Received: 6 December 2021 | Revised: 26 October 2022 | Accepted: 27 October 2022
DOI: 10.1111/corg.12504

ORIGINAL ARTICLE

WILEY

Climate-linked compensation, societal values, and climate change impact: International evidence

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Abstract

Research question/issue: We examine whether linking executive compensation to climate-related performance is associated with better firm-level climate change impact. We also explore the interaction of culture and climate-linked incentive compensation with climate change impact.

Research findings/insights: Using firm-level climate change strategy and carbon emissions to measure climate change impacts, we find that climate-linked compensation is associated with improved climate change strategy. Climate-related incentives for the CEO and other (operational) executives are found to be negatively associated with firm-level carbon emissions, although the relationship is not as strong; however, no such association is found for climate-linked compensation of the board and top-3 executives. Country-level attitudes to whether solutions for environmental issues are considered a joint (society) responsibility versus an individual's personal responsibility are found to have an effect on the association between climate-linked compensation and climate change impacts. We also find that country-level cultural views enhance the positive association between climate-linked compensation and climate change strategy but not the association with actual firm-level carbon emissions. Further analysis shows that non-US firms drive our study's findings. Finally, improvement in climate strategy is found to have a positive effect on Tobin's Q but has no effect on profitability.

Theoretical/academic implications: Academic research is growing on the role of climate change risk and carbon emissions in corporate decisions. The findings of our study are important given that linking executives' compensation with climate performance is gaining momentum. To the best of our knowledge, this is the first study to examine any link between climate-linked compensation and climate change impact.

Practitioner/policy implications: While climate-linked compensation is associated with positive changes in climate strategy, its association with firm-level carbon emissions is promising. This is particularly the case when this compensation is offered to executives who are likely to make operational decisions with a direct impact on a firm's carbon footprint and carbon emissions.

KEYWORDS
corporate governance, climate-related incentives, climate change performance, carbon emissions, international

1 | INTRODUCTION

Climate change events related to extreme weather volatility are costly to societies and can hurt firm growth and performance (Economic Intelligence Unit [EIU], 2015). However, many reasons can explain why managers have little incentive to reduce their firm's climate footprint to address the challenges of tackling climate change. Environmentally friendly activities generally require thought and effort before they can be implemented, and typically, they are not the firm's primary focus. With uncertain and difficult to measure costs involved in responding to climate change, the firm's longer-term performance may be affected (possibly after the current executives are gone). Furthermore, executives can rationally conclude that polluting is value-maximizing for shareholders, as Shapira and Zingales (2017) illustrate with a basic present value analysis using information from court documents from a case involving a well-respected firm. This largely occurs as the environment is an externality to a firm. Conversely, Chief Executive Officers (CEOs) may perceive climate-related investments as long-term strategic investments that ultimately improve firm performance. This is more likely to occur when more individuals in a society have positive attitudes towards environmentally friendly policies and actions—for example, they are willing to pay a premium for climate-friendly products. In addition, management may be more likely to make climate-related investments if society has positive attitudes towards government regulation of shared resources, making costs common to all competitors. In these cases, the attitudes of society make it more likely that these investments will have a positive effect on firm value, thereby providing an incentive for firms to make such investments. Yet, a firm's environmental performance is not the primary goal of its business activity, so it is not clear if executives will pursue these activities even when society values the environment.

One direct way to incentivize climate-friendly choices is to reward executives for their efforts to address environmental issues, as managers are more likely to pay attention to climate-related policies that directly benefit them. In this research, we examine whether linking executive pay to the firm's climate-related activities is associated with improving the firm's activities related to climate change. Furthermore, we explore whether this is affected by a society's attitudes towards the environment. The effects of climate-linked compensation may be stronger in societies that place a higher value on the environment.

Using a dataset that covers 40 countries from 2006 to 2018, we examine whether a link exists between executives' compensation and climate change impact, employing two unique measures for the latter. The first climate change impact measure is the CCPS from the CDP (previously, Carbon Disclosure Project), which measures a firm's commitment to addressing its climate-related activities. Firms with strategic goals and objectives to reduce carbon emissions receive higher CDP ratings. However, it might be more costly to reduce pollution than to plan (or signal) to reduce pollution as shown in the case study on Dupont by Shapira and Zingales (2017). An actual reduction in carbon emissions shows a true commitment to reducing the level of climate risk. Our study's second measure of climate change impact is carbon emissions, measured in carbon dioxide equivalent (CO_2-e) metric tons, which reflect substantive outcomes versus strategic objectives. This emissions measure is at the firm level. Our empirical strategy addresses sample selection bias using standard Heckman's (1979) correction; this bias arises from self-selecting as responses to the CDP questionnaire are voluntary. Our measure of climate-linked compensation indicates if the firm provides monetary incentives to management (defined as the following four groups) to focus on climate-related issues: CEOs, top executives (including the CEO), board of directors, and other executives (e.g., energy manager, business unit manager, environment/sustainability manager, facilities manager, process operation manager, procurement manager, public affairs manager, and risk manager).

Our results show that climate-linked compensation is robustly associated with higher CCPSs. When firms link CEO, executive, or board compensation to climate issues, the firm's climate-related performance score is significantly better. The score includes proposed plans and strategies, so the positive relationship does not automatically translate into lower carbon emissions. When we explore the direct effect on climate outcomes, as measured by carbon emissions, we find a weaker link between climate-linked compensation and actual emissions. Specifically, when compensation for the CEO, directors, top executives, or other executives is directly linked to climate change incentives, a significant improvement is observed in the climate change strategy score. To a lesser extent, climate-linked incentives for CEOs and other executives (i.e., non-top executives) are associated with a reduction in carbon emissions, while climate-linked incentives for top executives and directors are not associated with a reduction in carbon emissions. These results are primarily driven by countries excluding the United States (US). As suggested by these results, the link between compensation and climate performance largely improves CCPS but is not significantly related to actual carbon emissions. We further investigate the effect of climate-linked compensation on carbon emissions by decomposing carbon emissions into those that are directly (emitted directly by the company) and indirectly (including supply chain-related) under the firm's control. Linking incentives of executives to climate is shown to primarily affect direct emissions. Only the CEO's climate-linked compensation is associated with a reduction in indirect emissions.

Our cross-country sample allows the exploration of whether cultural attitudes about the environment influence the effectiveness of linking compensation to climate change impact. Henriques and Sadorsky (1999) argue that management's “greenness” depends on how sensitive it is to stakeholder pressures. We expect that the extent of these pressures will depend on a society's attitude towards the environment. The World Values Survey (WVS) is used to create two indices that measure a society's attitude towards the environment: (1) the extent to which environmental issues are considered a joint responsibility to be solved in a society, which we refer to as *Carbon-Society*; and (2) the extent to which taking personal responsibility for the environment is valued, which we refer to as *Carbon-Individual*. More support for government intervention may be present when values for *Carbon-Society* are higher, with the threat of intervention itself possibly being enough to influence firm behavior. Greater demand or willingness to pay more for greener products may exist when values for *Carbon-Individual* are higher, suggesting a market solution to carbon emission issues. Each of these cultural attitudes is found to be positively associated with better CCPS, but neither is significantly associated with lower carbon emissions.

We further explore the interaction of culture and climate-linked incentive compensation with climate performance measures. In countries excluding the US, the positive association between climate-linked incentives, CEO compensation, and the CCPS is strengthened by higher *Carbon-Society* index values. We find similar results for high *Carbon-Individual* index values. However, no significant relationship with carbon emissions is found. Again, evidence supports the view that improvement in CCPS does not produce substantive change in the firm's carbon footprint.

While our focus in this research is on whether climate-linked compensation alters manager behavior, it is natural to question how this affects shareholder value. Improvement in climate strategy is found to have a positive effect on Tobin's Q, but it has no effect on profitability. We divide firms in the sample based on the median *Carbon_Individual* index value and the median *Carbon_Society* value and again conduct the analysis. The results suggest that climate strategy is associated with a reduction in profitability in societies with a lower *Carbon-Individual* index value, that is, societies in which fewer individuals take personal action, such as choosing products that are better for the environment, to improve the environment.

We conduct a quasi-experimental analysis to address potential endogeneity. We explore whether a country's implementation of an emissions trading scheme (ETS) influences the effectiveness of climate-linked incentives. The effectiveness of climate-linked compensation is found to increase after a country establishes an ETS regulation. This is true for compensation for the CEO, top executives (including the CEO), the board, and other executives. However, overall carbon emissions are not reduced after ETS adoption, except for when climate-linked compensation is provided to the category of "other executives." One explanation may be that the "other executives" group captures those executives making operational decisions with a direct impact on the firm's carbon footprint and carbon emissions. For instance, Mike Barry, the Head of Sustainable Business at Marks & Spencer, focused on reducing the firm's carbon footprint with specific actions. Through reducing energy usage, moving to more efficient technologies, and focusing on recycling waste, Marks & Spencer became fully carbon neutral in 2011 (Smithers, 2012). When considering the effect of culture, we find that in countries with higher *Carbon-Society* values the association between climate-linked compensation and climate change performance becomes significantly stronger after ETS adoption.

Academic research is growing on the role of climate change risk and carbon emissions in corporate decisions. Climate change performance and carbon mitigation require substantial resources and long-term strategic commitments from shareholders, boards, and executive management. As countries begin to pass regulations on carbon emissions to address climate change, firms will internalize the cost of carbon emissions, forcing management to focus on mitigating carbon risk (Clarkson et al., 2015). Some researchers conjecture that markets punish firms with higher climate risk and that this risk is related to firm exposure to future regulatory actions through high carbon emissions. For instance, Matsumura et al. (2014), Clarkson et al. (2015), and Griffin et al. (2017) found that equity values are lower for firms with higher carbon emissions. Focusing on debt markets, Herbohn et al. (2019) found that firms with higher carbon risk receive higher loan spreads due to the potential for regulatory actions in the future. As is the case with these studies, we explore the market's role in incentivizing carbon risk reduction. Specifically, we investigate the role of a country's values in climate stewardship that may affect management's sensitivity to stakeholders.

Furthermore, our study explores how firms can incentivize management for the reduction of carbon-associated risks. Daradkeh et al. (2022) find that, generally, the more competent managers are focused on improving climate change disclosures. As in our research, Francoeur et al. (2017) explore the link between total compensation and environmental performance or corporate social responsibility (CSR) in general. They argue that the negative relationship between CEO compensation and climate performance is consistent with CEOs' moral stewardship of the environment, whereby CEOs substitute pecuniary reward for the intrinsic reward of working for a company with higher sustainability scores. Their interpretation contrasts with the growing literature on "greenwashing" that suggests that corporations may paint a picture of being environmental stewards but without substantial improvement in decarbonizing their operations (Lyon & Maxwell, 2011; Moneva et al., 2006). For countries other than the US, climate-linked compensation is found to show promise. This mirrors the observation by Ritz (2022) of "European [Oil & Gas] players … embracing the clean transition more strongly than U.S. peers." We contribute to, and extend, climate change research by providing evidence of the effects of climate-linked incentives which are increasing in popularity.

2 | DATA AND METHODOLOGY

For our study, data on strategy, performance, and compensation related to climate change are required to explore the effect of climate-linked compensation on corporate climate-related activities. Our primary sample consists of firms that responded to the annual CDP climate change questionnaire, these being firms for which we could obtain firm characteristics and compensation data. We address selection bias using an econometric specification that includes not only the firms in our sample but also firms to which CDP provided the questionnaire but chose not to respond. The first year that CDP provided the questionnaire and scored for climate change is 2006; as we employ the CDP2019 version of CDP data, our sample spans 2006–2018.[1] After merging the databases and excluding all incomplete observations, we obtain an initial sample of 3578 firm-year observations across 40 countries from 2006 to 2018.

2.1 | Climate change impact and compensation

We measure climate change impact using two proxies from CDP: the CCPS and the level of carbon emissions. The first measure, *CCPS*, scores firm-level governance and strategy for addressing climate change. This includes a summary of a firm's assessment of its risks and opportunities; initiatives for the reduction of carbon emissions; engagement with value chain partners; and whether the firm has performance metrics and targets regarding activities related to climate change. We follow the methodologies of Botosan and Plumlee (2002) and Daradkeh et al. (2022) to convert climate change scores into percentile ranks within each country and year. Specifically, we compute the percentile rank of climate change performance as (firm rank-1)/(number of firms-1). The resulting score for climate change performance ranges from 0 for the lowest-ranked firm to 1 for the highest-ranked firm, with the highest-ranked firm taking the most beneficial actions for the environment, relatively. Appendix A shows a detailed description of the score.

