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CEO power and firm decarbonisation efforts

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Using a global sample of 899 firms from 26 countries for the period 2000 to 2021, this study investigates the effect of CEO power on firms' decarbonisation efforts. We find that firms with higher levels of CEO power are associated with lower carbon emissions. Further analysis indicates that nationally diverse boards and older board members amplify the negative relationship between CEO power and carbon emissions. Similarly, powerful CEOs with high academic qualifications aggressively pursue corporate decarbonisation. The impact of CEO power on decarbonisation is more noticeable in carbon-intensive industries. Lastly, we document that climate legislation can be catalytic for decarbonisation.

1. Introduction

Companies consume a significant amount of fossil fuels, which has resulted in growing pressure from environmental activists and green investors for firms to reduce their reliance on hydrocarbons or other processes that cause anthropogenic pollution. Notably, about 100 firms are estimated to be responsible for 71 % of global carbon emissions (BBC, 2020; Guardian, 2017). Consequently, reducing corporate carbon emissions has been the central theme of burgeoning studies and has been a matter of increasing debate in recent years. One of the reasons for the pushback by firms and other stakeholders is that energy consumption directly impacts firms' earnings and market value. Therefore, firms are reluctant to reduce carbon emissions. However, the literature is inconclusive on whether there is a business case for corporate reliance on non-renewable energy sources (Busch & Lewandowski, 2018; Endrikat et al., 2014; Horvathova, 2010). Whilst earlier studies document the willingness and economic benefits of investing in environmentally sustainable production processes (Franzen, 2003; Gelissen, 2007), there is a paucity of research on the role of CEOs in corporate carbon abatement. In this study, we address this issue by examining the role of CEO Power in the drive for corporate decarbonisation.

Mounting evidence indicates that powerful CEOs influence various corporate decisions (Feng et al., 2011; Greve & Mitsuhashi, 2007; Schiehll et al., 2018). Accordingly, firms' decarbonisation efforts will be no different. Lending credence to this view, Fracassi and Tate (2012) document that dominant CEOs induce the appointment of directors and, as such, are subject to weaker board monitoring. In analysing factors that influence firms to reduce carbon emissions, recent studies show that institutional investors care about the environment and, thus, induce firms to engage in environmentally responsible activities (Marshall et al., 2022). CEOs of major companies have increasingly engaged in discussions on carbon emissions, often signalling their firms' commitment to reducing greenhouse gases. For instance, in 2020, Apple's CEO, Tim Cook, pledged to reduce the company's carbon emissions by 75 % by 2030, despite regulatory rollbacks during the Trump administration. This example, among others, highlights the significant role that CEOs can play in efforts to mitigate carbon emissions. However, other CEOs such as Darren Wood of ExxonMobil and Patrick Pouyanne of TotalEnergies resisted regulatory rollbacks, while Chris Wright of Libert Energy and Carlos Tavares of Stellantis leveraged them.

Furthermore, the corporate governance literature posits that firms alleviate information asymmetry friction when they engage in socially responsible activities (Ioannou & Serafeim, 2017). Similarly, Azar et al. (2021) demonstrate that the "Big Three" (BlackRock, Vanguard, and State Street Global Advisors) are leading the charge for the reduction of corporate carbon emissions around the world. A stream of recent

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empirical studies supports the concern that climate risk has financial implications and regulatory risk for institutional investors risk (Gibson-Brandon & Krueger, 2018; Hoepner et al., 2019). To this end, Krueger et al. (2020) show that institutional investors' portfolio value can be enhanced by CO_2 emissions reduction.

The corporate governance literature shows that CEOs exert power over the board due to their role in the board selection process (Hermalin & Weisbach, 1998; Shivdasani & Yermack, 1999). Thus, powerful CEOs can select from outside candidates with the sole objective of maximising shareholders' wealth. Accordingly, even though a powerful CEO may prefer to maximise his expected payoff, it may be subjected to the constraints of regulations and the board. Various studies indicate that a company's choice to invest in renewable energy is associated with the composition of its board of directors (see Altunbas et al., 2022; Borghesi et al., 2014; Hill & Jones, 1992; Konadu et al., 2022; Prado-Lorenzo & Garcia-Sanchez, 2010).

Using a panel of 899 firms from 26 countries from 2000 to 2021, our results show that firms with powerful CEOs emit less carbon. Furthermore, CEOs of firms in civil law countries take a more active stance regarding decarbonisation. Secondly, we show that older-dominated boards tend to influence powerful CEOs to reduce corporate carbon emissions. Third, we provide evidence that nationally diverse boards impact powerful CEOs to reduce Carbon emissions. Fourth, we demonstrate that carbon reduction legislation could help galvanise the decarbonisation efforts of firms led by powerful CEOs. Fifth, we find that CEOs with high academic qualifications pursue an aggressive carbon reduction policy. Sixth, the role of powerful CEOs in abating corporate carbon emissions is more pronounced in carbon-intensive industries. Sixth, the evidence confirms the notion that civil-law countries have strong corporate social responsibility ideology. This supports the argument that corporate legal origin is valuable in understanding the relationship between CEO power and corporate carbon emission. Seventh, we find that the effects of CEO power on carbon emissions reduction differ with the degree of industry reliance on carbon. We also evince that climate legislation can be catalytic for decarbonisation. Our results are robust to alternative measures of CEO power, placebo tests, and industry reduction intensity.

Our study makes the following important contributions to the burgeoning literature on corporate carbon emissions. One strand of the literature provides evidence on whether and how firms react to climate risk and shareholder value maximisation (Bansal et al., 2017; Bolton & Kacperczyk, 2021; Hsu et al., 2019). Recent studies investigate how institutional investors pressure firms to reduce carbon emissions to improve the environment (Gibson-Brandon & Krueger, 2018; Hoepner et al., 2019). We add to the increasing debate - the disagreement between institutional investors and corporations concerning the financial case for carbon emission reduction. We also complement the growing body of work that documents the role of boards and corporate governance structure in the race for net zero (see Altunbas et al., 2022).

Our study differs from existing studies examining corporate governance characteristics' role in environmental improvement (see, for example, Atif et al., 2021; Altunbas et al., 2022). Studies in social sciences postulate that CEO attributes and firm characteristics relate to corporate social responsibility. For instance, Hedge and Mishra (2019) find that CEO marital status plays a significant role in corporate social responsibility engagement. To the best of our knowledge, our study is the first to provide direct evidence of the role of CEO power in carbon abatement. Furthermore, we provide the first evidence in the literature that nationally diverse boards influence powerful CEOs to reduce corporate carbon emissions. Broader national representation in boards could promote discussions on the ravaging impact of climate change.

We also demonstrate that corporate legal origin is relevant for understanding the role of powerful CEOs in corporate carbon reduction efforts. This affirms the work of Marshall et al. (2022), who opines that foreign institutional investors from civil law countries influence Indian firms to engage more in corporate social responsibility.

2. Related literature and hypothesis development

2.1. Theoretical framework

The famed stakeholder theory is one theoretical explanation for why powerful CEOs may take positive climate actions. The theory is predicated on the premise that besides shareholders, other stakeholders are affected by a firm's outcomes. Therefore, managers need to pay attention to the priorities of stakeholders (i.e., shareholders, employees, customers, government, competitors, suppliers, and other pressure groups), particularly concerning their environmental priorities (Freeman, 2010;Freeman, 1984). In effect, firms have an implied social contract with key stakeholders, which they must uphold in their practices (Scherer & Palazzo, 2007). Some proponents of the literature argue that focusing on stakeholders can enhance the future profitability of firms (Donaldson & Preston, 1995). Others contend that the theory is not viable for corporate value maximisation because managers are drawn to multiple conflicting objectives (Jensen, 2010).

With respect to our setting, CEO power could be a vital tool for optimising value across various competing objectives. Since powerful CEOs often have significant control over their boardroom (see, for example, Fracassi & Tate, 2012; Shivdasani & Yermack, 1999), they typically have more capacity to address the needs of other stakeholders when they conflict with shareholders' priorities. Consequently, this capacity could manifest in powerful CEOs' ability to decarbonise compared to their less powerful counterparts.

