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An international empirical study of greenwashing and voluntary carbon disclosure

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ABSTRACT

Voluntary corporate environmental disclosure has increased significantly in the last decade. However, the increase in environmental disclosure has also been accompanied by the social questioning of its veracity. Previous studies have mainly focused on the determinant factors behind corporate decisions to disclose environmental data, with only limited consideration of both carbon performance and the veracity of the information disclosed. Based on an international sample of firms from 12 countries, this paper analyzes the impact of regulative pressures related to climate change on the likelihood of companies engaging in greenwashing. The results show that the number of regulations related to climate change negatively influences the propensity of firms to engage in greenwashing. Furthermore, firms in countries with stringent climate-related regulations are less likely to participate in greenwashing practices. This paper adds to the existing literature concerning greenwashing by demonstrating that institutional theory can deliver further insights into the explanation of corporate greenwashing behavior. This is the first study to incorporate international climate-related regulations into the analysis of corporate greenwashing. It also provides a new method for identifying greenwashing firms, based on their carbon performance and disclosure.

1. Introduction

Since the beginning of the 2000s, social concern related to global climate change has increased significantly (Stokes et al., 2015). Given that organizational activity has been identified as one of the main drivers of greenhouse gas (GHG) emissions, environmental pressures on organizations have also increased (Rosenberg et al., 2019; Walker and Wan, 2012). In response to these pressures, voluntary carbon disclosure has proved to be one of the main practices adopted by large organizations, who for the most part have used the Carbon Disclosure Project (CDP) as an instrument for their carbon disclosure (Tang and Demeritt, 2018).

However, the increase in environmental information provided by companies has also been accompanied by the social questioning of its veracity, due to the greenwashing practices companies may perform (Lyon and Montgomery, 2015; Yang et al., 2020; Yu et al., 2020). According to Delmas and Burbano (2011, p. 65), greenwashing is "*the intersection of two firm behaviors: poor environmental performance and positive communication about environmental performance*". The drivers of greenwashing have received much attention in the greenwashing literature (Gatti et al., 2019). In this regard, it is possible to find differing opinions concerning the influence that a country's regulatory context have on organizations' participation in greenwashing (Vos, 2009; Hrasky, 2012; Cho et al., 2015; Roulet and Touboul, 2015; Haque and Ntim, 2018), which would suggest that further research is required, especially in terms of empirical studies analyzing large datasets by country for the purpose of contrast (Lyon and Montgomery, 2015). What is more, greenwashing studies related to the specific case of climate change are extremely scarce (Haque and Ntim, 2018).

The lack of consensus as regards the influence of the regulatory/monitoring context on greenwashing combined with the scarcity of research into the effects of greenwashing on climate change reporting have prompted us to undertake this research. Our objective is to analyze the influence of both climate change-related regulation and the monitoring of its compliance at the international level on organizations' participation in greenwashing activities. To this end, we analyzed data of companies listed in the 2015 CDP report. More specifically, the sample firms are located in 12 countries around the world and belong to 9 different sectors.

For the purpose of our study, we have adopted Delmas and Burbano's

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(2011) greenwashing definition for two main reasons. In the first place, it is accepted and widely found in the greenwashing literature, and as such this may facilitate its operationalization and measurement. Secondly, in order to analyze the different institutional contexts within which companies participate in greenwashing (Marquis et al., 2016; Marquis and Toffel, 2012; Roulet and Touboul, 2015), this paper draws on New Institutional Sociology (hereinafter NIS). In line with this framework, greenwashing may be considered to constitute a decoupling strategy (Yang et al., 2020) by means of which organizations present an image reflecting their commitment to the business practice, thereby conforming to their institutional context. However, they neither modify their behavior nor disrupt their daily routines, which continue to be based on the search for economic efficiency (Meyer and Rowan, 1977; Bromley and Powell, 2012).

The results show that the probability of companies' engaging in greenwashing when disclosing voluntarily carbon information will be lower in the case of those countries with greater climate change-related regulation and a more stringent monitoring of organizations' compliance with said regulation.

Greater levels of research into greenwashing and corporate climate-related disclosures is important for both regulators and policy makers, in order to establish regulations and environmental policies that positively contribute to the prevention of greenwashing practices on the part of organizations (Delmas and Burbano, 2011); for investors, in order to enhance their assessment of the information provided by companies through reporting standards such as the CDP (Griffin et al., 2017); for consumers, so as to reduce their skepticism and mistrust with regard to the information disclosed by organizations (Pope and Wæraas, 2016); and also for managers, in order to encourage them to disclose more information concerning the substantive behavior of their companies as related to climate change, and for this information to be believed and appreciated by the various stakeholders of the companies (Bowen, 2014).

This paper contributes to the previous literature in several ways and responds to various calls for further research into environmental performance and environmental disclosures using an international sample of firms from different countries (Doan and Sassen, 2020; Mateo-Márquez et al., 2020; Yu et al., 2020). First of all, in terms of greenwashing literature, this paper is the first to produce an empirical measurement of greenwashing based on Delmas and Burbano's (2011) definition by using publicly available data; it can therefore be generated and utilized by future researchers and policy makers. More specifically, it provides a new method for the identification of greenwashing firms, based on their CDP disclosure score and their carbon performance. Secondly, greenwashing is particularized in this paper for climate change reporting (Haque and Ntim, 2018), since this study also considers climate change-related regulation[1] and not solely the more generic environmental regulation mainly used in previous studies (Mateo-Márquez et al., 2020, 2021). Thirdly, this paper presents an empirical study based on a broad dataset by country in order to analyze the impact of institutional pressures related to climate change on corporate greenwashing behavior (Lyon and Montgomery, 2015; Marquis et al., 2016; Yu et al., 2020), regarding which an intense debate exists within the specialized literature. Besides contributing to the greenwashing literature, this paper also makes a contribution to the theoretical perspective of NIS – to institutional decoupling in particular – since it considers the influence of the number of climate-related laws separately from their stringency, a distinction which generally speaking has not been made in prior studies (Mateo-Márquez et al., 2021) which tend to consider these influences under the umbrella term of the regulatory institutional pillar (Scott, 2014).

The remainder of the paper is organized as follows. Section 2 contains the literature review and the development of hypotheses. Section 3 outlines the research method, sample selection, empirical models, and variables, while Section 4 presents the empirical results and discussion. Our conclusions are detailed in Section 5.

2. Literature review and hypothesis development

The gap between what organizations say and what they do is defined as decoupling (Bowen, 2014), a concept that has been covered in depth by NIS (Bromley and Powell, 2012; Meyer and Rowan, 1977). According to this theoretical perspective, organizations can adapt to the pressures of their context by superficially or symbolically adopting a business practice (Delmas and Montes-Sancho, 2010), thus obtaining legitimacy through their conformation to the context, whilst not endangering their economic efficiency by actually developing said practice (Boxenbaum and Jonsson, 2017). Among the factors that can drive decoupling, we can highlight the high coercive pressure on organizations to implement the new practice, the existence of simultaneous contradictory pressures within the organizational context (Boxenbaum and Jonsson, 2017), as well as firms' perception that the business initiative does not contribute to their income statement (Hess and Warren, 2008).

Greenwashing can be considered as a decoupling strategy with respect to environmental aspects (Siano et al., 2017; Yang et al., 2020). Companies do seek legitimacy – but without compromising their economic efficiency due to the implementation of environmental practices that may prove costly. Given that legitimacy is based on perceptions, and that information contributes to the configuration of said perceptions (Deegan, 2002), organizations can carry out greenwashing through information disclosure (Bowen, 2014). In this way, through the CDP, organizations can report their objectives and strategies aimed at reducing their GHG emissions. However, this information does not reflect a real commitment on the part of the company to fight climate change, thereby implying a reduction in its environmental impact, since the company either does not make any changes to its activities or only modifies them symbolically and not in practice (Gonzalez and Ramírez, 2016). Along these lines, MacKay and Munro (2012) argued that climate change information may become a disruptive weapon used deliberately by organizations to influence public perception, instead of constituting a tool to be used for productive purposes.