The second measure of climate change impact is the firm-level total carbon emissions in CO_2-e metric tons (containing both direct and indirect sources of carbon). Firms worldwide publicly report their global carbon emissions, measured in metric tons of CO2-e, dividing them into direct and indirect sources of carbon emissions (WBCSD and WRI, 2004). The benefit of using carbon emissions is that the focus is on outcomes rather than strategy. Higher carbon emissions reflect a firm's risk exposure, including the potential for regulation or taxation of emissions, for example, clean-up, compliance, litigation costs, and reputational damage (Bose et al., 2021; Clarkson et al., 2015; Eccles et al., 2011; Griffin et al., 2017; Matsumura et al., 2014). We decompose total carbon emissions into those that are directly and indirectly related to the firm's activities. Direct sources include carbon emissions produced directly by sources owned or controlled by the firm. Indirect sources include carbon emissions originating from external sources that are not directly managed by the firm but that, nevertheless, are related to its activities, for example, from a firm's use of purchased electricity or energy (World Business Council for Sustainable Development [WBCSD] & World Research Institute [WRI], 2004).

Our compensation-related data relate to climate change incentives and total compensation of executives. Data on climate change incentives are also from the CDP database. In the CDP questionnaire, two questions relate to climate change incentives. The first question is: "Do you provide incentives for the management of climate-related issues, including the attainment of targets?" The second question is: "Provide further details on the incentives provided for the management of climate-related issues," specifically to the CEO, board, top executives, or other. The answers to these questions are used to create indicator variables for whether climate-related incentives are provided to the CEO, board of directors, top executives, or other executives (excluding the CEO, board, and top executives). These variables are denoted as *Climate_CEO*, *Climate_Director*, *Climate_TopExec*, and *Climate_Other*, respectively. We obtain total compensation data for the CEO and other top executives from the Capital IQ database. Compensation comprises salary, bonus, restricted stock, and option grants.

2.2 | Other variables linked to climate outcomes

Stock market and accounting data on firms in our sample are collected from Refinitiv (previously, Thomson Reuters) DataStream and Worldscope databases. We construct and provide descriptions and brief motivations for variables that the prior literature suggests may be linked to climate change performance. These variables comprise firm size *(SIZE)*, profitability *(ROA)*, leverage *(LEV)*, firm age *(FAGE)*, growth opportunities *(MB)*, sales growth *(SGROWTH)*, research & development expenditures *(RDINT)*, capital expenditures *(CAPEX)*, volatility *(VOL)*, foreign sales *(FOREIGN)*, institutional investors' ownership (*INSTOWN*), financial analysts' coverage *(ANALYST)*, and cross-listing status *(CROSS)*. All variables are defined in Appendix B.

Firm size *(SIZE)*, measured as the log of total assets, captures various factors, including public pressures or financial resources that motivate firms to respond to the CDP questionnaire (Matsumura et al., 2014) and to disclose additional information related to climate change (Clarkson et al., 2008; Dhaliwal et al., 2014). The level of carbon emissions and the firm's scale of operations are closely linked (Dahlmann et al., 2019). Firms with higher profitability *(ROA)*, measured as earnings before interest and taxes divided by assets, have more financial resources with which to engage in activities to protect the climate and to meet the relevant compliance performance targets (Clarkson et al., 2011; Qian & Schaltegger, 2017). We control for leverage *(LEV)*, measured as total debt to assets, following Clarkson et al. (2008) who show that debt is associated with better climate-related performance due to the monitoring of environmental risks by debtholders. Older firms, that is, greater firm age measured in years *(FAGE)*, may be more likely to have the infrastructure and financial means to manage climate change issues at a lower cost (de Villiers et al., 2011). Firms with better growth opportunities *(MB)*, measured as the ratio of the market value of equity to the book value of equity, may invest more in environmentally friendly technologies (de Villiers et al., 2011). However, firms in an expansionary period have limited financial resources for climate change performance due to financial constraints (Dhaliwal et al., 2012): Hence, we control for sales growth *(SGROWTH)*, measured as the percentage change in sales. In relation to growth, research and development (R&D) expenditure *(RDINT)*, measured as R&D expenditure divided by total assets, and capital expenditure (*CAPEX*), measured as capital expenditure divided by total assets, affect the need for external funds that may affect disclosure and the cost of external funds (Dhaliwal et al., 2014).

In their study, Clarkson et al. (2008) show that firms with higher information asymmetry have a higher level of environmental disclosures. In our study, our proxy for information asymmetry is stock return volatility *(VOL)*. Firms with foreign operations may face greater pressure to commit to reduce their climate change footprint or, alternatively, may use foreign operations to generate more pollution (Bose et al., 2021). As firms listed on multiple stock exchanges are more visible, they may face pressure to disclose, and improve on, climate performance (Dhaliwal et al., 2012). We measure both foreign sales and cross-listing as indicator variables equal to 1 if the firm has foreign sales or 1 if the firm is cross-listed, and 0 otherwise (*FOREIGN* and

CROSS, respectively). We also control for firm-level relative environmental performance (*ENVPERF*) to capture its impact on a firm's response to the CDP questionnaire, and the disclosure of extensive climate change information and the extent of firm-level carbon emissions. We measure ENVPERF using the environmental performance score from the Refinitiv ESG database. Specifically, we convert the score as the ratio of the difference between the original value of the environmental performance score and the sample minimum value

TABLE 1 Climate-linked incentive compensation by country

	CEO (%)	Board (%)	Top executive (%)	Other executive (%)	Overall (%)	Total sample
Australia	10.94	5.47	52.58	72.34	78.12	329
Austria	20.51	28.21	48.72	92.31	92.31	39
Belgium	13.95	9.30	62.79	88.37	88.37	43
Brazil	2.33	2.33	45.74	80.62	85.27	129
Canada	7.60	2.14	50.59	72.68	76.72	421
Chile	0.00	0.00	14.29	42.86	42.86	7
China	0.00	0.00	50.00	75.00	75.00	8
Colombia	6.67	0.00	53.33	100.00	100.00	15
Czech Republic	0.00	0.00	0.00	0.00	0.00	1
Denmark	6.52	4.35	52.17	56.52	69.57	92
Finland	2.61	0.87	36.52	68.70	74.78	115
France	16.02	18.31	55.61	67.51	80.55	437
Germany	4.55	29.22	67.21	76.30	84.09	308
Hong Kong	5.41	8.11	40.54	78.38	81.08	37
India	16.81	7.56	57.98	82.35	82.35	119
Ireland	15.87	4.76	55.56	82.54	85.71	63
Israel	0.00	0.00	0.00	66.67	66.67	6
Italy	23.58	6.60	55.66	75.47	84.91	106
Japan	2.00	10.18	43.41	83.83	87.23	1002
Luxembourg	0.00	0.00	28.57	42.86	42.86	7
Malaysia	20.00	0.00	60.00	70.00	70.00	10
Mexico	25.00	0.00	75.00	75.00	75.00	20
Netherlands	11.46	36.46	66.67	71.88	84.38	96
New Zealand	2.27	0.00	52.27	79.55	79.55	44
Norway	7.83	3.48	58.26	74.78	81.74	115
Philippines	0.00	0.00	37.50	43.75	43.75	16
Poland	0.00	0.00	100.00	100.00	100.00	2
Portugal	3.57	35.71	32.14	78.57	85.71	28
Russia	0.00	7.14	64.29	64.29	64.29	14
Singapore	2.56	5.13	58.97	84.62	84.62	39
South Africa	19.24	11.00	56.70	72.51	77.32	291
South Korea	4.60	6.90	52.30	88.51	94.25	174
Spain	9.20	17.18	57.06	74.23	85.28	163
Sweden	8.17	0.96	51.92	70.67	74.04	208
Switzerland	2.97	6.93	52.48	82.67	85.15	202
Thailand	11.11	33.33	66.67	77.78	77.78	18
Turkey	1.89	5.66	37.74	79.25	79.25	53
United Arab Emirates	0.00	0.00	0.00	100.00	100.00	3
United Kingdom	10.44	14.47	56.68	77.01	84.89	1092
United States	5.63	4.89	46.67	75.39	78.96	2044

Note: This table presents the country-wise descriptive statistics of climate-linked compensation. Appendix B provides the definitions of variables.

of the country-year-industry-adjusted environmental performance score over the difference between the sample maximum value of country-year-industry-adjusted environmental performance score and the sample minimum value of the country-year-industry-adjusted score.

We measure two external monitoring mechanisms: institutional investors' stock ownership *(INSTOWN)*, measured as institutional share ownership divided by shares outstanding, and financial analysts' coverage *(ANALYST)*, measured by the number of financial analysts, to capture the monitoring effect on disclosure and performance (Dyck et al., 2019). Institutional investors' ownership data are from the FactSet Lionshare database. Analyst forecast data are collected from the Refinitiv Institutional Brokers' Enterprise Systems (I/B/E/S) database.

In addition to firm-level control variables, we have several country-level control variables. We include the log of the gross domestic product *(GDP)*, from the World Bank, and the Global Climate Risk Index *(CRI)* score, from Germanwatch and Climate Action Network (2019), to capture the impact of financial development and climate change risk, respectively. We also control for country-level stakeholder orientation *(STAKE)* and country-level legal environment *(LEGAL)* to capture country-level institutional influences on firm-level climate change impact: *STAKE* is from Simnett et al. (2009), and *LEGAL* is from the World Bank database.

2.3 | Univariate analysis

Table 1 presents details of the percentage of firms in the sample that link compensation directly to carbon incentives for CEOs, the board of directors, top executives (including the CEO), and anyone affiliated with the firm who is not a CEO, a director, or an executive. The final two columns list the percentage of firms with climate-linked compensation and the total number of firms.

In total, 417 firm-year observations (11.6%) of the sample provide CEO compensation that is climate linked. The countries Mexico, Italy, Austria, Malaysia, and South Africa, have the highest percentage of firms in the sample with climate-linked CEO compensation. The top five countries with climate-linked board compensation comprise the Netherlands, Portugal, Thailand, Germany, and Austria. Firm-year observations with climate-linked board compensation represent 11.5% of firms in the sample. The countries Poland, Mexico, Germany, the Netherlands, and Thailand, have a greater percentage of firms in the sample with climate-linked compensation for top executives (including the CEO). Firms with climate-linked top executive compensation represent 55% of firms in the sample. Other top executives ("Other") that do not fall into the above categories represent 78% of firms in the sample, with climate-linked other executive compensation more prevalent among firms in the United Arab Emirates (UAE), Poland, and Colombia, based on the percentage of representation in the sample. It is important to note that, although the percentages seem high, the reason is that, in some countries, the number of firms in the sample is quite small.

Table 2 presents univariate analysis of the characteristics of firms that provide climate-linked incentives and of those that do not provide these incentives. Firms with climate-linked incentives have higher CCPS and lower carbon emissions. Both direct and indirect carbon emissions are found to be lower for firms with climate-linked compensation. Their overall CEO compensation is higher, which may reflect, in part, the additional effort required to pay attention to climate-related issues. These firms are also larger, with size having a robust association with compensation. Firms providing climate-linked incentives and firms that do not provide such incentives are similar in profitability, leverage, and growth opportunities. Although capital expenditures are greater, R&D expenditures are not significantly different. The average analyst following is greater in firms providing climate-linked incentives, but the median analyst following is lower for these firms in comparison with firms that do not provide such incentives, and institutional ownership is similar. Thus, firms with climate-linked incentives at the larger end of the size distribution may be subject to more monitoring.

2.4 | Method

Our sample is systematically biased if the firms that voluntarily disclose climate change-related information to CDP differ from those firms that do not disclose this information. More specifically, factors affecting a firm's CDP performance may be correlated with a firm's choice to disclose these factors in the survey. To correct for sample selection bias, we employ Heckman's (1979) two-stage selection model. In the first stage, we model the likelihood of a firm's response to the questionnaire. In the second stage, we examine the effect of compensation based on climate performance and address selection bias using the inverse Mills ratio (IMR) estimated from the first stage.

