative relationship between the level of leverage of these companies and

their disclosure. On the contrary, Clarkson *et al.* (2008) observed a positive and significant relationship between leverage and environmental disclosure. Following Freedman and Jaggi (2005), we assume that leverage will positively and significantly influence response to the CDP questionnaire and the score obtained. This study uses the total debt to total assets ratio to measure the companies' leverage (Borghesi and Leung, 2013).

Profitability. The previous literature on voluntary disclosure argues that the financial performance of companies may influence environmental disclosure. In this way, profitable companies may be better positioned to address the costs associated with reducing carbon emissions (Bewley and Li, 2000). However, for the most part, empirical studies do not demonstrate a conclusive relationship between company profitability and carbon reporting (Chu *et al.*, 2012; Luo *et al.*, 2013; Rankin *et al.*, 2011). In this study, it is assumed that company profitability will positively and significantly influence voluntary carbon reporting (Luo *et al.*, 2013). ROA (Return on Assets), as measured as earnings before interest and taxes divided by total assets (Penman, 2007; Subramanyam and Wild, 2009), is used as an approximation of company profitability.

4. Empirical results

This section presents a breakdown of the regulatory context and companies by country, as well as a summary of firms by sector. This section also details the descriptive analyses, the empirical results and the robustness tests.

4.1 Overview of climate change-related regulation by country

It is worth noting that the majority of countries in the sample have some type of carbon pricing system to reduce GHG emissions (see Table 2). ETS is the predominant carbon pricing instrument used in these countries. Conversely, no carbon pricing instrument had been officially implemented in Australia, India, Indonesia, South Africa and Turkey in 2015 (Kossoy *et al.*, 2015). However, South Africa and Turkey are considering introducing a system to set a price on GHG emissions in the future (Alton *et al.*, 2014; Kossoy *et al.*, 2015). In the United States, some carbon pricing initiatives do exist to reduce GHG emissions at the state level (e.g. California cap-and-trade scheme and The Regional Greenhouse Gas Initiative (RGGI)). Similarly, in some provinces of Canada (e.g. British Columbia, Alberta and Quebec) certain instruments existed in 2015 that put an explicit price on carbon emissions (carbon tax in British Columbia; ETS in Alberta and Quebec) (Kossoy *et al.*, 2015). While many countries are implementing carbon pricing instruments and struggling to mitigate GHG emissions through them, Australia abolished the carbon pricing mechanism it established in 2012 (World Bank, 2018).

European Union countries (France, Italy and the United Kingdom in the sample) implemented a cap-and-trade system in 2005 called the European Union Emission Trading Scheme (hereinafter EU ETS). As well as implementing the EU ETS, France and the United Kingdom established a carbon tax in 2014 and 2013 respectively (Kossoy *et al.*, 2015). By establishing a carbon tax, these countries internalize the external costs of those companies that are not covered by the EU ETS.

4.2 Descriptive statistics

Table 2 provides an overview of the EPSI index, carbon pricing instruments and firms by selected countries. Of the 2,183 companies, Japanese companies make up the largest

group, followed by companies from the United States and the United Kingdom. Together they account for more than 45 per cent of the sample. On the contrary, countries with less representation in the sample are Italy (3.16 per cent), South Africa (2.84 per cent) and Indonesia (1.83 per cent).

[Insert here Table 2]

It can be seen from the data in Table 2 that the countries with the highest regulatory stringency are the United Kingdom, France, Canada and Italy. They all have an EPSI index greater than 3.2 points. These countries have a carbon pricing instrument in place at the national or subnational level (Kossoy *et al.*, 2015). Similarly, these countries have a higher percentage of companies that respond to and make the CDP questionnaire public, with an average score greater than 80 points. In average terms, countries with stringent climate change-related regulation have a greater number of companies disclosing carbon information to the CDP. In addition, companies headquartered in these countries have, on average, a better CDP score, which means that they are disclosing high-quality information regarding their carbon emissions. It is of note that certain countries such as India, Indonesia, South Africa and Turkey, where there is no carbon pricing implemented, have less than 2 points in the EPSI index.

