

Carbon emissions and firm value: does firms' commitment to sustainable development goals matter?

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Abstract

Purpose – This study aims to clarify the value of sustainable development goals (SDGs) commitment by examining the moderating role of firms' commitment to SDGs on firms' carbon emissions (CE) and firm value (FV) nexus.

Design/methodology/approach – The study uses ordinary least squares and other robust estimations on data from 89 listed firms on the Johannesburg Stock Exchange (JSE) from 2013 to 2021.

Findings – Firms with high CE are associated with lower FV. However, firms' commitment to SDGs moderates the relationship by averting the value-destroying tendencies of high carbon-emitting firms.

Practical implications – Firms should integrate SDGs into their core business strategy and governance frameworks to enhance their environmental performance and FV. As market participants on the JSE, they should also focus on the allocation of resources for SDGs and the management of CE.

Social implications – The findings provide a basis for governments and policymakers to promote firm-level commitment to SDGs to help reduce the harmful effects of CE on society and help achieve SDG targets.

Originality/value – The study adds a new dimension to the existing environmental performance and financial outcomes literature by clarifying the moderating value of firms' commitment to SDGs in the CE and FV discourse.

Keywords Carbon emissions, Sustainable development goals (SDGs), Firm value, JSE

Paper type Research paper



1. Introduction

Carbon emissions (CE) are the measurable results of the carbon aspects of a firm's activities, processes, services and systems (Ott and Schiemann, 2023). Research on CE has evolved to consider the consequences on firms for emitting carbon gases and the environmental effects

(see [Benkraiem et al., 2022](#); [Choi et al., 2021](#); [Kumarasiri and Jubb, 2016](#)). This is because the activities of industrial corporations have been identified to contribute significantly to the degradation of the planet and its ecosystem ([Chen et al., 2023](#)). Thus, it is unsurprising that firms have attempted to manage pressure from stakeholders and society by adopting and communicating the activities that reduce their carbon footprint in recent years ([Appiagyei and Donkor, 2024](#); [Chen et al., 2023](#)).

Previous research on CE has established that capital markets reward (punish) low-(high-) carbon-emitting firms through the valuation of firms' shares (e.g. [Bedi and Singh, 2024](#); [Benkraiem et al., 2022](#); [Choi et al., 2021](#)). However, the role of firm actions in improving CE management and enhancing corporate value remains unconsidered in the literature. One critical action to advance CE management is the commitment to sustainable development goals (SDGs) [1] ([Patuelli et al., 2022](#)). SDGs are designed to protect the planet ([Abhayawansa et al., 2021](#); [Delgado-Ceballos et al., 2023](#)). However, research on the activities and disclosure of SDGs by firms and their influence on firm value (FV) has been inconclusive, with positive (e.g. [Mozas-Moral et al., 2021](#)), negative (e.g. [Lassala et al., 2021](#)) and mixed (e.g. [García-Meca and Martínez-Ferrero, 2021](#)) results reported. Thus, the value of firms' commitment to the SDGs remains contested. However, commitment to SDGs is a key action that can reduce CE and contribute to combating global warming. Therefore, we re-examine the value of firms' commitment to SDGs by focusing not on its direct effects but on its moderating role in the nexus between CE performance and FV.

Given that the SDGs seek to protect the planet and improve human life ([Abhayawansa et al., 2021](#); [Stefanescu, 2022](#)), we argue that firms' commitment to SDGs will enhance their ability to manage CE and hence, improve firm valuation on the capital market. This study, therefore, uses CE data of firms on the Johannesburg Stock Exchange (JSE) to examine the moderating role of firm commitment to SDGs on the relationship between CE performance and FV. South Africa presents an appropriate setting for such an investigation to provide practical and research contributions due to their regulatory and policy environment (recognised efforts in ensuring firms contribute to sustainability) and their significant CE due to overreliance on coal for energy generation ([Chininga et al., 2023](#)). South African companies are subjected to stringent regulations and policies to reduce CE and promote sustainability practices. The country has promulgated legislation such as the greenhouse gas (GHG) Reporting Regulations (2017) and the Carbon Tax Act (2019) to require large emitters and firms on the JSE to provide a plan for emissions reduction and reduce CE. In addition, it is the only country in the world to mandate integrated reporting for publicly listed firms. The mandatory integrated reporting regime for JSE firms ([Appiagyei et al., 2023](#); [Chininga et al., 2023](#)) and listing requirements for the assurance of non-financial information (King IV, 2021) reinforce the country's goals of promoting sustainability activities. However, the country is ranked the worst emitter in Africa and ranks in the top 15 emitters worldwide.

We use ordinary least square (OLS) regressions with alternative measures for FV and firm SDGs commitment and alternative models such as the endogenous delayed, lead-lagged and 3SLS models to validate our results. We find that poor corporate CE performance reduces FV, suggesting that investors on the JSE favour low-carbon-emitting firms. However, the detrimental influence of poor CE performance is assuaged by firms' commitment to SDGs. Thus, when firms commit to SDGs, the effect of CE is no longer considered value-destroying by the market ([Li et al., 2022](#)). This is, however, more pronounced for firms that commit to environmental dimensions of SDGs. The study contributes to the literature by assessing the role of firms' actions towards saving the planet (i.e. commitment to SDGs) in the CE performance and FV nexus.

Our findings have implications for firms, investors and policymakers. Firms on the JSE should be concerned about their CE performance as the market favours low-carbon-emitting firms. Furthermore, firms should be motivated to commit to SDGs, as it could be an avenue for managing their CE and improving FV. In addition, we provide evidence that market participants on the JSE appreciate managerial decisions to allocate resources for SDGs and CE management, justifying such resource allocations. Our findings help management understand the cost-benefit dynamics of SDG commitments and CE management, enabling them to manage sustainability initiatives' costs and identify areas for cost savings to improve FV. Based on our findings, governments and policymakers interested in promoting firms' support in achieving the SDGs can establish a business case for firms' commitment to SDGs, designing incentives and frameworks that encourage firms to commit to SDGs. Moreover, understanding the link between CE, SDGs and FV can help investors better manage environmental regulations and climate change risks.