According to NIS, as well as economic efficiency, organizations require legitimacy in order to improve their prospects for survival. Organizations obtain legitimacy by conforming to the pressures of their institutional context (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). The regulatory dimension of the institutional context, which stems primarily from governmental legislation (Bruton et al., 2010), constitutes the more explicit and direct form of pressure, guiding the behavior of organizations through coercion and the threat of formal sanctions (Scott, 2014). Furthermore, regulation may even influence the behavior of companies that are not subject to it, since a country's legislation generates social expectations regarding the appropriate and expected behavior of organizations in said country (Mateo-Márquez et al., 2020; Scott, 2014). Townshend et al. (2013) consider that national legislation is a crucial aspect for mitigating climate change, since it increases the probability of achieving international agreements and facilitates the likelihood of their implementation.

Various papers have analyzed the impact of countries' regulative context on voluntary corporate carbon reporting, the majority of which have found a positive relationship (Freedman and Jaggi, 2005; Grauel and Gotthardt, 2016; Kim and Lyon, 2011; Luo, 2019; Luo et al., 2013; Prado-Lorenzo et al., 2009; Tang and Luo, 2016). However, in general terms, the literature suffers from two important shortcomings: its focus on the corporate decision to report or not to report environmental

[1] Kim and Lyon (2015) studied greenwashing in the case of the Voluntary Reporting of Greenhouse Gases Program, established by the Energy Policy Act of 1992, focused on USA electric utilities. Unlike that study, our paper considers the mandatory regulation of climate change, at an international level and for nine different industries, thus allowing us to consider different institutional contexts.

information, mainly through the CDP survey; and its consideration of generic environmental regulation instead of specific climate change-related regulation (Haque and Ntim, 2018; Mateo-Márquez et al., 2020).

By considering companies' greenwashing activities, we are able to incorporate into our study not only companies' corporate carbon information as provided by themselves, but also their carbon performance, which gives us the opportunity to analyze the links between the two. In this respect, it is possible to pinpoint certain contradictory arguments put forward in the previous literature concerning the impact of the regulatory context on the probability of companies to engage in greenwashing. Thus, despite the fact that empirical studies are few and far between, the majority of the literature considers that higher levels of regulation do contribute to reducing firms' greenwashing practices (Cho et al., 2015; Delmas and Burbano, 2011; Vos, 2009). Similarly, the threat of increased regulation may drive companies to disclose carbon information (Hsueh, 2019), which also increases the likelihood of their substantively adopting a social initiative (Hess and Warren, 2008). In this respect, Delmas and Burbano (2011) conclude that the mandatory disclosure of environmental information would hinder corporate greenwashing behavior.

Roulet and Touboul (2015) argue that in economic environments where companies can compete freely, and where therefore there is less regulation, the likelihood of greenwashing is higher since companies will cut expenses that do not directly lead to subsequent profit maximization. This drives firms to focus on impression management instead of on effective environmental management, thus encouraging symbolic environmental behavior instead of substantive behavior. However, Roulet and Touboul (2015) also consider the opposing argument based on Jackson and Apostolakou's (2010) study. Thus, it may be argued that in environments where levels of regulation are lower, stakeholder pressure on firms to implement substantive environmental behavior will be higher in order to fill the void created by the lack of regulation.

Tang and Demeritt (2018) show that higher levels of regulation in a given country entail only modest changes in firms' emission profiles (less than 10%). Similarly, according to decoupling arguments from the theoretical perspective of NIS (Boxenbaum and Jonsson, 2017; Meyer and Rowan, 1977), it can be seen that when a country's regulatory pressure on companies to reduce their carbon emissions is higher, these firms may respond by providing carbon information in order to display their compliance with the regulatory context, while not actually modifying their activities so as not to damage their economic efficiency, thereby not making any changes to their carbon performance (Bowen, 2014; Siano et al., 2017).

Given the aforementioned contradictory arguments regarding the relationship between regulation and greenwashing, and drawing on the greenwashing literature that mainly upholds the theory that regulation contributes to a reduction in greenwashing practices (Cho et al., 2015; Delmas and Burbano, 2011; Vos, 2009; Yang et al., 2020), we test the following hypothesis:

Hypothesis 1. The number of countries' climate-related laws is negatively related to firms' likelihood to engage in greenwashing activities.

In addition to the number of climate change laws, monitoring and enforcement mechanisms are also essential to promote corporate carbon mitigation (Campbell, 2007). Thus, despite the existence of substantial environmental legislation, a lack of rigor in its application may lead to organizations' not reducing their environmental impact, while utilizing their voluntary disclosure as a self-laudatory tool (Mobus, 2005). In this sense, Haque and Ntim (2018) claim that regulations without suitable monitoring and enforcement mechanisms are unlikely to be successful in significantly reducing GHG emissions.

With regard to research into greenwashing more specifically, it is generally considered to be the case that stricter regulations imply the reduction of greenwashing on the part of companies (Gatti et al., 2019; Kim and Lyon, 2015; Yu et al., 2020). Similarly, Delmas and Burbano (2011) establish that more stringent and more thoroughly enforced regulation constitutes the most direct means to reducing greenwashing. Likewise, Bowen (2014) and Marquis and Qian (2014) consider monitoring to be an important factor in ensuring that social initiatives, such as the reduction of environmental impact, are substantively adopted. Greater levels of regulatory stringency may expose organized hypocrite and organizational façades (Cho et al., 2015), thereby undermining the confidence and good faith that supports the decoupling (Meyer and Rowan, 1977). In this way, more stringent regulation leads to organizations' engaging in decoupling to a lesser extent (Boxenbaum and Jonsson, 2017).

Furthermore, a more lax and uncertain regulatory environment is considered to be a key driver of greenwashing (Delmas and Burbano, 2011). Also, as Bowen (2014) indicates, if the monitoring of organizational behavior is weak, the likelihood of a symbolic adoption of environmental practices will be higher. In this respect, Laufer (2003) argues that the absence of verification and external monitoring increases the likelihood of deception on the part of organizations and, consequently, he recommends the participation of an independent third party together with organizations and regulators.

Despite the aforementioned arguments which uphold the role of more stringent regulation in reducing greenwashing activities, Roulet and Touboul (2015) consider the potential of the opposing argument. Thus, in more liberal economies where individual responsibility prevails, organizations may experience greater pressure to tackle social and environmental issues due to the more minor role played by the government. In this context, individuals are more susceptible to unethical behavior, and organizations fill the institutional void created by weak and less stringent regulation by substantively reducing their environmental impact in the interest of their stakeholders' welfare (Roulet and Touboul, 2015). Therefore, in contexts where greater levels of individual responsibility exist, it is also possible that the likelihood of greenwashing will be lower due to the role played by organizations in compensating for decreased levels of governmental responsibility, including the monitoring of regulatory compliance. Based on the previous greenwashing literature which identifies the stringency of regulation as the principal factor that contributes to the reduced participation of companies in greenwashing practices (Bowen, 2014; Delmas and Burbano, 2011; Gatti et al., 2019; Kim and Lyon, 2015; Laufer, 2003; Yang et al., 2020), we propose our second hypothesis:

Hypothesis 2. Countries' climate-related regulatory stringency is negatively related to firms' propensity to engage in greenwashing practices

3. Methods

3.1. Sample

Initially the sample was composed of 1521 companies from 12 countries that participated in the 2015 CDP report and made their data public. More specifically, the countries considered in the sample are Australia, Canada, France, Germany, India, Italy, Japan, South Africa, South Korea, Turkey, the United Kingdom, and the United States of America. However, the initial sample was reduced due to the following exclusions: financial companies (321) (Luo, 2019); firms which were duplicates in the CDP reports (7) or which were subsidiaries (20); and companies with missing financial or carbon-emissions data as available in Datastream (455). Subsequently, due to the construction of the dependent variable, a further 274 companies were eliminated from the remaining sample since their CDP disclosure score was lower than 94 points.[2] The final sample therefore consists of 444 firms from 12 different countries, operating in several sectors as per GICS.[3]