Specifically, we employ the following probit model for the first stage, where the dependent variable, *CDP_DISC*, is an indicator equal to 1 if a firm responds to the CDP questionnaire and 0 otherwise:

$$\begin{aligned}CDP\_DISC_{i,t} = {} & \beta_0 + \beta_1 PROPDISC_{i,t} + \beta_2 CDP\_DISC\_LAG_{i,t} + \beta_3 SIZE_{i,t} \\ & + \beta_4 ROA_{i,t} + \beta_5 LEV_{i,t} + \beta_6 FAGE_{i,t} + \beta_7 MB_{i,t} \\ & + \beta_8 INSTOWN_{i,t} + \beta_9 ANALYST_{i,t} + \beta_{10} VOL_{i,t} \\ & + \beta_{11} FOREIGN_{i,t} + \beta_{12} RD\_INT_{i,t} + \beta_{13} CAPEX_{i,t} \\ & + \beta_{14} SGROWTH_{i,t} + \beta_{15} ENV\_PERF_{i,t} + \beta_{16} CROSS_{i,t} \\ & + \beta_{17} LNGDP_{i,t} + \beta_{18} LNCRI_{i,t} + \beta_{19} STAKE_{i,t} + \beta_{20} LEGAL_{i,t} \\ & + \sum Year_{i,t} + \sum Industry_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

To satisfy the exclusion restriction criteria in the first-stage model, two instruments are included in Equation 1: industry pressure to respond to the CDP questionnaire *(PROPDISC)* and whether the firm responded to the CDP questionnaire in the prior year *(CDP_DISC_LAG)*. We measure *PROPDISC* as the proportion of firms that respond to the CDP questionnaire in an industry to the total number of firms in that industry at a country-year level. *CDP_DISC_LAG* is an indicator equal to 1 if the firm responded to the CDP questionnaire in the prior year. Through the differences in means (unreported), firms that responded to the CDP questionnaire are shown to experience

TABLE 2 Climate-linked incentives and no incentives of firms offering climate change measures

	Incentives (Obs = 2984)		No incentives (Obs = 594)		Sig difference (*p* value)	
	Mean	Median	Mean	Median	Mean test	Median test
CCPS	0.536	0.583	0.401	0.375	***	***
LNEMISSION	12.646	12.590	13.235	12.895	**	*
LNDIRECT	7.647	9.212	9.940	10.692	***	***
LNINDIRECT	7.949	10.562	10.053	11.391	***	***
CEO_COMP	14.620	14.881	14.018	14.603	***	***
SIZE	9.179	9.203	8.876	8.945	***	***
ROA	0.048	0.041	0.049	0.044		
LEV	0.253	0.236	0.248	0.237		
FAGE	2.307	2.485	2.195	2.485	***	**
MB	2.963	2.101	2.817	2.115		
INSTOWN	0.578	0.591	0.582	0.588		
ANALYST	5.214	5.308	5.146	5.252	***	**
VOL	0.019	0.017	0.021	0.019	***	***
FOREIGN	0.815	1.000	0.870	1.000	***	***
RDINT	0.020	0.000	0.018	0.000		
CAPEX	0.042	0.033	0.046	0.034	**	*
SGROWTH	0.032	0.027	0.051	0.045	**	***
ENV_PERF	0.328	0.243	0.214	0.000	***	***
CROSS	0.225	0.000	0.178	0.000	**	**
LNGDP	10.571	10.716	10.513	10.743	*	
LNCRI	4.125	4.001	4.121	4.016		
STAKE	0.384	0.000	0.365	0.000		
LEGAL	2.554	2.768	2.523	2.850		

Note: This table shows the comparison of carbon disclosure, carbon emissions, CEO compensation, and firm and corporate governance characteristics between firms that offer carbon incentives and firms that do not, for the sub-sample of firms that provide carbon disclosures. We report the means and medians for the 2984 firms that provide climate-linked incentives and the 594 firms that do not. We test for significant differences between the two groups, performing *t* tests (signed-rank tests) to determine whether the means (medians) for each variable significantly differ across the two groups.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

higher industry pressure and to have higher prior response rates to the CDP questionnaire compared to firms that did not respond.

In the second stage, we employ the following ordinary least squares (OLS) regression in which the dependent variable, *CLIMATE_IMPACT*, is either the climate change performance score *(CCPS)* or the level of carbon emissions *(EMISSION)*:

$$\begin{aligned} CLIMATE\_IMPACT_{i,t+1} = {} & \beta_0 + \beta_1 INCENTIVE_{i,t} + \beta_2 CEO\_Comp_{i,t} \\ & + \beta_3 SIZE_{i,t} + \beta_4 ROA_{i,t} + \beta_5 LEV_{i,t} + \beta_6 FAGE_{i,t} \\ & + \beta_7 MB_{i,t} + \beta_8 INSTOWN_{i,t} + \beta_9 ANALYST_{i,t} \\ & + \beta_{10} VOL_{i,t} + \beta_{11} FOREIGN_{i,t} + \beta_{12} RDINT_{i,t} \\ & + \beta_{13} CAPEX_{i,t} + \beta_{14} SGROWTH_{i,t} \\ & + \beta_{15} ENV\_PERF_{i,t} + \beta_{16} CROSS_{i,t} + \beta_{17} LNGDP_{i,t} \\ & + \beta_{18} LNCRI_{i,t} + \beta_{19} STAKE_{i,t} + \beta_{20} LEGAL_{i,t} \\ & + \beta_{21} IMR_{i,t} + \sum Year_{i,t} + \sum Industry_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where *INCENTIVE* is measured as one of four variables equal to 1 if incentive compensation is linked to climate change impact for: the CEO, board of directors, top executives (including the CEO), and other executives, denoted as *Climate_CEO*, *Climate_Director*, *Climate_TopExec*, and *Climate_Other*, respectively. The category "Other Executives" includes those in positions with the following titles/responsibilities: energy manager, business unit manager, environment/sustainability manager, facilities manager, operations manager, procurement manager, or risk manager. We include *IMR* in the second-stage model to control for self-selection bias. The other variables are described in Sections 2.1 and 2.2. Both the first- and second-stage regressions include year and industry fixed effects. We use industry classifications from Dhaliwal et al. (2012). Robust standard errors are clustered by country to address heteroskedasticity and serial correlation in the regression models.

TABLE 3 Compensation, carbon strategy, and carbon emissions: Full sample

	DV = CCPS				DV = Emissions			
Panel A: Full sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Climate_CEO	0.164*** (0.000)				−0.213* (0.051)			
Climate_Director		0.131*** (0.000)				0.073 (0.398)		
Climate_TopExec			0.079*** (0.000)				−0.011 (0.901)	
Climate_Other				0.070*** (0.000)				−0.171* (0.064)
CEO Comp	0.008*** (0.000)	0.008*** (0.000)	0.008*** (0.000)	0.009*** (0.000)	−0.050*** (0.003)	−0.050*** (0.002)	−0.050*** (0.002)	−0.049*** (0.003)
SIZE	0.066*** (0.000)	0.065*** (0.000)	0.063*** (0.000)	0.064*** (0.000)	0.840*** (0.000)	0.840*** (0.000)	0.841*** (0.000)	0.845*** (0.000)
ROA	−0.064 (0.560)	−0.034 (0.733)	−0.031 (0.750)	−0.067 (0.501)	−6.042*** (0.000)	−6.095*** (0.000)	−6.098*** (0.000)	−6.046*** (0.000)
LEV	0.019 (0.680)	0.012 (0.781)	0.026 (0.570)	0.018 (0.692)	−0.137 (0.575)	−0.138 (0.580)	−0.137 (0.582)	−0.130 (0.596)
FAGE	0.016** (0.012)	0.018*** (0.007)	0.015** (0.024)	0.016** (0.013)	0.070* (0.073)	0.070* (0.077)	0.069* (0.088)	0.070* (0.079)
MB	0.001 (0.378)	0.001 (0.391)	0.001 (0.465)	0.001 (0.511)	−0.066*** (0.007)	−0.066*** (0.007)	−0.066*** (0.007)	−0.065*** (0.007)
INSTOWN	−0.022 (0.309)	−0.024 (0.299)	−0.020 (0.416)	−0.021 (0.391)	−0.066 (0.701)	−0.064 (0.708)	−0.066 (0.704)	−0.072 (0.674)
ANALYST	−0.030* (0.078)	−0.025 (0.124)	−0.026 (0.112)	−0.025 (0.139)	−0.187 (0.224)	−0.190 (0.216)	−0.191 (0.213)	−0.194 (0.203)
VOL	−0.862 (0.353)	−1.060 (0.254)	−1.108 (0.258)	−1.137 (0.219)	17.964** (0.025)	18.272** (0.023)	18.244** (0.024)	18.377** (0.024)
FOREIGN	−0.010 (0.598)	−0.006 (0.723)	−0.005 (0.785)	−0.003 (0.886)	0.067 (0.649)	0.063 (0.670)	0.062 (0.674)	0.053 (0.711)
RDINT	−0.211 (0.269)	−0.189 (0.281)	−0.207 (0.262)	−0.273 (0.170)	−3.748** (0.033)	−3.710** (0.036)	−3.729** (0.034)	−3.570** (0.049)
CAPEX	−0.022 (0.912)	−0.076 (0.684)	−0.131 (0.503)	−0.097 (0.609)	7.326*** (0.004)	7.458*** (0.003)	7.440*** (0.003)	7.426*** (0.003)
SGROWTH	−0.047 (0.100)	−0.044* (0.093)	−0.050* (0.054)	−0.052** (0.041)	0.207 (0.364)	0.222 (0.338)	0.214 (0.349)	0.197 (0.394)
ENV_PERF	0.058*** (0.003)	0.060*** (0.002)	0.063*** (0.001)	0.061*** (0.002)	0.195* (0.076)	0.178 (0.108)	0.182* (0.096)	0.197* (0.071)
CROSS	0.025 (0.175)	0.025 (0.189)	0.022 (0.227)	0.024 (0.173)	0.146 (0.239)	0.139 (0.273)	0.141 (0.268)	0.149 (0.233)
LNGDP	−0.075*** (0.009)	−0.063** (0.019)	−0.072** (0.016)	−0.077** (0.015)	−0.195 (0.241)	−0.182 (0.266)	−0.191 (0.261)	−0.192 (0.258)
LNCRI	0.015 (0.445)	0.036* (0.090)	0.022 (0.266)	0.019 (0.366)	0.101 (0.572)	0.108 (0.548)	0.100 (0.584)	0.104 (0.570)
STAKE	−0.000 (0.983)	−0.015 (0.386)	−0.002 (0.891)	−0.000 (0.997)	−0.160 (0.222)	−0.162 (0.234)	−0.155 (0.248)	−0.158 (0.235)
LEGAL	0.054** (0.024)	0.039 (0.100)	0.046* (0.067)	0.049* (0.063)	−0.135 (0.348)	−0.138 (0.337)	−0.131 (0.370)	−0.131 (0.369)
IMR	−0.058*** (0.010)	−0.055** (0.012)	−0.067*** (0.006)	−0.063*** (0.010)	−0.272 (0.148)	−0.259 (0.158)	−0.265 (0.152)	−0.282 (0.130)
Intercept	0.446 (0.129)	0.273 (0.335)	0.365 (0.208)	0.422 (0.169)	8.935*** (0.000)	8.754*** (0.000)	8.856*** (0.000)	8.842*** (0.000)

TABLE 3 (Continued)

	DV = CCPS				DV = Emissions			
Panel A: Full sample	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3578	3578	3578	3578	3224	3224	3224	3224
Adj. R^2	0.193	0.179	0.177	0.168	0.545	0.544	0.544	0.545
	DV = CCPS				**DV = Emissions**			
Panel B: Non-US firms in sample	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Climate_CEO	0.154*** (0.000)				−0.229** (0.049)			
Climate_Director		0.118*** (0.000)				0.119 (0.198)		
Climate_TopExec			0.072*** (0.000)				−0.058 (0.497)	
Climate_Other				0.077*** (0.000)				−0.207** (0.046)
CEO Comp	0.010*** (0.000)	0.010*** (0.000)	0.010*** (0.000)	0.010*** (0.000)	−0.059*** (0.005)	−0.060*** (0.004)	−0.059*** (0.004)	−0.058*** (0.005)
IMR	−0.071*** (0.005)	−0.068*** (0.005)	−0.079*** (0.004)	−0.075*** (0.006)	−0.350* (0.071)	−0.333* (0.076)	−0.343* (0.070)	−0.359* (0.061)
Intercept	0.016 (0.927)	−0.118 (0.531)	−0.042 (0.813)	−0.038 (0.826)	13.250*** (0.000)	13.296*** (0.000)	13.313*** (0.000)	13.076*** (0.000)
Firm level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2750	2750	2750	2750	2494	2494	2494	2494
Adj. R^2	0.218	0.204	0.200	0.197	0.530	0.529	0.529	0.530
	DV = CCPS				**DV = Emissions**			
Panel C: US firms in sample	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Climate_CEO	0.180*** (0.000)				0.161 (0.331)			
Climate_Director		0.183*** (0.000)				0.239 (0.163)		
Climate_TopExec			0.087*** (0.000)				0.287*** (0.023)	
Climate_Other				0.017 (0.495)				0.040 (0.716)
CEO Comp	0.005 (0.308)	0.005 (0.361)	0.007 (0.174)	0.006 (0.205)	−0.055 (0.105)	−0.056* (0.098)	−0.052 (0.108)	−0.055 (0.106)
IMR	−0.032 (0.490)	−0.030 (0.514)	−0.038 (0.415)	−0.031 (0.502)	−0.044 (0.883)	−0.039 (0.895)	−0.041 (0.888)	−0.031 (0.917)
Intercept	−16.903 (0.284)	−18.469 (0.295)	−10.996 (0.548)	−15.800 (0.378)	229.297** (0.021)	227.716** (0.021)	238.790** (0.021)	225.142** (0.024)
Firm level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(Continues)

TABLE 3 (Continued)

Panel C: US firms in sample	DV = CCPS (1)	(2)	(3)	(4)	DV = Emissions (5)	(6)	(7)	(8)
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	828	828	828	828	730	730	730	730
Adj. R^2	0.186	0.180	0.181	0.158	0.718	0.718	0.722	0.718

Note: This table presents the regression results of the association between climate change incentives and climate change impact. Panel A shows the full sample results, whereas Panels B and C show the results for non-US firms and US firms in the sample, respectively. Models (1)–(4) show the regression results of the association between climate change incentives and climate change performance as a measure of climate change impact. Models (5)–(8) show the regression results of the association between climate change incentives and carbon emissions as a measure of climate change impact. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

In Appendix C, the first-stage probit regression of Heckman's (1979) model is reported, which estimates the likelihood of a firm responding to the CDP questionnaire. In total, 10,207 firm-year observations are for firms that responded to the CDP questionnaire, and 6000 firm-year observations are for firms that did not respond. Our study's results are consistent with those of Matsumura et al. (2014), showing that firms are more likely to respond if a greater percentage of firms in their industry respond, if they are larger, have higher leverage, or higher analyst following, or if they previously responded to the CDP questionnaire. These results are consistent with the idea that large firms may be more likely to suffer from reputational effects if they do not respond. We also find firms with greater exposure to international markets are more likely to respond, as shown by the significant coefficients of *CROSS* and *FOREIGN*. Firms with lower growth, higher capital expenditures, or lower risk are also more likely to respond. Surprisingly, country-level climate risk and country characteristics of stakeholder orientation or legal environment are insignificant.