We organise the remaining sections of the paper as follows. The ensuing section briefly reviews existing literature to develop our hypothesised relationship. This is followed by the description of the methods adopted in Section 3. We present and discuss our results in Section 4. The last section highlights our key findings and the implications of the study.

2. Literature review and hypotheses development

2.1 Concepts

Increased concerns about the positive relationship between global warming and firm CE have increased stakeholder scrutiny of the carbon footprints of firms and their related information (Chen *et al.*, 2023). CE performance reflects the amount of carbon gases emitted by firms and the measures taken to limit emissions (Hoffmann and Busch, 2008). Thus, it measures the firms' efforts to manage their CE (Velte *et al.*, 2020). The amount of CE attributable to firms may be direct (Scope 1), indirect (Scope 2) or from firms' supply chain (Lueg *et al.*, 2019).

External initiatives from regulators, such as carbon taxes and emission trading schemes (ETS), aim to reduce firms' CE by imposing costs on excessive emissions (Kumarasiri and Jubb, 2016). Carbon taxes incentivise firms to reduce emissions (Kumarasiri and Jubb, 2016; Rahman *et al.*, 2019). Likewise, carbon markets for ETS allow the pricing of carbon (Rahman *et al.*, 2019) and an opportunity for firms to buy carbon credits to compensate for exceeding their carbon limits (Choi and Luo, 2021). However, firms also reduce their emissions through strategic planning and measurement of CE (Kumarasiri and Jubb, 2016), adopting carbon-friendly technology, business models, renewable energy, production of green products and efficient use of materials and energy (Haque and Ntim, 2022). These initiatives, while imposing costs on firms, reduce CE and therefore lower carbon-related costs and improve FV (Haque and Ntim, 2022) by lowering compliance burden (Chapple *et al.*, 2013), cost of capital (Kim *et al.*, 2015) and attracting climate-sensitive customers (Luo *et al.*, 2013).

Firms may also reduce their CE if they commit to achieving the SDGs. The SDGs are the United Nations (UN's) environmental, social and economic goals to achieve a sustainable planet (Delgado-Ceballos *et al.*, 2023). They have 17 broad goals and 169 targets expected to be achieved by 2030 (Pedersen, 2018). In general, the SDGs aim to enhance human dignity and prosperity while at the same time safeguarding the fundamental biophysical processes of the planet and ecosystem services (Abhayawansa *et al.*, 2021; Delgado-Ceballos *et al.*, 2023). The development of the SDGs involved multiple stakeholders, including governments (Pedersen, 2018). Therefore, achieving the goals and targets also requires the involvement of various stakeholders.

2.2 Theoretical framework

We use two related theories, legitimacy and stakeholder theory, to explain the moderating role of firm commitment to SDGs on the relationship between firm CE and FV [2]. Stakeholder theory posits that a firm's success depends on its ability to successfully manage its relationship with all stakeholders (Freeman, 1994). Datt *et al.* (2022) assert that one of the responsibilities of organisations towards stakeholders is to protect the environment and report on their carbon performance, reducing information asymmetry between them and stakeholders. Like the stakeholder theory, the legitimacy theory posits that organisations can survive in their environment by carrying out their activities within societal norms and boundaries (Deegan, 2002). O'Donovan (2002) suggests that any potential or actual disparity between a firm and society's value systems threatens the entity's legitimacy. Given the increased concern of society for the environment and sustainability (Donkor *et al.*, 2023), firms have a responsibility to ensure the sustainability of the community in which they operate, and thus, any breach of this responsibility can adversely impact their survival (Datt *et al.*, 2022; Deegan, 2002). Firms are encouraged to engage in sustainable activities, including keeping their CE in check, to remain legitimate.

2.3 Hypotheses development

The disclosure of information has been identified as a dominant strategy for managing stakeholder relationships effectively (Appiagyei and Donkor, 2024; Nik Ahmad and Hossain, 2019). Likewise, firms use disclosures also to communicate their conformance to societal norms (Deegan, 2002), making information disclosure a strategy for managing firm legitimacy (Dowling and Pfeffer, 1975). Therefore, disclosing a firm CE performance is useful to stakeholders and society. Following the stakeholder and legitimacy theories, it is suggested that as firms create value for shareholders, managing other stakeholders' interests in society is also a concern (Freeman *et al.*, 2004). According to stakeholder and legitimacy theories, stakeholders and society can impose explicit and implicit costs on firms for undesirable behaviour (Humphrey *et al.*, 2012). These costs, which manifest in compliance costs, boycotts, penalties and regulations, affect the value of firms (McGuire *et al.*, 1988), thereby requiring firms to be socially responsible in managing stakeholders' interests and maintaining legitimacy (Humphrey *et al.*, 2012; McGuire *et al.*, 1988). Firms' CE is a social concern for stakeholders and society because of the effect of CE on the environment. Thus, from the stakeholder and legitimacy theories perspectives, the implications for firm CE include loss of reputation and stakeholder support and increased compliance costs that reduce FV (Makni *et al.*, 2009; McGuire *et al.*, 1988). Prior studies examining CE and FV have established a negative relationship (e.g. Bedi and Singh, 2024; Choi *et al.*, 2021). Thus, in general, the market values firms based on their level of CE, punishing poor/high carbon-emitting firms (Benkraiem *et al.*, 2022; Choi *et al.*, 2021). Consequently, the management of firms' CE should influence FV and its survival, as actions of stakeholders relating to CE performance affect the future cashflows and risks of firms (Choi and Luo, 2021; Lueg *et al.*, 2019; Velte *et al.*, 2020). We therefore hypothesise that:

H1. Firm CE performance reduces FV.