2.2. The upside of CEO power

Pfeffer (1993) posits that top managers require a certain level of power to lead organisations. Nonetheless, as the top executives gain more power, the agency problem is exacerbated, leading to CEO complacency, empire-building, and overinvestment in low-quality projects (Pan et al., 2016), which thus reduces shareholder wealth. However, the literature has been silent on specific issues that could influence powerful CEOs to adopt corporate policies that maximise shareholders' wealth. By exploring powerful CEOs' attitudes toward greenhouse carbon emissions, our study offers new insight into how powerful CEOs could be agents for good. Evidence shows that powerful CEOs have important leadership qualities and could offer potential benefits to the organisation. Bennis and Nanus (1985) documented that top executives need the power to initiate and sustain actions by translating intentions into reality. Top executives will use their power to transform their interests into coordinated activities that achieve valuable goals. Adams et al. (2005a, 2005b) find that powerful CEOs have varying degrees of firm performance. However, powerful CEOs can better implement their decisions, which can positively affect the organisation's performance. Having a powerful CEO can enhance the stability and productivity of the organisation.

2.3. CEO power and greenhouse gas emissions

The last decade has witnessed heightened attention given to sustainability concerns. For instance, the Paris Agreement to reduce greenhouse carbon emissions. Despite the growing attention, a prudent unexplored question of whether CEOs with greater power prompt the reduction of greenhouse carbon emissions. Consistent with the agency theory, the corporate governance literature postulates that environmental improvement incorporating social responsibility engagement is linked to the principal agency problem. CEOs merely engage in CSR activities to satisfy important non-investing stakeholders at the cost of shareholders (Masulis & Reza, 2015; Tirole, 2001). By contrast, if CEOs with greater power are assumed to be myopic, they will be reluctant to invest in carbon reduction ventures. Furthermore, powerful CEOs may perceive investment to improve the environment as costly and value-destroying (Di Giuli & Kostovetsky, 2014; Masulis & Reza, 2015).

Therefore, it will take external pressure and other externalities to pressure powerful CEOs to reduce their carbon emissions or go greener.

Similarly, underinvestment in environmental improvements will expose the firm to climate risk. Such exposure to environmental risk could significantly affect the wealth of powerful CEOs since this is often linked to the fortune of the company (Adams et al., 2005a, 2005b; Morse et al., 2011). Therefore, it is in the personal interest of powerful CEOs to reduce their firm exposure to climate risk.

Managers and different stakeholders may have varying opinions on corporate practices. For example, firms' practice of reducing greenhouse emissions may be praised by employees but criticised by shareholders who care about shareholders' wealth. Mitchell et al. (1997) postulate that power is one of the key determinants of the importance of stakeholder-management subgroups. We provide the channels through which CEOs with greater power could influence greenhouse carbon emissions. First, powerful CEOs have decision-making authority and can influence the company's policies and environmental strategies. Powerful CEOs often prioritise companies' image and reputation. They will, therefore, take significant steps to reduce carbon emissions, which can improve their public reputations and portray them as environmentally conscious and responsible leaders. Bernea and Rubin (2010) document that managers over-invest in corporate social responsibility (CSR) for the private benefit to enhance their reputation. Consistent with the view that powerful CEOs could implement greenhouse gas emissions reduction initiatives and allocate resources toward sustainable practices.

Second, we could argue that powerful CEOs care about corporate culture and values. This will make the CEO prioritise sustainability and emission reductions and embed them in the company's ethos and practices. Therefore, powerful CEOs can direct investments toward sustainable technologies and innovations to reduce carbon emissions. Li et al. (2018) find that higher CEO power improves the environmental, social, and governance disclosure effect on firm value. Finally, powerful CEOs can effectively engage stakeholders in discussions about carbon emissions reduction goals and progress, which can form a long-term strategy for the company. Jiraporn and Chintrakarn (2013) show that when CEOs are relatively powerful, increasing CEO power leads to more engagement in CSR.

H1. *Firms with Powerful CEOs are aggressive in their decarbonisation efforts.*

2.4. Interplay between board age and powerful CEOs

The adage suggests that age comes with experience and virtue. The overall effect of age on the economics of the family is debatable, and the literature on virtue is linked to age. Existing literature has shown that attributes of managers and board directors (i.e., political affiliations, education, religion, and marital status) affect corporate policy (Bertrand & Schoar, 2003; Dahl et al., 2012; Roussanov & Savor, 2014). Cronqvist and Yu (2017) document that CEOs with daughters implement pro-corporate and socially responsible policies.

On average, older board members may indicate a high level of experience on the board and such attributes that may influence CEO decisions and, ultimately, corporate outcomes. Furthermore, age plays an important role because older board members will exhibit prosocial preferences relative to younger board members (see Cutler et al., 2021; Ebner et al., 2006; Fernández-Feijoo et al., 2014). Therefore, older boards could influence management to be proactive in environmental sustainability. Given the arguments, we hypothesise that older boards will influence powerful CEOs to promote environmental sustainability and thus reduce Greenhouse Emissions.

H2. *Firms with older boards will influence powerful CEOs to reduce their Greenhouse Emission.*

Corporate board members have varying tasks and responsibilities to improve corporate survival. These roles have become crucial following the 2008 global financial crisis and the emergence of global warming. The nationality of board members and CEOs can be one of the key traits that could be used for managerial self-interest. Evidence suggests that legal origin can explain variations in corporate social responsibility activities (see Liang & Renneboog, 2017). They show that firms in civil law countries engage in high corporate social responsibility relative to common law countries. A recent study by Marshall et al. (2022) finds that institutional investors from civil law countries export corporate social responsibility overseas to the host countries.

We contend that the national diversity of CEOs and board members will impact the firm's carbon emissions. For instance, board members from civil law countries will promote carbon emissions reduction. This is consistent with the existing literature that provides evidence based on social norms, cultural background (Dyck et al., 2019; Huberman, 2001), and regulatory environment in common-law countries (La Porta et al., 2008). This indicates that board members of civil law origin who are socially accustomed and familiar with mandatory corporate social responsibility provisions will more likely influence the CEO to reduce carbon emissions relative to board members from a common law background. Following the above argument, we hypothesise (H_3) that board nationality heterogeneity will influence powerful CEOs to reduce carbon emissions.

H3. *Board national heterogeneity will encourage powerful CEOs to reduce Corporate Carbon Emissions.*

3. Data source and estimation strategy

3.1. Sample

To compile our sample, we first collect firm-level governance data for all countries in the Boardex database for the period 2000–2021. We then collect data on firm greenhouse emissions from Refinitiv Eikon. We also gather firm-level financial data from Worldscope in Thomson Refinitiv. We then merge all three datasets using common identifiers (ISIN numbers). This process yields a total of 5914 observations from 899 firms in 26 countries. We were constrained to this sample size due to the number of data available. Table 1 shows a distribution of the sample by country.

3.2. Measure of carbon emissions

Our dependent variable of interest is based on firms' carbon emissions - which include both scope 1 (i.e., direct emission) and scope 2 (i.e. indirect emission) emissions. We follow existing studies (see Adamolekun et al., 2022; Altunbas et al., 2022; Baboukardos, 2017; Konadu et al., 2022) and calculate the natural logarithm of a firm's reported carbon emissions level (CO2 Log). We also employ two other alternative measures. Firstly, we consider the changes in CO2 equivalence by firms from year to year (Carbon Change). Secondly, we also use changes in CO2 equivalence from year to year adjusted by the industry average for each firm (Carbon Change Intensity).

3.3. Measures of CEO power

Our primary measure of CEO power is based on the CEO's relative compensation (CEO Pay Slice). We compute this as the ratio of CEO compensation to total executive compensation (Bebchuk et al., 2011). This reflects managerial power and CEO pay dominance as it shows the proportion of compensation of the firm's top managers claimed by the CEO (Correa & Lel, 2016).

To ensure that our results are not sensitive to the choice of our measure of CEO power, we employ alternative measures of power in our robustness checks. Firstly, we use CEO network size, which captures the level of connections a CEO has through education, employment, or other activities. This is regarded as a measure of prestige power (Daily &

Table 1
Country Level Distribution, Carbon Reduction Legislations, Legal Origin and Country Paris Agreement Stance.

