



Carbon emission and board gender diversity: The moderating role of CEO duality

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Abstract

Purpose – This study aims to investigate how the board gender diversity (BDG) affects carbon performance (CP) based on total carbon emissions intensity and whether CEO duality moderates this relationship.

Methodology – The sample consists of 378 non-financial entities from European Union countries, covering the period from 2017 to 2020. We employ several regression models to test the hypotheses and also check results with robustness analyses.

Findings – Results show a negative association between BGD and CP, thus suggesting that the higher is the percentage of woman directors, the lesser is carbon emission. Also, we find that CEO duality moderates negatively such relationship.

Research limitations/implications – By addressing limitations of the study, we make suggestions for future research in the field of environmental performance and CG literature.

Originality – This study adds new insights to the current debate on the association between environmental performance and the role of CG mechanisms.

Keywords: Carbon Emissions, Gender Diversity, CEO Duality

1. Introduction

The international attention on environmental issues creates a lot of tension for firms. Specifically, the social, economic and regulatory pressure require the firms to improve corporate governance (CG) effectiveness to reduce carbon emissions (Konadu et al., 2022).

Overall, CG mechanisms formulate strategies that should mitigate any such activities negative impact on the environment and the society. Following this concern, scholars focused on the main CG drivers of carbon outputs (Velte et al., 2020; Qian & Schaltegger, 2017; Hahn et al., 2015) i.e. carbon disclosure (CD), regarded as the voluntary reporting of quantitative and qualitative information on emissions using the common frameworks from the Carbon Disclosure Project (CDP) and Climate Disclosure Standards Board (CDSB), and carbon performance (CP), intended as the actual carbon emission intensity of underlying a firm's assets (Nuber & Velte, 2020).

It is also worth noting that corporate decision-making that addresses the different and complex consequences of firm's environmental footprint may be shaped by board composition.

To this regard, CG literature has emphasized the crucial role of board gender diversity (BGD) (Konadu et al., 2022; Erhardt et al., 2003).

A growing number of studies, indeed, has analyzed how a specific aspect of diversity, i.e. the female representation on boards, could impact on sustainability and environmental performance (Cordeiro et al., 2020; Haque & Jones, 2020; Birindelli et al., 2019; Velte, 2017; Dawar & Singh, 2016).

Contrastingly, little is known about the role of BGD on carbon emissions (Tingbani et al., 2020). Indeed, the few existing studies focus more on carbon disclosure (Ben-Amar et al., 2017; Liao et al., 2015; Prado-Lorenzo & Garcia-Sanchez, 2010). Therefore, how BGD affects the CP is still underexplored, thus providing an issue that deserves further investigation. In addition, to the best of our knowledge, there is no existing research examining whether the existence of CEO duality has a moderating impact on the association between BDG and CP.

To bridge these gaps, this study aims to respond to the following questions:

RQ₁: *Does the BGD impact CP for listed European firms?*

RQ₂: *Does the CEO duality moderate the association between BGD and CP for listed European firms?*

The final sample consists of 378 non-financial entities from European Union (EU) countries covering the period from 2017 to 2020. We focus on such setting given the increasing attention by EU regulators on carbon emission. Specifically, several reforms have been introduced aimed at implementing the international commitments on climate change including the enactment of the Non-financial Reporting Directive (NFRD) and the “European Green Deal” project with major sustainable finance legislation (Nuber & Velte, 2020).

Results show that BGD is negatively associated with CP as well as CEO duality moderates negatively such relationship. We also check the robustness of such findings with additional analyses.

The paper answers the calls of more research on these issues, and contributes to literature by adding new evidence on environmental performance (García Martín & Herrero, 2020; Burkhardt et al., 2020; Elmagrhi et al., 2019; Lu & Herremans, 2019; Hollindale et al., 2017; Dienes & Velte, 2016; Kassinis et al., 2016; Frias-Aceituno et al., 2012), particularly in the field of carbon emissions (Tingbani et al., 2020; Ben-Amar et al., 2015). This study is also expected to provide useful implications from a regulatory and business practice perspective in order to understand how structure the boards in order to reduce the carbon emission, and thus to improve the overall environmental performance. Furthermore, given the negative moderating role of CEO duality, findings address some concerns regarding how the presence of a dominant CEO may represent a barrier to the proactive role of female directors.

