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Research article

# Impact of country governance mechanisms on carbon emissions performance of multinational entities

Babajide Oyewo [a,*], Venancio Tauringana [b], Vincent Tawiah [c], Oluseyi Aju [d]

[a] Essex Business School, University of Essex, Colchester, United Kingdom
[b] Department of Accounting, University of Southampton, Southampton, United Kingdom
[c] DCU Business School, Dublin City University, Dublin, Ireland
[d] Leeds Business School, Leeds Beckett University, Rose Bowl City Campus, LS1 3HL, United Kingdom

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ABSTRACT

This study investigates the impact of country governance mechanisms on carbon emissions performance of private sector organisations, using empirical evidence from 336 top multinational entities (MNEs) over a 15-year period. The results show that, at the aggregate level, Control of Corruption ($b = -0.021$, $p < 0.01$) and Voice & Accountability ($b = -0.015$, $p < 0.05$) are significantly and negatively associated with carbon emissions rate. While Political Stability ($b = 0.007$, $p < 0.05$) and Government Effectiveness ($b = 0.018$, $p < 0.05$) have significant positive impact on carbon emissions rate, the impact of Regulatory Quality and Rule of Law is negative but insignificant. Empirical evidence supports the conclusion that the existing institutional environment is not sufficient to deliver the net zero transition. There is a need for more coordination, strategic planning, and delivery monitoring in government institutions to achieve decarbonisation targets. The study contributes to knowledge within the context of the identified research gaps. First, the study adds to the limited literature on the impact of country governance on carbon emissions reduction, particularly with reference to scope 3 emissions. Second, with the sustainable development goals (SDGs) set to expire by 2030, the study provides empirical evidence on efforts governments of countries are making in achieving decarbonisation targets through improvement in country governance quality. Third, the study shows that the impact of the country governance on the carbon emissions performance of MNEs is contextual and varies across jurisdictions/geographical regions. Finally, the paper contributes to the debate on the actualisation of Agenda 2030, because presenting empirical evidence on the impact of country governance mechanisms on carbon emissions reduction—particularly scope 3 emissions—is an important discourse in the realisation of the SDGs.

## 1. Introduction

The consequences of climate change such as intense drought, wildfires, flooding, declining biodiversity, rising sea levels, water scarcity and catastrophic storms, amongst others, have continued to devastate the environment and heighten human sufferings in society. According to the Centre for Research on the Epidemiology of Disasters (Centre for Research on the Epidemiology of Disasters, CRED, 2022), in 2021 alone, a total of 432 catastrophic events were recorded in connection with climate change. In the last 20 years covering the period 2001–2020, there has been an average of close to 65,000 deaths, with 37,942 attributable to earthquakes, 10,442 caused by storms, 8684 arising from extreme temperatures, and 5185 connected to floods (Centre for Research on the Epidemiology of Disasters, CRED, 2022). Consistent with an average of 27 earthquakes per annum in the period 2001–2020, there were 28 recorded earthquakes in 2021, with a 7.2 magnitude earthquake in Haiti in August 2021, causing 2575 deaths (Centre for Research on the Epidemiology of Disasters, CRED, 2022). These catastrophic and traumatising events happening in many parts of the world have fuelled the debate on environmental protection and ecosystem preservation (Liu et al., 2021).

Climate change is causing widespread and irreversible impacts, and human activities have continued to trigger environmental destruction (Liu et al., 2016; Chen et al., 2023). According to the United Nations

* Corresponding author.
*E-mail addresses:* B.M.Oyewo@essex.ac.uk (B. Oyewo), V.Tauringana@soton.ac.uk (V. Tauringana), vincent.tawiah@dcu.ie (V. Tawiah), O.Aju@leedsbeckett.ac.uk (O. Aju).

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(2022a), the earth is now about 1.1°C warmer than it was in the late 1800s, as the last decade (2011–2020) was the warmest, going by the records. Various frameworks such as the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement, and the United Nations Sustainable Development Goals (SDGs) suggest three broad areas for action to address the climate change challenges; namely, cutting emissions, adapting to climate impacts, and financing sustainability projects that tackle the climate change problem (United Nations, 2022a, 2022b). Furthermore, the use of alternative technologies to reduce carbon emissions/achieve climate neutrality has been suggested in the literature (Haller et al., 2023). This is premised on the argument that alternative technologies can cut carbon emissions (Shahbaz et al., 2023). According to Serin (2023), cutting carbon emissions from the global energy system requires accelerating the deployment of technologies to achieve two objectives: (i) electrifying as much of the energy demand as possible and (ii) fully decarbonising the electricity supply, by using renewable sources. Other benefits of alternative technologies include increased energy security by reducing dependence on international energy supplies and ensuring sustainable/stable energy supply in the long term. However, investment in alternative technologies to achieve net zero is not without attendant challenges such as high cost of investment and the nascent nature of alternative technologies, although these are gaining traction especially in developing countries (Smokers et al., 2014; Haller et al., 2023).