South Korean, South African and Indian companies have an average CDP score greater than 90. Interestingly, although South Africa and India have a low EPSI index, these countries have the second and the third highest average CDP score in the sample (94.60 and 93.07 respectively). In these countries, climate change-related regulation has been improved and expanded over the last decade (Nachmany *et al.*, 2015; Never, 2012). Furthermore, from 2015 onwards, the majority of them have been considering the implementation of a carbon pricing mechanism in the future (Kossoy *et al.*, 2015), which in turn may imply a change in the level of mandatory disclosure. For instance, in 2015 South Africa was considering the introduction of a carbon pricing mechanism (Alton *et al.*, 2014; Vorster *et al.*, 2011). Therefore, companies in this country may be voluntarily providing high quality information to the CDP in order to adapt to future changes in climate change regulation, thus avoiding possible penalties and conforming to their institutional context (DiMaggio and Powell, 1983; Scott, 2014). Also, South Korea implemented its national cap-and-trade system in 2015 (Kossoy *et al.*, 2015). Thus South Korean companies may be disclosing high quality carbon information to the CDP to conform to the new regulation of trading of GHG emissions allowances.

Table 3 shows the breakdown of firms by sector. Consumer discretionary, Industrials and Materials are the largest group in the 2015 CDP report. Utilities companies have the highest average CDP score (93.02). Such companies (e.g. electric utilities) are under higher regulatory pressures that force them to control and report their carbon emissions (Kolk *et al.*, 2008). Thus, these companies take advantage of the synergy to participate in voluntary carbon reporting, such as the CDP. Telecommunication companies have the highest response rate, followed by Information Technology and Material companies.

[Insert here Table 3]

Table 4 contains the mean, standard deviation, minimum and maximum for each of the variables, taking into consideration all of the companies in the sample. In order to perform

a comparative analysis between those companies that do have a CDP score and those that do not, the descriptive statistics were broken down according to companies that responded to the CDP questionnaire (Table 5) and those that did not respond, declined to participate, or did not publish the CDP questionnaire (Table 6).

[Insert here Table 4]

[Insert here Table 5]

[Insert here Table 6]

The sample is composed of 2,183 companies, of which 1,094 participated in the 2015 CDP questionnaire, while 1,089 did not respond, declined to participate, or did not publish their response. As can be seen in Table 5, the average score of the companies that answered the CDP questionnaire is rather high (86.75). After comparing the descriptive statistics of Tables 5 and 6, it can be seen that those companies that did respond to the questionnaire are, on average, of greater size and possess higher levels of risk, leverage and profitability as compared to those companies that did not respond, declined to participate, or did not publish the 2015 CDP questionnaire. Furthermore, those companies that did respond and did publish the CDP questionnaire belong to countries that have an Environmental Policy Stringency Index (EPSI), which is slightly higher than the average of the companies included in the sample. It should be emphasised that the maximum value in the stringency index of the countries included in the sample is 3.83, which is quite far below the maximum degree of stringency (6).

Table 7 shows Pearson and Spearman's correlation coefficients. As it may be seen, there are no high or significant correlations between pairs of independent variables that could imply multicollinearity problems.

[Insert here Table 7]

4.3 Multivariate analysis

Table 8 displays the results of the Tobit regression. The first two columns show the variables under examination and the signs expected for each of them. The following column shows the coefficients of the Tobit regression for each of the independent variables. The Tobit regression coefficients in particular should not be interpreted as if they were linear regression estimates. Hence they must be broken down in order to assess the magnitude of the regressor in each of the two effects: on the one hand, the effect on the score obtained by the companies that did respond to and publish the CDP questionnaire; on the other, the effect on the probability of participation in the questionnaire on those companies that did not respond, declined to participate, or did not publish the questionnaire. The marginal effects for each of the independent variables are presented in the last two columns of Table 8.

[Insert here Table 8]

The EPSI variable, herein used as an approximation of the pressure of countries' regulatory context, shows a positive and significant relationship at the maximum level with the dependent variable (CDP). After controlling for other influences, this result supports both Hypothesis 1 and 2, i.e. that firms in countries with high levels of climate change-related regulatory stringency are more likely to voluntarily disclose their GHG

emissions through the CDP, as well as tending to provide better quality carbon information. That is to say, countries' climate change-related regulatory context encourages firms to voluntarily adopt a proactive carbon disclosure strategy. In contrast, companies in countries characterized by lower levels of climate change-related regulatory stringency are less likely to participate in voluntary carbon disclosures. The EPSI variable has an impact of 3.5 points on the score of the CDP, along with a 5 per cent increase in the probability of responding for each unit increase in the value of this variable. This finding is consistent with the argument that companies belonging to countries with strict regulations specifically related to climate change will be more likely to participate in voluntary carbon reporting.