For the most part, the data was manually retrieved from the 2015 CDP report for each country considered in the sample. The CDP climate reports include a list of firms that replied to the CDP climate questionnaire, and also indicate their corresponding CDP disclosure score, which measures the quality, comprehensiveness and completeness of the information reported in a firm's response to the CDP climate questionnaire (Lemma et al., 2019; Mateo-Márquez et al., 2020). The CDP is recognized as an effective mechanism for providing valuable information regarding organizations' carbon performance and management (Datt et al., 2019; Tang and Demeritt, 2018). Thus, CDP data has been considered in several previous studies on firms' environmental disclosures (Guo et al., 2020; Lemma et al., 2019; Luo, 2019; Mateo-Márquez et al., 2021; Tang and Demeritt, 2018). While the CDP is able to provide relevant carbon information and contribute to changing undesirable corporate activity (Crawford and Williams, 2010), it may also constitute a means to make symbolic use of environmental information, thereby allowing companies to obtain good publicity at a low cost (Knox-Hayes and Levy, 2011). From 2016 onwards, the CDP has simplified the scoring system for CDP climate reports by the use of a letter score (A-E) and has ceased to provide the numeric score as utilized in 2015. This study focuses on the CDP report from 2015 because at that time, the CDP disclosure score was based on a numeric score (0–100), which allows us to better determine firms' carbon performance and therefore permits a more robust construction of the dependent variable used in this study.

Carbon emissions data required for the calculation of the dependent variable was extracted from the Datastream database. Country-level data was collected from different sources: firstly, data regarding the total number of regulations related to climate change of countries in the sample was obtained from the Grantham Research Institute on Climate Change and the Environment (GRICCE), as available on its website; and secondly, data on the stringency of regulation was retrieved from the Factor 6.1. Effective Regulatory Enforcement from the Rule of Law Index, which is produced and published by the World Justice Project (WJP). Financial data needed for calculating firm-level control variables was gathered from Refinitiv Eikon Datastream.

3.2. Empirical models and variable definitions

This study uses the following econometric model in order to analyze companies' propensity to engage in greenwashing activities (1):

$$Greenwashing_{i,t} = \beta_0 + \beta_1 Laws_{i,t-1} + \beta_2 Rigor_{i,t-1} + \beta_3 Size_{i,t-1} + \beta_4 Profitability_{i,t-1} + \beta_5 Risk_{i,t-1} + \beta_{6-13} Industry + \varepsilon \quad (1)$$

Equation (1) is a probit model where the outcome variable is equal to one if a firm engaged in greenwashing in 2015, and zero otherwise. In Equation (1), i refers to the individual firm and t denotes the time period. Table 1 details the variables included in Equation (1).

We used the work of Delmas and Burbano (2011) as the basis for the construction of the dependent variable. According to these authors, greenwashing firms are characterized by performing two actions simultaneously: (1) reporting positive communication regarding their environmental performance; and (2) having poor environmental performance. On the contrary, non-greenwashing firms (also defined as "vocal green firms" (Delmas and Burbano, 2011)) are described as: (1) reporting positive communication regarding their environmental performance; and (2) having good environmental performance. In this sense, both greenwashing firms and non-greenwashing firms report positive communication concerning their environmental performance, but they differ in terms of their environmental performance, since greenwashing firms perform poorly while non-greenwashing firms perform well.

We used the 2015 CDP score in order to identify companies which report positive communication about their environmental performance. As shown in Table 2, the majority of firms in the sample received a high CDP score, and in fact the mean CDP score of sample firms is on the high side (91.08 points). More specifically, over 60% of firms in the sample achieved a CDP score of greater than 94 points. This indicates that those companies that did decide to respond to the CDP report included high-quality environmental data (Mateo-Márquez et al., 2021). Therefore,

Table 1
Definitions of variables.

Variables	Description	Source
Dependent variable		
Greenwashing	A dichotomous variable which is equal to 1 if the firm engaged in greenwashing in 2015, and 0 otherwise.	CDP & Datastream
Independent variables		
Laws (−)	Number of regulations related to climate change in a country.	GRICCE
Rigor (−)	Based on factor 6.1. Effective Regulatory Enforcement from Rule of Law Index produced and published by the WJP. This index reflects whether a country's rules and laws are effectively enforced. It has a range from 0 to 1, with 1 being the most effective.	WJP
Control variables		
Size	This represents the natural logarithm of firms' total assets.	Datastream
Profitability	Return on assets. Calculated by earnings before interest and taxes divided by total assets.	Datastream
Risk	Reflects companies' risk exposure, calculated as the inverse of companies' solvency ratio.	Datastream
Sectors	Dummy variables for each industry (GICS).	Datastream

Notes: GRICCE = Grantham Research Institute on Climate Change and the Environment. WJP = World Justice Project. GICS = Global Industry Classification Standard. Expected sign of independent variables is indicated in parentheses.

[2] Kim and Lyon (2015) used the term "brownwashing" to refer to those companies that carry out substantive actions to improve their environmental performance, but who disclose information that understates their environmental achievements. We have not considered companies such as these in our analysis, since we focus on greenwashing understood as a decoupling strategy. In this respect, and unlike Kim and Lyon (2015), we do not consider brownwashing to be a decoupling strategy because decoupling is based on the symbolic action and the disclosure of positive information by companies in order to achieve legitimacy. Brownwashing, however, implies that companies carry out substantive actions and restrict the disclosure of positive information in this regard for reasons of economic rationality, i.e. to avoid potential penalizations on the part of investors and shareholders given the higher costs involved in companies' undertaking said substantive environmental actions. We therefore consider that the basic assumptions of decoupling do not support Kim and Lyon's (2015) brownwashing definition.

[3] Global Industry Classification Standard.

Table 2
Distribution of the CDP disclosure score of sample firms.

Range	N	%	Mean	S.D.	Min.	Median	Max.
0 < = 2015 CDP score < 50	16	2.23	36.31	12.24	10.00	39.50	49.00
50 < = 2015 CDP score < 70	32	4.46	62.09	5.69	50.00	64.00	69.00
70 < = 2015 CDP score < 85	70	9.75	78.14	4.36	70.00	79.00	84.00
85 < = 2015 CDP score < 94	156	21.73	90.05	2.42	85.00	91.00	93.00
2015 CDP score > = 94	444	61.84	97.54	2.27	94.00	98.00	100.00
Total	718	100.00	91.08	12.56	10.00	94.00	100.00

Notes: N = number of firms; S.D. = standard deviation; Min. = minimum; Max. = maximum.

we assume that a firm has reported positive communication if it received a CDP disclosure score higher than 94 points (the median of sample firms, see Table 2).

Once the companies reporting positive communication had been identified, they were subsequently classified as good or poor environmental performers by considering their carbon performance. Different methods exist for determining a firm's environmental performance (Delmas and Burbano, 2011), but in this case, for the sake of simplicity, we have used firms' carbon intensity ratio, computed as firms' total Scope 1 GHG emissions divided by their total revenues (in thousands of US dollars) (Datt et al., 2019). Therefore, the higher the carbon intensity ratio of a firm, the poorer its environmental performance. Scope 2 GHG emissions (primarily indirect emissions resulting from electricity consumption) are not considered since certain authors cast doubts as to how these emissions are measured (Datt et al., 2019; Schmidt, 2009). In addition, researchers have also stated that it is difficult to determine and compare Scope 3 GHG emissions among firms (Huang et al., 2009). Thus, this study measures carbon intensity based on Scope 1 GHG emissions since these are direct GHG emissions from sources that are directly owned or managed by a firm (Datt et al., 2019; Lemma et al., 2019). This measurement of carbon intensity allows us to better compare carbon data among firms as it is not based on absolute emissions (Lemma et al., 2019; Matsumura et al., 2014).