3 | RESULTS

Table 3 presents the main OLS regression results using Equation 2. Panel A shows results for the full sample, Panel B for non-US firms, and Panel C for US firms. In regressions 1–4, the dependent variable is *CCPS* (climate change performance score). In regressions 5–8, the dependent variable is the natural logarithm of carbon emissions in CO_2-e metric tons. The independent variables of interest are CEO compensation and indicator variables for whether the CEO, board of directors, top executives (including the CEO), or other executives in the firm have climate-linked compensation (*Climate_CEO*, *Climate_Director*, *Climate_TopExec*, and *Climate_Other*, respectively).

The results in Table 3, Panel A show that firms in which CEOs receive climate-linked compensation have a higher CCPS. The coefficient of *Climate_CEO* indicates that firms directly linking CEO compensation to climate change initiatives see a 16.40% increase in the ranking of their CCPS. Carbon strategies are also significantly better when executives in the top management team, board members, or other executives have climate-linked incentives in their compensation. As the CCPS reflects plans for improving the firm's climate footprint and its climate impact, the next set of regressions focus on outcomes only. These regressions show that carbon emissions are also lower when the CEO's compensation is climate linked; yet, surprisingly, when the top management team (including the CEO) receives climate-linked compensation, this relationship is not significant. Carbon emissions show a 15.72% decrease when the compensation of operations managers, consultants, and other executives, not in the C-suite, is linked to the climate.[2] This may reflect that these employees primarily focus on environmental outcomes, whereas those in the C-suite would be likely to focus on their primary specialization for the firm. Results for the effect of climate-linked compensation on CCPS are stronger than for its effect on carbon emissions, reflecting the broader measures on which the CCPS score is based. These include firm-level climate assessment of risks, opportunities, and business strategy related to climate change. Thus, although upper management can discuss strategies that would positively affect their CCPS score, when measured by concrete outcomes on carbon emissions, the relationship between compensation and climate-related outcomes is not as strong.

We include CEO compensation in these estimations. When a firm does not undertake activities to reduce its carbon footprint, it increases externalities that are not borne by the firm. This may increase firm profitability and CEO compensation, resulting in a negative relationship between CEO compensation and climate-beneficial policies. On the other hand, CEOs who receive more compensation may do so, in part, due to the effort associated with environmental stewardship. In the regressions for climate strategy, CEO compensation is positive and significant, indicating that higher CEO compensation is associated with better climate performance scores (CCPS). This is consistent with the early work on US firms by Berrone and Gomez-Mejia (2009) who demonstrate that CEO compensation is positively associated with good pollution prevention strategy. In addition, the results show that higher CEO compensation is associated with fewer carbon emissions. The coefficient in Model (5) shows that a 1% increase in CEO compensation is associated with a 19.18% decrease in carbon emissions.

Focusing on the CCPS model's control variables, firms receive a higher CCPS if they are larger, older, or have better environmental performance. Firms have a lower CCPS if they have higher analyst coverage. Despite analyst following increasing the visibility of a firm, the analysts' focus may be on the firm's primary business and not on climate-related analysis. The results for country-level control variables suggest that firms in countries with a high GDP receive a weak CCPS, whereas firms receive a strong CCPS if they are in countries with a strong legal environment. Focusing on the *EMISSION* models, we find that larger firms, firms taking more risk, or firms with high capital expenditures emit more carbon. Firms that are profitable, or with higher growth, higher analyst coverage, or higher R&D expenditures have lower carbon emissions. Furthermore, the coefficient for *IMR* in Table 3, Panel A, is statistically significant for the CCPS models, suggesting that our findings are robust after addressing self-selection bias. However, the coefficient of *IMR* is statistically insignificant for the *EMISSION* models, suggesting that sample selection bias is not a significant concern.[3] In both the *CCPS* and *EMISSION* models, institutional ownership does not have a significant effect. This may reflect the differing roles and investment horizons of mutual funds, but these data were not available for the cross-country sample of firms in our study.

In Table 3, Panels B and C, we provide estimations for the non-US and US firms, respectively, as US firms constitute a significant portion (25%) of our sample. The regressions for US firms in the sample do not include country-level variables, and standard errors are clustered at the firm level. Again, Columns (1)–(4) show *CCPS* as the dependent variable, whereas Columns (5)–(8) show *EMISSION* as the dependent variable. For reasons of brevity, we report here only the variables of interest.

The main results, when excluding the US firms, reach the same conclusion as those for the full sample; that is, the CCPS and climate-linked compensation are positively related. In the emissions estimation, climate-linked compensation for both the CEO and other managers is associated with a significant reduction in carbon emissions. When US firms are excluded, the sign for *LEGAL* changes to become negative and significant (not reported). The differences found for estimations involving only US firms are shown in Panel C. In the US, directly linking CEO compensation is found to result in improvements in outcomes associated with strategy (i.e., the CCPS) but not carbon emissions. This is consistent with greenwashing and contrasts with results for non-US firms in the sample.

In seeking to provide further insights, our study explores the effect of compensation on two categories of total carbon emissions, that is, direct and indirect emissions. We modify Table 3 regressions using direct (indirect) emissions as the dependent variable. The results for the full sample are reported in Table 4. Columns (1)–(4) show the results for direct emissions, whereas Columns (5)–(8) show the results for indirect emissions. In our analysis of direct emissions, the coefficients of CEO, director, and top executive climate-linked compensation are negative and significant, whereas only the coefficient of CEO remains significant in the analysis for indirect emissions. Interestingly, the coefficient of *Climate_Other* is positive and significant for indirect emissions, suggesting that when other executives (non-top executives or non-directors) are provided with climate-linked incentives, indirect emissions increase. This may be consistent with offshoring some of the polluting activities to subsidiaries. As evidence of this, Li and Zhou (2017) find that a significant number of US firms reduce their pollution at home by offshoring production to poor and less regulated countries.

Table 4, Panels B and C show results for the non-US firms and US firms in the sample, respectively. In the non-US firms, CEO and director climate-linked compensation is negatively linked to direct emissions. CEO climate-linked compensation is also negatively related to indirect emissions. As in the total sample, other executives are positively and significantly related to indirect emissions. A notable difference in analysis of US firms in the sample is that only climate-linked CEO compensation is associated with a significant reduction in direct emissions (at the 10% level) but not indirect (or total) emissions.[4]

3.1 | Sub-sample analysis

In our study, certain industries are recognized as more carbon intensive, and they may find it more difficult to reduce their carbon footprint. However, these industries may also have more room for improvement and, therefore, could make changes that are more dramatic. To address this, firms in the sample are divided between those in high-polluting industries and those in low-polluting industries. We refer to carbon-intensive industries as "dirty" industries and non-carbon-intensive industries as "clean" industries. Based on the CDP's (2008) classifications, dirty industries comprise mining and construction, textiles, printing and publishing, chemicals and pharmaceuticals, extractive, manufacturing, transportation, and utilities, while the remaining industries are classified as clean industries.

In Table 5, results are reported for clean and dirty industries. These results show that climate-linked compensation positively influences a firm's CCPS regardless of the industry. However, climate-linked compensation for board directors, top executives, and other executives has stronger effects for firms in dirty industries. Climate-linked CEO compensation is associated with a reduction in carbon emissions only for dirty industries. In clean industries, only climate-linked compensation for board directors leads to reductions in carbon emissions.[5]

The expectation would be that having a greater percentage of compensation linked to climate performance would result in better climate-related outcomes. While measuring the percentage of compensation attributed to climate incentives would be of interest, data limitations prevent this in our study. We nevertheless attempt to gain some insights by interacting total CEO compensation with the climate-linked incentives indicator and re-estimate Equation 2. As

TABLE 4 Compensation and emissions: Full sample

Panel A: Full sample	DV = Direct emissions (1)	(2)	(3)	(4)	DV = Indirect emissions (5)	(6)	(7)	(8)
Climate_CEO	−0.659*** (0.000)				−0.894** (0.018)			
Climate_Director		−0.836*** (0.003)				−0.095 (0.652)		
Climate_TopExec			−0.263* (0.089)				0.080 (0.656)	
Climate_Other				−0.046 (0.827)				0.441*** (0.002)
CEO Comp	−0.176* (0.060)	−0.175* (0.062)	−0.174* (0.061)	−0.176* (0.060)	−0.290*** (0.007)	−0.289*** (0.007)	−0.290*** (0.007)	−0.293*** (0.007)
IMR	−0.282 (0.242)	−0.323 (0.180)	−0.271 (0.263)	−0.265 (0.257)	−0.455* (0.062)	−0.432* (0.079)	−0.422* (0.086)	−0.380 (0.115)
Intercept	5.711* (0.051)	6.613** (0.036)	5.511* (0.070)	5.476* (0.068)	3.308 (0.509)	3.126 (0.539)	2.990 (0.556)	3.072 (0.547)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3224	3224	3224	3224	3224	3224	3224	3224
Adj. R^2	0.193	0.179	0.177	0.168	0.545	0.544	0.544	0.545

Panel B: Non-US firms in the sample	DV = Direct emissions (1)	(2)	(3)	(4)	DV = Indirect emissions (5)	(6)	(7)	(8)
Climate_CEO	−0.652*** (0.003)				−1.002** (0.023)			
Climate_Director		−0.941*** (0.001)				−0.130 (0.602)		
Climate_TopExec			−0.256 (0.207)				0.093 (0.685)	
Climate_Other				−0.096 (0.712)				0.482** (0.011)
CEO Comp	−0.239*** (0.010)	−0.237*** (0.010)	−0.237*** (0.010)	−0.239*** (0.010)	−0.364*** (0.000)	−0.366*** (0.000)	−0.367*** (0.000)	−0.370*** (0.000)
IMR	−0.307 (0.241)	−0.350 (0.180)	−0.290 (0.266)	−0.291 (0.251)	−0.374 (0.185)	−0.346 (0.221)	−0.334 (0.235)	−0.296 (0.286)
Intercept	16.010*** (0.000)	16.928*** (0.000)	16.057*** (0.000)	16.195*** (0.000)	13.197** (0.035)	13.770** (0.032)	13.785** (0.032)	14.354** (0.026)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2494	2494	2494	2494	2494	2494	2494	2494
Adj. R^2	0.186	0.191	0.184	0.183	0.155	0.149	0.149	0.151

TABLE 4 (Continued)

Panel C: US firms in the sample	DV = Direct emissions (1)	(2)	(3)	(4)	DV = Indirect emissions (5)	(6)	(7)	(8)
Climate_CEO	−0.597* (0.062)				−0.528 (0.209)			
Climate_Director		0.211 (0.512)				0.124 (0.708)		
Climate_TopExec			−0.215 (0.415)				0.028 (0.919)	
Climate_Other				0.184 (0.475)				0.269 (0.384)
CEO Comp	0.144 (0.138)	0.140 (0.149)	0.140 (0.151)	0.141 (0.146)	0.160 (0.173)	0.158 (0.180)	0.159 (0.178)	0.157 (0.180)
IMR	−0.091 (0.880)	−0.115 (0.850)	−0.113 (0.853)	−0.086 (0.887)	−0.683 (0.330)	−0.704 (0.316)	−0.704 (0.317)	−0.661 (0.340)
Intercept	4.961** (0.042)	4.893** (0.046)	4.936** (0.043)	4.627* (0.079)	9.227*** (0.001)	9.188*** (0.001)	9.232*** (0.001)	6.813** (0.015)
Firm level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	730	730	730	730	730	730	730	730
Adj. R^2	0.334	0.331	0.332	0.331	0.160	0.158	0.158	0.160

Note: This table presents the regression results of the association between climate change incentives and climate change impact. Models (1)–(4) show the regression results of the association between climate change incentives and direct carbon emissions as a measure of climate change impact. Models (5)–(8) show the regression results of the association between climate change incentives and indirect carbon emissions as a measure of climate change impact. Panel A is for the full sample, while Panel B is for non-US firms in the sample and Panel C is for US firms in the sample. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

Climate_CEO is an indicator variable and CEO compensation *(CEO Comp)* is continuous and never 0, this estimation can effectively answer only whether CEO compensation has a different effect in companies with climate-linked compensation versus companies without climate-linked compensation. For example, the coefficient of CEO Comp captures the effect of compensation for firms without climate-linked incentive compensation on CCPS (or the dependent variable). The coefficient of Climate_CEO indicates the effect of compensation for firms with climate-linked incentive compensation, conditional on CEO compensation, on the dependent variable. We only report the main variables of interest for reasons of brevity.