In addition, a positive and significant association was found between voluntary carbon disclosures and the presence of an ETS. Consistent with prior studies (e.g. Luo *et al.*, 2012, 2018), this research found that the implementation of an ETS influences companies' participation in voluntary carbon disclosure practices. The implementation of an ETS creates a regulatory framework that pressures firms to measure, trade, report and verify their GHG emissions. Therefore, consistent with the NIS perspective, companies in an ETS country are able to take advantage of synergy with existing environmental information systems in order to participate in voluntary carbon disclosures, as well as to disclose high quality information.

Climate change-related regulation forms part of the regulatory pillar in countries which establish mandatory rules that can oblige liable companies to mandatorily disclose their carbon emissions. By providing carbon information, companies comply with the regulation and will both avoid sanctions and enhance their future survival (Scott, 2014). However, the climate change-related regulation also generates social expectations that may condition the behaviour of companies both subject to regulation and, those that are not. Adaptation to these social expectations (which constitute what society expects companies to do as considered to be correct) can condition companies to carry out carbon reporting on a voluntary basis through the CDP. Thus, by sharing the same institutional context, companies will share the social rules and expectations of their context, adapt to them and ultimately present isomorphic behaviour in relation to carbon disclosures.

Regarding the control variables, the estimated coefficients for a company's size are positive and significant at the $p = 0.01$ level, which suggests that larger companies are more likely to participate in voluntary carbon disclosures. Large firms tend to disclose more carbon information due to pressures from both stakeholders (Freeman, 1984; Luo *et al.*, 2018) and society in general (Patten, 2002). The influence of size on carbon reporting has been widely investigated in previous research (e.g. Cormier *et al.*, 2005; Liu and Anbumozhi, 2009; Martínez *et al.*, 2015; Matisoff 2013), where it is shown to be a relevant variable, as is the case with our model. Financial risk, as measured by companies' Beta, also presents a high incidence rate on environmental disclosures. Beta presents a positive and significant coefficient at 99 per cent, coinciding with the argument that companies with higher financial risk will provide stakeholders with greater levels of carbon disclosure (Luo *et al.*, 2012). Conversely, coefficients for TobinQ, leverage and profitability are not significant.

4.4 Robustness tests

There are many instances of climate change-related regulation in the 12 countries covered by this study (Nachmany *et al.*, 2015). As this paper discussed previously, the number of climate change-related laws that a country has enacted is not a perfect measure of its response to climate change. However, this same number of laws may be a good measure of the seriousness of the country towards climate change (Townshend *et al.*, 2013). Therefore, this study formulates an additional Tobit model in which the ETS variable is replaced by a variable taken from the study by Nachmany *et al.*, (2015), which classifies countries according to the number of climate change-related laws they have. This study runs a regression which considers the combination between the EPSI index and the number of climate change laws that a country has enacted. In this way, this model takes into account the countries' climate change-related regulatory body as much as their level of stringency. Table 9 presents the result of the Tobit model.

[Insert here Table 9]

The results obtained were similar to those presented in Table 8. The significance and the signs of the variables are similar to those shown in model 1 of Table 8. Similarly, the coefficients do not present significant value variations. These results serve to reinforce the findings of this study, and to confirm the relationship between countries' regulatory context and voluntary carbon reporting on the part of companies headquartered in those countries. In addition, the data was analysed using ordinary least squares regression. The results (not tabulated) are qualitatively similar and do not change the inferences of the study.

5. Conclusions

The main objective of this paper was to analyse the influence of different countries' regulatory context on both the decision of companies in said countries to participate in carbon reporting through the CDP questionnaire, and on the score they obtained. Given its focus on the influence of the regulatory environment on organisational behaviour, this paper has relied on New Institutional Sociology in order to analyse the pressure exerted by the specific climate change regulation in 12 different countries on the response of companies to the demands of carbon reporting. This research has used the Tobit regression to analyse the data collected and to study the effects on the score obtained in the CDP, as well as the effects on the probability of responding to the questionnaire in the case of those companies that did not respond, declined to respond or did not publish the CDP questionnaire.