Subsequently, we tabulated firms' carbon intensity data by quartiles (see Table 3) in order to compare their data with the mean of their sector-quartile. Therefore, in line with Delmas and Burbano (2011), the dependent variable (Greenwashing) takes a value of one when a company reports a positive communication and has poor environmental performance, i.e. it has a CDP disclosure score greater than 94 points and its carbon intensity is situated in quartiles 3 or 4 depending on its sector. Conversely, the Greenwashing variable is equal to zero when a firm reports positive communication and has good environmental performance, i.e. it received a CDP score greater than 94 points and its carbon intensity is situated in quartiles 1 or 2 (meaning that the company is one of the least carbon intensive in its sector, see Table 3). Consistent with previous studies (Hsueh, 2019; Luo, 2019), the sectors with the highest mean of carbon intensity are Utilities, Energy and Materials. Conversely, the least carbon intensive sectors are Telecommunication Services, Information Technology and Health Care.

In order to test the hypotheses of this study, two independent variables were incorporated into Model 1 (Laws and Rigor). The Laws variable indicates the number of climate-related regulatory pieces of a country. We collected this data from the Climate Change Laws of the World database, operated by GRICCE as part of a broader research area that covers topics related to climate change issues in light of different institutional contexts (GRICCE, 2022). It specifically includes the number of climate laws, policies and litigation cases that exist globally. This study focuses on the legislative portfolio contained in this database, which comprises rules and laws that have been promulgated by parliament and other regulatory bodies.

The Rigor variable reflects whether a country's rules and laws are effectively enforced. More specifically, this variable is based on Factor 6.1. Effective Regulatory Enforcement from the Rule of Law Index, and reflects the level of implementation and enforcement of government regulations, considering specific environment-related laws (World Justice Project, 2015). It has a range from 0 to 1, with 1 being the most effective. Model 1 also includes three firm-level control variables (Size, Profitability and Risk), which previous studies have associated with corporate greenwashing (Roulet and Touboul, 2015). All the continuous variables were winsorized at 1% in the upper and lower tails of the distribution. Eight sector dummies based on GICS were also included in Model 1 in order to control for sector fixed effects.

4. Results and discussion

4.1. Overview of climate change laws by country

Table 4 provides the distribution of firms by country, along with statistics corresponding to firms' greenwashing behavior.

As can be seen, firms in the United States of America constitute the largest group and represent 24% of the whole sample (106 out of 444). The second largest group is comprised by firms from the United Kingdom (81), followed by companies headquartered in Japan (68) and South Africa (36). It is worth noting that certain countries such as Turkey and India have fewer than 15 observations.

South Korea (16) has the highest number of climate change laws, followed by Japan (14), and Germany (11). In addition, Australia, the

Table 3
Breakdown of average carbon intensity by sector.

GICS Sector	Q1		Q2		Q3		Q4		Total firms	Mean
	N	Mean	N	Mean	N	Mean	N	Mean		
Consumer Discretionary	16	0.00	15	0.00	27	0.02	17	0.13	75	0.04
Consumer Staples	12	0.00	18	0.02	11	0.04	12	0.24	53	0.07
Energy	7	0.05	5	0.25	7	0.42	5	1.61	24	0.53
Health Care	3	0.00	7	0.01	6	0.01	8	0.03	24	0.02
Industrials	18	0.01	21	0.01	27	0.04	24	0.54	90	0.16
Information Technology	10	0.00	16	0.00	17	0.00	11	0.03	54	0.01
Materials	14	0.05	18	0.18	23	0.40	17	3.16	72	0.93
Telecommunication Services	3	0.00	6	0.00	4	0.00	6	0.01	19	0.00
Utilities	7	0.03	10	0.27	9	1.07	7	6.63	33	1.79
Total	90	0.02	116	0.07	131	0.18	107	1.19	444	0.36

Notes: *Mean* represents average carbon intensity by industry. Carbon intensity is calculated as firms' total Scope 1 GHG (tons of CO2) emissions divided by their total revenues (in thousands of US dollars).

Table 4
Distribution of the climate-related regulative context and firms by country.

Country	Laws	Rigor	Greenwashing = 0		Greenwashing = 1		Total	%
			N	%	N	%		
Australia	10	0.78	6	35.29	11	64.71	17	3.83
Canada	3	0.70	9	45.00	11	55.00	20	4.50
France	4	0.72	15	42.86	20	57.14	35	7.88
Germany	11	0.69	12	48.00	13	52.00	25	5.63
India	4	0.38	2	15.38	11	84.62	13	2.93
Italy	10	0.56	6	40.00	9	60.00	15	3.38
Japan	14	0.70	37	54.41	31	45.59	68	15.32
South Africa	5	0.51	16	44.44	20	55.56	36	8.11
South Korea	16	0.62	14	56.00	11	44.00	25	5.63
Turkey	9	0.55	1	33.33	2	66.67	3	0.68
United Kingdom	10	0.72	40	49.38	41	50.62	81	18.24
United States	9	0.67	48	45.28	58	54.72	106	23.87
Total			206	46.40	238	53.60	444	100.00

United Kingdom and France possess a stringent regulatory environment, as evidenced by the Rigor variable. In the case of Germany and the United Kingdom, the number of companies engaging in greenwashing is very similar to that of companies not doing so; however, in the case of Australia, the number of companies engaging in greenwashing is almost twice that of those not doing so (see Table 4). This may be due to greater levels of uncertainty existing in Australia with regard to the fight against climate change (Head, 2014). Hence several authors (Delmas and Burbano, 2011; Lyon and Montgomery, 2015) attribute higher levels of organizational participation in greenwashing to the uncertainty of government regulation. Conversely, India, France and Canada have the lowest number of regulatory pieces related to climate change. Regarding regulatory stringency, India, South Africa and Turkey are the countries with the lowest regulatory stringency. It appears that firms located in countries with lower climate-related regulations and lower levels of stringency – such as India or Turkey – are more likely to engage in greenwashing activities.

4.2. Descriptive analyses

Table 5 details the main statistics for both dependent and independent variables. Table 5 Panel A reports the descriptive statistics for total sample firms, while Panels B and C provide similar statistics, respectively, for subsamples of companies that did not engage in greenwashing practices and those that did so.

The mean of the Greenwashing variable is 0.54, indicating that 54% (238 out of 444) of sample firms participated in greenwashing practices. This therefore means that there are 206 (46%) non-greenwashing firms, which is both significant and to be expected given the construction of this variable. The mean of the Laws variable is 9.39, indicating that the sample firms are headquartered in countries which have implemented more than 9 climate-related laws. The Rigor variable shows a mean of 0.67, which signals that the majority of firms are located in countries with stringent regulations.

It can be seen that those firms that did engage in greenwashing, on average, are larger and possess higher levels of risk exposure as compared to those firms that did not engage in greenwashing (see Panels B and C of Table 5). In addition, greenwashing firms belong to countries whose number of climate-related laws is slightly lower than the average of firms in the sample. Furthermore, greenwashing companies are found to be headquartered in countries with less stringent regulations.

Table 6 reports both the Pearson and Spearman correlation coefficients, situated in the lower and upper diagonal of the matrix respectively. As can be seen, the correlation coefficients among pairs of

Table 5
Descriptive statistics.

Panel A. Full sample								
Variable	N	Mean	SD	Min.	P25	Median	P75	Max.
Greenwashing	444	0.54	0.50	0.00	0.00	1.00	1.00	1.00
Laws	444	9.39	3.54	3.00	9.00	10.00	11.00	16.00
Rigor	444	0.67	0.08	0.38	0.67	0.69	0.72	0.78
Size	444	16.50	1.31	12.41	15.68	16.54	17.44	18.88
Profitability	444	0.08	0.08	−0.28	0.04	0.07	0.11	0.37
Risk	444	0.26	0.15	0.00	0.16	0.25	0.38	0.73
Panel B. Greenwashing = 0								
Greenwashing	206	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Laws	206	9.76	3.56	3.00	9.00	10.00	11.00	16.00
Rigor	206	0.67	0.07	0.38	0.67	0.70	0.72	0.78
Size	206	16.35	1.29	13.10	15.50	16.41	17.29	18.88
Profitability	206	0.09	0.08	−0.14	0.05	0.08	0.12	0.37
Risk	206	0.25	0.15	0.00	0.13	0.23	0.35	0.73
Panel C. Greenwashing = 1								
Greenwashing	238	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Laws	238	9.08	3.51	3.00	5.00	9.00	10.00	16.00
Rigor	238	0.66	0.09	0.38	0.67	0.69	0.72	0.78
Size	238	16.63	1.33	12.41	15.74	16.68	17.52	18.88
Profitability	238	0.08	0.08	−0.28	0.04	0.07	0.11	0.37
Risk	238	0.28	0.14	0.00	0.19	0.27	0.38	0.73

Notes: N = Number of firms. P25 and P75 are the 25th and the 75th percentiles of the variables, respectively.