The remainder of the paper is structured as follows. In the Section 2, we review the relevant literature and develop the hypotheses. In Section 3, we describe the research design. Then, the empirical results are presented in Section 4, while concluding remarks are included in Section 5.

2. Literature review and hypothesis development

2.1 The effect of board gender diversity on carbon emissions

The inclusion of females on boards and the relative impact on environmental performance are receiving increasing attention amongst researchers. To this regard, García Martín & Herrero (2020) and Dienes & Velte (2016) argue that BGD strengthens not only the firm’s corporate social responsibility (CSR) but also environmental policies. Furthermore, Hollindale et al. (2017) and Frias-Aceituno et al. (2012) suggest that women on boards are more inclined to address environmental issues and to implement strategies which minimize environmental risks. In line with such arguments, empirical research finds a positive association between BGD and environmental performance, by also examining different context such as France, China and America (Burkhardt et al., 2020; Elmagrhi et al., 2019; Lu & Herremans, 2019; Kassinis et al., 2016).

Following this concern, few studies examined the role of BGD on the specific outcome of carbon emissions (Tingbani et al., 2020). This is quite surprising considering that the increasing female directors on board enhances environmental awareness of the firm and lays the bases for the implementation of strategies aimed at promoting and safeguarding the climate-related risks (Ben-Amar et al., 2015).

Overall, female directors contribute to better address demands and expectations of stakeholders serving the interests of multiple stakeholders (Zhang et al., 2013). Accordingly, the appointment of female directors has a positive impact on the image of the firm which might achieve wider acceptance and support from various key stakeholders and the access to valuable resources (Catalyst, 1993).

The resource dependence theory is an adequate theoretical framework to explain the association between BGD and CP. In fact, following the theory, BGD appears a good mechanism to meet the pressures of influential stakeholders in order to reduce organizations negative environmental impact. Thus, the firm will gain control over external resources to carry out its strategy and develop internally additional resources (Provan et al., 1980; Pfeffer & Salancik, 1978). Therefore, BGD ensures the presence of a variety of resources such as expertise, contacts, reputation and information (Liu, 2018). Specifically, the literature indicates that women and men have different environmental attitudes. Women are more care about of the needs of other stakeholders and show greater sensitivity towards environmental topics. In other words, they are more empathetic and more willing to change. For this reason, female directors are more aware of environmental issues and potential environmental risks (Jones & Dunlap, 2010; Ibrahim & Angelidis, 1994; Bord & O’Connor, 1997; Blocker & Eckberg, 1989). Therefore, given that they bring different ethical values than male directors regarding environmental decision-making, the combination of skills provided by a balanced gender board is more likely to lead to improved decision making. To this regard, Hillman et al. (2007) and Provan et al. (1980) argue that more woman directors with expertise on environmental matters contribute to increase the access to preferential information and resources in order to mitigate uncertainty related to environmental challenges. As female directors are assumed to be more responsible and active in relations with stakeholder regarding environmental concerns, we expect that climate change policies will be promoted by BGD and should lead to lower carbon emissions. In this sense, adopting the resource dependence theory, we expect a negative association between BDG and CP. Thus, we propose the following hypothesis:

H₁: Ceteris paribus, BGD is negatively associated with CP.**2.2 The moderating role of CEO duality**

The prior research findings on the relationship between female representation on the board and CP are controversial. The fragmented and contradictory evidence might be caused by using of data coming from different time periods, heterogeneous proxies or various regression methods (Nuber & Velte, 2020). Moreover, this ambiguity of findings might also be due to the fact that the moderating variables related to CG mechanisms have not been considered. Therefore, we explore the moderating role of CEO duality that is associated with the presence of the same person in the position of the board chairman and the chief executive officer (CEO) (Peng et al., 2007).

From an agency theory perspective, several studies highlight negative sides of CEO duality. Specifically, the concentration of power in the one individual may constrain board independence by limiting the control function of other directors and shareholders (Roberts et al., 2005). Moreover, CEO duality assigns a greater power into the hands of a one person that may be more likely to pursue personal goals without considering the interests of external stakeholders, thus resulting in reluctance to pursue the growth of business value and the respect for environmental issues (Khan et al., 2013; Haniffa & Hudaib, 2006). In line with these arguments, scholars find a negative association between CEO duality and sustainability performance (Uyar et al., 2021; Shahbaz et al., 2020; Naciti, 2019; Mallin & Michelin, 2011).