After controlling for social and financial pressures, the results obtained show that the probability of companies' participating in voluntary carbon reporting, along with the quality of the response – as measured by the score obtained in the CDP questionnaire – are explained by countries' climate change-related regulatory context. More specifically, the results show that countries' regulatory environment has a positive and significant influence, both in terms of the probability of participating in the CDP questionnaire and of the score obtained, whereby both hypotheses H1 and H2 are confirmed. Hence, companies that belong to countries with higher levels of stringency as regards climate change regulation (with a higher score in the EPSI index), will be more likely to

participate in voluntary carbon reporting. The presence of an ETS also positively and significantly influences voluntary carbon disclosure through the CDP questionnaire.

With respect to the control variables introduced into the model, both company size and risk do positively and significantly affect voluntary carbon reporting through the CDP, which is consistent with the results found in previous research (Clarkson *et al.*, 2008; González and Zamora, 2016b; Luo *et al.*, 2012). The results also show that leverage, profitability and TobinQ have no statistically significant influence on voluntary carbon disclosure.

This study provides empirical evidence that the regulatory dimension of institutions offers explanations for the impact of specific climate change-related regulations on voluntary carbon disclosures (DiMaggio and Powell, 1983; Meyer and Rowan, 1977; Scott, 2014). It also provides a complementary explanation of how companies manage their legitimacy and adapt to social expectations through voluntary carbon disclosures. To date, papers that have examined the influence of the regulatory context on carbon reporting, considered environmental or sustainability regulations which, although they may contain some reference to climate change, are rather generalist in nature. However, this study considers the influence of specific climate change-related regulation which, apart from imposing binding rules on target companies, also generates greater visibility for the problem of climate change in society, thus contributing to the creation of social expectations with regard to the appropriate corporate behaviour required. This research reinforces this argument, and implies that increased stringency in levels of climate change regulation can generate social expectations more focused on companies' behaviour related to climate change, thus facilitating evaluation and scrutiny by different agents or stakeholders. This has an influence on companies' behaviour, since they tend to adapt to social expectations, as evidenced by their greater participation in voluntary carbon disclosures, as well as by the high quality of information disclosed.

The results of this research suggest that a combination of voluntary and mandatory mechanisms for reporting carbon information are required in order to urge firms to disclose better quality information in terms of their carbon footprint. In this way, they can help policymakers to make informed decisions regarding specific climate change regulation, as well as to implement or improve the design of carbon pricing systems. Moreover, these results are helpful for stakeholders, as they need to incorporate climate-related regulatory risks into their economic decisions. For their part, company managers can use the CDP questionnaire to reveal to society the actions they are undertaking in order to mitigate climate change-related risks, thus demonstrating how they are adapting to the pressures of their country's regulatory context.

As this paper shows, climate change-related regulations generate social expectations that affect the disclosure behaviour of companies both subject to regulation and those that are not. Therefore, adaptation to these social expectations (Scott, 2014) influences firms to carry out voluntary carbon disclosure. And by articulating a more specific set of regulative rules for addressing the climate challenge, regulators and policymakers may thus create the conditions that promote the adoption of voluntary carbon disclosure on the part of companies. The findings of this paper are also informative for both investors and regulators, since they show how companies are adapting to their regulatory environment,

as well as how companies in more stringent environments take advantage of synergy to disclose high-quality carbon information.