S/No	Country	Per cent	Carbon Reduction Law	Legal Origin	Ratified the Paris Agreement?
1	Australia	0.05	Climate Change Act (2022)	Common Law	Yes
2	Austria	0.03		Civil Law	Yes
3	Belgium	0.12		Civil Law	Yes
4	Canada	0.25	Canadian Net-Zero Emissions Accountability Act (2021)	Common Law	Yes
5	Cyprus	0.12		Common Law	Yes
6	Denmark	0.05	Climate Act (2020)	Civil Law	Yes
7	Finland	0.36	Climate Change Act (2015)	Civil Law	Yes
8	France	5.77	Energy Transition for Green Growth Act (2015)	Civil Law	Yes
9	Germany	2.5	Climate Action Law (2019)	Civil Law	Yes
10	India	0.15	National Action Plan on Climate Change (2008)	Common Law	Yes
11	Ireland	2.67	Climate Action and Low Carbon Development Act (2015)	Common Law	Yes
12	Israel	0.05		Mixed	Yes
13	Italy	0.98	National Energy and Climate Plan (2019)	Civil Law	Yes
14	Luxembourg	0.29		Civil Law	Yes
15	Mexico	0.02	General Law on Climate Change (2012)	Civil Law	Yes
16	Netherlands	1.86	Netherlands	Civil Law	Yes
17	Norway	0.1	Climate Change Act (2017)	Civil Law	Yes
18	Russian Federation	0.02	Climate Doctrine (2009)	Civil Law	Yes
19	Singapore	0.07		Common Law	
20	Spain	1.07	Climate Change and Energy Transition Law (2021)	Civil Law	Yes
21	Sweden	0.36	Climate Act (2018)	Civil Law	Yes
22	Switzerland	1.32		Civil Law	Yes
23	United Arab Emirates	0.08	UAE Net Zero by 2050 Strategic Initiative (2021)	Civil Law	Yes
24	United Kingdom	34.16	Climate Change Act (2008)	Common Law	Yes
25	United States	47.51	Inflation Reduction Act (2022)	Common Law	Yes
26	Uruguay	0.05		Civil Law	Yes
	Total	100			

The Table presents country-level information on carbon reduction legislation, country of legal origin and their Paris Agreement stance.

Johnson, 1997). Secondly, CEO ownership power is used, which captures the value of equity held by the CEO (Bebchuk et al., 2011; Chikh & Filbien, 2011; Liu & Jiraporn, 2010; Sheikh, 2022). Lastly, we also use the time the CEO spends in the company (CEO Time in Coy).

3.4. Control variables

Following the literature, we use several variables to account for other factors that could influence corporate carbon emissions levels. As in Konadu et al. (2022), Adamolekun et al. (2022), Garel and Petit-Romec (2022), and Altunbas et al. (2022), we control for firm size, market-to-book ratio, slack, leverage, ROA, country carbon emissions level. We provide further information on our variable definition in Appendix 1.

4. Empirical analysis

4.1. Summary statistics

We begin our discussions with a geographical representation of CEO power in Fig. 1. The pictorial representation of our sample suggests that firms in Mexico, Russia, France, Spain, Sweden, Italy, and Austria have relatively powerful CEOs. However, it is worth noting that Mexico and Russia are sparsely represented in our sample.

Table 1 presents sample countries employed in our analysis. Notably, a significant portion of the sample comprises firms from the USA, UK, France, Germany, Ireland, Netherlands, and Switzerland. Furthermore, we report details of the industry distribution of our data in Appendix 2. Most countries represented in the sample were signatories to the Paris Agreement and have passed carbon reduction legislation.

Table 2 Panel A presents summary statistics of firms with powerful and non-powerful CEOs. Markedly, the *t*-test suggests that firms with powerful CEOs emit less carbon when compared with their weak counterparts. Similarly, firms with powerful CEOs hold more slack and less leverage than their counterparts. Markedly, firms with powerful CEOs are significantly smaller than firms with weak CEOs. In terms of CEO features, powerful CEOs, according to our description, have a higher pay slice, longer tenure, and more coopt board members. Similarly, firms with dominant CEOs have spent less time in the company, hold less equity, and have a lesser network when compared with their counterparts.

Panel B of Table 2 reports the test for parallel trend, a necessary criterion for employing a difference in differences regression. To perform this test, we identify firms before the emergence of a powerful CEO and compare their carbon emissions before this transition to those of firms with consistently weak CEOs. The result of the analysis suggests that before the emergence of powerful CEOs, the carbon emissions levels of both subsamples were indistinguishable. This affirms the view that future differences in carbon emissions of such firms could be attributed to the emergence of a powerful CEO.

4.2. Multivariate analysis

We commence our empirical analysis by examining whether CEO power significantly affects corporate carbon emissions levels (GhCE). We specify a difference-in-difference regression (DiD) using Eq. (1).

$$CE_{ist} = \delta_t + \delta_s + z_{ist}\beta + CEO\ Power_{ist}\gamma + \varepsilon_{ist} \tag{1}$$

CE_{it} is the dependent variable, which is a firm's carbon emissions. i index firms, t indexes year, and s indexes industry (ICB classification). δ_t refers to year-fixed effects. δ_s are the industry-fixed effects. z_{ist} refers to the covariates. ε_{ist} is the error term. $CEO\ Power_{ist}$ denotes the treatment that identifies firms with powerful CEOs (treated group) and counterpart firms with weaker CEOs (untreated group).

Table 3 reports the results of the DiD regression specified in Eq. (1). The findings suggest that powerful CEOs emit less carbon when compared with their cohorts, who do not wield as much power. We also document, albeit conservatively, that powerful CEOs pursue aggressive carbon reduction policies when compared with their counterparts. However, this effect is weakened when corporate carbon reduction is adjusted by the industry average. Considering the inherent corporate risk embedded in a firm's environmental practice, the findings confirm the power and risk aversion argument proposed by Smith and Stulz (1985). In effect, CEO power can be a catalyst for reducing adverse corporate environmental practices (Walls & Berrone, 2017). One proposition that explains this result is that the personal wealth of powerful CEOs is often tied to the future prosperity of their firm (Adams et al.,

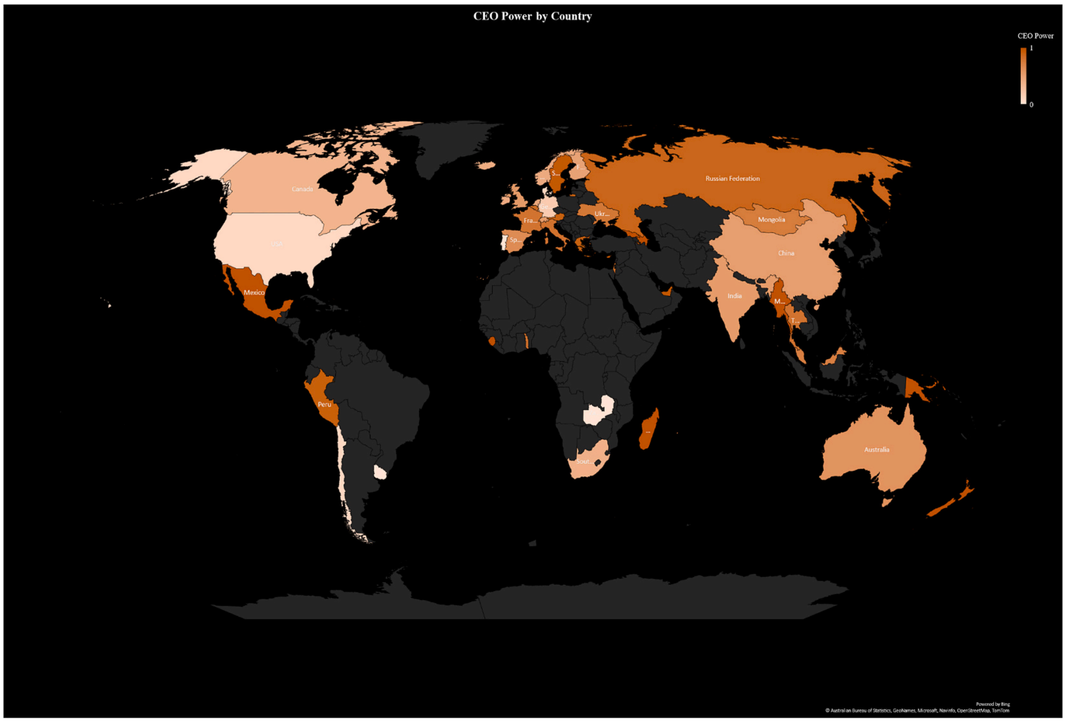

Fig. 1. CEO Power by Country.
The figure reports the concentration of CEO power among countries in our sample.

