Impact of Corporate Governance Performance and Firm Financial Performance: Mediating Role of Leverage in Carbon-Intensive Firms in South Africa

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Article

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Abstract

This study seeks to establish how financial leverage mediates the relationship between corporate governance and firm financial performance of 58 carbon-intensive firms listed on the Johannesburg Stock Exchange for a period 2015-2023. The research employed a two-step system generalized method of moments to address endogeneity issues. The study indicates that leverage negatively impacts firm financial performance; but leverage does not mediate the relationship between corporate governance and firm financial performance in carbon-intensive firms. The results of the study also reveal that board remuneration negatively influences firm financial performance, yet board independence shows insignificant impact on firm performance. These results underscore the need for carbon-intensive companies to reassess their remuneration policies to ensure alignment with short-term financial benefits and long-term sustainability initiatives. The findings also suggest that sustainability projects financed predominantly by debts may negatively impact short- firm financial performance, indicating the importance of balanced capital structure during the decarbonisation process.

Keywords: carbon-intensive firms; decarbonisation; firm financial performance; financial leverage; Johannesburg Stock Exchange

1. Introduction

Corporate governance (GC) is widely recognised as an essential determinant of firm financial performance (FFP), influencing how firms manage financial risk, protect shareholder interests, and maintain high quality financial reporting (Nasrakkah and ElKhiury, 2021; Bui and Krajcsak, 2023; Alodat, Salleh, Hashim and Sulong, 2022; Atugeba and Acquah-Sam, 2024; Bagh, Hunjra and Corbet, 2025). Effective CG promotes reliable and transparent financial reporting, which in turn improves FFP (Bui, Nguyen and Nguyen, 2024; Miao, Muhammad, Saghir and Syed, 2023). Effective CG practices become even more important for carbon-emitting companies, which operate under extensive stakeholders' pressure to invest in green technologies and comply with environmental standards (Chen, Xie and He, 2024; Hasan and Chen, 2025).

Carbon-intensive companies such as mining, oil and gas, manufacturing, industrial and consumer goods are major contributors to South Africa's economic growth, yet they are responsible for a significant proportion of greenhouse gas (GHG) emission recorded in the country (Akinbami, Oke & Bodunrin, 2021). Therefore, carbon-intensive firms face significant pressure from regulatory and stakeholders to invest on environmental protection technologies to mitigate GHG emission in their operations. CG assumes greater importance in guiding executive to the balance debt with equity in order to navigate these challenges and achieve superior firm performance (Kijkasiwat, Hussain and Mumtaz, 2022). Although, debt can support environment protection investment, excessive financial leverage (LEV) may increase firm financial vulnerability (Puni and Anlesinya, 2020). This makes corporate board oversight role crucial in guiding financial decisions, monitoring management and aligning incentives.

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Therefore, CG practices play a key role in supporting these companies to adopt judicious LEV approaches that foster environmentally sustainable practices and drive firm performance. Firms with independent board members and performance-aligned board remuneration (BR) usually enjoy prudent LEV strategies (Nugraha & Soewarno, 2022). It evident that CG alone may not fully explain the FFP through oversight and strategic guidance; instead, LEV emerges as a crucial mechanism through which CG mechanisms shape FFP.

Many researchers have investigated the association between CG mechanisms such, board independence (BI) and BR on FFP (Kapil & Mishra,2019; Neralla, 2021; Kufo & Shtembari, 2023; Pathak & Chandani, 2023; Mlilo & Gwatidzo, 2020; Asdullah & Juhandi, 2023; Amin, Mollah, Kamal, Zhao & Simsek, 2024; Sunny & Hoque, 2024), CG and LEV (Kieschnick & Moussawi, 2018;Zhou, Li & Chen, 2021; Mwaungulu, Li-Kuehne & Subedi, 2023), and capital structure (CS) and FFP (Boshnak, 2023; Ronoowah & Seetanak, 2023). However, few studies explored the potential mediating role of LEV in CG-FFP nexus (Detthamrong, Chancharat & Vithessonthi, 2017; Ngatno, Apriatni & Youlianto, 2021; Shakri, Yong and Xiang, 2025). Furthermore, in the context of carbon-intensive companies listed on the Johannesburg Stock Exchange (JSE), there is still a scarcity of research on how LEV mediate the relationship between CG and FFP. This study addresses these gaps by exploring whether LEV mediates the relationship between CG and FFP in carbon emitting companies listed on the JSE.