This paper contributes to the literature concerning the determinants that motivate voluntary corporate carbon disclosure, particularly through the CDP (Luo *et al.*, 2012; Stanny, 2013). Previous studies on this matter have considered different factors such as finance (e.g. profitability, leverage, capital spending), ecology (e.g. carbon emissions, carbon-intensive industry), the regulatory context (e.g. stringency of environmental regulations, ETS, common-law countries), as well as disclosure-related determinants (e.g. companies' CDP participation, corporate environmental and sustainability reports) (Clarkson *et al.*, 2008; Cotter and Najah, 2012; Jira and Toffel, 2013; Luo *et al.*, 2012; Prado *et al.*, 2009; Rankin *et al.*, 2011; Reid and Toffel, 2009; Stanny, 2013). However, the papers that studied the influence of the regulatory context on voluntary carbon reporting considered environmental regulations that are rather generalist in nature (e.g. Luo *et al.*, 2012; Rankin *et al.*, 2011; Reid and Toffel, 2009). Thus the use of specific climate change regulation has not been investigated. This paper fills this gap by examining the influence of regulatory pressures on voluntary carbon disclosure while taking into account more specific measures within the regulatory context related to climate change. This is important because many countries worldwide are now improving and expanding specific regulations in order to address the climate challenge (Nachmany *et al.*, 2015). In this sense, it considers the influence of specific climate change-related regulation as opposed to previous research which considers generic environmental or sustainability regulations (e.g. Luo *et al.*, 2012; Rankin *et al.*, 2011; Reid and Toffel, 2009). Therefore, this paper contributes to the previous literature in several ways: it provides specific measurements of countries' regulatory pressures related to climate change; it connects voluntary carbon reporting with the institutional context in which it takes place (González and Zamora, 2016a) and it links the national institutional context and its mandatory regulation with the voluntary decision of companies in this context to disclose carbon information (Grauel and Gotthardt, 2016). Furthermore, this study took into consideration all the companies that appear in the 2015 CDP reports by country/region, thus avoiding the bias found in many previous studies which only consider larger-scale companies or those listed in the main indices of specific countries (e.g. Freedman and Jaggi, 2005; Luo *et al.*, 2012; Prado *et al.*, 2009; Tang and Luo, 2011).

Although this research goes beyond typical studies regarding the determinants of corporate carbon disclosure, there may still be scope for a broader consideration of isomorphic pressures. As it stands, this paper focuses on coercive isomorphism, more specifically on formal coercive pressures from state-imposed regulations related to climate change. Thus further research is required into other forms of regulation, e.g. "decentered regulation" (Black, 2008). Furthermore, there are other institutional pressures that may also affect companies' participation in voluntary carbon disclosure; the influence of normative and mimetic pressures on voluntary carbon reporting in particular remains unexplored. In relation to normative pressures, companies may adopt voluntary initiatives such as the TCFD (Task Force on Climate-Related Financial Disclosures) guidelines (TCFD, 2019) not because they are imposed by regulations, but rather because they believe it is morally the right thing to do (Scott, 2014). Hence further research could explore how normative pressures may affect voluntary corporate carbon disclosure. With regard to mimetic pressures, further research could investigate whether

shared cultural conceptions regarding climate change do influence firms' disclosure behaviour. It is expected that companies in countries with high levels of climate change awareness will be more likely to voluntarily disclose carbon information, thus leading to greater participation in the CDP. However, as Larrinaga (2010) points out, one of the main drawbacks of mimetic pressures is their measurement. In addition, given that institutional pressures are not presented in isolation and that, in many cases, it is difficult to separate them even under empirical scenarios (DiMaggio and Powell, 1983; Scott, 2014), further research could examine the interplay of different isomorphic pressures (coercive, normative and mimetic) in creating the conditions for the adoption of voluntary carbon disclosure practices.

Even though a large number of companies were available for this research, it was only possible to consider companies from 12 different countries, hence the findings cannot be generalised to other institutional contexts. In this sense, future research may consider applying this analysis to companies across a greater number of countries, which would allow the consistency of the results to be increased. Likewise, in line with other studies (Zamora *et al.*, 2016), it would be of interest to analyse the influence of different countries' regulatory context on carbon reporting and its value relevance for the market.

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<i>Dependent variable</i>			
CDP	0 if company no response/decline to participate/non-public CDP questionnaire (NR/DP/NP). CDP score, otherwise.		
<i>Independent variables</i>			
	<i>Description</i>	<i>References</i>	<i>Predicted sign</i>
EPSI	Index that measures the stringency of each country's specific environmental policy. It has a range of values from 0 (not stringent) to 6 (highest degree of stringency).	(Botta & Koźluk, 2014)	+
ETS	Dummy variable, taking value 1 if the firm belongs to a country that has an established emissions trading scheme, and 0 otherwise.	(Luo, 2017; Tang & Luo, 2016)	+
<i>Control variables</i>			
Size	Natural logarithm of total revenues.	(Cotter & Najah, 2012; Matisoff, 2013)	+
Beta	Beta is a measure of systematic risk of the firms. In this study, it is based on 23 to 35 consecutive end-of-month price percentage changes, and their relativity to the local market index.	(González & Zamora, 2016b; Luo <i>et al.</i> , 2012; 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 <i>et al.</i> , 2008; González & Zamora, 2016b; Luo <i>et al.</i> , 2012)	+
Leverage	Total debt divided by total assets at the end of fiscal year 2014.	(Borghei & Leung, 2012; González & Zamora, 2016b; Luo <i>et al.</i> , 2012; Stanny & Ely, 2008)	+
Profitability	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)	+

Table 1. Variables used in the test.