Table 6
Correlation matrix.

Variable	1	2	3	4	5	6
1. Greenwashing	1.00	−0.10**	−0.04	0.11**	−0.11**	0.13***
2. Laws	−0.10**	1.00	0.17***	0.01	−0.15***	0.02
3. Rigor	−0.09*	0.29***	1.00	0.01	−0.14***	−0.01
4. Size	0.10**	−0.08*	0.18***	1.00	−0.08	0.20***
5. Profitability	−0.10**	−0.09*	−0.19***	−0.11**	1.00	−0.10**
6. Risk	0.11**	0.04	0.04	0.19***	−0.08*	1.00

Notes: The Pearson and Spearman correlation coefficients are situated in the lower and upper diagonal of the matrix respectively. * = correlation is significant at 1% level (two-tailed), ** = correlation is significant at 5% level (two-tailed), and *** = correlation is significant at 10% level (two-tailed).

predictor variables are not high or significant, which indicates that there are no multicollinearity problems. In addition, we also computed variance inflation factors (VIF) for all of the models reported in Table 7 in order to determine the existence of multicollinearity. None of the VIF of each independent variable was above 2, which suggests that multicollinearity should not be a problem in our models.

4.3. Regression results and discussion

We used two probit models (equations) in order to analyze the incremental effect of climate-related regulative pressures on greenwashing, and the results are reported in Table 7.

In Model 1 (see column 2 of Table 7), only the Laws variable and control variables are included in the equation. The Laws variable shows a negative and significant coefficient (−0.03, $p < 0.01$). This result suggests that the number of regulations related to climate change in a country does negatively influence the greenwashing behavior of organizations in said country. Model 1 correctly estimated the outcome of the greenwashing behavior of firms for more than 60% of the observations. This finding demonstrates that apart from increasing the likelihood of firms' participating in the CDP (Mateo-Márquez et al., 2020), climate change-related regulation also reduces the probability of companies' engaging in greenwashing (Cho et al., 2015; Delmas and Burbano, 2011; Vos, 2009; Yang et al., 2020), which confirms our first hypothesis. In this sense, the extent of a country's climate change legislation is representative of the importance attributed to it by society (Townshend et al., 2013). Regulation anticipates substantive behavior on the part of organizations in response to environmental issues, which may lead to a loss of legitimacy in the case of those companies not conforming to the social expectations generated by regulation in terms of expected behavior (Mateo-Márquez et al., 2020; Scott, 2014).

Table 7
Regression results.

Model	(1)			(2)		
Variable	Coeff.	z-stat	Sig.	Coeff.	z-stat	Sig.
Independent variables						
Laws (−)	−0.03	−2.61	***	−0.02	−1.76	*
Rigor (−)				−2.06	−2.53	**
Firms' controls						
Size	0.08	1.74	*	0.10	2.19	**
Profitability	−1.59	−1.95	*	−1.94	−2.34	**
Risk	1.14	2.48	**	1.21	2.61	***
Sector controls						
Consumer Staples	−0.40	−1.73	*	−0.46	−1.99	**
Energy	−0.41	−1.35	ns	−0.43	−1.43	ns
Health Care	−0.08	−0.27	ns	−0.13	−0.46	ns
Industrials	−0.09	−0.48	ns	−0.09	−0.48	ns
Information Technology	−0.08	−0.37	ns	−0.13	−0.60	ns
Materials	−0.14	−0.69	ns	−0.22	−1.05	ns
Telecommunication Services	−0.30	−0.88	ns	−0.37	−1.10	ns
Utilities	−0.58	−2.08	**	−0.64	−2.31	**
Observations	444			444		
Log-likelihood	−293.91			−290.61		
Chi^2	25.38***			31.99***		
Pseudo R^2	0.0414			0.0522		
% Correctly predicted	60.36%			61.49%		

Notes: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.10$, ns = $p > 0.10$.

The confirmation of Hypothesis 1 is in line with the argument that when greater levels of competition combined with lower levels regulation exist in a given environment, companies will cut expenses that do not directly lead to subsequent profit maximization and will focus more on symbolic environmental behavior (Roulet and Touboul, 2015). Conversely, in cases where lower levels of regulation exist in a given country, our results do not support the argument that this void will be filled by greater stakeholder pressure on companies to adopt substantive behavior (Jackson and Apostolakou, 2010). More specifically as regards climate change, this may be partially explained by the fact that investors tend to focus primarily on whether companies disclose information or not, as opposed to the quality of the information disclosed (Sullivan and Gouldson, 2012).

In column 3 of Table 7 (Model 2), indicators of the number of laws related to climate change (the Laws variable) along with regulatory stringency (the Rigor variable) are incorporated into the model. The Laws variable presents a negative and significant coefficient, which is consistent with Model 1. The significant negative coefficient of Rigor (−2.06, $p < 0.05$) provides support for our second hypothesis, and indicates that higher levels of regulatory stringency contribute to a decrease in corporate greenwashing (Delmas and Burbano, 2011; Kim and Lyon, 2015; Laufer, 2003). In this respect, our results are similar to those found in the majority of the existing literature (Gatti et al., 2019), which argues that greater monitoring of regulatory compliance increases the probability of companies' adopting environmental initiatives substantively, thereby reducing greenwashing behavior (Bowen, 2014; Haque and Ntim, 2018; Hess and Warren, 2008; Marquis and Qian, 2014; Mobus, 2005). As such, regulatory stringency entails an increase in levels of monitoring as regards the compliance of companies' behavior with the provisions of the law. Greater monitoring increases the probability of greenwashing activity being identified, along with the likelihood that greenwashers, as well as having to face the stipulated punitive consequences (Feinstein, 2013), will also experience a loss of legitimacy (Delmas and Burbano, 2011).

Regulatory stringency undermines one of the principles on which decoupling is based. i.e. the lack of inspection (Meyer and Rowan, 1977), since inspection can reveal organizations' true behavior, as well as identifying activities, such as greenwashing, that do not conform to the institutional pressures of the context (Bowen, 2014). Regulatory stringency contributes to the divulgence of organizational façades (Cho et al., 2015) by making them evident (Bromley et al., 2012). Thus, regulatory stringency leads to lower levels of decoupling on the part of organizations (Boxenbaum and Jonsson, 2017) and, therefore, to a decrease in their use of greenwashing in environmental practices such as the reduction of GHG emissions. In fact, when regulatory stringency is incorporated into Model 2 along with regulation, the model's explicative power increases (pseudo R^2) as compared to Model 1 which only

includes the number of climate-related laws and control variables. This highlights the fact that regulatory stringency reinforces the effect of regulation on the propensity of companies to engage in greenwashing. Thus, our results show that not only is the number of climate-related laws important, but also their stringency, which contributes to mitigate decoupling strategies such as greenwashing.

The control variables considered in this study present a significant statistically relationship and adhere to the patterns of behavior observed in previous studies. The estimated coefficients of the Size variable are positive and significant. Thus larger firms are more likely to engage in greenwashing activities (Roulet and Touboul, 2015; Yu et al., 2020). The Risk variable also presents a positive and significant association with greenwashing, suggesting that companies' propensity to engage in greenwashing behavior increases with their risk exposure (Roulet and Touboul, 2015). Furthermore, the Profitability variable presents a significant and negative relationship with greenwashing, suggesting that more profitable firms are less likely to engage in greenwashing practices (Roulet and Touboul, 2015; Walker and Wan, 2012).