2005a, 2005b; Morse et al., 2011). The results are consistent with those of powerful CEOs such as Tim Cook, Darren Woods, Patrick Pouyanné, Chris Wright, and Carlos Tavares, who have engaged in reducing greenhouse emissions. Therefore, it is in the interest of powerful CEOs to mitigate their firms' exposure to climate risk. Furthermore, the result corroborates our conjecture that CEO power could be a valuable tool for navigating conflicting interests among stakeholders.

4.3. The role of older board members

In this section, we analyse the idea that older board members can influence powerful CEOs to reduce corporate carbon emissions. We present the results in Table 4. Columns 1 to 3 show that older boards indeed have a combined effect with powerful CEOs to reduce carbon emissions. The coefficients are negative and statistically significant. This confirms Hershfield et al.'s (2014) assertion that countries with significantly older people take their environmental concerns seriously. One proposition that explains these findings is that older board members are often more experienced and share a longer-term view of the firm, hence more concerned about the environmental sustainability of their actions. This, in turn, will result in older board members advocating for investments in environmentally sustainable processes.

4.4. Does board nationality mix matter?

Next, employing the difference in difference in differences (DDD) regression, we explore whether board nationality spread accentuates the impact of powerful CEOs. We evaluate whether powerful CEOs with nationally diverse boards take a stricter stance regarding their carbon reduction efforts. The motivation for doing this is that broader national representation on boards could increase the appreciation of the impact of anthropogenic climate change.

We report the results in Table 5. The result suggests that powerful CEOs with nationally diverse boards reduce their carbon emissions level more aggressively than their counterparts. This confirms our view that broader national representation on boards could accentuate the impact of powerful CEOs in combating high corporate carbon emissions. Our findings lend credence to the argument that board nationality mix can be leveraged for positive corporate outcomes (García-Meca et al., 2015).

4.5. Additional analysis and robustness tests

4.5.1. CEO power, legal origin and the efficacy of the paris agreement

Legal approaches shape the extent to which stakeholders are protected from expropriating managers and controlling shareholders (La Porta et al., 2000). Consequently, this can curtail the extent to which executives or other corporate actors exert their authority. To address this issue, we examine if the legal origin of a company moderates the impact of CEO power in corporate carbon reduction efforts. The estimation procedure is similar to what is presented in Eq. 1. The only difference is that the sample is split into firms from common law and civil law countries. We report the result of this analysis in Tables 6 & 7.

The results imply that before the Paris Agreement, powerful CEOs in civil law countries were more efficient at reducing their companies' carbon footprints than powerful CEOs from common law countries. We also document that before the Paris Agreement, firms with powerful CEOs from civil law emitted less carbon. Upon introducing the Paris Agreement as an exogenous shock, we find carbon reduction efforts appear more pronounced among powerful CEOs from civil law countries.

The evidence suggests that legal origin explains cross-country variations in corporate social responsibility (Liang & Renneboog, 2017). The European Union, dominated by civil law countries, drives global legislation for firms and investors to engage in environmentally sustainable activities (Amor-Esteban et al., 2018). Conversely, firms in common law countries, such as the US, perform poorly on sustainable practices.

4.5.2. Do national climate reduction legislations matter?

Next, we evaluate how the passage of climate legislation across the countries represented in our sample affects decarbonisation drive-by firms with powerful CEOs. To test this, we perform a difference in difference regression that examines changes in various decarbonisation

Table 2
Descriptive Statistics.

Panel A: Summary Statistics

	Powerful CEO							Non-Powerful CEO							
	count	mean	sd	min	p25	max	p75	count	mean	sd	min	p25	max	p75	Diff
CO2 Eqv	1934	5,568,653	18,100,000	72	48,359	178,000,000	1,439,418	3980	8,313,816	21,500,000	0	137,757	190,000,000	4,297,000	−2745163**
Carbon Change	1934	0.03	0.31	−0.63	−0.08	1.85	0.07	3980	0.03	0.29	−0.63	−0.07	1.85	0.06	0.00
CO2 Log	1934	12.48	2.64	4.28	10.79	19.00	14.18	3980	13.55	2.46	−1.17	11.83	19.06	15.27	−1.06**
Carbon Change Intensity	1934	−0.03	0.33	−0.94	−0.15	1.74	0.05	3980	−0.04	0.32	−0.94	−0.15	1.74	0.04	0.01
CEO Pay slice	1934	0.68	0.19	0.43	0.53	1.00	0.80	3980	0.26	0.10	0.00	0.17	0.43	0.34	0.42**
CEO Time in Coy	1934	10.49	8.88	0.00	3.50	41.10	14.90	3980	15.03	10.24	0.00	6.70	48.90	21.30	−4.54**
CEO Tenure	1827	5.20	4.86	0.00	1.90	33.90	6.90	3971	4.69	4.40	0.00	1.70	31.90	6.40	0.51**
Co-opt Board	1827	0.58	0.29	0.00	0.33	1.00	0.83	3971	0.47	0.28	0.00	0.25	1.00	0.69	0.11**
CEO Network Size	1926	1680	1802	23	475	11,604	2298	3922	2525	2102	15	943	11,604	3473	−845.32**
CEO Ownership	1727	40,857	307,709	0	639	6,384,267	11,460	3644	158,381	2,251,692	0	3328	103,000,000	26,242	−117524**
Size	1934	22.34	1.89	15.85	20.83	27.69	23.93	3980	23.39	1.48	17.47	22.52	27.50	24.34	−1.0**
Leverage	1934	0.25	0.17	0.00	0.14	1.67	0.35	3980	0.28	0.17	0.00	0.16	2.56	0.37	−0.03**
ROA	1934	0.08	0.18	−1.61	0.02	3.36	0.11	3980	0.07	0.14	−1.61	0.03	3.88	0.11	0.01
MTB	1934	1.75	3.65	0.01	0.58	84.10	1.96	3980	1.62	3.14	0.03	0.66	133.26	1.98	0.13
Slack	1934	0.37	0.19	0.00	0.22	1.00	0.48	3980	0.36	0.20	0.02	0.20	0.99	0.49	0.01**
Country Level CO2	1934	7.08	3.00	1.65	5.43	21.76	7.56	3980	13.33	4.38	1.41	8.86	21.48	16.11	−6.3**

Panel B: Parallel Tend Assumption

Group	Obs	Mean - CO2 Emission Log	Std. error	Std. dev.	Difference	T-stat
Before Powerful CEO	251	12.76	0.15	2.42	*0.11*	*0.63*
Non-Powerful CEO	1107	12.65	0.08	2.60		

The Table presents the summary statistics of firms with powerful and nonpowerful CEOs. To identify firms with powerful CEOs, we classify firms with CEO Pay Slice above the fourth quintile in a given year as powerful. We also report the difference in means and report the results of the difference in means. ** Refers to significance level below 10 %. Further details on the variable definition are provided in Appendix 1.

Table 3
CEO Power and Corporate Carbon Reduction Efforts.