This study makes several novel contributions to ESG and firm performance literature. First, it offers empirical evidence on how LEV mediate the relationship between CG mechanisms and FFP in JSE- high carbon emission companies. Although much research has been conducted on CG-FFP nexus, this study uniquely explores mediating role of leverage. Second, it extends CG-FFP literature by investigating this relationship within carbon-emitting firms listed on the JSE. Third, the research contributes to the emerging ESG-FFP literature by providing evidence from South Africa, offering valuable insights to comparable, market institutional settings. Finally, by focusing on the high carbon intensive companies that play a significant role in South African economy and of employment creation, especially for marginalised groups, study offers sector-specific governance insights with potential implications for enhancing FFP.

2. Literature Review and Hypotheses Development

2.1. Corporate Governance and Financial Performance

Corporate governance (CG) refers to the system of relationships among a firm's management, board of directors, shareholders, and other stakeholders. It can be viewed from two complementary views: firs, as the actual behaviour of companies shown in performance, efficiency, financial structure, and the treatment of stakeholders (Bui and Krajcsak, 2023); and second, as the formal rules, regulations, and institutional frameworks within companies operate (Adegbayibi & Adelowotan, 2024). CG also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined (Yasser et al. 2011). All countries have their own official procedures according to their customs, political environment, religious beliefs, and social and economic backgrounds. In this stud, CG is measured using BR and BI, while FFP is operationalised using return on asset (ROA) and return on equity (ROE).

Countries have their own set of CG codes that protect the rights of stakeholders (Khan et al. 2016). CG is one way to deal with agency problems when conflict arises between owners and agents, resulting in variations in firm performance. CG changes the rules or introduces motivation strategies that motivate agents to protect the interests of shareholders and resolve conflicts. The next section explores the impact of board renumeration and BI on firm performance, and the second is the mediating role of leverage in influencing the association between CG mechanisms and FFP.

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2.1.1. Board Remuneration (BR) and Firm Financial Performance

Board remuneration (BR) has gained increasing attention in CG-FFP research, as it regarded as a key mechanism for addressing conflict of interests arising from misalignment between managers's incentives and and stakeholders' interests (Khandelwal, Tripathi, Chotia, Srivastava, Sharma & Kalyani, 2023). Performance-aligned board compensation ensure that board of directors are incentivised to support managers to make strategic decisions that enhance firm performance (Owusu, Sarpong, Tchuiendem & Coleman, 2023). Director remuneration must be competitive to attract high-calibre individuals and to reward them for their responsibilities.

Some researchers on CG-FFP relationship suggest that BR positively impact financial performance. For example, Pathak and Chandani (2023), using a sample of 319 non-financial firms from the BSE-500 Index for the period 2011-2020, reported that BR has a positive impact on FFP. Similarly, based on the sample of 1 736 firm-year observations on firms listed on JSE, Lemma, Mlilo and Gwatidzo (2020) found that board compensation positively influences firm performance. Moreover, Scholtz, Jachi and Nel (2025) investigated this relationship among JSE listed companies, and results revealed that BR is positively associated with both accounting-based (EPS) and market-based (TQ) indicators of FFP.

However, other researchers, such as Padia and Callaghan (2020) found no relationship between board compensation and FFP. Similarly, Watto, Fahlevi, Mehmood, Asdullah and Juhandi (2023) reported no impact of executive remuneration on firm performance of Pakistani banks. Furthermore, Bussin and Nel (2015), revealed a negative relationship between BR and FFP. Based on these perspectives, the following hypothesis is proposed:

H1: BR is positively associated with FFP among carbon-intensive firms listed on the JSE.