Firms are increasingly considering their contribution to SDGs as part of strategic plans that help manage the expectations of stakeholders and society for legitimacy purposes and performance improvement (Bose *et al.*, 2024; Zampone *et al.*, 2024). Advancing SDGs not only helps firms meet the social responsibility expectations of stakeholders and society (Orlitzky *et al.*, 2003) but also creates an avenue for competitive benefits (Endrikat *et al.*, 2014), such as premiums from socially sensitive customers and investors and improved reputation (Brammer *et al.*, 2006;

Delmas and Toffel, 2008). Neglecting SDGs may suggest that firms are ignoring stakeholder and societal concerns about the impact of their activities on the environment, damaging stakeholder and legitimacy dealings (Brammer *et al.*, 2006; Delmas and Toffel, 2008). Thus, firms' commitment to SDGs indicates efforts to manage their environmental impact, as aspects of SDGs respond to environmental concerns (Halkos and Gkampoura, 2021). Such indications and competitive benefits influence stakeholders' understanding and valuation of firms (Makni *et al.*, 2009; Orlitzky *et al.*, 2003), which can affect FV and/or the effect of firms' CE on FV. Previous studies on the relationship between SDGs and FV, although few, have yet to be conclusive, with positive (Mozas-Moral *et al.*, 2021), negative (Lassala *et al.*, 2021) and insignificant (García-Meca and Martínez-Ferrero, 2021) results reported.

Given the inconclusive findings in previous studies on how SDGs influence firm performance and protect the planet (i.e. reducing CE), the role of firm commitment to SDGs on the CE and firm performance nexus needs to be clarified. This is more so because commitment to SDGs enhances firms' reputation among stakeholders (Zampone *et al.*, 2024) as it is a means of achieving some reduction in carbon footprint. At the same time, such action is not costless. Commitment to SDGs may mean sacrificing profitable projects and investing in non-traditional business areas (Lassala *et al.*, 2021; Mozas-Moral *et al.*, 2021). Such actions have effects on cash flows, risks and investor perceptions. The aims of SDGs, which include improvement in human life and safeguarding the environment (Abhayawansa *et al.*, 2021), suggest that although firms that commit to SDGs may incur a cost, such commitments help improve the carbon performance of firms (i.e. reducing their levels of CE). Thus, organisations' strategic integration of and commitment to SDGs sets the tone for firms to increase the benefits they enjoy from all other engagements, including carbon performance. Hence, it may be argued that there is an overlap between CE and SDG commitments. However, whether firms pursuing SDGs will have low CE can be contested. While SDGs can contribute to combating global warming, the different dimensions suggest that some SDGs may be more useful for reducing CE than others (Delgado-Ceballos *et al.*, 2023; Halkos and Gkampoura, 2021). Moreover, differences in industry and firms' operations suggest that some firms may be constrained in reducing their CE, leading to the adoption of longer-term strategies (Haque and Ntim, 2022) or engaging in ETS (Choi and Luo, 2021) that do not translate to an immediate significant reduction in CE. This suggests that firms may commit to SDGs while working on avenues to reduce their CE. Thus, the effect of SDG commitment on the value relevance of CE may depend on the SDG dimensions pursued and the strategic motivations for such commitments. However, due to the sustainability narratives associated with SDG commitment, it may become an effective tool in managing stakeholder and societal expectations. We, therefore, contend that SDG commitment could be an avenue for firms to reduce the negative influence of their CE on their FV. Hence, there is motivation for firms to commit to SDGs, although such a commitment may not lead to a reduction in CE. This suggests that the potential negative relationship between CE performance and FV may be averted by firm commitment to SDGs. This study, therefore, tests this assumption by formulating the following hypothesis:

H2. Firm commitment to SDGs favourably moderates the relationship between CE performance and FV.

3. Methodology

3.1 Sample selection

Data for the study are gleaned from the Refinitiv database, a trusted source of transparent environmental, social, and governance (ESG) data for many firms worldwide. Firms listed

on the JSE with data on CE from 2013 to 2021 are sampled. We focus on the South African context due to its uniqueness regarding mandatory integrated reporting for firms on the JSE (Appiagyei *et al.*, 2023; Chininga *et al.*, 2023). Moreover, focusing on a single country limits the likely effects of country regulatory systems. We follow prior literature to exclude financial firms due to notable differences in their regulatory and reporting frameworks compared to non-financial firms (Konadu *et al.*, 2022), resulting in a final sample of 89 unique firms. Table 1 presents a summary of the study's sample determination process study.

3.2 Definition of variables and measurement

3.2.1 Dependent variable – firm value. Firms' financial success has been generally assessed using accounting and market-based measures (Lassala *et al.*, 2021). We measure FV using an accounting-based measure (ROE) and a market-based measure (TobinsQ). Using these two measures not only helps to understand our hypothesised relationship from different perspectives but also enhances the robustness of our results. We measure ROE as the net income ratio to total shareholders' equity. TobinsQ is measured as the sum of the market value of equity and the book value of total assets, scaled by total assets (Lee and Min, 2015). A higher TobinsQ and ROE indicate a higher FV, and vice versa.

3.2.2 Independent variable – carbon emissions performance. The CE data reported by Refinitiv complies with the boundaries and scopes of the GHG Protocol Initiative (Konadu *et al.*, 2022), reflecting scopes one, two and three [3]. We follow the existing literature and use total scope one and two CE rates as they capture direct and indirect firm emissions for which firms exert control (Konadu *et al.*, 2022). Following prior literature, CE performance is based on CE intensity and measured as the natural log of total scope one and two GHG firm emissions in metric tons scaled by total sales in millions of dollars (Datt *et al.*, 2019; Luo, 2019) [4]. A higher value indicates poor CE performance and vice versa.