	(1)	(2)	(3)
	CO2 Log	Carbon Change	Carbon Change Intensity
ATET			
CEO Power	−0.0493***	−0.0366**	−0.0330
	(−2.68)	(−2.03)	(−1.54)
Controls			
CO2 Log$_{[t-1]}$	0.6074***		
	(20.78)		
CO2 Level$_{[t-1]}$			
Size	0.2764***	0.0632***	0.0617***
	(9.22)	(3.19)	(2.99)
Leverage	−0.0617	0.0114	−0.0256
	(−0.68)	(0.17)	(−0.36)
ROA	−0.0242	0.0297	0.0210
	(−0.30)	(0.52)	(0.35)
Market to Book	0.0074	0.0027	0.0012
	(1.54)	(0.61)	(0.25)
Slack	0.0579	−0.1921**	−0.1730**
	(0.62)	(−2.38)	(−2.13)
Country Level CO2	0.0260*	−0.0008	−0.0111
	(1.70)	(−0.06)	(−0.69)
Constant	−1.2672**	−1.1451**	−1.1552**
	(−2.07)	(−2.26)	(−2.21)
Industry Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Observations	5914	5914	5914

The Table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

measures among countries with carbon reduction regulation and firms led by powerful CEOs. Notably, there are significant differences in regulatory coverage and enforcement quality. For example, the EU has comprehensive climate regulations and a robust carbon trading system, which, to a large extent, has been effective in catalysing corporate decarbonisation (Adamolekun et al., 2024). In contrast, in the USA, there is no concerted national corporate decarbonisation drive (Carley & Konisky, 2020). Therefore, the degree of adoption and enforcement of the legislation could have wide-ranging implications for the corporate decarbonisation drive. We attempt to address the problem of heterogeneity of national carbon legislation in our model by accounting for country effects. We report the results of this analysis in Table 8a. The findings from the analysis indicate that climate legislation can be catalytic for decarbonisation. Accordingly, we document that firms with powerful CEOs who operate in countries that passed carbon reduction legislation are more aggressive in reducing their carbon emissions level. Hence, such legislation, though lacking in enforcement, may be an essential signalling tool that forces decarbonisation efforts from corporate leaders.

To further understand the role of decarbonization-linked legislation in the low-carbon economy, we specify a model based on a US subsample. Accordingly, we run a difference in difference regression based on state carbon reduction law in the USA. We present the result of the difference in difference regression in Table 8b. The result indicates that state regulations are ineffective in catalysing firm decarbonisation efforts among powerful CEOs. One explanation for these findings is that firms can move their corporate headquarters elsewhere in the US if the laws are inhabitable. For example, several US firms, such as Tesla, Caterpillar, Oracle, Hewlett Packard Enterprise (HPE), and Charles Schwab, have moved their headquarters due to hostile regulatory changes.

Table 4
CEO Power, Board Age and Corporate Decarbonization.

	(1)	(2)	(3)
	CO2 Log	Carbon Change	Carbon Change Intensity
ATET			
CEO Power & Board Age	−0.0528***	−0.0570***	−0.0683*
	(−2.70)	(−3.28)	(−1.74)
Controls			
CO2 Log$_{[t-1]}$	0.6081***		
	(20.85)		
Size	0.2795***	0.0666***	0.0782
	(9.28)	(3.35)	(1.35)
Leverage	−0.0696	0.0016	−0.0571
	(−0.76)	(0.02)	(−0.46)
ROA	−0.0266	0.0279	−0.0464
	(−0.34)	(0.50)	(−0.35)
Market to Book	0.0078*	0.0030	0.0079
	(1.66)	(0.68)	(0.77)
Slack	0.0654	−0.1830**	−0.1115
	(0.70)	(−2.28)	(−0.40)
CO2 emissions	0.0254*	−0.0010	−0.0078
	(1.67)	(−0.07)	(−0.17)
CO2 Level$_{[t-1]}$			
Constant	−1.3424**	−1.2168**	−1.4974
	(−2.18)	(−2.40)	(−0.89)
Industry Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Observations	5914	5914	5914

The table presents the result of the difference in difference in differences (DDD) regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1. Similar to CEO power, we identify old boards as those in and above the third quintile of board age.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

Table 5
CEO Power, Board Nationality Mix and Carbon Emission.

	(1)
	CO2 Log
ATET	
CEO Power & Board Nationality	−0.0450*
	(−1.96)
Controls	
CO2 Log$_{[t-1]}$	0.6072***
	(20.76)
Size	0.2776***
	(9.27)
Leverage	−0.0643
	(−0.71)
ROA	−0.0292
	(−0.37)
Market to Book	0.0076*
	(1.65)
Slack	0.0606
	(0.65)
Country Level CO2	0.0259*
	(1.69)
Constant	−1.3001**
	(−2.12)
Industry Effect	Yes
Year Effect	Yes
Observations	5914

The table presents the result of the difference in difference in differences (DDD) regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1. Similar to CEO power, we identify nationally diverse boards as those in and above the fourth quintile of national diversity.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

Table 6
Law of Origin and Carbon Reduction Efforts Before Paris Agreement.

	Civil	Common	Civil	Common
	CO2 Log		Carbon Change	
ATET				
CEO Power	−0.0989**	−0.0352*	−0.1306*	−0.0127
	(−2.10)	(−1.77)	(−1.98)	(−0.78)
Controls				
CO2 Log$_{[t-1]}$	0.5315***	0.6196***		
	(15.13)	(18.22)		
Size	0.3104***	0.2668***	0.0610	0.0646***
	(3.45)	(8.23)	(0.73)	(3.27)
Leverage	−0.2433	−0.0439	−0.1436	0.0400
	(−0.99)	(−0.44)	(−0.57)	(0.55)
ROA	−0.1120	−0.0189	−0.1171	0.0386
	(−0.76)	(−0.21)	(−0.63)	(0.65)
Market to Book	0.0087	0.0070	0.0562	0.0018
	(0.17)	(1.52)	(1.10)	(0.44)
Slack	0.2422	0.0375	−0.5139	−0.1500*
	(0.67)	(0.40)	(−1.60)	(−1.83)
Country Level CO2	0.0363	0.0355*	0.0078	0.0129
	(1.24)	(1.70)	(0.26)	(0.70)
Constant	−0.9195	−1.3807**	−0.9439	−1.4228***
	(−0.41)	(−1.97)	(−0.45)	(−2.70)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
Observations	880	5016	880	5016

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

Table 7
Law of Origin and Carbon Reduction Efforts After Paris Agreement.

	Civil	Common	Civil	Common
	CO2 Log		Carbon Change	
ATET				
CEO Power	−0.0843	−0.0568***	−0.1086**	−0.0741***
	(−1.32)	(−2.63)	(−2.50)	(−4.16)
Controls				
CO2 Log$_{[t-1]}$	0.5309***	0.6206***		
	(14.64)	(18.26)		
Size	0.3148***	0.2674***	0.0663	0.0651***
	(3.48)	(8.19)	(0.80)	(3.29)
Leverage	−0.2597	−0.0517	−0.1646	0.0268
	(−1.03)	(−0.52)	(−0.64)	(0.37)
ROA	−0.1152	−0.0241	−0.1216	0.0334
	(−0.76)	(−0.26)	(−0.63)	(0.56)
Market to Book	0.0024	0.0059	0.0482	0.0000
	(0.05)	(1.36)	(0.97)	(0.00)
Slack	0.3038	0.0459	−0.4351	−0.1368*
	(0.84)	(0.48)	(−1.31)	(−1.67)
Country Level CO2	0.0417	0.0318	0.0147	0.0098
	(1.31)	(1.52)	(0.49)	(0.52)
Constant	−1.1285	−1.3562*	−1.2180	−1.3838***
	(−0.50)	(−1.93)	(−0.58)	(−2.61)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
Observations	880	5016	880	5016

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

4.5.3. *Do qualified powerful CEOs take a tougher carbon reduction stance?*

Powerful CEOs with expert knowledge steer their firms toward a greener future (Walls & Berrone, 2017). Building on this premise, we examine if powerful CEOs with high qualifications cut their emissions level significantly more than their counterparts. To test this conjecture, we rely on a difference-in-difference-in-differences (DDD) regression and report the results in Table 9.

The result in Table 9 suggests that powerful CEOs with higher qualifications are more aggressive in their carbon reduction drive. The findings align with the view that CEO power could be leveraged to fight for positive causes (Humphery-Jenner et al., 2022).

Table 8a
CEO Power, National Carbon Reduction Law, and Corporate Decarbonization Efforts.