4.4. Robustness checks

Several sensitivity tests were conducted in order to further understand corporate greenwashing behavior. Firstly, we used unwinsorized data to run regressions in order to determine whether the findings of this study are robust to the winsorization operation (which caused a 2% change as regards the original data in the sample). The results (not

Table 8
Robust regressions.

Panel A: Regressions considering alternative measures of the dependent variable

Model	(1)			(2)		
Variable	Coef.	z-stat	Sig.	Coef.	z-stat	Sig.
Independent variables						
Laws (−)	−0.05	−2.47	**	−0.03	−1.82	*
Rigor (−)				−4.12	−2.92	***
Firms' controls						
Size	0.06	0.89	ns	0.11	1.68	*
Profitability	−2.06	−1.47	ns	−2.82	−1.91	*
Risk	1.92	2.61	***	2.25	2.95	***
Sector controls						
Consumer Staples	0.08	0.24	ns	−0.19	−0.51	ns
Energy	−0.55	−1.23	ns	−0.63	−1.38	ns
Health Care	0.37	0.79	ns	0.16	0.33	ns
Industrials	−0.04	−0.16	ns	−0.08	−0.28	ns
Information Technology	0.20	0.56	ns	0.12	0.34	ns
Materials	−0.04	−0.13	ns	−0.30	−0.87	ns
Telecommunication Services	0.26	0.49	ns	0.03	0.07	ns
Utilities	−0.56	−1.28	ns	−0.79	−1.74	*
Observations	197			197		
Log-likelihood	−125.96			−121.28		
Chi^2	19.71*			29.07***		
Pseudo R^2	0.0726			0.107		
% Correctly predicted	62.44%			63.96%		

Panel B: Regressions including the Heckman correction factor (Lamda)

Model	(1)			(2)		
Variable	Coef.	z-stat	Sig.	Coef.	z-stat	Sig.
Independent variables						
Laws (−)	−0.06	−3.34	***	−0.05	−2.10	**
Rigor (−)				−1.87	−1.96	*
Firms' controls						
Size	0.36	2.12	**	0.27	1.97	*
Profitability	−1.33	−1.63	ns	−1.53	−1.74	*
Risk	0.97	2.07	**	1.04	2.16	**
Lambda	1.27	1.22	ns	0.79	0.82	ns
Sector controls						
Consumer Staples	−0.28	−1.21	ns	−0.35	−1.36	ns
Energy	−0.66	−2.06	**	−0.58	−1.70	*
Health Care	−0.16	−0.55	ns	−0.14	−0.48	ns
Industrials	0.06	0.29	ns	0.00	0.02	ns
Information Technology	0.19	0.74	ns	0.07	0.24	ns
Materials	0.07	0.29	ns	−0.04	−0.16	ns
Telecommunication Services	−0.23	−0.66	ns	−0.30	−0.83	ns
Utilities	−0.81	−2.73	***	−0.75	−2.45	**
Observations	444			444		
Log-likelihood	−291.08			−290.88		
Chi^2	31.05***			31.44***		
Pseudo R^2	0.0506			0.0513		
% Correctly predicted	60.81%			60.80%		

Notes: *** = p < 0.01, ** = p < 0.05, * = p < 0.10, ns = p > 0.10.

reported) do not change our main inferences. Secondly, we ran an additional regression where firms from Japan, the UK and the US, which make up half of the sample, were excluded. The results (not tabulated) were consistent to those presented in Table 7. Thirdly, we considered a more robust construction of the dependent variable. More specifically, in order to identify good/poor environmental performers, we only took into account quartiles 1 (good performers) and 4 (poor performers) of carbon intensity by sector. Therefore, for the models presented in Panel A of Table 8, the dependent variable takes a value of one when a company has a CDP score of higher than 94 points and is located among the most polluting companies in its sector, i.e. it is located in the fourth quartile of its sector (see Table 3). On the contrary, the dependent variable takes a value of zero when a company receives a CDP score of higher than 94 points and is situated among the least polluting firms in its industry, i.e. it is situated in first quartile of its sector according to carbon performance (see Table 3). Although the sample is reduced due to the construction of the outcome variable, the statistical results (reported in Panel A of Table 8) are largely consistent with the findings presented in Table 7. Additionally, we considered Scope 1 and Scope 2 emissions in the construction of Greenwashing variable, and this produced similar results. Fourthly, equation (1) was estimated using an Ordinary Least Squares (OLS) model (not reported), and the variables reported similar significance levels.

Finally, given that our sample is based on firms that did respond to the CDP climate survey, along with the fact that companies' participation in this initiative is on a voluntary basis, sample selection bias may be introduced into Equation (1) (Breen, 1996; Luo, 2019). Therefore, in order to address this concern and to correct for sample selection bias, we used a two-stage model (Luo, 2019; Mateo-Márquez et al., 2021). Firstly, we estimated a probit model based on the likelihood of companies' responding to the CDP climate survey, where the dependent variable is equal to 1 if the firm voluntarily participated in the 2015 CDP report, and 0 otherwise. To be consistent, we have used same independent and control variables included in Equation (1). We have subsequently calculated the Heckman correction factor (Lambda), and have included this in Equation (1). The results (presented in Panel B of Table 8) of the second stage model, which includes the Lambda variable, are qualitatively similar to those reported in Table 7.

5. Conclusions

This paper analyzes the impact that both climate change-related regulation and the stringency thereof at the country level have on the propensity of companies to engage in greenwashing. The study's results demonstrate that higher levels of specific climate change-related regulation in a given country reduce the likelihood of organizations' engaging in greenwashing. Likewise, higher levels of stringency pertaining to a country's climate change-related regulative context reduce the propensity of companies to participate in greenwashing activities.

The main contribution of this work to the previous literature is the light it sheds on the current intense academic debate concerning the mentioned factors on the probability of companies to engage in greenwashing, with specific regard the issue of climate change. In this respect, two unique approaches used in this study should be highlighted: firstly, the consideration of countries' legislation as specifically related to climate change; and secondly, the consideration of a broader, country-level dataset in order to contrast the hypotheses formulated. This study also provides a new method for identifying whether companies are engaging in greenwashing or not, based on their score from the CDP questionnaire and their carbon performance. This could greatly facilitate future development of scant existing research into greenwashing explicitly focused on issues related to climate change.

Furthermore, our analysis is also of relevance to the literature concerning institutional decoupling since it considers the influence of the number of climate-related laws separately from their stringency, while the specialized literature considers both within the context of the regulatory pillar and takes for granted that fact that the application of the regulation would imply certain levels of supervision and rigor. Our differentiation between the above two factors in this paper has allowed us to demonstrate how regulatory stringency contributes to reinforcing regulation aimed at deterring climate change-related greenwashing practices because it undermines the "avoidance of inspection and effective evaluation" (Meyer and Rowan, 1977, p. 360) principle on which the decoupling is based. In this sense, our findings also imply that companies will find it increasingly difficult to build an environmental strategy based on greenwashing. Climate change-related regulation is growing at the global level due to increased social awareness together with the need for countries to take measures in order to achieve the objectives set out in international agreements on climate change. Furthermore, the scope for the external scrutiny of corporate behavior is also increasing due to, among other considerations, the development of information technologies and globalization.

Moreover, greenwashing can constitute an important obstacle for companies in terms of improving their competitiveness. Hermundsdottir and Aspelund (2021) show that a positive relationship exists between sustainability innovations and firm competitiveness. Thus, if companies adopt a ceremonial behavior in order to introduce changes in their products or processes with the aim of reducing their GHG gases and consequently improve their environmental performance, then companies will not achieve the competitiveness benefits derived from those changes. In addition, companies in an industrial sector engage in greenwashing, in contrast to those who undertake sustainability innovations on a substantive basis, may even find that their competitiveness weakens over time as compared to their peers.