These results for the full sample, as well as the non-US and the US only samples, are presented in Table 6. We first focus on the estimations that use *CCPS* as the dependent variable. The key variable of interest in Table 6 is the interaction term *Climate_CEO* × *CEO Comp* that suggests a difference in the effects of CEO compensation on CCPS between firms with and without climate-linked incentive compensation. We find that the coefficients of *Climate_CEO* × *CEO Comp* are positive and statistically significant for the full sample and for the sample excluding US firms. These results indicate that, when controlling for other factors, the average increase in CCPS led by CEO compensation is larger for firms with climate-linked incentive compensation than for firms without climate-linked incentive compensation. Using coefficients of the full sample, an increase of one standard deviation in CEO compensation leads to a 1.64% (0.007 × 2.337) increase in the CCPS for firms without climate-linked incentive compensation, whereas an increase of one standard deviation in CEO compensation leads to a 6.31% increase in the CCPS for firms with climate-linked incentive compensation.[6] In contrast to non-US firms in the sample, for US firms in the sample, neither CEO compensation nor its interaction with the climate-linked indicator variable has a statistically significant association.

Turning our attention to the emissions regressions for firms in our sample, excluding US firms, we see that CEO compensation is associated with lower carbon emissions and the interaction term between CEO compensation and the climate-linked indicator variable is insignificant. For US firms, the interaction term, *Climate_CEO*×*CEO Comp*, is positive and statistically significant. This suggests that, when controlling for other factors, the average decrease in carbon emissions led by CEO compensation is larger for firms with climate-linked incentive compensation than for firms without climate-linked incentive compensation.

TABLE 5 Industry-level pollution

Panel A: *CCPS* as dependent variable (DV)	Dirty industries (1)	(2)	(3)	(4)	Clean industries (5)	(6)	(7)	(8)
Climate_CEO	0.175*** (0.000)				0.155*** (0.000)			
Climate_Director		0.086** (0.011)				0.166*** (0.000)		
Climate_TopExec			0.103*** (0.001)				0.065*** (0.000)	
Climate_Other				0.093*** (0.000)				0.054*** (0.002)
CEO Comp	0.010*** (0.001)	0.011*** (0.002)	0.010*** (0.004)	0.010*** (0.001)	0.007*** (0.006)	0.007*** (0.010)	0.007*** (0.007)	0.007*** (0.006)
IMR	−0.031 (0.316)	−0.033 (0.300)	−0.045 (0.175)	−0.040 (0.250)	−0.064* (0.065)	−0.058 (0.103)	−0.069* (0.065)	−0.066* (0.080)
Intercept	−0.027 (0.927)	−0.243 (0.469)	0.010 (0.975)	−0.027 (0.934)	0.870** (0.020)	0.708** (0.038)	0.794** (0.028)	0.865** (0.025)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1298	1298	1298	1298	2280	2280	2280	2280
Adj. R^2	0.234	0.203	0.223	0.210	0.169	0.172	0.152	0.145
Chi^2 test	0.69*	8.72**	4.11**	3.14*				
Panel B: *EMISSION* as dependent variable (DV)	**Dirty industries (1)**	**(2)**	**(3)**	**(4)**	**Clean industries (5)**	**(6)**	**(7)**	**(8)**
Climate_CEO	−0.630*** (0.001)				0.062 (0.517)			
Climate_Director		−0.154 (0.581)				−0.213** (0.013)		
Climate_TopExec			−0.215 (0.278)				−0.122 (0.285)	
Climate_Other				−0.071 (0.675)				−0.214 (0.115)
CEO Comp	−0.023 (0.411)	−0.023 (0.402)	−0.026 (0.344)	−0.023 (0.410)	−0.070*** (0.000)	−0.070*** (0.000)	−0.069*** (0.000)	−0.068*** (0.000)
IMR	−0.642** (0.018)	−0.626** (0.022)	−0.615** (0.031)	−0.613** (0.029)	−0.044 (0.748)	−0.032 (0.804)	−0.053 (0.704)	−0.070 (0.598)
Intercept	11.527*** (0.003)	11.971*** (0.002)	12.110*** (0.004)	11.641*** (0.004)	6.837*** (0.000)	6.598*** (0.000)	7.019*** (0.000)	6.925*** (0.000)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1168	1168	1168	1168	2056	2056	2056	2056
Adj. R^2	0.451	0.444	0.445	0.443	0.508	0.509	0.508	0.509
Chi^2 test	19.01***	5.08**	6.37***	0.93				

Note: This table presents the regression results of the association between climate change incentives and climate change impact based on segmenting firms by the extent of their pollution. Panel A shows regression results for dirty industries vs. clean industries using *CCPS* as the dependent variable, whereas Panel B shows the results for dirty industries vs. clean industries using *EMISSION* as the dependent variable, respectively. Models (1)–(4) show the regression results of the association between climate change incentives and climate change performance as a measure of climate change impact. Models (5)–(8) show the regression results of the association between climate change incentives and carbon emissions as a measure of climate change impact. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

TABLE 6 CEO compensation and carbon incentives

	DV = CCPS			DV = Emissions		
	Full sample (1)	Non-US firms (2)	US firms (3)	Full sample (4)	Non-US firms (5)	US firms (6)
Climate_CEO	−0.132* (0.079)	−0.136* (0.099)	0.425* (0.059)	0.187 (0.735)	0.203 (0.748)	6.871* (0.078)
Climate_CEO × CEO Comp	0.020*** (0.000)	0.020*** (0.002)	−0.015 (0.276)	−0.028 (0.444)	−0.030 (0.491)	−0.420* (0.083)
CEO Comp	0.007*** (0.000)	0.009*** (0.000)	0.005 (0.277)	−0.049*** (0.004)	−0.057*** (0.007)	−0.042 (0.197)
IMR	−0.058*** (0.010)	−0.070*** (0.005)	−0.019 (0.702)	−0.271 (0.148)	−0.350* (0.070)	0.075 (0.798)
Intercept	0.464 (0.108)	0.057 (0.741)	−16.892 (0.279)	8.900*** (0.000)	13.212*** (0.000)	221.085** (0.033)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	No	Yes	Yes	No
Observations	3578	2750	828	3224	2494	730
Adj. R^2	0.194	0.219	0.185	0.545	0.530	0.722

Note: This table presents the regression results of the moderating role of CEO compensation in the association between climate change incentives paid to the CEO and climate change impact. Models (1)–(3) show the regression results of the association between climate change incentives paid to the CEO and climate change performance as a measure of climate change impact for the full sample, non-US firms in the sample, and US firms in the sample, respectively. Models (4)–(6) show the regression results of the association between climate change incentives paid to the CEO and carbon emissions as a measure of climate change impact. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

Hence, for firms in countries other than the US, incentive compensation linked to climate performance is associated with better climate strategy scores. For US firms, climate-linked compensation is associated with lower carbon emissions but only when coupled with high compensation. It is possible that the difference between firms in non-US countries and US firms reflects differences in attitudes towards climate change and climate responsibility, as reflected in the US entry to, withdrawal from, and re-entry to the Paris Climate Agreement, even though other countries continue to show consistent commitment to environmental issues.[7] This is likely to be influenced by cultural attitudes towards climate change. The next section further considers this point.

4 | COMPENSATION, CULTURE, AND CLIMATE OUTCOMES

In this section, our study empirically investigates how a country's cultural attitudes towards environmental stewardship and incentives jointly affect climate change performance and carbon activities. Culture, or the shared attitudes and beliefs of a society, can affect the way a person responds to incentives, thereby influencing management's choices, with this reflected in firm activities. For example, previous research shows that cultural attitudes towards the value of competition and individualism affect how incentives from compensation are viewed (Burns et al., 2017). Similarly, prior research shows that the concern of board members for the environment is reflected in their choices that affect the environment. For example, as reported by Atif et al. (2021), firms use more renewable energy if they have more female directors on their boards. Liao et al. (2015) indicate that firms with female directors have a higher likelihood of disclosing climate change information. Thus, personal characteristics and associated preferences influence choices that affect the environment. In fact, anecdotal evidence suggests that society's preferences towards environmental stewardship may act as a substitute for environmental regulations, particularly in the presence of consumer pressure for green products and firms. However, as summarized in the Harvard Business Review (2019), an "intention–action" gap is apparently evident. As culture influences and reflects preferences, we expect that, in cultures where people feel more strongly about environmental protection, stronger outcomes will be associated with climate-linked incentives.

If cultural attitudes regarding environmental stewardship result in common costs or benefits to firms, these attitudes can also indirectly affect environmental choices. In countries where more people consider it important to take care of the environment, individuals may find firms with more environmentally friendly policies appealing, thereby increasing the benefits to these firms. If a country's population is willing to pay more for products that are environmentally friendly, firms can cater to their preferences. For example, a firm can use environmentally friendly materials that are more expensive, passing the cost to consumers who are willing to pay the associated additional cost. Culture has the added benefit of guiding desirable or ethical choices, which can be nebulous. As a result, regardless of the personal effects of compensation, executives may make choices favoring environmental stewardship in countries where environmental stewardship values are stronger.

Citizens' support for government regulation of shared resources can result in regulation of environmental stewardship practices. One benefit of regulation is that it imposes common costs, making it harder for one firm to gain competitive advantage by not being environmentally friendly. Importantly, even the credible threat of regulation can serve as an incentive, with credibility more likely when citizens consider the environment a joint responsibility. Therefore, we expect that climate-linked compensation would have stronger effects in countries where individuals are more willing to take personal environmental stewardship action or in countries in which more citizens support government intervention. On the other hand, political lobbying can influence governments and dampen any potential effects from climate-linked compensation.

4.1 | Measures of society's attitudes towards the environment

We construct two proxies for cultural attitudes towards the environment: *Carbon_Individual* and *Carbon_Society*. Our measures are derived from the WVS, which is a worldwide survey of cultural attitudes collected by social scientists. We employ Wave 5 (2005–2009) and Wave 6 (2010–2014) and match the closest response of cultural items from the WVS wave to the year of our compensation data. We construct indices of related cultural attitudes and use the mean value for a country as a measure of a country's attitude towards the environment. As Welzel (2013) explains, culture takes place at the group level; therefore, using the mean value of an attitude is useful as an aggregate measure of a country's attitudes.

Our first index, *Carbon_Individual*, measures the extent to which individuals take personal action to improve the environment, such as choosing products that are better for the environment, recycling, reducing water consumption, or being willing to pay more for a product to protect the environment. Specifically, we construct *Carbon_Individual* using the following six WVS items to capture an individual's attitudes on (1) looking after the environment; (2) giving part of his/her income towards the environment; (3) buying things at a 20% higher price if this helps to protect the environment; (4) choosing products that are better for the environment; (5) recycling; and (6) reducing personal water consumption. Our second measure, *Carbon_Society*, measures the tendency of a country to view environmental pollution as society's problem to resolve. This attitude may affect regulation or the potential for regulation. Items used to construct *Carbon_Society* include the extent of the agreement or action by an

TABLE 7 Descriptive statistics: Country-level carbon culture

	Carbon_Society	*Carbon_Individualism*
Country	**Median**	**Median**
Australia	0.203	0.677
Austria	0.113	0.615
Belgium	0.113	0.686
Brazil	0.074	0.779
Canada	0.689	0.703
Chile	0.160	0.686
China	0.025	0.635
Colombia	0.139	0.852
Czech Republic	0.343	0.529
Denmark	0.486	0.767
Finland	0.486	0.767
France	--	0.686
Germany	0.113	0.615
Hong Kong	0.395	0.611
India	0.121	0.692
Ireland	--	0.713
Israel	0.049	0.699
Italy	0.747	0.541
Japan	0.067	0.534
Luxembourg	0.113	0.615
Malaysia	0.137	0.742
Mexico	0.154	0.796
Netherlands	0.168	0.650
New Zealand	0.164	0.649
Norway	0.111	0.680
Philippines	0.121	0.786
Poland	0.039	0.760
Portugal	0.072	0.731
Russia	0.026	0.691
Singapore	0.154	0.618
South Africa	0.129	0.676
South Korea	0.109	0.612
Spain	0.072	0.731
Sweden	0.226	0.700
Switzerland	0.63	0.702
Thailand	0.114	0.680
Turkey	0.059	0.752
United Kingdom	--	0.713
United States	0.123	0.609
Total	0.152	0.686
Standard deviation	0.207	0.079

Note: This table shows the breakdown of the median values of our two measures of culture as described in Appendix D. The range in values is between 0 and 1, with 1 denoting the highest level of cultural value.

individual to undertake the following: (1) supporting an increase in taxes if used to prevent environmental pollution; (2) expressing the opinion that the government should reduce environmental pollution; (3) attending meetings or signing petitions to support the environment; (4) giving money to an ecological organization in the previous 2 years; (5) participating in demonstrations supporting the environment in the previous 2 years; and (6) contributing to an environmental organization.