	CO2 Log	Carbon Change	Carbon Change Intensity
ATET			
CEO Power & Carbon Law	−0.0684**	−0.0526**	−0.0950**
	(−2.54)	(−2.40)	(−2.23)
Controls			
CO2 Log$_{[t-1]}$	0.5740***	−0.3632***	−0.8759***
	(22.45)	(−15.59)	(−5.08)
Size	0.2882***	0.2394***	0.5298***
	(8.20)	(8.25)	(4.07)
Leverage	−0.0579	−0.0463	−0.2117
	(−0.68)	(−0.72)	(−1.13)
ROA	0.0089	−0.0399	−0.2015
	(0.11)	(−0.74)	(−1.57)
Market to Book	0.0022	0.0017	0.0020
	(0.59)	(0.44)	(0.26)
Slack	0.1101	−0.0572	0.2721
	(0.99)	(−0.65)	(0.71)
Carbon Act	0.0789**	0.0776**	0.0972
	(2.02)	(2.05)	(1.02)
Country Level CO2	0.0199	0.0110	0.0422
	(1.03)	(0.68)	(0.66)
CO2 Level$_{[t-1]}$			
Constant	−1.1349	−0.6086	−0.9637
	(−1.44)	(−0.96)	(−0.38)
Industry Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Observations	4748	4748	4748

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

4.5.4. *Is this trend more pronounced in non-carbon-intensive industries?*

The environmental, physical, and regulatory risks attributable to climate change are more concentrated in carbon-intensive industries (Ben-Amar & McIlkenny, 2015). Consequently, powerful CEOs of firms in carbon-intensive industries may be more responsive to the clamour for responsible corporate environmental practices. Accordingly, we test if this factor is valuable for understanding the relationship between CEO power and corporate carbon emissions and report the results in Tables 10 and 11. To test this, we employ a DDD. The results suggest that the Paris Agreement stimulated greater reaction among powerful CEOs in carbon-intensive industries. The findings contradict the view that the impact of governance structure on corporate environmental practice is less prominent in carbon-intensive industries (Liao et al., 2015).

4.5.5. *Alternative measures of CEO power*

The results documented in our study may be primarily driven by the chosen measure of CEO power (CEO pay slice). To alleviate this concern, we specify our DiD models using alternative measures of CEO power. The results of the analyses are presented in Table 12. The first alternative measure of power that we will adopt in our study is the CEO network. El-Khatib et al. (2015) posit that CEOs with strong connections have greater bargaining power and more control over the boardroom. Based on this measure of CEO power, the findings reported in column 1 of Table 12 confirm our view.

Table 8b
CEO Power, US State Carbon Reduction Law and Firm Carbon Emissions.

	(1)	(2)	(3)	(4)
	CO2 Log	CO2 Level	Carbon Change	Carbon Change Intensity
ATET				
Powerful CEO & US State Law	0.0487	0.0000	0.0406	0.1547
	(0.53)	(0.47)	(0.41)	(0.98)
Controls				
CO2 Log $_{[t-1]}$	0.6076***		−0.3154***	−0.9442***
	(15.23)		(−9.26)	(−3.09)
Size	0.2395***	−0.0000***	0.1963***	0.5590**
	(4.80)	(−3.17)	(4.76)	(2.43)
Leverage	−0.1302	0.0000	−0.1393*	−0.2236
	(−1.42)	(1.37)	(−1.78)	(−1.18)
ROA	0.1087	−0.0001*	0.1096	0.1908
	(0.93)	(−1.89)	(1.19)	(1.01)
Market to Book	−0.0151	0.0000	−0.0154	−0.0521
	(−0.95)	(0.73)	(−1.18)	(−1.51)
Slack	0.0958	−0.0000	−0.0643	0.6094
	(0.77)	(−1.40)	(−0.63)	(1.12)
CO2 Level $_{[t-1]}$		0.7654***		
		(14.95)		
CO2 emissions			0.0410***	0.0668
			(2.91)	(1.22)
Constant	−0.0296	0.0012***	−0.8330	−1.2563
	(−0.03)	(3.31)	(−0.85)	(−0.40)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
Observations	2263	2263	2263	2263

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

Table 9
Powerful CEO Qualification and Carbon Reduction Intensity.

	(1)
ATET	
Qualification of Powerful CEO	−0.0920**
	(−1.97)
Controls	
Size	0.0740
	(1.25)
Leverage	−0.0433
	(−0.36)
ROA	−0.0461
	(−0.35)
Market to Book	0.0079
	(0.77)
Slack	−0.1190
	(−0.42)
Country Level CO2	−0.0057
	(−0.12)
Constant	−1.4455
	(−0.85)
Industry Effect	Yes
Year Effect	Yes
Observations	5914

The table presents the result of the difference in difference in differences (DDD) regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1. Similar to CEO power, we identify CEOs with high qualifications as those located in and above the 4th quintile of CEO Qualification. t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

Similarly, following Sheikh (2022), we use the amount of equity held by the CEO as a proxy for CEO power. The equity held by a CEO also mirrors the CEO's ownership power (Bebchuk et al., 2011; Chikh & Filbien, 2011; Liu & Jiraporn, 2010; Sheikh, 2022). In column 2 of Table 12, we report the results of this analysis. The results confirm our view that powerful CEOs emit less carbon than their counterparts.

We also consider the length of time spent in a company as a measure of a CEO's power since this may indicate the degree of social capital a CEO has in a company. Building on the proposition that CEOs who have spent a long period in a company understand the architecture of the business and may be able to influence policies and decisions more effectively than their counterparts who have spent significantly less time in their company, we run a DiD regression and present the results in column 3 of Table 12. The results align with our argument that powerful CEOs are more effective in their corporate carbon reduction efforts than their counterparts.

4.6. Placebo test

For added rigour, we conducted another robustness test that only included firms with weak CEOs and excluded those with powerful ones from our sample. After that, we split the weak set of CEOs into powerful and otherwise and run a DiD model. We split the remnant CEOs based on the quintile location of their CEO pay slice. Firms above the median quintile are identified as powerful, and those below the median quintile are identified as weak CEOs. Based on this dichotomy, we rerun our models to see if the effect remains despite excluding powerful CEOs. The results of our findings are reported in Table 13. The coefficient of the relationship between CEO power and corporate carbon emission is insignificant. This confirms our view that the results are unique to CEOs who wield a significant amount of power.

4.7. Fixed-effects panel regression

Lastly, rather than running our model using a difference-in-differences regression, we specify the model using a normal fixed-effect model. This is mainly to control the effects of unobserved variables that may correlate with CEO power. We report the result of the analysis in Table 14. The result of our analysis affirms our position that firms with powerful CEOs emit less carbon and are more aggressive in cutting back on carbon emissions.

4.8. Accounting for corporate governance and country level control

Notably, omitted variables and sample representation can bias the results reported. To address this issue, we adopt two strategies. Firstly, we adopt stricter sample selection criteria by ensuring that firms in this subsample analysis have at least 5 years of observation. As a result of these restriction criteria, the number of countries in our sample declined from 26 to 18. Firms in Australia, Austria, Denmark, Israel, Mexico, Russia, Singapore, and Uruguay were left out of the sample used for this estimation. However, the industry distribution of our sample was not affected by the introduction of the stringent sample selection criteria. We report the sample distribution of this procedure in Appendix 3. In addition, we also account for firm-level corporate governance factors and other national-level indicators that could affect firm environmental behaviour (see, for example, Choi & Luo, 2021; Adamolekun et al., 2024). The factors we consider include CEO duality, proportion of independent directors, proportion of female directors, and board size. We also account for country-level indicators such as HHI, rule of law, GDP per capita, CVI (climate vulnerability index), GDP growth, and the presence of carbon reduction legislation. We report the result of this analysis in Table 15. Despite the introduction of these control variables and strict sample selection criteria, we find support for our baseline results. The findings confirm that CEO power could catalyse firm carbon reduction efforts. In addition to the aforementioned robustness test, we

Table 10
Industry Carbon Emission Intensity and CEO Power Pre-Paris Agreement.