3.2.3 Moderating variable – sustainable development goal commitment. Refinitiv provides data on firms' support towards the 17 SDGs using a dummy variable, 1 where there is evidence of support for the SDG and 0 if otherwise (see Tagliatela *et al.*, 2023). We, therefore, measure the level of firms' commitment towards the SDGs using an index computed as the sum of SDG values divided by the number of SDGs (i.e. 17) (Bose *et al.*, 2024). This measure is, therefore, a ratio that ranges between 0 and 1 for each firm. SDG commitment values closer to 1 indicate higher firm support and disclosure of SDGs. In addition, we adopt an alternative measure for SDG commitment based on a firm's commitment towards SDG 13 – related to climate action and therefore reflective of firm

Table 1. Sample selection

Criteria	No. of firms	Firm years
Firms on JSE	327	2,943
Less firms with incomplete carbon emissions data reports for the period under consideration	(232)	(2,088)
Less financial firms for the period under consideration	(6)	(54)
Less missing DV data		(8)
Less missing control variables data		(144)
Observations	89	649

Source: Authors' own work

actions related to their GHG emissions. This dummy variable is assigned a value of 1, where there is support for SDG 13 by a firm and 0 if otherwise.

3.2.4 Control variables. Following prior literature, we include firm characteristics such as size (FSIZE), leverage (LEV), market-to-book equity value (MBV) and property plant and equipment (PPE) as controls (Benkraiem *et al.*, 2022; Dhaliwal *et al.*, 2008; Hosny and Elgharbawy, 2022; Shan, 2019). Large firms have access to more resources and enjoy economies of scale, which influences FV positively. Capital structure decisions influence FV. Debt signals management's future intentions and restricts the use of excess cash flow, thus influencing FV. Firms with high capital intensity are resourceful and more innovative to remain competitive, influencing their value. Investors consider firms with high growth opportunities (indicated by their MBV) more valuable.

We also include board characteristics such as size (BSIZE), independence (Fairholm *et al.*, 2018) and gender diversity as controls (Hosny and Elgharbawy, 2022; Shan, 2019). Large boards are more diversified and have more expertise to improve the board's effectiveness in influencing FV. Independent directors improve board effectiveness by monitoring managerial actions to ensure goal congruence influencing FV. Gender diversity provides different perspectives on the board and enhances monitoring, leading to quality board decisions that influence FV. Investor activity and decisions were found to be influenced by the COVID-19 pandemic (Djadjadikerta *et al.*, 2022), with volatility in the stock market experienced during the pandemic period (Janda and Chalmers, 2020). For this reason, we control for the potential effect of COVID-19 on the value of firms by including the pandemic periods as a dummy variable in our model.

3.3 Model estimation

We use the OLS regression approach to test our hypotheses. We estimate the model below to examine the influence of firm CEP on FV. *H1* is tested based on the sign and significance of the coefficient CEP_{it} . Given our measure for CEP, a negative and significant coefficient suggests that high CE (i.e. poor CE performance) reduces FV. A positive and significant coefficient for CEP_{it} , however, suggests that firms with high (i.e. poor CE performance) may have higher FV:

$$FValue_{it} = b_0 + b_1 CEP_{it} + Contrls_{it} + \sum IndD + \sum YearD + \varepsilon_{it} \quad (1)$$

The moderating role of firm commitment to SDGs is tested based on Model 2 below:

$$FValue_{it} = b_0 + b_1 CEP_{it} + (CEP_{it} * SDG_{it}) + Contrls_{it} + \sum IndD + \sum YearD + \varepsilon_{it} \quad (2)$$

where $FValue_{it}$ is firm value, CEP_{it} is CE performance, SDG_{it} is a firm commitment to SDGs, $(CEP_{it} * SDG_{it})$ is the moderation effect and $Contrls_{it}$ represents all controls used in the study. All for the individual firms i and years t .

A significant coefficient for $CEP_{it} * SDG_{it}$ suggests that firm commitment to SDGs moderates the relationship between firm CE performance and FV. A positive sign for this coefficient suggests that firm commitment to SDGs averts the negative relationship between firm CE and FV, whereas a negative coefficient suggests otherwise.

Endogeneity concerns are addressed in our model by using two measures of firm performance (ROE and TobinsQ) and firm commitment to SDGs (SDG and SDG13). In addition, alternative estimation models such as the endogenous delayed, lead-lagged and

three-stage least squares (3SLS) models are also used as part of our robustness checks (e.g. [Appiagyei and Donkor, 2024](#); [Donkor et al., 2024](#); [Yorke et al., 2023](#)).

4. Empirical analysis

4.1 Descriptive and correlation analysis

The descriptive statistics of variables for the study are presented in [Table 2](#). TobinsQ recorded a mean score greater than one, implying that the average market value of sample firms is higher than their book value of assets. This aligns with the expectations of every growing firm ([Lewandowski, 2017](#)). Besides, the improved FV of sample firms is affirmed by the positive average ROE score, indicating that sample firms have mostly been profitable over the study period. On average, sample firms recorded a CEP of 8.25 (2.8 million tons) based on the natural logarithm of CE intensity, with a maximum score of 12.58 and a minimum of 2.77. The closeness of the average to the maximum score shows that most of the sample firms recorded high CEP, indicating poor emission performance. The high CEP among the sample firms aligns with the CE issues of South Africa, which is identified as one of the top global greenhouse gas-emitting countries ([Chininga et al., 2023](#)).

On average, the sample firms' commitment to SDGs is 11%, indicating a low level of SDG activities implementation and disclosure among firms on the JSE. While some firms show no commitment towards SDGs (i.e. a minimum score of 0), others portray a high sense of commitment with a maximum score of 94.1%. Regarding the control variables, an average board size of 2.45 members with a maximum of 3.00 members is recorded. Approximately 60% of the board members are independent directors, while 26.5% are female directors. Whereas some sample firms are highly geared with leverage scores of as high as 92.1%, the average is 23% of total asset financing. These characteristics align with prior literature that focused on firms on JSE ([Appiagyei et al., 2023](#); [Appiagyei and Donkor, 2024](#); [Donkor et al., 2022](#)).