Table 7 presents the median and mean values of cultural attitudes by country.[8] Across countries with firms in our sample, the median value of *Carbon_Society* is 0.15, whereas the median value of *Carbon_Individual* is 0.69. The standard deviation is much higher for *Carbon_Individual* than for *Carbon_Society*, indicating more variation among values for *Carbon_Individual* than for *Carbon_Society*. This suggests that agreement with one proxy does not imply agreement with the other. In the US, for example, significantly more agreement is expressed for individuals undertaking stewardship actions (*Carbon_Individual* score of 0.61) than on agreement for actions undertaken by society (*Carbon_Society* score of 0.12). This contrasts with Denmark that has a lower value of 0.49 for *Carbon_Individual* and a higher value for *Carbon_Society* of 0.76.

4.2 | Results

To investigate the interaction effects between culture and compensation, firms in our sample are divided by their country's culture, with this including the interaction of CEO compensation with climate-linked CEO compensation. Table 8 presents results for the full sample and for the non-US sample. Panel A shows results for the dependent variable, *CCPS*, whereas Panel B shows results for carbon emissions. For the full sample, the results indicate that climate-linked incentives do not matter for either high or low values of *Carbon_Society* (the coefficient of the climate-linked incentives–CEO compensation interaction is not significant). However, differences are found when exploring the effects based on *Carbon_Individual*, that is, individuals' willingness to undertake individual actions towards environmental stewardship. In countries with a stronger sentiment for making individual sacrifices, the positive association between CEO compensation and CCPS is enhanced for firms with climate-linked incentive compensation. In contrast to CCPS, climate-linked compensation, based on a country's culture, has no differential effect on carbon emissions.

Linking a CEO's compensation and the firm's climate change risk results in better climate strategies that may improve a firm's environmental reputation. However, climate-linked compensation does not result in lower carbon emissions. A firm's actions could be more focused on stylistic changes than on substantive changes that would be reflected in lower carbon emissions. Results are similar when excluding US firms except the interaction between climate-linked compensation and CEO compensation is found to be larger for societies that believe care for the environment to be a communal problem. In unreported results, we examine the cultural split for top executives versus CEOs and find qualitatively similar findings. Also, in unreported results, we estimate Equation 2 by culture (and without the interaction term), and the conclusions are not substantially different.

5 | SHAREHOLDER VALUE AND FIRM PERFORMANCE IMPLICATIONS

While our study's focus is on whether climate-linked compensation alters manager behavior, it is natural to wonder how this affects shareholder value. Climate change strategy may have a positive effect on firm value. This could occur if firms internalize the costs of carbon emissions, with this change in strategy reducing litigation costs and reputation costs (Bose et al., 2021; Clarkson et al., 2015; Eccles et al., 2011; Griffin et al., 2017; Matsumura et al., 2014) or enabling the firm to pass the costs onto the consumer. Alternatively, a negative effect on firm value may occur if the market perceives the strategy as greenwashing or that it is likely to be expensive and profit reducing, with associated costs unable to be passed on to the consumer. We therefore analyze the effect of CCPS on firm value, modifying Table 3's basic model but with shareholder value as the dependent variable. Shareholder value is measured as Tobin's Q (*TOBINQ*, the sum of the book value of total assets plus the market value of equity minus the book value of equity divided by total assets) and profitability (*ROA*, net profit after tax divided by total assets) at time $(t + 1)$ relative to the explanatory variables. As a firm's ability to pass costs onto the consumer depends on country attitudes as well as country regulation, as outlined earlier, we consider the effects of *Carbon_Individual* and *Carbon_Society* on climate strategy and climate performance and their impact on firm value.

The results for the full sample are presented in Table 9, Panel A. Improvement in climate strategy is found to have a positive effect on *TOBINQ* but to have no effect on *ROA*. Firms in the sample are divided based on median values for *Carbon_Individual* and *Carbon_Society*, and the analysis is conducted again. The results are presented in Table 9, Panel B. Climate strategy is associated with a reduction in profitability for firms in societies with lower *Carbon_Individual*, that is, when fewer individuals take personal action, such as choosing environmentally friendly products, to improve the environment. This is consistent with the idea that culture affects why managers may not naturally try to reduce environmental externalities created by their firms.

In unreported results, we substitute *EMISSION* for climate strategies in these regressions. When we replace *CCPS* with *EMISSION*, negative and significant relationships are found between *EMISSION* and *TOBINQ* and *ROA*.

6 | QUASI-EXPERIMENTAL ANALYSIS

We use the adoption of an ETS as an external shock to a firm's climate change performance and carbon emissions. The objective of

TABLE 8 CEO compensation, culture, CCPS, and carbon emissions

Panel A: CCPS as dependent variable (DV)								
	Full sample				Non-US firms			
	Carbon_Society		*Carbon Individualism*		*Carbon_Society*		*Carbon Individualism*	
	High	Low	High	Low	High	Low	High	Low
Climate_CEO	−0.263 (0.463)	0.036 (0.791)	−0.473* (0.053)	0.064 (0.736)	−0.345 (0.357)	−0.109 (0.374)	−0.473* (0.053)	−0.048 (0.784)
Climate_CEO × CEO Comp	0.031 (0.206)	0.010 (0.308)	0.045** (0.012)	0.009 (0.480)	0.036 (0.159)	0.021** (0.038)	0.045** (0.012)	0.017 (0.171)
CEO Comp	0.005 (0.101)	0.012*** (0.002)	0.007* (0.081)	0.007** (0.049)	0.007** (0.012)	0.009** (0.025)	0.007* (0.081)	0.009** (0.035)
IMR	−0.005 (0.894)	−0.090 (0.105)	−0.041 (0.406)	−0.044 (0.243)	−0.013 (0.760)	−0.138 (0.209)	−0.041 (0.406)	−0.069 (0.201)
Intercept	0.075 (0.872)	−0.002 (0.996)	−0.409 (0.452)	0.767*** (0.001)	−0.525 (0.413)	0.388 (0.155)	−0.409 (0.452)	0.514** (0.049)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	935	1546	577	1904	822	831	577	1076
Adj. R^2	0.284	0.168	0.311	0.198	0.309	0.198	0.311	0.238
Panel B: Emissions as dependent variable (DV)								
	Full sample				Non-US firms			
	Carbon_Society		Carbon Individualism		Carbon_Society		Carbon Individualism	
	High	Low	High	Low	High	Low	High	Low
Climate CEO	1.249 (0.425)	0.836 (0.406)	0.952 (0.570)	1.448 (0.288)	0.908 (0.621)	0.528 (0.606)	0.952 (0.570)	0.305 (0.798)
Climate_CEO × CEO Comp	−0.098 (0.375)	−0.059 (0.351)	−0.079 (0.488)	−0.101 (0.264)	−0.072 (0.576)	−0.055 (0.477)	−0.079 (0.488)	−0.029 (0.735)
CEO Comp	−0.052** (0.033)	−0.011 (0.796)	−0.061 (0.218)	−0.038* (0.085)	−0.049* (0.098)	0.028 (0.552)	−0.061 (0.218)	−0.031 (0.176)
IMR	−0.487*** (0.007)	0.231 (0.175)	−0.167 (0.404)	−0.150 (0.580)	−0.439** (0.018)	0.387 (0.289)	−0.167 (0.404)	−0.196 (0.639)
Intercept	23.890*** (0.000)	6.059*** (0.001)	22.691*** (0.000)	9.814** (0.011)	24.521*** (0.001)	7.390*** (0.002)	22.691*** (0.000)	9.338** (0.039)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	744	1253	468	1529	678	653	468	863
Adj. R^2	0.608	0.548	0.566	0.570	0.597	0.542	0.566	0.568

Note: This table presents the regression results of the moderating role of CEO compensation in the association between climate change incentives paid to the CEO and top executives, respectively, and climate change impact based on country-level carbon culture. Panel A, Models (1)–(8) show the regression results of the association between climate change incentives paid to the CEO and climate change performance as a measure of climate change impact for carbon society and carbon individualism cultures, respectively. Panel B, Models (1)–(8) show the regression results of the association between climate change incentives paid to the CEO and carbon emissions as a measure of climate change impact for carbon society and carbon individualism cultures, respectively. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

TABLE 9 Compensation, carbon strategy, and performance

Panel A: Compensation, carbon strategy, financial performance

	DV = TOBINQ				DV = ROA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CCPS	0.098* (0.053)	0.106** (0.032)	0.110** (0.022)	0.124** (0.012)	−0.002 (0.548)	−0.001 (0.729)	−0.001 (0.746)	−0.002 (0.487)
Climate_CEO	0.049 (0.202)				0.004 (0.429)			
Climate_Director		0.023 (0.621)				−0.001 (0.720)		
Climate_TopExec			0.001 (0.971)				−0.001 (0.403)	
Climate_Other				−0.076** (0.023)				0.005** (0.010)
CEO Comp	0.004 (0.173)	0.004 (0.185)	0.004 (0.175)	0.004 (0.142)	−0.000 (0.699)	−0.000 (0.722)	−0.000 (0.732)	−0.000 (0.656)
IMR	0.035 (0.505)	0.036 (0.512)	0.034 (0.516)	0.032 (0.537)	0.001 (0.870)	0.001 (0.899)	0.001 (0.881)	0.001 (0.862)
Intercept	1.158 (0.223)	1.123 (0.245)	1.147 (0.232)	1.153 (0.216)	0.062 (0.136)	0.063 (0.133)	0.062 (0.139)	0.061 (0.151)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3578	3578	3578	3578	3578	3578	3578	3578
Adj. R^2	0.600	0.599	0.599	0.600	0.354	0.354	0.354	0.355

Panel B: Compensation, carbon strategy, financial performance, and culture

	DV = TOBINQ				DV = ROA			
	Carbon_Society		Carbon Individualism		Carbon_Society		Carbon Individualism	
	High	Low	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Climate_CEO	0.030 (0.662)	0.037 (0.182)	0.173* (0.088)	0.027 (0.158)	−0.002 (0.658)	0.013*** (0.006)		
CEO Comp	0.001 (0.875)	0.005 (0.583)	0.000 (0.970)	0.002 (0.298)	−0.000 (0.637)	−0.000 (0.889)	−0.000 (0.855)	−0.000 (0.967)
CCPS	0.101 (0.405)	0.079 (0.407)	0.082 (0.440)	0.077 (0.411)	0.001 (0.893)	−0.007 (0.127)	0.014 (0.284)	−0.010** (0.027)
IMR	0.078 (0.410)	−0.038 (0.797)	−0.247 (0.122)	0.095 (0.272)	0.007 (0.153)	−0.005 (0.632)	0.005 (0.546)	0.002 (0.798)
Intercept	3.051 (0.102)	1.304* (0.069)	0.022 (0.988)	−0.387 (0.555)	−0.015 (0.942)	0.152*** (0.001)	0.222 (0.105)	0.017 (0.728)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	935	1546	577	1904	935	1546	577	1904
Adj. R^2	0.724	0.627	0.730	0.626	0.492	0.361	0.547	0.363

Note: This table presents the regression results of the association between performance, climate change incentives and climate change impact. Panel A shows regression results for *CCPS*, whereas Panel B shows the performance results based on country-level carbon culture. Models (1)–(4) show the regression results focusing on market-based performance as measured by *TOBINQ*. Models (5)–(8) show the regression results for accounting-based performance, specifically *ROA*. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

TABLE 10 Country adoption of emissions trading scheme (ETS)