Country	EPSI	CPI	Total firms	NR/DP/NP		R		Average score
				N	%	N	%	
Australia	3.17	0	179	116	64.80	63	35.20	81.48
Canada	3.28	1	134	55	41.04	79	58.96	84.56
France	3.58	1	210	133	63.33	77	36.67	86.73
India	1.82	0	142	112	78.87	30	21.13	93.07
Indonesia	1.08	0	40	36	90.00	4	10.00	53.00
Italy	3.28	1	69	33	47.83	36	52.17	86.00
Japan	3.17	1	397	191	48.11	206	51.89	89.23
South Africa	0.71	0*	62	10	16.13	52	83.87	94.60
South Korea	3.07	1	207	162	78.26	45	21.74	94.62
Turkey	1.92	0*	89	62	69.66	27	30.34	77.89
United Kingdom	3.83	1	261	56	21.46	205	78.54	84.49
United States	2.69	1	393	123	31.30	270	68.70	86.42
Total			2,183	1,089	49.89	1,094	50.11	86.75

Table 2. Distribution of regulatory context and companies by countries. CPI = Carbon Pricing Instrument; 1 = countries with a CPI in place at the national or subnational level; * = the country is considering the introduction of a CPI in the future; 0 = countries where there is no CPI in place. NR/DP/NP = no response/decline to participate/non-public CDP questionnaire. R = responding companies. The percentage is determined by dividing the number of companies by the total firms in the country. The average score is calculated using the total score of responding companies divided by the total firms in the country.

Sector	Total firms	NR/DP/NP		R		Average score
		N	%	N	%	
Consumer Discretionary	473	272	57.51	201	42.49	84.51
Consumer Staples	202	95	47.03	107	52.97	92.15
Energy	180	104	57.78	76	42.22	85.95
Healthcare	184	117	63.59	67	36.41	84.40
Industrials	446	201	45.07	245	54.93	85.29
Information Technology	233	94	40.34	139	59.66	85.71
Materials	306	132	43.14	174	56.86	87.61
Telecommunication	48	16	33.33	32	66.67	90.25
Utilities	111	58	52.25	53	47.75	93.02
Total	2,183	1,089	49.89	1,094	50.11	86.75

Table 3. Distribution of firms by sector. NR/DP/NP = no response/decline to participate/non-public CDP questionnaire. R = responding companies. The percentage is determined by dividing the number of companies by the total firms in the sector. The average score is calculated using the total score of responding companies divided by the total firms in the sector.

<i>Variables</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
CDP	2,183	43.475	45.190	0	100
Size	2,183	15.005	1.6777	8.123	20.288
Beta	2,183	0.923	0.464	-0.264	4.419
TobinQ	2,183	1.990	2.404	0.140	57.753
Leverage	2,183	0.240	0.179	0	1.594
ROA	2,183	0.081	0.141	-2.724	3.161
EPSI	2,183	2.956	0.707	0.71	3.83
ETS	2,183	0.584	0.494	0	1

Table 4. Descriptive statistics: all companies.

<i>Variables</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
CDP	1,094	86.752	17.861	3	100
Size	1,094	15.655	1.570	9.852	20.288
Beta	1,094	0.970	0.473	-0.209	4.4198
TobinQ	1,094	1.863	2.650	0.140	57.753
Leverage	1,094	0.252	0.159	0	1.272
ROA	1,094	0.086	0.130	-0.861	3.161
EPSI	1,094	3.019	0.722	0.71	3.83
ETS	1,094	0.651	0.477	0	1

Table 5. Descriptive statistics: responding companies.

<i>Variables</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
CDP	1,089	0	0	0	0
Size	1,089	14.353	1.523	8.123	18.972
Beta	1,089	0.875	0.450	-0.264	3.917
TobinQ	1,089	2.118	2.124	0.221	21.699
Leverage	1,089	0.229	0.198	0	1.594
ROA	1,089	0.076	0.151	-2.724	0.910
EPSI	1,089	2.892	0.686	0.71	3.83
ETS	1,089	0.516	0.499	0	1

Table 6. Descriptive statistics: companies that did not respond, declined to participate, or did not make their response public.