The findings of this work have also several practical and policy implications. First of all, it provides evidence to regulators that in order for advances to be made as regards the impartiality of carbon reporting, regulation is necessary, together with the monitoring of compliance thereof on the part of organizations. Secondly, it supports activists and other stakeholders in their demands for the veracity of disclosed environmental information, thus revealing how it is that the CDP is used by many companies for the purpose of greenwashing. And thirdly, the results of this study demonstrate the need for progress in terms of specific climate change-related regulation that is both stringent and minimizes uncertainty, thereby reducing greenwashing; increasing stakeholders' confidence in the carbon information disclosed by companies; and encouraging organizations to continue to disclose accurate information regarding their climate change behavior.

Nonetheless, there are certain limitations to this research. Firstly, the sample is restricted to one year only (2015), which is relatively short compared with prior studies on greenwashing (Haque and Ntim, 2018; Roulet and Touboul, 2015). However, its transnational design, which includes 12 institutional contexts and firms operating in a number of different industries, does help to compensate for this limitation. Future research, therefore, may consider analyzing corporate greenwashing and voluntary environmental disclosures over a longer period of time, using additional years of data. In addition, greenwashing can have negative repercussions on the morale of a company's workforce, who over time may also internalize the values of an environmental practice. This in turn can lead to ceremonial organizational behavior developing into substantive behavior in the long term. Thus, another interesting line of research would be to investigate whether with time greenwashing can transform into substantive behavior practices on the part of companies, thereby resulting in tangible improvements in terms of environmental performance. That said, it may prove difficult to conduct longitudinal studies considering CDP data given that the CDP climate survey and its scoring methodology are subject to changes over time. Secondly, the study focuses solely on regulative contexts related explicitly to climate change issues. For this reason, caution should be exercised when extrapolating the results of this work to other institutional environments. Further studies could also analyze corporate greenwashing considering different institutional environments. And finally, given that

the operationalization of greenwashing is limited to the CDP disclosure score and carbon performance, future research could consider other disclosure frameworks in order to proxy firms' corporate greenwashing behavior.

CRediT authorship contribution statement

Antonio J. Mateo-Márquez: Conceptualization, Methodology, Writing – original draft, Funding acquisition. **José M. González-González:** Visualization, Investigation, Writing – review & editing. **Constancio Zamora-Ramírez:** Data curation, Methodology, Software, Validation, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Bowen, F., 2014. After Greenwashing: Symbolic Corporate Environmentalism and Society. Cambridge University Press.
Boxenbaum, E., Jonsson, S., 2017. Isomorphism, diffusion and decoupling: concept evolution and theoretical challenges. Sage handb. Organ. Institutionalism 2, 77–101.
Breen, R., 1996. Regression Models: Censored, Sample Selected, or Truncated Data. Sage, Thousand Oaks.
Bromley, P., Powell, W.W., 2012. From smoke and mirrors to walking the talk: decoupling in the contemporary world. Acad. Manag. Ann. 6, 483–530. https://doi.org/10.1080/19416520.2012.684462.
Bromley, P., Hwang, H., Powell, W.W., 2012. Decoupling revisited: common pressures, divergent strategies in the US nonprofit sector. Management 15, 469–501. https://doi.org/10.3917/mana.155.0469.
Bruton, G.D., Ahlstrom, D., Li, H., 2010. Institutional theory and entrepreneurship: where are we now and where do we need to move in the future? Entrep. Theory Pract. 34, 421–440. https://doi.org/10.1111/j.1540-6520.2010.00390.x.
Campbell, J.L., 2007. Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility. Acad. Manag. Rev. 32, 946–967. https://doi.org/10.5465/amr.2007.25275684.
Cho, C.H., Laine, M., Roberts, R.W., Rodrigue, M., 2015. Organized hypocrite, organizational façades, and sustainability reporting. Account. Org. Soc. 40, 78–94. https://doi.org/10.1016/j.aos.2014.12.003.
Crawford, E.P., Williams, C.C., 2010. Should corporate social reporting be voluntary or mandatory? Evidence from the banking sector in France and the United States. Corp. Gov. Int. J. Bus. Soc. 10, 512–526. https://doi.org/10.1108/14720701011069722.
Datt, R.R., Luo, L., Tang, Q., 2019. Corporate voluntary carbon disclosure strategy and carbon performance in the USA. Account. Res. J. 32, 417–435. https://doi.org/10.1108/ARJ-02-2017-0031.
Deegan, C., 2002. The legitimising effect of social and environmental disclosures–a theoretical foundation. Accounting, Audit. Account. J 15, 282–311. https://doi.org/10.1108/09513570210435852.
Delmas, M.A., Burbano, V.C., 2011. The drivers of greenwashing. Calif. Manag. Rev. 54, 64–87. https://doi.org/10.1525/cmr.2011.54.1.64.
Delmas, M.A., Montes-Sancho, M.J., 2010. Voluntary agreements to improve environmental quality: symbolic and substantive cooperation. Strat. Manag. J. 31, 575–601. https://doi.org/10.1002/smj.826.
DiMaggio, P.J., Powell, W.W., 1983. The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. Am. Socio. Rev. 48, 147–160. https://doi.org/10.2307/2095101.
Doan, M.H., Sassen, R., 2020. The relationship between environmental performance and environmental disclosure: a meta-analysis. J. Ind. Ecol. 24, 1140–1157. https://doi.org/10.1111/jiec.13002.
Feinstein, N., 2013. Learning from past mistakes: future regulation to prevent greenwashing. Boston Coll. Environ. Aff. Law Rev. 40, 229.
Freedman, M., Jaggi, B., 2005. Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. Int. J. Account. 40, 215–232. https://doi.org/10.1016/j.intacc.2005.06.004.
Gatti, L., Seele, P., Rademacher, L., 2019. Grey zone in–greenwash out. A review of greenwashing research and implications for the voluntary-mandatory transition of CSR. Int. J. Corp. Soc. Responsib. 4, 6–21. https://doi.org/10.1186/s40991-019-0044-9.
Gonzalez, J.M.G., Ramírez, C.Z., 2016. Organisational communication on climate change. Int. J. Clim. Chang. Strateg. Manag. 8, 286–316. https://doi.org/10.1108/IJCCSM-10-2014-0126.
Grauel, J., Gotthardt, D., 2016. The relevance of national contexts for carbon disclosure decisions of stock-listed companies: a multilevel analysis. J. Clean. Prod. 133, 1204–1217. https://doi.org/10.1016/j.jclepro.2016.05.182.
GRICCE, 2022. Climate Change Laws of the World [WWW Document]. URL. https://climate-laws.org/, 7.14.17.
Griffin, P.A., Lont, D.H., Sun, E.Y., 2017. The relevance to investors of greenhouse gas emission disclosures. Contemp. Account. Res. 34, 1265–1297. https://doi.org/10.1111/1911-3846.12298.
Guo, T., Zha, G., Lee, C.L., Tang, Q., 2020. Does corporate green ranking reflect carbon-mitigation performance? J. Clean. Prod. 277, 123601 https://doi.org/10.1016/j.jclepro.2020.123601.
Haque, F., Ntim, C.G., 2018. Environmental policy, sustainable development, governance mechanisms and environmental performance. Bus. Strat. Environ. 27, 415–435. https://doi.org/10.1002/bse.2007.
Head, B.W., 2014. Evidence, uncertainty, and wicked problems in climate change decision making in Australia. Environ. Plann. C Govern. Pol. 32, 663–679. https://doi.org/10.1068/cl240.
Hermundsdottir, F., Aspelund, A., 2021. Sustainability innovations and firm competitiveness: a review. J. Clean. Prod. 280, 124715.
Hess, D., Warren, D.E., 2008. The meaning and meaningfulness of corporate social initiatives. Bus. Soc. Rev. 113, 163–197. https://doi.org/10.1111/j.1467-8594.2008.00317.x.
Hrasky, S., 2012. Carbon footprints and legitimation strategies: symbolism or action? Accounting, Audit. Account. J. 25 (1), 174–198. https://doi.org/10.1108/09513571211191798.
Hsueh, L., 2019. Voluntary climate action and credible regulatory threat: evidence from the carbon disclosure project. J. Regul. Econ. 56, 188–225. https://doi.org/10.1007/s11149-019-09390-z.
Huang, Y.A., Weber, C.L., Matthews, H.S., 2009. Categorization of scope 3 emissions for streamlined enterprise carbon footprinting. Environ. Sci. Technol. 43, 8509–8515. https://doi.org/10.1021/es901643a.
Jackson, G., Apostolakou, A., 2010. Corporate social responsibility in Western Europe: an institutional mirror or substitute? J. Bus. Ethics 94, 371–394. https://doi.org/10.1007/s10551-009-0269-8.
World Justice Project, 2015. World Justice Project - Rule of Law Index 2015.
Kim, E.-H., Lyon, T.P., 2011. Strategic environmental disclosure: evidence from the DOE's voluntary greenhouse gas registry. J. Environ. Econ. Manag. 61, 311–326. https://doi.org/10.1016/j.jeem.2010.11.001.
Kim, E.-H., Lyon, T.P., 2015. Greenwash vs. brownwash: exaggeration and undue modesty in corporate sustainability disclosure. Organ. Sci. 26, 705–723. https://doi.org/10.1287/orsc.2014.0949.
Knox-Hayes, J., Levy, D.L., 2011. The politics of carbon disclosure as climate governance. Strat. Organ. 9, 91–99. https://doi.org/10.1177/1476127010395066.
Laufer, W.S., 2003. Social accountability and corporate greenwashing. J. Bus. Ethics 43, 253–261. https://doi.org/10.1023/A:1022962719299.
Lemma, T.T., Feedman, M., Mlilo, M., Park, J.D., 2019. Corporate carbon risk, voluntary disclosure, and cost of capital: South African evidence. Bus. Strat. Environ. 28, 111–126. https://doi.org/10.1002/bse.2242.
Luo, L., 2019. The influence of institutional contexts on the relationship between voluntary carbon disclosure and carbon emission performance. Account. Finance 59, 1235–1264. https://doi.org/10.1111/acfi.12267.
Luo, L., Tang, Q., Lan, Y., 2013. Comparison of propensity for carbon disclosure between developing and developed countries. Account. Res. J. 26, 6–34. https://doi.org/10.1108/ARJ-04-2012-0024.
Lyon, T.P., Montgomery, A.W., 2015. The means and end of greenwash. Organ. Environ. 28, 223–249. https://doi.org/10.1177/1086026615575332.
MacKay, B., Munro, I., 2012. Information warfare and new organizational landscapes: an inquiry into the ExxonMobil–Greenpeace dispute over climate change. Organ. Stud. 33, 1507–1536. https://doi.org/10.1177/0170840612463318.
Marquis, C., Qian, C., 2014. Corporate social responsibility reporting in China: symbol or substance? Organ. Sci. 25, 127–148. https://doi.org/10.1287/orsc.2013.0837.
Marquis, C., Toffel, M.W., 2012. When Do Firms Greenwash?: Corporate Visibility, Civil Society Scrutiny, and Environmental Disclosure. Harvard Business School Boston, MA.
Marquis, C., Toffel, M.W., Zhou, Y., 2016. Scrutiny, norms, and selective disclosure: a global study of greenwashing. Organ. Sci. 27, 483–504. https://doi.org/10.1287/orsc.2015.1039.
Mateo-Márquez, A.J., González-González, J.M., Zamora-Ramírez, C., 2020. Countries' regulatory context and voluntary carbon disclosures. Sustain. Accounting, Manag. Policy J. 11, 383–408. https://doi.org/10.1108/SAMPJ-11-2018-0302.
Mateo-Márquez, A.J., González-González, J.M., Zamora-Ramírez, C., 2021. Components of countries' regulative dimensions and voluntary carbon disclosures. Sustainability 13, 1–22. https://doi.org/10.3390/su13041914.
Matsumura, E.M., Prakash, R., Vera-Muñoz, S.C., 2014. Firm-value effects of carbon emissions and carbon disclosures. Account. Rev. 89, 695–724. https://doi.org/10.2308/accr-50629.
Meyer, J.W., Rowan, B., 1977. Institutionalized organizations: formal structure as myth and ceremony. Am. J. Sociol. 83, 340–363. https://doi.org/10.1086/226550.
Mobus, J.L., 2005. Mandatory environmental disclosures in a legitimacy theory context. Accounting. Audit. Account. J 18, 492–517. https://doi.org/10.1108/09513570510609333.