2.1.2. Board Independence (BI) and Firm Financial Performance

Board independence (BI) is measured by the proportion of independent board of directors on the board (Kufo & Shtembari, 2023). Independent directors play significant role in addressing agency problems and controlling management decisions (Al-Saidi, 2021). Independent board of directors protect shareholders interests against management's risky decisions due to their ability to monitor management effectively (Amin, Mollah, Kamal, Zhao & Simsek, 2024).

However, prior research produces a mixed results on the impact of BI on FFP. For instance, Pucheta-Martinez and Gallego-Alverez (2020) indicate that independent board members ensure effective monitoring and value creation. In the same vein, Ngo, Le, Nguyen and Luu (2022) explored the impact of BI on the FFP of firms listed on the Vietnamese Stock Exchange, documented a positive relationship. Similarly, Omenihu and Nwafor (2025) explored the association between CG mechanisms and FFP, reporting a positive relationship.

Conversely, Rao and Tilt (2016) argue that excessive independent may limit directors' firm-specific knowledge, hindering board oversight. In the same vein, Neralla (2022) examined the impact of CG practices on FFP of Indian Bombay Stock Exchange for the period 2015-2020, revealing no relationship between BI with FFP indicators, namely, ROA, EPS and net profit margin (NPM). In the same vein, Mishra (2023) investigated the impact of BI on FFP using the sample of all listed Indian firms for the period 2003 to 2019, documenting no relationship between BI and FFP. Furthermore, Molla, Islam and Rehaman (2021) examined the relationship between CG and firm performance of listed banks in Bangladesh and found no relationship. These findings suggest that mere presence of non-executive directors on the board may not be enough to enhance FFP or to successfully motivate managers to act in the best interests of stakeholders.

Furthermore, study conducted by Sunny and Hoque (2024) in 45 firms listed on Dhaka Stock Exchange (DSE) for the period 2016-2021, reported that excessive monitoring by independent board of directors limits managerial flexibility and strategic risk-taking, reducing firm performance. Khan, Saleem, Ud Din and Khan (2024) investigated the relationship between BI and FFP (measured by ROA, ROE, market-to-book ratio and TQ) of 152 non-financial companies listed on the Pakistan Stock Exchange for the period of 2023 to 2018, reporting significantly negative relationship. In the same

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vein, Amin, Ali, Rehman, Naseem and Ahmand (2022) revealed that BI had a negative impact on FFP of listed firms in Pakistan. To establish BI affect FFP, the study hypotheses the following:

H2: BI is passively associates with FFP among JSE carbon-intensive firms.

2.2. Corporate Governance and Financial Leverage (LEV)

Prior research suggest that financial crisis can be caused, among other variables, failures and weakness in CG practices (Gennaro & Nietlispach, 2021). Effective CG mechanisms help firms in making correct capital structure decisions, which in turn have important impact on firm performance (Zhou, Li & Chen, 2021).

2.2.1. Board Remuneration (BR) and Financial Leverage (LEV)

In CG research, board of directors play an important role in mitigating information asymmetry between the capital providers and firms (Pathak, Chandani, Ubarhande & Bagade, 2025). Research has focused on BR to ensure that they protect the interests of shareholders. Firm with attractive and competitive BR help address information asymmetry (Grey, Flynn & Adu, 2024). Performance-aligned BR can motivate board of directors to guide managers towards prudent debt management, thereby improving FFP.

Zain et al. (2019) argues that compensation is typically used as an incentive to influence directors' action and strategies, that influence firm's level of leverage. Zain et al. (2019) reports that high BR cannot motivate and retail directors to carry out their duties and work harder for the benefits of shareholders. Ahmed Sheikh and Wang (2012) report a negative association between BR and capital structure in non-financial firms listed on Karachi Stock Exchange. Similarly, Ur Rahman, Khalil, Cavaliere and Khelifa (2023) investigated the impact of board of directors on the capital structure of listed non-financial firms on the Pakistan Stock Exchange, reported a negative connection between BR and capital structure. Based on the above the following hypothesis is proposed:

He: BR is negatively associated with leverage in JSE carbon-intensive companies.