[Table 3](#) presents the correlation matrix for the study. A positive significant association is established between TobinsQ and ROE at 1% significance levels. CEP is negatively associated with TobinsQ and ROE at 1% and 5% significance levels, respectively. Firms' commitment to SDGs is positively associated with ROE and TobinsQ but only significant for ROE at a 1% significance level. The low associations among the independent and control variables suggest no concerns with multicollinearity ([Kılıç and Kuzey, 2018](#)).

Table 2. Descriptive statistics

Variable	Mean	SD	Min	Max
TOBINQ	1.396	0.753	0.414	6.518
ROE	0.125	0.150	-0.618	1.227
CEP	8.251	1.818	2.766	12.577
SDG	0.110	0.236	0.000	0.941
FSIZE	20.806	1.686	16.054	24.669
MBV	0.692	0.855	0.010	7.518
LEV	0.230	0.185	0.000	0.921
PPE	0.299	0.246	0.000	0.934
BFSIZE	2.454	0.251	1.792	2.996
BIND	0.607	0.133	0.273	0.875
BGD	0.265	0.121	0.000	0.727
COVID19	0.353	0.478	0.000	1.000

Source: Authors' own work

Table 3. Pairwise correlations table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) TOBINQ	1.000											
(2) ROE	0.546***	1.000										
(3) CEP	-0.163***	-0.081**	1.000									
(4) SDG	0.033	0.121***	-0.004	1.000								
(5) FSIZE	0.181***	0.373***	-0.083**	0.136***	1.000							
(6) MBV	0.555***	0.381***	0.109***	-0.033	0.377***	1.000						
(7) LEV	-0.012	-0.169***	0.126***	0.046	-0.245***	-0.163***	1.000					
(8) PPE	0.022	-0.037	0.354***	-0.004	-0.064	0.169***	0.218***	1.000				
(9) BSIZE	-0.078**	0.074*	-0.112***	0.003	0.295***	-0.101**	-0.124***	-0.155***	1.000			
(10) BIND	-0.075*	-0.075*	0.011	0.230***	-0.058	-0.082**	0.100**	0.089**	-0.072*	1.000		
(11) BGD	0.038	0.057	-0.023	0.254***	-0.096**	-0.027	0.194***	-0.010	-0.022	0.264***	1.000	
(12) COVID19	-0.092**	-0.073*	-0.005	0.330***	-0.007	-0.082**	0.129***	-0.056	-0.053	0.177***	0.316***	1.000

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Source: Authors' own work

4.2 Multivariate regression analysis

Table 4 presents the regression output related to the nexus of the firm's CEP, the firm's value and the moderating role of the firm's commitment to SDGs. A negative significant influence is established between CEP and both measures of FV used (i.e. $\beta = -0.117, p < 0.01$, for *TobinsQ* and $\beta = -0.007, p < 0.10$ for *ROE*) [see columns 1 and 5], indicating an acceptance of *H1*. This implies that CEP influences the value of firms. Thus, a worsening emission performance (i.e. increases in CEP) of firms negatively affects their value. Firms on the JSE seeking to improve their value must pay attention to their CE level. This finding aligns with prior literature (e.g. Benkraiem *et al.*, 2022; Choi *et al.*, 2021), which suggests that emissions over and above allowable limits negatively affect the performance of firms. Hence, firms benefit from practices that limit their CE. Our finding is consistent with the stakeholder and legitimacy theories. Society and stakeholders such as investors, regulators and activists take action on firms for their CE, pushing firms to manage CE or face costs that affect cashflows, profits and market value (Choi and Luo, 2021; Lueg *et al.*, 2019; Velte *et al.*, 2020).

To differentiate the current study from prior studies, we argue that commitment to SDGs has strategic relevance for firms, potentially limiting the negative influence of CEP on FV. Thus, regarding *H2*, the moderating role of firms' commitment to SDGs on the CEP-FV nexus is evaluated (i.e. the interaction variables CEP*SDG and CEP*SDG13), and the results are presented in columns 2 and 6 of Table 4.

From Table 4, columns 2 and 6, the coefficients of the interaction term (CEP*SDG) of interest are positive and significant for both measures of FV (i.e. $\beta = 0.108, p < 0.01$ for *TobinsQ* and $\beta = 0.035, p < 0.05$ for *ROE*). This implies that firms' commitment to SDGs, reflected by the implementation and disclosure of SDG activities, moderates the CEP and FV nexus. With a negative significant effect of CEP on FV, the positive moderating effect of firms' commitment to SDGs suggests that when firms commit to SDGs, CEP is no longer seen as value-destroying (Li *et al.*, 2022). Thus, increases in firms' commitment to SDGs reduce/avert the negative influences of CEP on FV. This result is affirmed when firms' commitment to SDG is viewed from their commitment to SDG 13, which focuses directly on climate change. Thus, based on the results (i.e. Table 4, columns 4 and 8), a positive significant effect is established for the interaction term CEP*SDG13 (i.e. $\beta = 0.065, p < 0.05$ for *TobinsQ* and $\beta = 0.025, p < 0.05$ for *ROE*).

Our finding aligns with the stakeholder and legitimacy theories and suggests that stakeholders value firm actions that promote sustainability (Datt *et al.*, 2022; Deegan, 2002). Implementing SDGs and disclosing such practices is an opportunity to improve the public image and appeal to environmentally sensitive stakeholders (Cucchiella *et al.*, 2017), thereby limiting the negative tendencies of firm CE. JSE firms may support and disclose their SDG activities for legitimacy purposes. Aside from the calls by the UN for all stakeholders to help achieve the SDGs, the increased stakeholder and societal expectations for sustainability activities exert pressure on firms to implement and disclose SDGs (Bose *et al.*, 2024; Zampone *et al.*, 2024). Furthermore, SDG commitment allows firms to improve their reputation and remain competitive as the focus of capital providers on sustainability continues to grow (Bose *et al.*, 2024).