	DV = CCPS				DV = Emissions			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Climate_CEO	0.097*** (0.001)				−0.320 (0.135)			
Climate_CEO × ETS	0.072** (0.031)				0.139 (0.571)			
Climate_Director		0.043 (0.294)				0.241 (0.133)		
Climate_Director × ETS		0.095** (0.041)				−0.185 (0.348)		
Climate_TopExec			0.002 (0.959)				−0.205 (0.157)	
Climate_TopExec × ETS			0.092* (0.094)				0.237 (0.199)	
Climate_Other				0.011 (0.808)				−0.372** (0.013)
Climate_Other × ETS				0.070 (0.112)				0.257* (0.065)
ETS	0.114*** (0.003)	0.122*** (0.004)	0.082 (0.166)	0.078 (0.192)	−0.269* (0.068)	−0.248* (0.059)	−0.348** (0.036)	−0.414*** (0.006)
CEO Comp	0.007*** (0.000)	0.007*** (0.001)	0.007*** (0.002)	0.007*** (0.001)	−0.048*** (0.004)	−0.048*** (0.004)	−0.047*** (0.004)	−0.046*** (0.004)
IMR	−0.057** (0.015)	−0.054** (0.018)	−0.068*** (0.005)	−0.062** (0.012)	−0.296 (0.108)	−0.282 (0.119)	−0.291 (0.109)	−0.306* (0.100)
Intercept	0.533* (0.061)	0.342 (0.207)	0.497* (0.082)	0.542* (0.079)	11.537*** (0.000)	11.370*** (0.000)	11.578*** (0.000)	11.487*** (0.000)
Firm level and country level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3578	3578	3578	3578	2861	2861	2861	2861
Adj. R^2	0.210	0.198	0.199	0.188	0.529	0.528	0.528	0.530

Note: This table presents the regression results of the quasi-experimental analysis. Models (1)–(4) show the regression results of the association between climate change incentives and climate change disclosures as a measure of climate change impact. Models (5)–(8) show the regression results of the association between climate change incentives and carbon emissions as a measure of climate change impact. Coefficient values (*p* values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

an ETS is to help firms achieve their commitments to reducing carbon emissions in a cost-effective way (European Union Emissions Trading System [EU ETS], 2021). As our study covers an international setting, there is variation in whether countries adopted a national-level ETS and variation in the years of adoption. For example, the Regional Greenhouse Gas Initiative (RGGI) in the US has operated mandatory carbon emissions trading since 2009. New Zealand enacted an ETS in 2008. Hence, the introduction of an ETS in these countries offers a quasi-experimental setting in which to study the effects of a firm's climate change incentives on that firm's climate change performance and carbon emissions. We expect that executives of firms domiciled in countries with an ETS are more focused on improving their CCPS and reducing carbon emissions after ETS adoption. Our variable of interest is *ETS*, an indicator variable equal to 1 if the country initiated an ETS and 0 otherwise. We interact *ETS* and climate change incentives of the CEO, the board, top executives, and other executives. This interaction captures whether a firm's provision of climate change incentives influences its climate change performance and carbon emissions following a change in legislation related to climate change.

Table 10 reports the regression results. We document an increase in the effectiveness of climate-linked CEO compensation in improving CCPS after ETS adoption. The board of directors, top executives, and other executives are also associated with better CCPS after ETS adoption. However, providing climate change incentives after the ETS's issuance does not appear to reduce carbon emissions. These findings can be interpreted as a firm improving its plans to reduce its carbon footprint after ETS introduction; however, its carbon emissions do not decrease significantly.

7 | CONCLUSION

In this study, we examine whether linking a firm's executive compensation to its climate performance can spur investments towards a low-carbon future and whether this linkage leads to improved climate performance impact. The study uses two measures of a firm's climate-related performance: Performance scores primarily related to strategy and performance measured by carbon emissions. Our study's dataset covers 40 countries from 2006 to 2018, enabling us to explore cultural differences in the link between climate-linked compensation and climate performance, with our study finding that the two are positively associated. This finding is interpreted to mean that firms linking the compensation of the CEO, executives, or board directors to climate-related issues exhibit higher firm-level climate impact. Furthermore, we find that climate-related incentives given to the CEO and other executives are negatively associated with the level of carbon emissions, although the relationship is not as strong. After segmenting carbon emissions by direct and indirect emissions, we find evidence that firms may be offshoring polluting activities to subsidiaries to reduce direct emissions but increase indirect emissions.

We find that two proxies for country-level cultural views on the environment are positively associated with a firm's climate-related strategy but not its carbon emissions. We also find that two proxies for country-level cultural views, based on two ideas that the environment is a societal problem or that individuals should try to improve the environment, are positively associated with a firm's climate change performance but not its carbon emissions. Further analysis shows that non-US firms are driving our results.

We also examine whether climate strategy affects shareholder value and find that the improvement in climate strategy is positively associated with Tobin's Q, but it has no effect on profitability. We further divide firms in the sample based on the median *Carbon_Individual* index value and the median *Carbon_Society* value and again rerun the analysis. The results indicate that climate strategy is linked to a reduction in profitability in societies with a lower *Carbon-Individual* index value. We employ the adoption of an ETS as an exogenous event to a firm's climate change performance and its carbon emissions to control for potential endogeneity in our estimation. Climate-linked compensation is associated with a firm's better climate change performance after its country's ETS adoption compared to before this adoption. However, there is no evidence of a reduction in carbon emissions after the ETS issuance.

Although a firm's climate-linked compensation is associated with positive changes in its climate strategy, its association with the firm's carbon emissions, although showing promise, is not meaningfully consistent. Specifically, firms offer incentives to executives who are likely to make operational decisions with a direct impact on the firm's carbon footprint and emissions. This is especially important given that linking executives' compensation with climate performance is gaining momentum.

ACKNOWLEDGMENT

No funders available.

DATA AVAILABILITY STATEMENT

All data are publicly available as mentioned in the paper.

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NOTES

[1] The CDP database is frequently used for climate change-related research (Bose et al., 2021; Griffin et al., 2017; Ioannou et al., 2016; Matsumura et al., 2014). The questionnaire can be obtained from <https://www.cdp.net/en/guidance/guidance-for-companies>. The company first started collecting data in 2002, but in the early years, the survey was merely quantitative. The first year that the CDP climate change score was reported was 2006. CDP2019 corresponds to the financial year 2018.

[2] We compute the economic magnitude of 15.72% as follows: exp $(-0.171-1) \times 100$. We also use carbon emissions intensity as an alternative measure of carbon emissions, which is computed as the ratio of total carbon emissions to total revenue. We do not report the regression results for brevity. However, the unreported results suggest that our findings remain qualitatively similar.

[3] We calculate variance inflation factor (VIF) values for *IMR* to ensure that multicollinearity is not the reason for *IMR*'s insignificant coefficient. The unreported VIF values for *IMR* vary between 1.19 and 3.21 in the *EMISSION* models, thus indicating that multicollinearity is not an issue. Although for reasons of brevity the analysis is not reported, we compute three classifications of institutional investors' ownership, following Bushee (1998): transient, quasi-indexers, and dedicated. Following Pathan et al. (2021), we adopt Bushee's (1998) transient investor category as a measure of short-term shareholdings and the sum of shareholdings by quasi-indexers and dedicated investors as a measure of long-term shareholdings. We include these two classifications of institutional investors' ownership in our baseline model for US firms. We find that long-term holdings are insignificant in both the *CCPS* and *EMISSION* models. However, short-term holdings are positively and significantly associated with *EMISSION* models but not with *CCPS* models.

[4] We also adjust direct and indirect carbon emissions by total revenue. We do not report the regression results for brevity. However, the unreported results suggest that our findings remain qualitatively similar.

[5] We test the equality of coefficients for significant differences between dirty and clean industries using a chi-square test. In unreported estimations, we also conduct this analysis for countries with higher and lower levels of pollution. We define polluted countries as those in which country-level emissions are higher than median country emissions each year. No significant difference is found between polluted and less-polluted countries in the effectiveness of climate-linked incentives.

[6] The 6.31% increase is calculated as ($0.020 \times 2.337 + 0.007 \times 2.337$).

[7] See for example https://www.nationalgeographic.com/science/article/how-trump-is-changing-science-environment (accessed July 2, 2022).

[8] Several countries are missing coverage of certain culture questions in the WVS; thus, our observations are fewer in number for these tests. Additionally, we do not have WVS cultural variables for United Arab Emirates (UAE).

REFERENCES

Atif, M., Hossain, M., Alam, M. S., & Goergen, M. (2021). Does board gender diversity affect renewable energy consumption? *Journal of Corporate Finance*, *66*, 101665. https://doi.org/10.1016/j.jcorpfin.2020.101665

Berrone, P., & Gomez-Mejia, L. R. (2009). Environmental performance and executive compensation: An integrated agency–institutional perspective. *Academy of Management Journal*, *52*, 103–126. https://doi.org/10.5465/amj.2009.36461950

Bose, S., Minnick, K., & Shams, S. (2021). Does carbon risk matter for corporate acquisition decisions? *Journal of Corporate Finance*, *70*, 1–24. https://doi.org/10.1016/j.jcorpfin.2021.102058

Botosan, C. A., & Plumlee, M. A. (2002). A re-examination of disclosure level and the expected cost of equity capital. *Journal of Accounting Research*, *40*, 21–40. https://doi.org/10.1111/1475-679X.00037

Burns, N., Minnick, K., & Starks, L. (2017). CEO tournaments: A cross-country analysis of causes, cultural influences, and consequences. *Journal of Financial and Quantitative Analysis*, *52*, 519–551. https://doi.org/10.1017/S0022109017000163

Bushee, B. J. (1998). The influence of institutional investors on myopic R&D investment behavior. *The Accounting Review*, *73*, 305–333. https://www.jstor.org/stable/248542

CDP (formerly Carbon Disclosure Project). (2008) *Carbon Disclosure Project Report 2008: Globalizations 500*. https://www.cdproject.net/Documents/cdp_global_500_report_2008.pdf

Clarkson, P. M., Li, Y., Pinnuck, M., & Richardson, G. (2015). The value relevance of greenhouse gas emissions under the European Union carbon emissions trading scheme. *The European Accounting Review*, *24*, 551–580. https://doi.org/10.1080/09638180.2014.927782

Clarkson, P. M., Li, Y., Richardson, G., & Vasvari, F. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, *33*, 303–327. https://doi.org/10.1016/j.aos.2007.05.003

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, *30*, 122–144. https://doi.org/10.1016/j.jaccpubpol.2010.09.013

Dahlmann, F., Branicki, L., & Brammer, S. (2019). Managing carbon aspirations: The influence of corporate climate change targets on environmental performance. *Journal of Business Ethics*, *158*, 1–24. https://doi.org/10.1007/s10551-017-3731-z

Daradkeh, H., Shams, S., Bose, S. & Gunasekarage, A. (2022) *Does Managerial Ability Matter for Corporate Climate Change Disclosures? Corporate Governance: An International Review*, https://doi.org/10.1111/corg.12436

de Villiers, C., Naiker, V., & van Staden, C. J. (2011). The effect of board characteristics on firm environmental performance. *Journal of Management*, *37*, 1636–1663. https://doi.org/10.1177/0149206311411506

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2014). Corporate social responsibility disclosure and the cost of equity capital: The roles of stakeholder orientation and financial transparency. *Journal of Accounting and Public Policy*, *33*, 328–355. https://doi.org/10.1016/j.jaccpubpol.2014.04.006

Dhaliwal, D. S., Radhakrishnan, S., Tsang, A., & George, Y. Y. (2012). Nonfinancial disclosure and analyst forecast accuracy: International evidence on corporate social responsibility disclosure. *The Accounting Review*, *87*, 723–759. https://doi.org/10.2308/accr-10218

Djankov, S., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2008). The law and economics of self-dealing. *Journal of Financial Economics*, *88*, 430–465. https://doi.org/10.1016/j.jfineco.2007.02.007

Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019). Do institutional investors drive corporate social responsibility? International evidence. *Journal of Financial Economics*, *131*, 693–714. https://doi.org/10.1016/j.jfineco.2018.08.013

Eccles, R. G., Serafeim, G., & Krzus, M. P. (2011). Market interest in nonfinancial information. *Journal of Applied Corporate Finance*, *23*, 113–127. https://doi.org/10.1111/j.1745-6622.2011.00357.x

Economic Intelligence Unit (EIU). (2015) *Economic and geopolitical insight guiding the world's organisations*. https://www.eiu.com/n/

European Union Emissions Trading System (EU ETS). (2021) *Climate action*. https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en (accessed on November 15, 2021).

Francoeur, C., Melis, A., Gaia, S., & Aresu, S. (2017). Green or greed? An alternative look at CEO compensation and corporate environmental commitment. *Journal of Business Ethics*, *140*, 439–453. https://doi.org/10.1007/s10551-015-2674-5

Germanwatch & Climate Action Network. (2019) *The Climate Change Performance Index*. https://www.climate-change-performance-index.org/downloads (accessed on September 13, 2022).