2.2.2. Board Independence and Financial Leverage (LEV)

Independent directors who are not involved in the day-to-day operation of the firms improves firm's reputation and assist to win trust of finance providers and creditors (Kijkasiwat, Hussain & Muntaz, 2022). The significant proportion of non-executive directors serving on the board may give guidance on the firms on the level of investment and leverage (Vafeas & Vittis, 2018). Independent directors assist firms to improve company's transparency, internal control and reporting quality, leading to enhanced FFP (Zubeltzu-Jaka, Ortas & Alvarez-Exteberria, 2019).

The association between BI and LEV depends on the firm context, yet the presence of independent board of directors promotes more prudent financial strategies, encouraging a balance capital structure (Hamida, Colot & Kechad, 2025). The empirical results on the relationship between BI and leverage are inconclusive and mixed. For instance, Tahir, Rahman, Masud and Rahman (2023) in Malaysia, Sani, Alifiah and Dikko (2020) in Nigeria, Thakolwiroj and Sithipolvanichgul (2021) in Thailand and Abdel-Wanis and Rashed (2023) in Egypt, document a negative relationship. This implies that, in weak governance and institutional environments, non-executive directors may support heavily reliance on debt financing. In supporting these findings, Kijkasiwat, Hussain and Mumtaz (2022) also found that BI reduce LEV, noting that firm contexts play a critical role.

Conversely, Hermassi, Adjaoud and Aloui (2015), Detthamrong, Chancharat and Vithessonthi (2017) and Sewpersadh (2019) reports no relationship between BI and leverage. This indicates that the impact of BI relies less on its presence, but more on the firm governance environment. Furthermore, several studies, for example, Ahmed (2019) and Yakubu and Oumarou (2023) in Ghana, Amin, Ur Rehman, Ali & Mohd Said (2022) in Pakistan and Bazhair (2023) in Saudi Arabia, document a positive relationship between BI and LEV. This imply that non-executive directors may support the reliance on debt in a poor and weak government settings.

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It is evident that as number of non-executive directors serving on the board increase, board monitoring and oversight become efficient and successful in balance capital structure. BI reduces agency costs, improve quality reporting, foster relationship with finance providers, contributing to FFP. This study anticipates the negative association between BI and leverage, then the following hypothesis is proposed:

H5: BI is negatively associated with LEV in carbon-intensive firm listed on the JSE.

2.3. The Impact of Financial Leverage (LEV) on Firm Financial Performance (FFP)

The link between leverage and CG can influence FFP positively or negatively (Bae et al., 2017). This suggests that these relationships can either deteriorate or improve FFP. In carbon-intensive firms, these mixed results can be observed when companies heavily rely on debt finance when acquiring green technologies that mitigate carbon emissions in their operations. However, Ghardallou (2022) argues that although debt finance reduces FFP, it can compete with equity when company needs external capital during financial crisis. Vithessonthi and Tongurai (2015), Iqbal and Usman (2018), Boshnak (2023) and Ronoowah & Seetanak (2023) reported a negative association between LEV and FFP. These researchers argue that cost of debts such as higher interest rate can negatively impact firm value, leading to decreased FFP.

In contrary, Yang et al. (2016) and Dakua (2019) found a positive relationship between leverage and FFP. Similalry, Zhang et al. (2019) and Xin et al. (2019) contended that debt financing strategy help companies to access technological innovation initiatives and necessary resources for mitigating GHG emission. Nevertheless, LEV may reduce FFP, especially during the early stage of the decarbonation process.

From the above prior research, the next hypothesis is formulated:

H6: LEV is negatively associated with FFP in JSE carbon-intensive firms.

2.4. Corporate Governance and Firm Financial Performance with the Mediating Role of Financial Leverage

Some studies argue that CG mechanisms may not adequately explain the firm performance; rather their influence operates through finance leverage (Santoso & Salim, 2022). These scholars argue that CG mechanisms do not affect FFP directly, but instead influence company's financing decisions, then capital structure impact FFP.

Cao, Ming and Yuying (2022) support the mediating role of LEV, arguing that ineffective CG can result in excessive leverage, leading to decreased firm performance. Similarly, Agustina (2019) states that FFP tends to decrease if companies use debt to fund its assets. Contrary, Tran (2022) states that companies with very small proportion of debts in their capital structure can miss opportunities for improved performance. Hantono (2021) support this perspective, suggesting that firm that adopt a debt in their capital structure increase profits for their investors. Both studies emphasise the mediating role of LEV on the relationship between CG and FFP.