Contrastingly, other researchers, based on the stewardship theory, emphasize benefits of CEO duality. For example, Finkelstein and D'Aveni (1994) state that the joining of two separate management positions (i.e. CEO and board chairman) into one establishes a stronger unity of command that could make key decisions promptly. Accordingly, firms with a strengthened leadership structure can acquire support and additional resources from stakeholders (Pfeffer & Salancik, 1978).

Furthermore, other researchers examine CEO duality as a possible moderation factor rather than an antecedent. For example, according to Velte (2019) and Li et al. (2018), the positive impact of sustainability performance on financial performance is more pronounced by the presence of CEO with an increased power. Also, Walls and Berrone (2017) include CEO power, associated with the presence of CEO duality, as moderator of the shareholder activism and environmental performance, by finding a negative influence of CEO power.

Based on such arguments, we conclude that, although the female directors possess the potential to develop sustainability practice, being more inclined to consider environmental risks in decision-making process (Pucheta-Martínez & Gallego-Alvarez, 2019; Bord & O'Connor, 1997), however, their proactive role may be mitigated by a powerful CEO who also serves as board chairman.

Therefore, our research aims to test if the relationship between BDG and CP can be constrained by the presence of CEO duality. Thus, we posit the following hypothesis:

H₂: CEO duality negatively moderates the association between BGD and CP.**3. Research Design****3.1. Sample**

Our initial sample consisted of EU non-financial companies from 2017 to 2020 period. We collected observations by using Thomson Reuters Eikon database, which is one of the most inclusive databases that provides company fundamentals equivalent to 99% of the global market scale and, more importantly, includes a wide numerous of carbon emissions data. Since our empirical model (described in the following paragraph) requires to use a combination of CO₂, CG and financial variables, we excluded firm-year observations with missing data. In this way, we got the final sample, consisting of 378 entities (i.e. 1,512 firm-year observations).

Table 1, Panel A shows the steps of sample construction. Table 1 also shows sample composition by industry (Panel B) and by country (Panel C). The industries with the highest share of firms are industrial (21.96%) and consumer cyclical (19.05%). With regard to the country distribution, the highest proportions of firms originate from Germany (24.34%) and France (23.81%).

Panel A. Sample Construction		
Steps	Firm	
Initial sample	3,206	
Observations with missing data	2,828	
Final sample	378	
Panel B. Sample composition by industry		
Industry	Observations	Percentage
Basic Materials	46	12.17%
Consumer Cyclical	72	19.05%
Consumer Non-Cyclical	26	6.88%
Energy	26	6.88%

Healthcare	25	6.61%
Industrials	83	21.96%
Real Estate	21	5.56%
Technology	52	13.76%
Utilities	27	7.14%
Total	378	100.00%

Panel C. Sample composition by country		
Country	Observations	Percentage
Austria	13	3.44%
Belgium	21	5.56%
Finland	25	6.61%
France	90	23.81%
Germany	92	24.34%
Greece	9	2.38%
Ireland	6	1.59%
Italy	32	8.47%
Luxembourg	8	2.12%
Netherlands	36	9.52%
Portugal	8	2.12%
Spain	38	10.05%
Total	378	100.00%

Table 1. Sample construction and composition by industry and by country

3.2. Econometric model

To examine the association between CP and BGD as well as the moderating role of CEO duality, we specify the following model:

$$CP_{i,t} = \alpha_0 + \alpha_1 BGD_{i,t} + \alpha_2 CEO\ Duality_{i,t} + \alpha_3 BGD * CEO\ Duality_{i,t} + \alpha_4 \sum_{i=1}^n Control\ variables_{i,t} + e_{i,t} \quad (1)$$

where i represents the firm, t is the period and n is the numerous of control variables. The dependent variable CP, measured as the total carbon dioxide in tonnes (sourced by Thomson Reuters Eikon), is regressed in function of a set of explanatory variables:

- BGD is the percentage of woman directors and the variable of interest to test H₁;
- CEO duality is a dummy variable equal to 1 whether there is no role separation between CEO and chairman (and to 0, otherwise);
- BGD*CEO duality is the interaction variable between BGD and CEO Duality and the variable of interest to test H₂;
- control variable is a vector of firm-level control variables defined in Table 2;
- e measures residuals.