Variable	CDP	Size	Beta	TobinQ	Leverage	ROA	EPSI	ETS
CDP	1	0.495***	0.120***	-0.039*	0.119***	0.001	0.072***	0.114***
Size	0.417***	1	0.227***	-0.131***	0.253***	-0.015	-0.120***	0.139***
Beta	0.106***	0.142***	1	-0.086***	0.047**	-0.062***	-0.165***	-0.073***
TobinQ	-0.062***	-0.131***	-0.046**	1	-0.187***	0.624***	-0.143***	0.060***
Leverage	0.076***	0.193***	0.065***	-0.115***	1	-0.255***	-0.050**	0.096***
ROA	0.021	0.149***	-0.083***	0.445***	-0.210***	1	-0.193***	0.015
EPSI	0.072***	0.002	-0.059***	-0.172***	-0.040	-0.110***	1	0.349***
ETS	0.123***	0.139***	-0.039*	-0.028	0.079***	0.036*	0.453***	1

Table 7. Correlation matrix. Spearman (above diagonal). Pearson (below diagonal). *Correlation is significant at 0.10, **Correlation is significant at 0.05 and ***Correlation is significant at 0.01.

Variables	Predicted sign	Tobit regression coefficients	Marginal effects on observable variable, given uncensored	Marginal effects on probability of being uncensored
Size	+	20.254***(18.77)	8.203***(19.48)	0.111***(18.70)
Beta	+	10.144***(2.73)	4.108***(2.74)	0.056***(2.73)
TobinQ	+	0.247(0.28)	0.101(0.28)	0.001(0.28)
Leverage	+	-4.619(-0.45)	-1.870(-0.45)	-0.025(-0.45)
ROA	+	-0.380(-0.02)	-0.154(-0.02)	-0.002(-0.02)
EPSI	+	8.652***(3.11)	3.504***(3.12)	0.048***(3.11)
ETS	+	7.742***(1.97)	3.135***(1.97)	0.043***(1.97)
Control of sector effects		Yes	Yes	Yes
Control of country effects		Yes	Yes	Yes
Constant		-323.452***(-17.13)		
Total observations		2,183	2,183	2,183
Left censored observations		1,089	1,089	1,089
<i>Log likelihood</i>		-6,961.76		
<i>LR Chi2</i>		71.317***		
Pseudo R2		0.0326		

Table 8. Tobit regression. *** = significant $p < 0.01$, ** = significant $p < 0.05$, * = significant $p < 0.10$. Coefficients of the Tobit regression are estimated by maximum likelihood method. t-values (Tobit regression coefficients) and z-statistics (marginal effects) are reported in parentheses.

Variables	Predicted sign	Tobit regression coefficients	Marginal effects on observable variable, given uncensored	Marginal effects on probability of being uncensored
Size	+	20.877***(19.43)	8.457***(20.24)	0.115***(19.37)
Beta	+	12.015***(3.22)	4.867***(3.22)	0.066***(3.22)
TobinQ	+	0.145(0.16)	0.059(0.16)	0.001(0.16)
Leverage	+	-3.594(-0.35)	-1.456(-0.35)	-0.020(-0.35)
ROA	+	-2.995(-0.17)	-1.213(-0.17)	-0.017(-0.17)
EPSI	+	5.478***(1.99)	2.219***(1.99)	0.030***(1.99)
Climate laws	+	1.502***(4.52)	0.608***(4.52)	0.013***(4.52)
Control of sector effects		Yes	Yes	Yes
Control of country effects		Yes	Yes	Yes
Constant		-336.906***(-18.19)		
Total observations		2,183	2,183	2,183
Left censored observations		1,089	1,089	1,089
<i>Log likelihood</i>		-6,953.54		
<i>LR Chi2</i>		70.981***		
Pseudo R2		0.0337		

Table 9. Robust analysis. *** = significant $p < 0.01$, ** = significant $p < 0.05$, * = significant $p < 0.10$. Coefficients of the Tobit regression are estimated by maximum likelihood method. t-values (Tobit regression coefficients) and z-statistics (marginal effects) are reported in parentheses.