Griffin, P. A., Lont, D. H., & Sun, Y. (2017). The relevance to investors of greenhouse gas emission disclosures. *Contemporary Accounting Research*, *34*, 1265–1297. https://doi.org/10.1111/1911-3846.12298

Harvard Business Review. (2019) https://hbr.org/2019/07/the-elusive-green-consumer (accessed June 15, 2022)

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, *47*, 153–161. https://doi.org/10.2307/1912352

Henriques, I., & Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal*, *42*, 87–99. https://doi.org/10.2307/256876

Herbohn, K., Gao, R., & Clarkson, P. (2019). Evidence on whether banks consider carbon risk in their lending decisions. *Journal of Business Ethics*, *158*, 155–175. https://doi.org/10.1007/s10551-017-3711-3

Ioannou, I., Li, S. X., & Serafeim, G. (2016). The effect of target difficulty on target completion: The case of reducing carbon emissions. *The Accounting Review*, *91*, 1467–1492. https://doi.org/10.2308/accr-51307

Lang, M. H., & Lundholm, R. J. (1993). Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of Accounting Research*, *31*, 246–271. https://doi.org/10.2307/2491273

Lang, M. H., & Lundholm, R. J. (1996). Corporate disclosure policy and analyst behavior. *The Accounting Review*, *71*, 467–492. https://www.jstor.org/stable/248567

Li, X., & Zhou, Y. M. (2017). Offshoring pollution while offshoring production? *Strategic Management Journal*, *38*, 2310–2329. https://doi.org/10.1002/smj.2656

Liao, L., Luo, L., & Tang, Q. (2015). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, *47*, 409–424. https://doi.org/10.1016/j.bar.2014.01.002

Lyon, T. P., & Maxwell, J. W. (2011). Greenwash: Corporate environmental disclosure under threat of audit. *Journal of Economics and Management Strategy*, *20*, 3–41. https://doi.org/10.1111/j.1530-9134.2010.00282.x

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-value effects of carbon emissions and carbon disclosures. *The Accounting Review*, *89*, 695–724. https://doi.org/10.2308/accr-50629

Moneva, J. M., Archel, P., & Correa, C. (2006). GRI and the camouflaging of corporate unsustainability. In *GRI and the Camouflaging of Corporate Unsustainability* (pp. 121–137). Elsevier.

Pathan, S., Haq, M., Faff, R., & Seymour, T. (2021). Institutional investor horizon and bank risk-taking. *Journal of Corporate Finance*, *66*, 101794. https://doi.org/10.1016/j.jcorpfin.2020.101794

Qian, W., & Schaltegger, S. (2017). Revisiting carbon disclosure and performance: Legitimacy and management views. *The British Accounting Review*, *49*, 365–379. https://doi.org/10.1016/j.bar.2017.05.005

Ritz, R. A. (2022). Linking executive compensation to climate performance. *California Management Review*, *64*, 124–140. https://doi.org/10.1177/00081256221077470

Shapira, R. & Zingales, L. (2017) *Is Pollution Value-Maximizing? The DuPont Case*. https://www.nber.org/papers/w23866

Simnett, R., Vanstraelen, A., & Chua, W. F. (2009). Assurance on sustainability reports: An international comparison. *The Accounting Review*, *84*, 937–967. https://doi.org/10.2308/accr.2009.84.3.937

Smithers, R. (2012). M&S becomes 'carbon neutral'. In *The Guardian*. https://www.theguardian.com/environment/2012/jun/07/marks-spencer-carbon-neutral-sustainability. accessed on July 1, 2022

Welzel, C. (2013). *Freedom Rising*. Cambridge University Press. https://doi.org/10.1017/CBO9781139540919

World Business Council for Sustainable Development & World Resources Institute (WBCSD and WRI). (2004) *The Greenhouse Gas Protocol—A Corporate Accounting and Reporting Standard*. http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf (accessed on May 20, 2022).

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How to cite this article: Bose, S., Burns, N., Minnick, K., & Shams, S. (2023). Climate-linked compensation, societal values, and climate change impact: International evidence. *Corporate Governance: An International Review*, *31*(5), 759–785. https://doi.org/10.1111/corg.12504

APPENDIX A: CARBON DISCLOSURE PROJECT (CDP)

The score includes the following items:

1. Governance: questions to assess board and management oversight of climate-related risk and opportunities.
2. Climate risks and opportunities management: identification of risk and opportunities, assessment of planning, time horizon.
3. Strategy and scenario analysis: Has the firm identified changes to its business model required to adapt to a low-carbon future?
4. Targets and performance: Does the firm have an active emissions reduction target, are targets tracked and consistent with science-based emissions targets?
5. Metrics: Does the firm have mechanisms for measuring targets? Does the firm's carbon pricing system comply with carbon pricing regulation and include carbon tax policies?
6. Carbon pricing and trading: How does the firm price carbon?
7. Investment: What investments are made for achieving low-carbon energy efficiency or alternative products?
8. Supply chain: What methods is the firm using to engage its supply chain?

The CCPS has changed over time and is not comparable across years. The CCPS has ranged from 0 to 100 since CDP2006. However, CDP changed its scoring system in 2015, and it provides climate change performance grades based on the scores instead of providing the actual scores. CDP provides eight performance bands (i.e., A, A-, B, B-, C, C-, D, and D-) based on firms' disclosures of climate change information. Therefore, we convert the grades starting from those in 2015 into numeric scores. We assign the following points based on the grade: A = 8, A- = 7, B = 6, B- = 5, C = 4, C- = 3, D = 2, D- = 1 following the existing literature (Lang & Lundholm, 1993; Lang & Lundholm, 1996; Botosan & Plumlee, 2002). We then convert these into percentile ranks based on country and year. Specifically, for each year, we calculate the rank of CCPS, as (firm rank-1)/(number of firm-1). The CCPS ranges from 0 for the lowest-ranked firm to 1 for the highest-ranked firm.

APPENDIX B: DESCRIPTIONS OF VARIABLES

Variable		Explanation	Source
Panel A: Dependent variables			
CDP_DISC	CDP response	An indicator variable that takes a value of 1 if the firm responds to the CDP questionnaire and 0 otherwise.	CDP database
CCPS	Climate change disclosures	The firm's percentile rank climate change score. Climate change score summarizes a firm's climate change initiatives in governance, strategy, targets, emissions, carbon pricing, and engagement with supply chain partners.	CDP database
LNEMISSION	Carbon emissions	The natural logarithm of the total carbon emissions (metric tons) by a firm.	CDP database
Panel B: Exclusion restriction variables			
PROPDISC	Industry pressure	The ratio of the number of firms with publicly available CDP responses to the number of firms in the industry.	CDP database
CDP_LAG	Prior year's CDP response	An indicator variable that takes a value of 1 if the firm responds to the CDP questionnaire in the previous year and 0 otherwise.	CDP database
Panel C: Research variables			
Climate_CEO	CEO climate change incentives	An indicator variable that takes a value of 1 if climate incentives are given to the CEO and 0 otherwise.	CDP database
Climate_Board	Board directors' climate change incentives	An indicator variable that takes a value of 1 if climate incentives are given to board directors and 0 otherwise.	CDP database
Climate_TopExec	Top executives' climate change incentives	An indicator variable that takes a value of 1 if climate incentives are given to top executives and 0 otherwise.	CDP database

Variable		Explanation	Source
Climate_Others	Other executives' climate change incentives	An indicator variable that takes a value of 1 if climate incentives are given to other executives and 0 otherwise.	CDP database
CEO Comp	CEO compensation	The natural logarithm of the total annual compensation of the CEO.	BoardEx Database
Panel D: Firm-level control variables			
SIZE	Firm size	The natural logarithm of the market capitalization at the beginning of the year.	Worldscope
ROA	Profitability	The ratio of net income before extraordinary items to total assets.	Worldscope
LEV	Leverage	The ratio of total debt to total assets.	Worldscope
FAGE	Firm age	The natural logarithm of the total number of years since the firm first appears in the Worldscope database.	Worldscope
MB	Market-to-book ratio	The ratio of the market value of equity to the book value of equity.	Worldscope
INSTOWN	Institutional ownership	The percentage of ownership held by institutional owners.	FactSet Lion Share
ANALYST	Analysts' coverage	The natural logarithm of the total number of analysts.	I/B/E/S
VOL	Firm risk	The standard deviation of the daily stock return over the fiscal year.	DataStream
FOREIGN	Foreign operations	An indicator variable of 1 if a firm has foreign operations and 0 otherwise.	Worldscope
RDINT	Research and development	The ratio of research and development (R&D) expenditures to total assets.	Worldscope
CAPEX	Capital expenditures	Total capital expenditures scaled by total assets.	Worldscope
SGROWTH	Sales growth	Annual sales growth.	Worldscope
ENV_PERF	Environmental performance	The environmental pillar score from the Thomson Reuters Asset4 database.	ASSET4
CROSS	Cross-listing	Total number of stock exchanges on which the firm is listed.	Worldscope
TOBINQ	Tobin's Q	The sum of the book value of total assets plus the market value of equity minus the book value of equity divided by total assets.	Worldscope
Panel E: Country-level control variables			
LNGDP	Gross domestic product	The natural logarithm of the country's gross domestic product.	World Bank
LNCRI	Climate change risk	The natural logarithm of the country-level global climate change risk score.	Germanwatch and Climate Action Network
STAKE	Stakeholder orientation	An indicator variable of 1 if the firm operates in a code law country, and 0 if the firm operates in a common law country.	Djankov et al. (2008) and Simnett et al. (2009)
LEGAL	Legal environment	Principal component of Rule of Law, Regulatory Quality and Control of Corruption from the Worldwide Governance Indicator (World Bank).	World Bank
Carbon_Society	Carbon society	Carbon society culture score from the World Values Survey.	World Values Survey
Carbon_Individualism	Carbon individualism	Carbon individualism culture score from the World Values Survey.	World Values Survey

(Continues)

Variable		Explanation	Source
ETS	Country-level emissions trading scheme	An indicator variable that takes a value of 1 after a country adopts either a national or regional-level emissions trading scheme and 0 otherwise.	https://icapcarbonaction.com

APPENDIX C: FIRST STAGE OF HECKMAN'S SELECTION MODEL FOR RESPONSE TO CDP QUESTIONNAIRE

	DV = CDP Response
	(1)
PROPDISC	3.131*** (0.000)
CDP_DISC_LAG	2.81*** (0.000)
SIZE	0.183*** (0.000)
ROA	−0.457 (0.143)
LEV	0.222 (0.178)
FAGE	0.017 (0.408)
MB	−0.018*** (0.000)
INSTOWN	0.100 (0.144)
ANALYST	0.168*** (0.001)
VOL	−5.094** (0.047)
FOREIGN	0.242*** (0.001)
RD_INT	−0.339 (0.596)
CAPEX	0.984** (0.037)
SGROWTH	−0.203** (0.031)
ENV_PERF	0.562*** (0.000)
CROSS	0.184*** (0.004)
LNGDP	−0.086 (0.163)
LNCRI	0.068 (0.426)
STAKE	0.089 (0.101)
LEGAL	0.021 (0.743)
Intercept	−5.113*** (0.000)
Year fixed effects	Yes
Industry fixed effects	Yes
Observations	16,207
Pseudo R^2	0.746

Note: This panel reports the logit estimation of the likelihood of responding to the CDP questionnaire. The dependent variable equals 1 if the firm responds to the CDP questionnaire and 0 otherwise. The regression includes year and industry fixed effects. Coefficient values (p values) are shown with standard errors clustered at the country level. Appendix B provides the definitions of variables.

*** Statistically significant at the 1% level.

** Statistically significant at the 5% level.

* Statistically significant at the 10% level.

APPENDIX D: COUNTRY ATTITUDES TOWARDS ENVIRONMENTAL ISSUES

We measure five cultural attitudes based on answers related to the World Values Survey questions. Before the question, we state the value that we have coded as acceptance of the attitude. Following Welzel (2013), we standardize each item on a scale with a minimum of 0 and a maximum of 1 with acceptance of the attitude obtaining the highest score.

Carbon_Individual
1. Very much like me: It is important to this person: looking after the environment
2. Strongly agree: Would give part of my income for the environment
3. Strongly agree: Would buy things at a 20% higher price if it helped to protect environment
4. Have done: Environmental action: chosen products that are better for the environment
5. Have done: Environmental action: recycle
6. Have done: Environmental action: reduce water consumption
Carbon_Society
1. Strongly agree: Support an increase in taxes if used to prevent environmental pollution
2. Strongly agree: Government should reduce environmental pollution
3. Have done: Environmental action: attended meeting, signed petition
4. Yes: Past two years: Given money to ecological organization
5. Yes: Past two years: Participated in demonstrations for environment
6. Have done: Environmental action: contributed to environmental organization