Variable	Description	Source	Exp. sign
Woman managers	The percentage of woman managers for period <i>t</i> .	Cordeiro et al., 2020	-
Board size	The natural logarithm of the number of directors for period <i>t</i> .	Romano et al., 2020	-
Independent directors	The percentage of independent directors for period <i>t</i> .	Cordeiro et al., 2020; Romano et al., 2020	+/-
CSR/Sustainability committee	The dummy variable equal to 1 if firm i has a committee specialized on CSR/Sustainability matters (and to 0, otherwise) for period <i>t</i> .	Cordeiro et al., 2020	-
Consumed energy	Total energy consumption in gigajoules for period <i>t</i> .	Bekun et al., 2019	+
Size	The natural logarithm of total assets at the reporting date <i>t</i> .	Luo and Tang, 2020 Luo and Tang, 2020; Romano et al., 2020	+
Leverage	The ratio of total debt on total assets at the reporting date <i>t</i> .	Cordeiro et al., 2020; Luo and Tang, 2020; Romano et al., 2020	+
Sales	The natural logarithm of revenues at the reporting date <i>t</i> .	Cordeiro et al. 2020	+/-
ROA	Return on assets for the period <i>t</i> .	Cordeiro et al., 2020; Luo and Tang, 2020; Romano et al., 2020	+/-
Market capitalization	The natural logarithm of market capitalization at the reporting date <i>t</i> .	Lourenço et al., 2014	-

Table 2. Variable description of independent control variables

Note: The source refers to previous studies that use the variable at the first column of Table 2 as determinant of non-financial performance (e.g. CSR and environmental performance) (Cordeiro et al., 2019; Romano et al., 2020).

4. Results

4.1 Descriptive statistics and correlation matrix

Table 3 presents the descriptive statistics of the variables used at the Equation 1. The dependent variable CP shows an average mean of 12.766% with a high value of deviation from the average mean (2.608), that, therefore, provides an uneven distribution across sample firms. Regarding the variables of interest of the model, Table 3 shows that BGD, CEO duality, BGD*CEO duality have a mean value (standard deviation) of 12.766 (2.609), 32.739 (12.645) and 0.382 (0.486), respectively.

Variable	Obs	Mean	Std. Dev.	Min	Max
CP	1,512	12.766	2.609	5.852	19.087
BGD	1,512	32.739	12.645	0.000	69.290
CEO duality	1,512	0.382	0.486	0	1
BGD*CEO duality	1,512	12.462	17.681	0.000	65.290
Woman managers	1,512	0.175	0.145	0.000	0.603
Board size	1,512	2.400	0.378	0.693	3.135
Independent directors	1,512	58.361	26.781	0.000	100.000
CSR/Sustainability committee	1,512	0.823	0.381	0	1
Consumed Energy	1,512	17.025	3.804	0.000	20.664
Size	1,512	22.882	1.412	16.775	27.028
Leverage	1,512	0.275	0.169	0.000	1.502
Sales	1,512	18.911	7.790	-0.105	26.566
ROA	1,512	0.045	0.128	-4.177	0.563
Market capitalization	1,512	22.568	1.996	0.000	26.687

Table 3. Descriptive Statistics

Table 4 provides the correlation coefficients. It shows that CP is negatively correlated with BGD (-0.045) and positively correlated with CEO duality (0.411). The largest significant correlations among the independent variables are 0.551 and 0.428, which are widely below the threshold of 0.80 (Dougherty, 2017). Therefore, we deduce that there is no problem of multicollinearity at Equation 1.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 CP	1												
2 BGD	-0.045	1											
3 CEO duality	0.411*	-0.009	1										
4 Woman managers	-0.072*	0.168*	-0.057*	1									
5 Board size	0.099*	0.118*	0.042	0.060*	1								
6 Independent directors	0.008	0.019	-0.072*	0.002	-0.300*	1							
7 CSR/Sustainability committee	0.012	0.122*	0.029	0.132*	0.146*	0.039	1						
8 Consumed Energy	0.068*	-0.065*	0.075*	-0.036	-0.02	0.004	-0.051*	1					
9 Size	0.165*	0.127*	0.065*	0.052*	0.421*	0.093*	0.252*	0.004	1				
10 Leverage	0.006	-0.107*	-0.015	0.086*	0.006	0.009	0.025	-0.021	0.143*	1			
11 Sales	-0.011	0.034	-0.021	0.428*	-0.016	-0.001	-0.013	-0.012	0.052*	0.011	1		
12 ROA	-0.051*	0.051*	-0.061*	0.045	-0.015	-0.021	0.053*	-0.003	-0.019	-0.095*	-0.046	1	
13 Market capitalization	0.075*	0.189*	0.032	0.076*	0.194*	0.170*	0.251*	-0.002	0.551*	-0.147*	0.009	0.125*	1

Table 4. Correlation matrix

Note: * denotes p-value < 0.05 level (two-tailed), N = 1,512. Pairwise correlation.