We find support for extant literature postulating that firms' commitment to SDGs has favourable effects on FV (Mozas-Moral *et al.*, 2021). Although some studies suggest no effect (see García-Meca and Martínez-Ferrero, 2021) and negative effect (see Lassala *et al.*, 2021) of firm SDGs commitment on FV, our results suggest a positive and significant influence of SDGs commitment on FV in all models. Furthermore, we extend the literature by empirically evincing that commitment to SDGs by firms reduces the negative influence of firms' CE on FV. Thus, we suggest that firm commitment to SDGs is an avenue to reduce the

Table 4. Relation between carbon emission performance (CEP) and firm value moderated by firms' SDG commitment

Variables	1	2	3	4	5	6	7	8
CEP*SDG		0.108*** (0.04)				0.035** (0.017)		
CEP*SDG13		-0.117*** (0.016)		0.065** (0.025)		-0.012* (0.007)		0.025** (0.012)
CEP	0.185*** (0.044)	-0.133*** (0.033)	-0.117*** (0.029)	-0.133*** (0.033)	-0.007** (0.003)	-0.012* (0.007)	-0.007** (0.003)	-0.012* (0.007)
SDG		1.05*** (0.396)			0.113*** (0.029)	0.367*** (0.157)		
SDG13			0.147* (0.087)	0.684*** (0.254)			0.06** (0.028)	0.267** (0.114)
FSIZE	-0.015 (0.042)	-0.014 (0.042)	-0.016 (0.042)	-0.015 (0.042)	0.024*** (0.007)	0.025*** (0.007)	0.024*** (0.007)	0.025*** (0.007)
MBV	0.518*** (0.078)	0.516*** (0.078)	0.516*** (0.077)	0.515*** (0.077)	0.046*** (0.011)	0.045*** (0.011)	0.045*** (0.011)	0.044*** (0.011)
LEV	0.509** (0.258)	0.518** (0.258)	0.49* (0.259)	0.503* (0.258)	-0.04 (0.054)	-0.037 (0.054)	-0.048 (0.054)	-0.043 (0.055)
PPE	0.192 (0.26)	0.218 (0.258)	0.205 (0.257)	0.227 (0.255)	0.008 (0.034)	0 (0.033)	0.003 (0.033)	0.006 (0.033)
BFSIZE	-0.099 (0.186)	-0.111 (0.187)	-0.106 (0.184)	-0.114 (0.184)	-0.038 (0.032)	-0.042 (0.033)	-0.041 (0.032)	-0.044 (0.033)
BIND	-0.403 (0.352)	-0.424 (0.353)	-0.402 (0.351)	-0.424 (0.352)	-0.084 (0.061)	-0.091 (0.062)	-0.082 (0.06)	-0.09 (0.061)
BGD	0.344 (0.43)	0.339 (0.431)	0.329 (0.434)	0.339 (0.434)	0.153* (0.087)	0.151* (0.089)	0.147* (0.086)	0.151* (0.088)
COVID19	-0.352*** (0.11)	-0.308** (0.132)	-0.214** (0.103)	-0.324*** (0.112)	-0.07*** (0.028)	-0.038* (0.023)	-0.087*** (0.022)	-0.039* (0.023)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.801 (0.697)	0.656 (0.69)	0.821 (0.696)	0.701 (0.689)	-0.315*** (0.116)	-0.362*** (0.116)	-0.311** (0.12)	-0.357*** (0.119)
Adjusted R ²	0.388	0.392	0.388	0.391	0.239	0.251	0.243	0.258
F statistics	29.75***	31.17***	25.24	26.33***	6.58***	7.58***	6.60***	7.07***
Observations	649	649	649	649	649	649	649	649

Notes: The table denotes the regression output of the moderation effect of firms' commitment to SDGs on the carbon emission and firm value relationship. Variables are winsorised at 1% and 99, except dummy variables. Standard errors are reported in parentheses and clustered by firm and industry. ***, **, * denotes 1, 5 and 10% statistical significance levels

Source: Authors' own work

negative tendencies of carbon footprint and improve FV. Our study, therefore, provides empirical evidence supporting the need for firms to commit to SDGs to limit the negative influence of their CEP on FV. Thus, we affirm that the market values such commitments, leading to the value-enhancing effect rather than the value-destroying effect. Therefore, firms' commitment to SDGs matters to the nexus between firms' CE performance and FV.

4.3 Robustness

In addition to using two alternative measures of FV, the study follows prior literature to adopt delayed endogenous, lead-lagged and 3SLS models to deal with endogeneity issues and validate our results. Following [García-Sánchez et al. \(2022\)](#), we use the delayed endogenous model as there is a potential effect of prior year FV on current year FV (i.e. $T - 1$ May influence t for FV). From [Table 5](#), columns 1–4, the results are affirmed for *H1* and *H2*. That is, a negative significant effect is established for CEP for all measures used (i.e. $\beta = -0.034$, $p < 0.01$, $\beta = -0.032$, $p < 0.01$ for *TobinsQ* and $\beta = -0.008$, $p < 0.05$, $\beta = -0.008$, $p < 0.10$ for *ROE*), and the positive significant effect for the two interaction variables are affirmed (i.e. $\beta = 0.049$, $p < 0.05$, $\beta = 0.026$, $p < 0.05$ for *TobinsQ* and $\beta = 0.047$, $p < 0.05$, $\beta = 0.029$, $p < 0.05$ for *ROE*).