In response to the growing concerns on the need for urgent action to protect the environment, the United Nations (UN)—through the launching of the sustainable development agenda in 2015—specifies various goals relating to environmental protection, including SDG 13 on climate change (Oyewo et al., 2022). SDG 13 (climate change) calls for urgent action to combat climate change and its impacts. SDG 13 has five targets which are to be achieved by 2030: (i) strengthen resilience and adaptive capacity to climate-related disasters; (ii) integrate climate change measures into policies and planning; (iii) build knowledge and capacity to meet climate change; (iv) implement the UN Framework Convention on Climate Change; and (v) promote mechanisms to raise capacity for planning and management. In sum, achieving the SDGs 2030 requires the full and active participation of private sector organisations, governments, intergovernmental organisations, major groups, and other stakeholders (Liu et al., 2021; Erin et al., 2022).

Carbon emissions reduction has noteworthy benefits for the environment, the climate, and human health (Yamineva and Liu, 2019). This perhaps explains the focus on setting carbon emissions reduction targets as documented in the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Governments have a critical role to play in attaining net zero emissions (Bisdounis, 2023), and a major mechanism for government intervention is improving the quality of country governance mechanisms (Sweet and Sandholtz, 2023). Country governance refers to the deployment of political and administrative authority at nationwide level to manage a country's affairs. Country governance mechanisms provide unique opportunities for governments to address SDG 13 targets, as the regulatory role of government involves formulating and implementing various direct and indirect measures to monitor and regulate the activities of individuals and private sector firms. It is, thus, crucial to evaluate the contributions of government to achieving the SDGs through country governance mechanisms, especially in regulating carbon emissions and providing the enabling environment for private sector entities to commit to decarbonisation (Patay et al., 2023). However, the review of the literature on the subject exposes some gaps which the current study seeks to address.

First, little is known about the impact of country governance on carbon emissions reduction (Hope, 2003; Ernstberger and Grüning, 2013) as most studies have examined the impact of corporate governance on carbon emissions performance (e.g., Elsayih et al., 2021; Nuber and Velte, 2021). Corporate environmental practices are largely unregulated but voluntary (Rupley et al., 2012; Yamineva and Liu, 2019), and this applies particularly to emissions not directly attributable to organisations (i.e., scope 3 emissions). Ultimately, decisions on decarbonisation are managerial and influenced by the board of directors and shareholders (Moussa et al., 2020). While companies will typically emplace corporate governance mechanisms to control emissions directly attributable to them (i.e., scope 1 and 2 emissions), their motivation to control emissions not directly attributable to them (scope 3 emissions) may be weak or non-existent (He et al., 2013). Building on this argument, companies may not ordinarily be interested in reducing scope 3 emissions unless there is government action. Government intervention may, therefore, be necessary in ensuring that multinational entities (MNEs) commit to reducing scope 3 emissions (Deloitte, 2022). This makes it compelling to assess the influence of country governance on carbon emissions management because reaching net zero emissions will involve tackling scope 3 emissions. However, there is limited empirical evidence on the relevance of country governance to carbon emissions reduction.

Second, actualising Agenda 2030 is a complex, massive, and ongoing task that calls for public–private partnership (Liu et al., 2019; Yamineva and Liu, 2019). With the SDGs set to expire in 2030, there is an urgent need for more empirical evidence on what countries' governments are doing to achieve the goals. One of the significant ways that governments can intervene is to put structures in place for the private sector to be more involved in reducing scope 3 emissions as documented in SDG 17 (Partnership for the goals). Meanwhile, there have been calls for investigation into scope 3 emissions in the SDGs era (Dijkstra-Silva et al., 2022) because it is a more comprehensive dimension of the emissions indirectly attributable to organisations, arising from their value chains. Accounting for scope 3 emissions is important because most of the greenhouse gas (GHG) emissions and cost reduction opportunities for many companies lie outside their own operations. For many businesses, scope 3 emissions account for more than 70% of their carbon footprint (Deloitte, 2022). By measuring scope 3 emissions, organisations can identify energy efficiency and cost reduction opportunities in their value chains, as well as manage resource and energy risks in their supply chain (World Resources Institute, 2022). Accounting for scope 3 emissions also helps organisations to improve the energy efficiency of their products, and positively engage with employees, suppliers, business partners, and other stakeholders that organisations exert influence over to reduce their emissions (Deloitte, 2022). Most studies have focused on the contributions of private sector entities to achieving the SDGs in terms of addressing environmental pollution issues such as carbon emissions reduction (e.g., Moussa et al., 2020; Elsayih et al., 2021; Huang et al., 2023). However, little is known—based on empirical evidence—on the extent to which Agenda 2030 has impacted the governments of nations in improving country governance mechanisms in the millennium development goals (MDGs) and SDGs eras. In sum, evaluating governments' responses to improving country governance mechanisms to facilitate achieving net zero emissions is an important discourse in the actualisation of Agenda 2030 set to expire in less than eight years from the time of writing.