4.2 Regression results

Table 5 presents the regression results of the OLS regression. Column (1), (2) and (3) includes OLS, robust OLS and fixed effect estimates, respectively. Results show that the coefficient for BGD is significantly (p-value<0.05) negative, suggesting that the association between the percentage of woman directors and CP is negative. Thus, findings support H1.

The empirical evidence of the study is consistent with previous studies (García Martín & Herrero, 2020; Dienes & Velte, 2016) arguing that the presence of women on Board strengthens environmental policies. This may be due given that female directors are more inclined to address related issues and to implement strategies which minimize risks (Hollindale et al., 2017; Frias-Aceituno et al., 2012).

This study may be associated to previous studies that found a positive association between BGD and environmental performance (Burkhardt et al., 2020; Elmagrhi et al., 2019; Lu & Herremans, 2019; Kassinis et al., 2016). More specifically, we add new evidence on the negative relationship between carbon emissions and gender diversity (Tingbani et al., 2020; Ben-Amar et al., 2015).

Further, Table 5 shows that the coefficient of the interaction variable BGD*CEO duality is significantly (p -value<0.05) positive, suggesting that CEO duality moderates negatively the association between the percentage of woman directors and CP. Thus, findings support H2.

Emerged results are in line with previous literature explaining that the concentration of power in one person may constrain board independence by limiting the control function of other directors and shareholders (Roberts et al., 2005). Exactly, the greater power is more likely to be used to achieve personal goals, thus resulting in reluctance to pursue the growth of business value and the respect for environmental issues (Khan et al., 2013; Haniffa & Hudaib, 2006). To this end, this study offers an empirical evidence showing the relevant role of CEO duality as negative moderator within the association between BGD and CP.

Variable	OLS estimates			Robust OLS estimates			Fixed-effect estimates		
	Coef.	T	p-value	Coef.	T	p-value	Coef.	t	p-value
BGD	-0.017***	-2.320	0.02	-0.017***	-2.170	0.03	-0.023***	-2.240	0.025
CEO duality	1.371***	3.99	0	1.371***	3.72	0	1.398***	3.48	0.001
BGD*CEO Duality	0.023***	2.29	0.022	0.023***	2.12	0.034	0.021*	1.82	0.07
Woman managers	-0.278	-0.510	0.613	-0.278	-0.470	0.639	-1.139	-1.410	0.16
Board size	0.471***	2.17	0.03	0.471***	2.23	0.026	0.439	0.66	0.511
Independent directors	0	0.15	0.88	0	0.15	0.877	-0.011	-1.190	0.235
CSR/Sustainability committee	-0.218	-1.260	0.206	-0.218	-1.260	0.206	-0.246	-0.780	0.435
Consumed Energy	0.017	1.04	0.297	0.017	1.17	0.242	0.031*	1.68	0.092
Size	0.214***	3.32	0.001	0.214***	3.18	0.002	0.321	1.04	0.298
Leverage	0.288	0.73	0.467	0.288	0.7	0.483	0.253	0.23	0.816
Sales	0	-0.020	0.982	0	-0.020	0.983	0.006	0.54	0.592
ROA	-0.372	-0.760	0.445	-0.372	-0.710	0.476	0.648	1.06	0.287
Market capitalization	-0.004	-0.080	0.933	-0.004	-0.080	0.934	3.957	0.92	0.358
Cons	7.779***	6.6	0	7.779***	6.58	0	-84.698	-0.870	0.382
Year			Yes						
Country			Yes						
Industry			Yes						
Obs			1,512			1,512			1,512
R-squared			0.233			0.233			
Adjusted R-squared			0.214						
R-squared within									0.171
P-value			0.000			0.000			0.000

Table 5. Regression estimates

Note: ***, ** and * denote significance at 1%, 5% and 10% level

4.3. Robustness checks

We conduct an additional sensitivity analysis to check the robustness of emerged results in the previous paragraph by running Equation 1 with an alternative measure of CP. Exactly, we consider the Emission score, sourced by Thomson Reuters Eikon Database, that measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes. To proxy CP, we multiply the score for -1. Given the estimated coefficients in Table 6, we find that results from such robustness model are coherent with than ones of the main analysis.