Following [Bellemare et al. \(2017\)](#), we further perform lead-lagged analysis, which lagged endogenous predictors to “exogenise” them as “ Y_t cannot explain X_{t-1} ” ([Appiagyei and Donkor, 2024](#); [Donkor et al., 2022](#)). From [Table 5](#), columns 5–8, lagged CEP on FV is negative, and the lagged interaction terms are also positive and significant, affirming our initial results. We also use the 3SLS model to address endogeneity and further substantiate our findings. The 3SLS model uses the two main variables of interest (i.e. FV and CEP) endogenously in simultaneous equations to address issues of reverse causality and omitted variable bias ([Appiagyei and Donkor, 2024](#); [Donkor et al., 2022](#)). Our initial findings are affirmed based on the results in [Table 5](#), columns 9–12. Thus, a negative significant effect is established for the CEP and FV nexus, while the interaction terms are also found to affect both measures of FV adopted positively. Our findings are further supported based on untabulated results using fixed and random effects panel estimations and return on assets as an additional measure of FV.

4.4 Further analysis

[Amos \(2023\)](#) suggests that firm CE behaviour is determined by specific firm context, with ESG performance indicative of firm responses to stakeholders on carbon issues. Thus, based on the role of ESG performance in firm market valuation ([Chininga et al., 2023](#)) and the established relationships between firm size and CE, ESG performance and FV ([Ghose et al., 2023](#)), we perform further analysis by focusing on large and small firms and high and low-ESG-performing firms. We divide our sample firms into large and small firms, as well as high and low-ESG-performing firms, using the median values of these measures. The results reported in [Table 6](#) show that the negative influence of CE on FV does not differ between large or small firms, although the effect is greater in large firms (i.e. $\beta = -0.154$, $p < 0.01$ for large firms and $\beta = -0.087$, $p < 0.01$ for small firms). However, the moderating role of firm commitment to SDGs is only significant for large firms. This is plausible because large firms are visible, and for that matter, their SDG activities become noticeable by the market, thereby limiting the negative tendencies of their CE on their value.

Similarly, for high and low-ESG-performing firms, the negative influence of CE on FV does not differ, although the effect is greater in low-ESG-performing firms (i.e. $\beta = -0.107$, $p < 0.01$ for high-ESG-performing firms and $\beta = -0.153$, $p < 0.01$ for low-ESG-performing firms). Regarding the moderating role of firm commitment to SDGs, we find this significant

Table 5. Robustness

Variables	Delayed endogenous model			Lead-Lagged model			3SLS model					
	1	2	3	4	5	6	7	8	9	10	11	12
CEP*SDG	0.049*** (0.021)		0.047** (0.019)									
L.CEP*L.SDG							0.039*** (0.015)				0.037*** (0.011)	
CEP*SDG13		0.026** (0.012)		0.029** (0.014)		0.128*** (0.042)				0.079*** (0.03)		0.027*** (0.007)
L.CEP*L.SDG13							0.078*** (0.025)	0.023*** (0.008)				
CEP	-0.034*** (0.005)	-0.032*** (0.005)	-0.008** (0.004)	-0.008* (0.004)	-0.13*** (0.032)	-0.13*** (0.032)	-0.007 (0.006)	-0.006 (0.007)	-0.145*** (0.018)	-0.143*** (0.018)	-0.014*** (0.004)	-0.015*** (0.004)
L.CEP									1.171*** (0.392)			
SDG	0.439** (0.202)		0.381** (0.186)		1.152*** (0.416)		0.322*** (0.126)			0.749*** (0.26)		0.305*** (0.061)
L.SDG												
SDG13		0.261** (0.123)		0.207* (0.113)		0.714*** (0.241)		0.19*** (0.069)				
L.SDG13												
L.TobinQ	0.725*** (0.023)	0.725*** (0.024)		0.553*** (0.128)								
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.05 (0.141)	0.081 (0.149)	-0.182** (0.075)	-0.18** (0.078)	0.299 (0.595)	0.32 (0.596)	-0.431*** (0.117)	-0.426*** (0.119)	0.328 (0.385)	0.387 (0.383)	-0.385*** (0.09)	-0.388*** (0.089)
Adjusted R ²	0.824	0.824	0.458	0.463	0.408	0.407	0.225	0.223	0.420	0.419	0.262	0.270
F Statistics/Chi ²	632.51***	630.29***	73.51***	79.69***	25.48***	22.51***	10.68***	9.68***	396.67***	396.11***	192.23	200.52
Observations	548	548	548	548	548	548	548	548	548	548	548	548

Notes: The table denotes the regression output of the moderation effect of firms' commitment to SDGs on the carbon emission and firm value relationship. Variables are winsorised at 1% and 99%, except dummy variables. Standard errors are reported in parentheses and clustered by firm and industry. ***, **, * denotes 1%, 5% and 10% statistical significance levels

Source: Authors' own work

Table 6. Large – small firms and high – low ESG firms

Variables	TOBINQ			
	Large firm	Small firm	High ESG	Low ESG
CEP*SDG	0.165** (0.064)	0.076 (0.133)	0.142** (0.064)	0.089 (0.132)
CEP	-0.154*** (0.026)	-0.087*** (0.030)	-0.107*** (0.027)	-0.153*** (0.032)
SDG	1.254** (0.576)	0.604 (1.062)	1.083* (0.558)	0.696 (1.072)
All controls	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes
Constant	2.543 (1.134)	0.841 (0.825)	0.606 (0.674)	-0.953 (0.676)
Adjusted R ²	0.252	0.094	0.194	0.151
F statistics	7.47***	2.951***	5.62***	4.35***
Observations	328	321	328	321

Notes: The table denotes the regression output of the moderation effect of firms' commitment to SDGs on the carbon emission and firm value relationship based on subsamples. Variables are winsorised at 1% and 99%, except dummy variables. Standard errors are reported in parentheses and clustered by firm and industry. ***, **, * denotes 1, 5 and 10% statistical significance levels

Source: Authors' own work

only for high-ESG-performing firms. This is plausible because the response of high-ESG-performing firms to ESG activities makes them more susceptible to committing to SDGs. Hence, when valuing such firms, the market recognises their sustainability activities. Unreported results focusing on environmentally sensitive and non-sensitive industries affirm the findings and suggest that commitment to SDGs is more beneficial for environmentally sensitive firms.