Third, there is limited empirical evidence on how country governance mechanisms have impacted the decarbonisation commitment of MNEs operating in environmentally sensitive/carbon-intensive industries in comparison to those in non-carbon-intensive industries. The increased attention and closer public scrutiny of high carbon-emitting firms may increase government pressure to regulate such industries to improve carbon emissions management (Elsayih et al., 2021). This is particularly true of scope 3 emissions because MNEs may be passive about reducing emissions not directly attributable to them—unless there is government intervention to enforce taking such actions. Meanwhile, achieving net zero may not be possible without addressing scope 3 emissions because most of the opportunity for emissions reduction lies in scope 3 emissions (Deloitte, 2022). Government intervention may affect carbon-intensive and non-carbon-intensive industries differently (Konadu et al., 2022). However, little is known about the impact of country governance on carbon emissions reduction in carbon-intensive

and non-carbon-intensive industries.

Finally, country governance quality differs by countries and geographical regions (Tawiah, 2023; World Bank, 2023). Building on this argument, it is conceivable that the impact of the country governance mechanisms on carbon emissions of MNEs may be dissimilar across jurisdictions (Shahbaz et al., 2023). However, there is limited knowledge on the impact of country governance on carbon emissions performance based on countries and geographical regions. Knowledge of the impact of country governance factors on carbon emissions management is beneficial in formulating and implementing net zero policies specific to jurisdictions and for tackling environmental pollution challenges (Bisdounis, 2023).

Against this backdrop, the aim of the current study is to investigate the impact of country governance on carbon emissions performance of private sector organisations, using empirical evidence from 336 top multinational entities (MNEs), cutting across 42 non-financial industry groups from 32 countries. We focus on six dimensions of country governance mechanisms as suggested by the World bank, notably (i) Control of Corruption; (ii) Voice & Accountability; (iii) Political Stability & Absence of Violence/Terrorism; (iv) Government Effectiveness; (v) Regulatory Quality; and (vi) Rule of Law (World Bank, 2023). These aspects of governance quality have been reiterated in extant literature as important dimensions of country governance (e.g., Dragomir et al., 2021; Tawiah, 2023).

Using a quantitative research design and panel data analysis, the study analysed empirical evidence from 336 top multinational entities (MNEs) over a 15-year period. The results show that, at the aggregate level, Control of Corruption and Voice & Accountability are significantly and negatively associated with carbon emissions rate. Whilst Political Stability and Government Effectiveness have significant positive impact on carbon emissions rate, the impact of Regulatory Quality and Rule of Law is negative but insignificant. Empirical evidence supports the conclusion that the existing institutional environment is not sufficient to deliver the net zero transition. There is a need for more coordination, strategic planning, and delivery monitoring in government institutions to achieve decarbonisation targets.

The study is unique by contributing to knowledge in four ways. First, it examines the impact of country governance mechanisms on firm-level carbon emissions performance of private sector organisations, particularly with reference to scope 3 emissions. Whilst studies examining the impact of country-level/public governance factors on environmental issues are limited, the study is different from related studies by focusing on scope 3 emissions. Meanwhile, studies on carbon emissions management have predominantly examined scope 1 and scope 2 emissions because of the challenges of measuring and obtaining data for scope 3 emissions (Nuber and Velte, 2021; Konadu et al., 2022). However, it is important to focus on scope 3 emissions because controlling scope 3 emissions provides greater opportunity for organisations to address carbon emissions issues more comprehensively because for many businesses, Scope 3 emissions account for more than 70 percent of their carbon footprint (Deloitte, 2022). Second, by adopting a longitudinal study outlook, the study presents evidence on how country governance mechanisms impact carbon emissions performance of MNEs differently in the MDGs and SDGs eras. Related studies examining the subject did not disaggregate results in this manner (e.g., Tilt, 1994; Neu et al., 1998; Yamineva and Liu, 2019). With the SDGs set to expire by 2030, the study provides empirical evidence on the efforts that governments of countries are making to achieve decarbonisation targets through improvements in country governance quality in the pre- and post- SDGs eras. Third, whereas related prior studies did not decompose results by countries/geographical regions (e.g., Rupley et al., 2012; Yamineva and Liu, 2019), the current study adopted a cross-country approach to present empirical evidence that the impact of country governance on carbon emissions performance of MNEs is contextual and varies across jurisdictions/geographical regions as suggested by institutional theory (DiMaggio and Powell, 1991; Saqib et al., 2021). Finally, the paper contributes to the debate on the actualisation of Agenda 2030, because presenting empirical evidence on the impact of country governance mechanisms on carbon emissions reduction—particularly scope 3 emissions, as documented in the current study—is an important discourse in the realisation of the SDGs.