Effective CG plays a crucial role in providing a support and guidance on financing decision and how each new project are financed. The firm performance relies on how board of directors provide guidance on financing decisions (Jin & Xu, 2022). The CG mechanisms influence quality of financing choices, leading to FFP.

BI is important mechanism in CG governance that ensures effective monitoring and oversight, including the guidance on proportion of debts in the firm' capital structure (Queiri, Madbouly, Dwaikat & Husain, 2024). The lack of non-executive directors on the board can increase the probability of poor financing investments, which ultimately impact the firm performance (Eltahir, Taha, Alnor, Adam & Musa, 2025). BR also ensure that the management interests is aligned with those of shareholders. Attractive and competitive BR encourages board members to guide managers to adopt capital structures that improve FFP From the prior studies, the last hypothesis formulated:

H6: LEV mediates the relationship between CG mechanisms and FFP in carbon-intensive companies listed on the JSE.

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3. Materials and Methods

3.1. Data and Sample Description

The sample consists of 58 carbon-intensive companies listed on the JSE. Carbon-intensive firms are included in the sample because they face substantial stakeholder and regulatory pressure to adopt sustainability practices aimed at mitigating GHG emission in their operations. The CG and financial data were obtained from annual integrated reports for the period 2015-2023 (Madwe, Nzuza & Olarewaju, 2025). The researcher analysed data using STATA, version 18.

The study period of 2015-2023 coincides with the intensified adoption of ESG-related reforms and sustainability reporting practices in South Africa. Initial population consists of 114 firms. Following Madwe et al. (2025), the study adopts a purposive sampling approach based on market Capitalisation, with the top 50% of firms within each high-risk sector included to ensure economic relevance and data availability. This research focuses on four sectors known for generating GHG gas emission, namely, basic material, consumer goods, industrial and oil and gas, resulting in a final sample of 58 companies as illustrated in Table 1.

Table 1. Carbon-intensive firm included in the sample.

Sector	Number of companies per sector	50% of the top companies in the population	Companies included in the sample
Basic material/Mining	45	50%	23
Consumer Goods	20	50%	10
Industrial	46	50%	23
Oil & Gas	3	50%	2
Total	114	50%	58

Source: Developed by the author (Adapted from Madwe et al., 2025).

3.2. Variable Measurements

Following prior research, Table 2 presents study variables, measurements and supporting prior research.

Table 2. Variable measurements.

Type of Variable	Variable	Description	Supporting literature
IDV	BR	The ratio of independent directors' remuneration to the total directors' remuneration	Mashele, Mouton and Pelcher (2023))
	BI	The ratio of the number of independent directors to the number of all directors	Mashele et al. (2023
DV	ROA	The ratio of net profit to total assets	Bazhair and Sulimany (2023)
	ROE	The ratio of net profit to shareholders' equity	(Almustafa, Nguyen, Liu and Dang (2023).
MedV	LEV	The ratio of total debt to total assets	Pamungkas et al. (2023) and Naz et al. (2022)
ContrV	AGE	Number of years firm in operation form its inception up to year of the study	Eltahir et al. (2025)
	SIZE	Natural logarithm of total assets	Li, Tang and Li (2024).

Source: Developed by Author.

3.3. Study Model

This study employs a two-step generalized method of moments (GMM) to establish the mediating role of leverage between CG and FFP for 58 firms listed on the JSE in the period from 2015 to 2023. Control variables in four models include firm size, age and growth. This study formulates