Non-Carbon Intensive				Carbon Intensive Industry		
	CO2 Log	Carbon Change	Carbon Reduction Intensity	CO2 Log	Carbon Change	Carbon Change Intensity
ATET						
CEO Power	−0.0438*	−0.0513**	−0.0557	−0.0558*	−0.0199	−0.0008
	(−1.94)	(−2.02)	(−1.33)	(−1.89)	(−0.78)	(−0.02)
Controls						
CO2 Log $_{[t-1]}$	0.6336***			0.5781***		
	(16.77)			(13.29)		
CO2 Level $_{[t-1]}$						
	(8.35)	(3.59)	(2.57)	(4.62)	(0.78)	(0.12)
Leverage	−0.0655	0.0021	−0.0504	−0.0321	0.1090	0.0752
	(−0.57)	(0.03)	(−0.46)	(−0.22)	(0.76)	(0.29)
ROA	0.0535	0.0539	0.1466	−0.0983	0.0240	−0.1381
	(0.83)	(0.90)	(0.98)	(−0.89)	(0.26)	(−0.68)
Market to Book	0.0050	0.0007	0.0056	0.0242	0.0288**	0.0352
	(1.11)	(0.16)	(0.54)	(1.43)	(2.13)	(0.99)
Slack	0.0881	−0.3109***	−0.2791	−0.0191	0.0161	0.1796
	(0.88)	(−3.29)	(−1.31)	(−0.10)	(0.11)	(0.26)
Country Level CO2	0.0322	0.0000	0.0355	0.0219	0.0022	−0.0479
	(1.58)	(0.00)	(0.53)	(0.98)	(0.13)	(−0.74)
Constant	−2.0667***	−1.6712**	−3.3405**	−0.3584	−0.4787	0.3321
	(−3.20)	(−2.58)	(−2.38)	(−0.29)	(−0.64)	(0.10)
Industry Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3208	3208	3208	2706	2706	2706

The table presents the result of the difference in differences (DiD) regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

Table 11
CEO Power, Industry Carbon Emission Intensity Post Paris Agreement.

Non-Carbon Intensive Industry				Carbon Intensive Industry		
	CO2 Log	Carbon Change	Carbon Change Intensity	CO2 Log	Carbon Change	Carbon Change Intensity
ATET						
CEO Power	−0.0444**	−0.0699***	−0.1373**	−0.0742**	−0.0767***	−0.1384***
	(−2.13)	(−3.43)	(−2.28)	(−2.20)	(−3.18)	(−3.15)
Controls						
CO2 Log $_{[t-1]}$	0.6337***			0.5798***		
	(16.78)			(13.31)		
CO2 Level $_{[t-1]}$						
Size	0.2805***	0.0936***	0.1360**	0.2722***	0.0210	0.0127
	(8.37)	(3.58)	(2.56)	(4.57)	(0.74)	(0.11)
Leverage	−0.0674	−0.0033	−0.0671	−0.0569	0.0834	0.0295
	(−0.59)	(−0.05)	(−0.58)	(−0.38)	(0.57)	(0.11)
ROA	0.0461	0.0442	0.1332	−0.1017	0.0221	−0.1394
	(0.72)	(0.74)	(0.91)	(−0.91)	(0.23)	(−0.69)
Market to Book	0.0043	−0.0005	0.0028	0.0220	0.0248*	0.0264
	(1.01)	(−0.11)	(0.31)	(1.28)	(1.82)	(0.73)
Slack	0.0979	−0.2956***	−0.2499	−0.0087	0.0316	0.2123
	(0.97)	(−3.12)	(−1.13)	(−0.04)	(0.22)	(0.31)
Country Level CO2	0.0336*	0.0028	0.0424	0.0258	0.0068	−0.0392
	(1.67)	(0.13)	(0.64)	(1.12)	(0.40)	(−0.63)
Constant	−2.1211***	−1.7410***	−3.4371**	−0.4074	−0.5160	0.2761
	(−3.25)	(−2.67)	(−2.42)	(−0.33)	(−0.69)	(0.08)
Industry Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3208	3208	3208	2706	2706	2706

The table presents the result of the difference in differences (DiD) regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

also account for multi-level fixed effects. To do this, we explore how the joint effects of country and year affect the results. Accordingly, despite this additional restriction, we find consistent results. However, for brevity, we report the results of this analysis in Appendix 4.

5. Conclusion

In this study, we contribute to the ongoing discussion on corporate carbon emissions by investigating if CEO power can be leveraged for decarbonisation. Our results show that firms with powerful CEOs emit less carbon and are more aggressive in their carbon reduction efforts. Similarly, we demonstrate that having older board members appears to invigorate powerful CEOs to reduce their carbon footprint.

Corporate legal origin is also valuable in understanding the extent to which powerful CEOs can exert their influence in shaping corporate carbon reduction efforts. We opine that powerful CEOs with firms

Table 12
Alternative Measures of CEO Power.

	(1)	(2)	(3)
	CO2 Log	CO2 Log	CO2 Log
ATET			
CEO Power-Network	−0.0386*		
	(−1.77)		
CEO Power-Ownership		−0.0423**	
		(−2.10)	
CEO Power -Time in Coy			−0.0250*
			(−1.79)
Controls			
CO2 Log $_{[t-1]}$	0.5876***	0.5863***	0.6071***
	(14.86)	(15.03)	(20.72)
Size	0.3045***	0.3292***	0.2786***
	(7.77)	(8.49)	(9.30)
Leverage	−0.0559	0.0123	−0.0562
	(−0.59)	(0.16)	(−0.62)
ROA	0.0213	−0.0064	−0.0221
	(0.22)	(−0.07)	(−0.28)
Market to Book	0.0096	0.0235***	0.0077
	(1.55)	(2.73)	(1.61)
Slack	0.0691	0.1415	0.0548
	(0.62)	(1.29)	(0.59)
Country Level CO2	0.0412*	0.0160	0.0254*
	(1.84)	(0.90)	(1.66)
Constant	−1.8850**	−2.1056***	−1.3070**
	(−2.43)	(−2.91)	(−2.13)
Industry Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Observations	4288	4376	5914

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

Table 13
Placebo.

	(1)	(2)	(3)
	CO2 Log	Carbon Change	Carbon Change Intensity
ATET			
CEO Power	0.0013	0.0560	0.0651
	(0.01)	(0.52)	(0.20)
Controls			
CO2 Log $_{[t-1]}$	0.5864***		
	(15.49)		
CO2 Level $_{[t-1]}$			
Size	0.2652***	0.0571**	0.0877
	(7.08)	(2.50)	(1.45)
Leverage	−0.1338	−0.0572	−0.0973
	(−1.13)	(−0.81)	(−0.89)
ROA	−0.1160	0.0497	−0.1012
	(−1.02)	(0.78)	(−0.48)
Market to Book	0.0017	−0.0009	0.0019
	(0.29)	(−0.17)	(0.23)
Slack	0.1837*	−0.1138	0.2026
	(1.82)	(−1.20)	(0.69)
Country Level CO2	0.0222	0.0188	0.0851
	(0.85)	(1.02)	(1.42)
Constant	−0.6859	−1.3692**	−3.3076**
	(−0.89)	(−2.20)	(−2.03)
Industry Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Observations	3751	3980	3980

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

Table 14
CEO Power and Corporate co2 – FE Model.

	(1)	(3)	(4)
	CO2 Log	Carbon Change	Carbon Change Intensity
CEO Power	−0.0853***	−0.0000***	−0.0000***
	(−4.57)	(−2.65)	(−3.72)
Size			−0.0000***
			(−7.09)
Leverage			−0.0000*
			(−1.75)
ROA			−0.0001***
			(−5.26)
Market to Book			0.0000
			(0.21)
Slack			−0.0000
			(−1.00)
Country Level CO2			0.0000**
			(2.57)
Constant	12.4774***	0.0002***	0.0010***
	(1588.51)	(68.50)	(6.25)
Industry Effect	No	No	Yes
Year Effect	No	No	Yes
Observations	11,381	10,535	5809
Adj	0.00	0.00	0.473

The table presents the result of a fixed effect regression. t statistics in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

Table 15
Accounting For Country and Corporate Governance Controls.