In addition, we extend our findings by examining whether the influence of the separate dimensions of SDGs on the CE-FV relationship differs significantly. Following the view that SDGs encompass economic, social and environmental dimensions (Halkos and Gkampoura, 2021), we focus on the influence of firms' commitment to the three dimensions of SDGs [5]. The results, as reported in Table 7, indicate that firms' commitment to environmental, social and economic dimensions of SDGs positively moderate the CE-FV nexus (i.e. $\beta = 0.098$, $p < 0.01$, $\beta = 0.096$, $p < 0.05$ and $\beta = 0.092$, $p < 0.01$, respectively, for environmental, social and economic dimensions). Although the influence of the individual dimensions of SDGs on the CE-FV nexus does not differ significantly (see Table 7, Panel B), commitment to environmental SDGs has the greatest effect. Thus, the market recognises SDGs efforts to reduce environmental impact in estimating the negative tendencies of emissions on FV.

5. Conclusion

The increased concerns about firms' carbon footprint by stakeholders and society require action. It is established in the literature that high emissions affect the value of firms. Adopting measures that enhance firms' CE management is useful in improving FV. Firms' contribution to the SDGs is considered a catalyst for achieving the targets in 2030. Given that SDGs promote the protection of the environment, they can be a conduit to limit firms' carbon footprint and improve FV. However, previous studies that have examined the CE and FV relationship do not consider the role of firms' commitment to SDGs. We, thus, examine the moderating role of firm commitment to SDGs in the relationship between firm CE and FV.

Using sample firms on the JSE, a context recognised for poor CE performance, we find that high carbon-emitting firms (i.e. poor CE performance) have lower market value and

Table 7. SDG dimensions

Variables	TOBINQ		
	Environmental SDGs	Social SDGs	Economic SDGs
CEP*SDGenv	0.098*** (0.035)		
CEP*SDGsoc		0.096** (0.038)	
CEP*SDGeco			0.092*** (0.034)
CEP	-0.132*** (0.033)	-0.131*** (0.033)	-0.133*** (0.032)
SDGenv	0.918*** (0.343)		
SDGsoc		0.918** (0.363)	
SDGeco			0.942*** (0.352)
Controls, year and ind. effects	Yes	Yes	Yes
Constant	0.366 (0.705)	0.361 (0.702)	0.396 (0.709)
Adjusted R ²	0.409	0.409	0.412
F statistics	27.98***	34.641***	32.50***
Observations	649	649	649
<i>Panel B: test of differences</i>	Chi ²	Prob > Chi ²	
CEP*SDGenv Vrs. CEP*SDGsoc	0.02	0.891	
CEP*SDGenv Vrs. CEP*SDGeco	0.11	0.744	
CEP*SDGsoc Vrs. CEP*SDGeco	0.07	0.785	

Notes: The table denotes the regression output of the moderation effect of firms' commitment to SDGs on the carbon emission and firm value relationship based on sub-groupings of SDG (environment – SDGs 6, 7, 11, 12, 13, 14, 15, social – SDGs 1, 2, 3, 4, 5, 10, 16 and economic – SDGs 8, 9, 17). Variables are winsorised at 1 and 99%, except dummy variables. Standard errors are reported in parentheses and clustered by firm and industry. ***, **, * denotes 1, 5 and 10% statistical significance levels

Source: Authors' own work

profitability. This suggests that investors on the JSE reward low CE and punish high emissions. Therefore, firms on the JSE should be concerned about managing their carbon footprints, as it has implications for their financial performance. In addition, our findings establish that the commitment to SDGs assuages the detrimental influence of CE on FV. Thus, SDGs commitment limits the value-destroying tendencies of firm CE. Further analysis establishes that the market punishes large and low-ESG-performing firms more for their CE, and firms' commitment to SDGs limits the detrimental influence of firm CE for large and high-ESG-performing firms.

We extend the existing literature by affirming the relevance of firm commitment to SDGs in reducing the negative tendencies of CE on FV. Our findings should interest policymakers and governments seeking to promote the achievement of SDGs by 2030. Based on our findings, a business case for firms' involvement in SDGs can be established. Firms' involvement in SDGs will catalyse achieving them and potentially enhance the management of carbon footprints, thereby improving FV. Given the potential benefits of SDGs' commitment to CE and FV, firms on the JSE are encouraged to incorporate SDGs in their strategic and operational plans. Our findings also imply that the managerial decision to allocate resources for SDGs and management of CE is justified as market participants on the JSE recognise these allocations as prudent use of firms' resources. Although our findings could be generalisable to other contexts with similar poor carbon performance, our focus on a single country context limits the global generalisability of the findings. Therefore, future studies should examine our hypothesised relationships in different contexts.

Notes

1. Commitment to SDGs here does not connote a radical change in ESG practices but firms incremental/gradual contributions towards achieving SDGs.
2. *These two theories have been widely applied to explain non-financial reporting (Cotter et al., 2011; Gray et al., 1995). Some scholars have argued that rather than viewing stakeholder and legitimacy theories as competing, they should be alternative lenses for explaining firm behaviour towards non-financial information disclosure (Gray et al., 1995).*
3. *Scope 1 and 2 measure direct and indirect firm emissions, respectively, while Scope 3 relates to emissions from entities in the firms' supply (Konadu et al., 2022).*
4. *Higher carbon emission intensity (CEI) indicates firms' inefficient resource use, hence a poor emitter. Carbon emission intensity is scaled by sales to align with prior literature.*
5. *Environmental SDGs (SDGs 6, 7, 11, 12, 13, 14, 15), social SDGs (SDGs 1, 2, 3, 4, 5, 10, 16) and economic SDGs (SDGs 8, 9, 17) – Halkos and Gkampoura (2021).*

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