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the following equation to test hypotheses based on prior research (citations). To explore whether LEV mediates the relationship between CG and FFP, the study follows four mediation conditions whereby: (i) (CG) mechanisms (BR & BI) predict LEV (mediating variable); (ii), CG mechanisms (BR & BI) affect FFP (ROA and ROE); (iii),LEV(mediating variable) influence FFP (ROA & ROE); and (iv), the inclusion of LEV reduces the direct effects of CG mechanism (BR & BI) on FFP (Kijkasiwat et al., 2022). A two-step SGMM estimator is applied to address endogenous concerns. The GMM specification is designed as follows:

$$\text{FFP}_{it} = \alpha_0 + \delta\,\text{FFP}_{i,t-1} + \beta_1\,\text{BR}_{it} + \beta_2\,\text{BI}_{it} + \boldsymbol{\gamma}'\mathbf{X}_{nit} + \mu_i + \varepsilon_{it} \quad \text{.....(1)}$$

The study estimates two separate models, with ROA and ROE, alternative indicators for FFP:

$$ROA_{it} = \alpha_0 + \delta_1\,\text{ROA}_{i,t-1} + \beta_1\,\text{BR}_{it} + \beta_2\,\text{BI}_{it} + \beta_3\,\text{LEV}_{it} + \beta_4\,\text{Controls}_{it} + \mu_i + \varepsilon_{it} \quad \text{.. (2a)}$$

$$ROE_{it} = \alpha_0 + \delta_1\,\text{ROE}_{i,t-1} + \beta_1\,\text{BR}_{it} + \beta_2\,\text{BI}_{it} + \beta_3\,\text{LEV}_{it} + \beta_4\,\text{Controls}_{it} + \mu_i + \varepsilon_{it} \quad \text{.. (2b)}$$

The following model is applied to estimate LEV as a mediating variable:

$$\text{LEV}_{it} = \alpha_1 + \phi\,\text{LEV}_{i,t-1} + \theta_1\,\text{BR}_{it} + \theta_2\,\text{BI}_{it} + \boldsymbol{\lambda}'\mathbf{Z}_{it} + \nu_i + \eta_{it} \quad \text{.....(3)}$$

The following equation were adopted to determine Indirect (mediation) effect of BI and BR FFP (ROA & ROE) through LEV.

$$\text{ROA} = Indirect\ Effect_{BR\to LEV\to FFP} = \theta_1 \times \beta_3 \quad \text{.....(4a)}$$

$$\text{ROE} = Indirect\ Effect_{BI\to LEV\to FFP} = \theta_2 \times \beta_3 \quad \text{.....(4b)}$$

Where FFP_{it} is company financial performance measured by ROA and ROE; $\text{FFP}_{i,t-1}$ is lagged independent variable; BR_{it} : board remuneration; BI_{it}=board independence; $\mathbf{X}_{nit}$ is a vector of control variables (firm size and age); μ_i= firm fixed effects; ε_{it} = idiosyncratic error; LEV_{it} is financial leverage; $\mathbf{Z}_{it}$ is a vector of control variables; ν_i = firm fixed effects; η_{it} = error; $\theta_1\ and\ \theta_2$ = effect of independent variables (BR and BI) on LEV; β_3 = effect of LEV on FFP.

4. Results and Discussion

4.1. Descriptive Statistics

Descriptive statistics are presented to provide a summary of the central tendency, dispersion and variability of the data sample. Table 3 reports the number of observations, mean, standard deviation (Std. dev), minimum value (Min) and maximum value (Max). The mean of ROE was 1.69, ranging from -27.40 to 416.20. ROA similar trend value fluctuating from negative to positive.

Table 3 illustrates a wide dispersion in leverage, with max of 2400, indicating that some companies have a balanced capital structure, while other seem to maintain more conservation capital structures. On average, non-executive directors consist of 35% of board. The range from 0.21 to 0.93 shows a substantial variation in board composition, with some companies appointing primarily non-executive directors, while other depend more heavily on executive directors.

Min of 6.99 and Max of 138) indicates that the sample includes both young and very mature companies. SIZE values suggest the sample is dominated by relatively large firms.

Table 3. Descriptive Statistics.

Variable	Observations	Mean	Std.dev.	Min	Max
ROE	522	1.69	19.28	-27.40	416.20
ROA	522	0.08	0.35	-1.14	7.40
LEV	522	34.89	255.85	-21.53	2429.80
BI	522	0.35	0.09	0.21	0.93
BR	522	0.07	0.14	-1.50	2.04
AGE	522	56.22	51.92	6.99	138

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Size	522	10.83	0.84	9.39	12.02

Source: Developed by author.