	(1)	(2)	(3)
	CO2 Log	Carbon Change	Carbon Change Intensity
ATET			
CEO Power	−0.0508**	−0.0246	−0.0245
	(−2.22)	(−1.34)	(−0.56)
Controls			
CO2 Log $_{[t-1]}$	0.5725***	−0.3635***	−0.8778***
	(22.41)	(−15.56)	(−5.06)
Size	0.2914***	0.2414***	0.5404***
	(8.28)	(8.31)	(3.97)
Leverage	−0.0519	−0.0595	−0.1696
	(−0.62)	(−0.92)	(−0.91)
ROA	0.0030	−0.0495	−0.1808
	(0.04)	(−0.94)	(−1.49)
Market to Book	0.0014	0.0002	0.0003
	(0.37)	(0.05)	(0.04)
Slack	0.1195	−0.0424	0.3012
	(1.06)	(−0.48)	(0.78)
CEO Duality	0.0150	0.0111	0.0659
	(0.75)	(0.67)	(1.38)
Indp Dir	−0.0318	0.0309	−0.0313
	(−0.35)	(0.37)	(−0.16)
Female Dir	−0.0009	−0.0001	−0.0034
	(−0.42)	(−0.05)	(−0.57)
Board Size	−1.6776	−1.9131	−7.1308
	(−0.88)	(−1.10)	(−1.38)
HHI	−0.1254	−0.0006	−0.0397
	(−1.26)	(−0.01)	(−0.13)
Rule of Law	1.2089	−2.4296	5.4813
	(0.44)	(−0.97)	(0.79)
CVI	0.0000	0.0000**	0.0000
	(1.26)	(2.07)	(0.49)
GDP per capita	0.0034	0.0004	−0.0010
	(0.88)	(0.10)	(−0.17)
GDP growth	0.0094	0.0031	−0.4858
	(0.06)	(0.03)	(−1.28)
CO2 Level $_{[t-1]}$	0.0263	0.0147	0.0312
	(1.42)	(0.90)	(0.47)

(*continued on next page*)

Table 15 (*continued*)

	(1)	(2)	(3)
	CO2 Log	Carbon Change	Carbon Change Intensity
Carbon Reduction Law	−0.0371		
	(−0.93)		
Country Level CO2 CEO Duality			
		0.0760**	0.0393
		(2.09)	(0.42)
Constant	−1.4210	0.0386	−1.9143
	(−1.26)	(0.04)	(−0.56)
Industry Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Observations	4667	4667	4667

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1% respectively.

domiciled in civil law countries are more effective in decarbonising. We also demonstrate that a multi-nationality on boards amplifies the relationship between CEO power and corporate decarbonisation drive. We argue that broader national representation in boards would encourage discussions regarding the environmental impact of climate change and induce powerful CEOs to act. The results demonstrate that national carbon reduction legislation could help accelerate the decarbonisation drive by firms with powerful CEOs. The findings also reveal that highly qualified CEOs reduce corporate carbon emissions more aggressively. Lastly, the effect of this relationship is more pronounced in carbon-intensive industries. Our results are robust to a battery of tests and methodology.

Our explanation for the findings is that the wealth effect of most CEOs is aligned with that of their organisation vis-a-vis equity incentives (Morse et al., 2011). Therefore, CEOs are forced to derisk their corporations' environmental exposure through decarbonisation. The central message of our paper is that corporations and stakeholders can use the power of their CEOs to their advantage in the race to net zero. Future studies could evaluate the channel through which powerful CEOs wean their corporations of dependency on fossil fuels. Furthermore, understanding the interaction between corporate decarbonisation drive and board appointments is a fascinating area of future research.

Appendix 1

Variable	Definition
CO2 Eqv	CO2 Equivalence consists of a firm's scope 1 and scope 2 emissions.
Carbon Reduction	This refers to a year-on-year change in corporate CO2 equivalence.
CO2 Log	This is the natural logarithm of a firm's CO2
Carbon Reduction Intensity	This is the year-on-year change in corporate CO2 equivalence adjusted by the industry average.
CEO Pay slice	This refers to CEO pay deflated by total managerial pay.
CEO Power	This is a dummy variable that is equal to 1 if a CEO's pay slice is located in the fourth and fifth quintile and 0 otherwise.
CEO Time in Coy	This is the total time a CEO has spent in a company.
CEO Tenure	This refers to the time spent as CEO
Co-opt Board	This is the number of co-opted directors divided by deflated by the total number of board members.
CEO Network Size	This accounts for a CEO's network.
CEO Ownership	This is the value of equity in a firm held by a CEO
CEO Duality	This dummy variable takes the value of 1 if a CEO is the CEO and Chairman of the board and 0 otherwise.
Size	This is the natural logarithm of a firm's total assets.
Leverage	This is defined as total debts deflated by total assets.
ROA	This refers to EBITDA deflated by total assets.
MTB	The market-to-book ratio is the market value of equity divided by the book value of equity.
Slack	This is the current asset deflated by total assets.
Country Level CO2	This captures the country's carbon emissions level.
Indp Dir	This captures the number of independent directors on a firm's board.
Female Dir	This refers to the proportion of directors that are female.
Board Size	This is the total number of board members a firm has.
HHI	HHI (Herfindahl-Hirschman Index) is a proxy for the degree of competition in a country.
GDP growth	This is the growth rate in a country's economy, as implied by its gross domestic product.
Rule of Law	This captures the degree to which citizens of a country have confidence in the law.
CVI	CVI (Climate Vulnerability Index) measures a country's susceptibility to adverse climate events.
GDP per capita	This measures the standard of living of a country by standardising the GDP by the country's population.
Carbon Reduction Law	This dummy variable takes the value of 1 if a country has/ has passed a carbon reduction legislation in a year.

Appendix 2. Industry Classification.

ICB Industry Name	Frequency	Per Cent
Basic Materials	420	7.1
Consumer Discretionary	1135	9.19
Consumer Staples	578	9.77
Energy	470	7.95
Financials	70	1.18
Health Care	502	8.49
Industrials	1281	1.66
Real Estate	88	1.49
Technology	574	9.71
Telecommunications	261	4.41
Utilities	535	9.05
Total	5914	100

Appendix 3. Sample distribution after screening criteria.

	Country Distribution				Industry Distribution		
	Country	Frequency	Per Cent		Industry	Frequency	Per Cent
1	Belgium	7	0.14	1	Basic Materials	345	6.91
2	Canada	13	0.26	2	Consumer Discretionary	895	17.92
3	Cyprus	7	0.14	3	Consumer Staples	500	10.01
4	Finland	14	0.28	4	Energy	401	8.03
5	France	327	6.55	5	Financials	50	1
6	Germany	121	2.42	6	Health Care	417	8.35
7	India	9	0.18	7	Industrials	1105	22.12
8	Ireland	133	2.66	8	Real Estate	67	1.34
9	Italy	58	1.16	9	Technology	484	9.69
10	Luxembourg	10	0.2	10	Telecommunications	233	4.66
11	Netherlands	97	1.94	11	Utilities	498	9.97
12	Norway	5	0.1		Total	4995	100
13	Spain	60	1.2				
14	Sweden	20	0.4				
15	Switzerland	48	0.96				
16	United Arab Emirates	5	0.1				
17	United Kingdom	1593	31.89				
18	United States	2468	49.41				
	Total	4995	100				

Appendix 4. Country and Year Effect.

	(1)	(2)	(3)	(4)
	CO2 Natural Log	CO2 Level	Carbon Change	Carbon Change Intensity
ATET				
CEO Power	−0.0441**	−0.0000**	−0.0345**	−0.0462
	(−2.26)	(−2.06)	(−2.04)	(−1.28)
Controls				
L.CO2 Natural Log	0.6079***		−0.3376***	−0.8369***
	(19.87)		(−14.09)	(−6.12)
Size	0.2806***	−0.0000***	0.2437***	0.5220***
	(8.63)	(−3.61)	(8.94)	(5.00)
Leverage	−0.0560	−0.0000	−0.0371	−0.1021
	(−0.56)	(−0.76)	(−0.54)	(−0.57)
ROA	−0.0212	−0.0001	−0.0332	−0.1722
	(−0.25)	(−1.32)	(−0.66)	(−1.24)
Market to Book	0.0053	0.0000	0.0020	0.0084
	(1.11)	(0.45)	(0.52)	(0.75)
Slack	0.1042	−0.0000	0.0001	0.3441
	(1.06)	(−0.79)	(0.00)	(1.02)
CO2 emissions	0.0620	0.0000	0.0664	0.2436
	(0.81)	(1.27)	(0.67)	(1.16)
CO2 Level		0.6989***		
		(17.72)		
Constant	−1.8731	0.0007	−1.7248	−4.0967
	(−1.51)	(1.27)	(−1.17)	(−1.25)
Country & Year	Yes	Yes	Yes	Yes
Industry Effect	Yes	Yes	Yes	Yes
Observations	5914	5809	5914	5914

The table presents the result of the difference in differences regression. ATET refers to the after-treatment effect on the treated. Details of the variable description are provided in Appendix 1.t statistics are reported in parentheses. *, **, and *** refers to significance level at less than 10 %, 5 %, and 1 % respectively.

Data availability

Data will be made available on request.

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