Pope, S., Wæraas, A., 2016. CSR-washing is rare: a conceptual framework, literature review, and critique. J. Bus. Ethics 137, 173–193. https://doi.org/10.1007/s10551-015-2546-z.

Prado-Lorenzo, J.-M., Rodríguez-Domínguez, L., Gallego-Álvarez, I., García-Sánchez, I.-M., 2009. Factors influencing the disclosure of greenhouse gas emissions in companies world-wide. Manag. Decis. 47, 1133–1157. https://doi.org/10.1108/00251740910978340.

Rosenberg, M., Berrone, P., Rousseau, H., 2019. Environmental sensibility and firm strategic actions: how to become sustainable while avoiding greenwashing. In: General Management in Latin and Ibero-American Organizations, pp. 78–97.

Roulet, T.J., Touboul, S., 2015. The intentions with which the road is paved: attitudes to liberalism as determinants of greenwashing. J. Bus. Ethics 128, 305–320. https://doi.org/10.1007/s10551-014-2097-8.

Schmidt, M., 2009. Carbon accounting and carbon footprint–more than just diced results? Int. J. Clim. Chang. Strateg. Manag. 1, 19–30. https://doi.org/10.1108/17568690910934372.

Scott, W.R., 2014. Institutions and Organizations : Ideas, Interests, and Identities, fourth ed. Sage, Thousand Oaks.

Siano, A., Vollero, A., Conte, F., Amabile, S., 2017. "More than words": expanding the taxonomy of greenwashing after the Volkswagen scandal. J. Bus. Res. 71, 27–37. https://doi.org/10.1016/j.jbusres.2016.11.002.

Stokes, B., Wike, R., Carle, J., 2015. Global concern about climate change, broad support for limiting emissions. Pew Res. Cent. 5, 1–43.

Sullivan, R., Gouldson, A., 2012. Does voluntary carbon reporting meet investors' needs? J. Clean. Prod. 36, 60–67. https://doi.org/10.1016/j.jclepro.2012.02.020.

Tang, S., Demeritt, D., 2018. Climate change and mandatory carbon reporting: impacts on business process and performance. Bus. Strat. Environ. 27, 437–455. https://doi.org/10.1002/bse.1985.

Tang, Q., Luo, L., 2016. Corporate ecological transparency: theories and empirical evidence. Asian Rev. Account. 24, 498–524. https://doi.org/10.1108/ARA-01-2015-0007.

Townshend, T., Fankhauser, S., Aybar, R., Collins, M., Landesman, T., Nachmany, M., Pavese, C., 2013. How national legislation can help to solve climate change. Nat. Clim. Change 3, 430–432. https://doi.org/10.1038/nclimate1894.

Vos, J., 2009. Actions Speak Louder than Words: Greenwashing in Corporate America, vol. 23. Notre Dame JL Ethics Pub. Pol'y, pp. 673–697.

Walker, K., Wan, F., 2012. The harm of symbolic actions and green-washing: corporate actions and communications on environmental performance and their financial implications. J. Bus. Ethics 109, 227–242. https://doi.org/10.1007/s10551-011-1122-4.

Yang, Z., Nguyen, T.T.H., Nguyen, H.N., Nguyen, T.T.N., Cao, T.T., 2020. Greenwashing behaviours: causes, taxonomy and consequences based on a systematic literature review. J. Bus. Econ. Manag. 21, 1486–1507. https://doi.org/10.3846/jbem.2020.13225.

Yu, E.P., Van Luu, B., Chen, C.H., 2020. Greenwashing in environmental, social and governance disclosures. Res. Int. Bus. Finance 52, 101192. https://doi.org/10.1016/j.ribaf.2020.101192.