4.2. Correlation Matrix

No pairwise correlation exceeds 0.8, suggesting that severe multicollinearity is unlikely to bias the regression estimates (Thanh, Sang & Khuong, 2024). Both ROE and ROA indicate a moderate positive correlation. Table 4 shows that BI is positively associated with FFP measured by ROE (0.23*) and ROA (0.18**), highlighting that companies with a higher proportion of non-executive directors tend to show better performance. However, Table 4 indicate that BR shows insignificant relationship with both ROE and ROA.

LEV is positively associated with ROE (0.16**), but negatively correlated with ROA (-0.09), indicating that LEV relates differently to alternative performance indicators. The Table 4 also reports negative impact of BI (-0.18**) on leverage. No relationship was found between firm size and financial performance (ROE=-0.18 and ROA=-0.11). However, firm size significantly and positively correlates with leverage (0.24***). No correlation was found between age and all variables of the study.

Table 4. Correlation matrix.

	ROE	ROA	BI	BR	LEV	SIZE	AGE
ROE	1						
ROA	0.42***	1					
BI	0.23***	0.18**	1				
BR	0.06	0.07	-0.06	1			
LEV	0.16**	-0.09	-0.18**	0.041	1		
Size	-0.18*	-0.11*	-0.17**	0.0231	0.24***	1	
Age	-0.02	0.02	-0.04	0.0385	0.09	0.07	1

Source: Developed by author.

4.3. Regression Results

The study presents two diagnostic tests to assess the validity of system GMM, namely the Hansen J-test and Arellano-Bond. Table 5 shows that in Hansen J-tests p-values are above 0.10, indicating that the instruments are valid. The Arellano-Bond tests in the first order (AR (1) and second order (AR(2) test p-values are above 0.10, confirming no evidence of first or second order serial correlation in the differenced errors.

The Lagged dependent variable (past ROE and ROA) has insignificant impact on the current FFP for carbon-intensive firms included in the sample. This suggests within the sample, past performance does not impact current performance after controlling for governance variables, leverage and firm characteristics.

The models are structure to examine mediating role of LEV. Model (ROE 1) and ROA 3 reports specification before inclusion of LEV, while ROE 2 and ROA 4 include the mediating variable (LEV).

Model ROE (1) and ROE (3) reports that BI is not statistically associated with either ROE or ROA. These results suggest that in JSE carbon-intensive firms, the presence of independent directors in boardrooms does not translate into enhanced FFP. One of the possible explanations is that some non-executive directors' appointments may be compliance-driven rather than competence-driven, restricting their effectiveness in monitoring management (Mashele et al., 2024). Therefore, these findings do not support hypothesis H2. Insignificant association is also consistent with previous studies revealing no association between BI and FFP (Ali et al., 2022; Khan et al., 2024; Sunny & Hoque, 2024). These results also challenge stakeholder theory and RBV, which underscores non-

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executive directors are pro-organisational and resourceful through motivating managers to act in the best the interest stakeholders to enhance firm value.

In contrast, BR is negatively associated with both ROE and ROA, suggesting that higher board compensation is linked to weaker FFP. This emphasises the importance of remuneration structures that strengthen board oversight and align incentives with firm performance. These findings do not support the hypothesis 1, and they contradict prior research revealing positive association between BR and FFP (Lemma et al., 2020; Scholtz et al. 2025).

When leverage is included as mediating variable ROE (2) and ROA (4), BI remains statistical insignificant for both performance indicators, suggesting that the BI- performance relationship is not supported (fails condition ii). However, LEV is negatively and significantly associated with both ROE and ROA, satisfying the requirement that the mediator influences the dependent variables (condition iii). Because BI does not significantly impact ROA/ROE directly, and because the inclusion of LEV does not change BI's insignificance, the evidence does not support mediation of BI-FFP relationship through LEV in this study. Importantly, BR remains negatively significant across specifications, suggesting that its association with FFP is robust to the inclusion of leverage. These findings contradict Augustina (2019) and Cao et al. (2022) who reported a negative relationship between LEV and FFP. Yet BR still reveals a negative influence financial performance in both models. This indicate that the association between BR and ROE and ROA on FFP is robust and not diluted by inclusion of leverage. These findings are consistent with those of Wu, Fei, Yuan and Lu (2020b). This meets the third requirement of mediation assumption, stating that mediating variable must impact the dependent variable.