Variable	OLS estimates			Robust OLS estimates			Fixed-effect estimates		
	Coef.	T	p-value	Coef.	T	p-value	Coef.	t	p-value
BGD	-0.260***	-4.290	0	-0.260***	-4.290	0	-0.272***	-6.060	0
CEO duality	9.412***	3.3	0.001	9.412***	3.3	0.001	4.426***	2.47	0.014
BGD*CEO Duality	-0.257***	-3.180	0.001	-0.257***	-3.180	0.001	-0.151***	-2.990	0.003
Woman managers	-15.972***	-3.500	0	-15.972***	-3.500	0	-3.987	-1.100	0.27
Board size	-10.332***	-7.220	0	-10.332***	-7.220	0	-6.912***	-2.320	0.021
Independent directors	0.498***	4.74	0	0.498***	4.74	0	-0.145***	-3.500	0
CSR/Sustainability committee	-3.452	-0.850	0.394	-3.452	-0.850	0.394	-9.214***	-6.550	0
Consumed Energy	-3.315***	-6.160	0	-3.315***	-6.160	0	-0.125	-1.500	0.134
Size	4.712	1.43	0.153	4.712	1.43	0.153	-4.907***	-3.560	0
Leverage	-9.547***	-5.290	0	-9.547***	-5.290	0	-3.810	-0.780	0.433
Sales	-0.051***	-2.260	0.024	-0.051***	-2.260	0.024	-0.005	-0.090	0.93
ROA	0.000*	1.65	0.099	0.000*	1.65	0.099	-0.506	-0.190	0.852
Market capitalization	-0.906***	-2.630	0.009	-0.906***	-2.630	0.009	-38.544***	-2.010	0.045
Cons	65.771***	6.9	0	6.577***	6.51	0	955.212***	2.21	0.027
Year		Yes							
Country		Yes							
Industry		Yes							
Obs		1,512			1,512			1,512	
R-squared		0.386			0.385				
Adjusted R-squared		0.37							
R-squared within								0.154	
P-value		0.000			0.000			0.000	

Table 6. Regression estimates with an alternative dependent variable

Note: ***, ** and * denote significance at 1%, 5% and 10% level

5. Conclusions

This study has examined the association between CP and BGD as well as the moderating role of CEO duality on such relationship. Based on a sample of 378 non-financial companies from European Union countries, results have shown that boards with a major percentage of woman directors have a better CP, i.e. a lesser emission of CO₂. Furthermore, we found that CEO duality covers a negative moderating role within the association between CP and BGD.

This study contributes to previous literature examining the role of BGD on environmental performance (García Martín & Herrero, 2020; Dienes & Velte, 2016; Hollindale et al., 2017; Frias-Aceituno et al., 2012; Burkhardt et al., 2020; Elmagrhi et al., 2019; Lu & Herremans, 2019; Kassinis et al., 2016), by adding new evidence on its impact on carbon emissions (Tingbani et al., 2020; Ben-Amar et al., 2015). Also, in light of previous literature on CG determinants (Roberts et al., 2005; Khan et al., 2013; Haniffa & Hudaib, 2006), we provide an empirical evidence of the negative moderator of CEO duality on such association.

This research has also practical implications. Exactly, given the negative association between BGD and CP, the empirical evidence offers insights to regulators and policy-makers in order to enhance corporate governance practices, by encouraging BoD diversity and avoiding the power concentration within CEO duality.

Our study suffers some limitations, which provide opportunities for future research.

Namely, since we focus on Euro area sample, scholars may extend the investigation to other foreign countries (e.g. US companies) in order to make results more generalizable.

Also, given that we focus on CEO duality, it may be interesting to examine whether and how other CG mechanisms moderates the association between BGD and CP.

Finally, although we focus specifically on CO₂ emission, there are other proxies (e.g. waste intensity) that may be considered to add new evidence regarding the association between BGD and the larger context of environmental performance.

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