Table 5 also indicates that BI is positively and significantly associated LEV, highlighting that BI is linked to higher leverage (condition i). These findings contradict Tahir et al. (2023) and Sani et al. (2020) who reported a negative relationship these two variables. These researchers suggest that institutional context may shape how BI influence financing decisions. However, BR is not significantly associated with LEV, indicating that compensation policies do not materially explain capital structure choices in the sample. In terms of control variables, SIZE has negative, but weak impact on FFP, and no association between AGE and any model exist. The results concur with those of Detthmrong et al. (2017), Sewpersadh (2019) and Yakubu and Oumarou (2023).

Table 5. Corporate governance and leverage on firm financial performance.

Variable	ROE (1) Without LEV	ROE (2) With LEV	ROA (3) Without LEV	ROA (4) With LEV	LEV Mediator
Lagged	0.061	0.058	0.163	0.157	-
	(0.054)	(0.052)	(0.103)	(0.098)	
BI	4.233	3.918	0.092	0.082	0.287
	(7.912)	(7.554)	(0.401)	(0.389)	(0.118) **
BR	-5.115*	-5.002*	-0.412**	-0.398**	-0.022
	(3.011)	(2.944)	(0.192)	(0.186)	(0.045)
LEV	-	-3.225**	-	-0.624**	-
		(1.511)		(0.241)	
SIZE	-	-1.745*	-	-0.198*	0.072
		(1.013)		(0.107)	(0.058)
AGE	-	-0.022	-	0.010	0.005
		(0.162)		(0.014)	(0.001)
_Cons	-3.523	-4.011	1.734	1.544	-0.831

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	(4.882)	(4.774)	(1.921)	(1.877)	(0.622)
Obervations	522	522	522	522	522
Hansen J-test (p-values)	0.259	0.281	0.457	0.442	-
AR(1)	0.291	0.288	0.298	0.294	-
AR(2)	0.602	0.587	0.669	0.651	-
*** indicate significant level at 1%, ** significant level at 5%, * significant level at 10%.					

5. Conclusions

This study explores the mediating impact of financial leverage on the association between corporate governance mechanisms (board remuneration and board independence) and firm financial performance of 58 carbon-intensive companies listed on the JSE. The findings of this study provide implication for firms, policymakers and regulators and investors. Investors may consider board remuneration policies and leverage level when assessing JSE carbon-intensive firms, instead of relying only on the presence of non-executive directors as an indicator for governance quality. In addition, the findings suggest that higher BR and higher LEV do not necessarily translate into enhanced FFP during the decarbonisation process.

Firms should interpret the insignificant impact of BI as potential signal that some non-executive appointments may be compliance-driven and may not support oversight in practice. Therefore, firm need to strengthen nomination criteria by emphasising relevant expertise and independence in substance, not only in form. Remuneration policies should be redesigned to better align incentive with performance and long-term transition objectives. Where external financing is required, companies may prioritise lower-cost green finance instruments over high-cost private debt, to reduce profitability pressures associated with LEV.

Policymakers and regulators should encourage board composition criteria that emphasis firm expertise, effectiveness, accountability and compensation oversight. They must also foster green financing options for sustainability investment to reduce firm reliance on debt that reduce FFP.

However, this study is confined to 58 carbon-intensive firm listed on the JSE, which may limit the generalisation of the findings to other industries. Furthermore, the research focuses only BI and board BR as indicators of CG mechanisms, which may not capture the full breadth of CG quality. In addition, FFP was proxied primarily by accounting-based measures, which may not fully represent market valuations.

Futures studies could extend this research by including additional CG mechanisms (e.g., gender diversity, board expertise and board size) to offer comprehensive assessment of CG impact on FFP. Future scholars could include market-performance indicators, such as Tobin's Q or conduct comparative study across emerging and developing countries.

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