The rest of the paper has six parts (sections 2–7). Literature review and hypotheses development are covered in section 2. The methodology is explained in section 3, followed by the results in section 4 and robustness checks in section 5. Discussion of findings is covered in section 6, and the paper is concluded in section 7.

## 2. Literature review and hypotheses development

### 2.1. Theoretical framework

The current study relies on legitimacy theory and institutional theory of isomorphism as theoretical framework. The selection of both theories is based on their interrelatedness in explaining the influence of country governance mechanisms on carbon emissions performance. A multi-theoretical approach presents a robust basis for discussing the impact of governance mechanisms on environmental issues (Mangena et al., 2012; Oyewo et al., 2023). Whereas the legitimacy theory provides the social contract basis for private sector organisations/MNEs response to carbon emissions management (Haniffa and Cooke, 2005), the institutional theory of isomorphism explains the coercive factors driving the compliance of MNEs with environmental laws on carbon emissions management (DiMaggio and Powell, 1983). Both theories complement each other in the sense that whilst the legitimacy theory represents a "soft approach" in which MNEs willingly comply with environmental laws given that government provides the enabling environment to manage carbon emissions (Liu et al., 2021), the institutional theory of isomorphism typifies a "hard approach" in which MNEs are compelled to address carbon emissions issues (DiMaggio and Powell, 1983; Chen and Cheng, 2020). The theories are discussed and contextualised to the study thus.

(a) Legitimacy Theory

Legitimacy theory is defined as "a generalised perception or assumption that the actions of any entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995, p. 574). The legitimacy theory suggests that there is an implied social contract between an organisation and the society. The organisation is a subsystem of the larger society—therefore, society provides the resources and conducive environment for an organisation to thrive and carry out business. In return, the organisation is expected to 'give back' to the society by addressing social, environmental, and economic sustainability issues confronting the society (Haniffa and Cooke, 2005; Liu et al., 2021). Extending the legitimacy theory to the context of environmental sustainability practice, Bansal and Clelland (2004, p. 94) define corporate environmental legitimacy as "the generalised perception or assumption that a firm's corporate environmental performance is desirable, proper, or appropriate".

The implied symbiotic relationship between organisations and society subsists if the organisation continues to contribute to societal advancement (Clarke and Gibson-Sweet, 1999). However, the social contract will be in jeopardy when an organisation creates a 'legitimacy gap' by failing to discharge their duties to the society or when there is disparity between organisational and social values (Haniffa and Cooke, 2005). A crucial part of the legitimation process is taking actions to convince wider society that the organisation is socially responsible (Gray et al., 1995). To preserve corporate legitimacy, organisations will want to address sustainable development challenges such as carbon emissions reduction as key partners for the actualisation of Agenda 2030 (Rupley et al., 2012).

In relation to the country governance/emissions management debate, there is a social contract between the society and organisations. On the part of the society, the society fulfils its social contract in terms of creating an enabling environment for companies to operate by ensuring political stability, absence of violence, and control of corruption (Rothstein, 2015). In response, MNEs will want to preserve corporate legitimacy in the eyes of stakeholders by addressing climate change challenges through setting and achieving net zero targets. Further, MNEs will want to demonstrate that they are responsible corporate citizens by listening and yielding to the clamour of stakeholders for emissions reduction (Voice & Accountability), and by complying with relevant environmental laws (i.e., Rule of Law) in order not to violate their social contract with the society.

Therefore, country governance factors which indicate that society is fulfilling their social contract in creating enabling environment (Political Stability & Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, and Control of Corruption) and country governance factors which demonstrate that organisations are fulfilling their social contract (i.e., yielding to Voice & Accountability, and obeying Rule of Law) may influence the carbon emissions management practices of MNEs (Rupley et al., 2012; Chen and Cheng, 2020), especially taking action to control emissions not directly attributable to them —i.e., scope 3 emissions. When MNEs influence decarbonisation strategies of their business partners and/or in their supply chain, they will be demonstrating to society that they (MNEs) are concerned about climate change issues.

(b) Institutional Theory of Isomorphism

Institutional theory explains the process by which rules, norms, structures, and practices become established as authoritative guidelines for social behaviour. Institutional theory helps in understanding organisational practices as the product of social rather than economic pressures (Chen and Cheng, 2020). In relation to the subject of this paper, the institutional theory is relevant in explaining the motivation of MNEs to reduce carbon emissions in response to the social pressure for conformity and legitimacy rather than economic motivation for decarbonisation. Specifically, the institutional theory of isomorphism explains the process of homogenisation in which organisations faced with the same environmental conditions will resemble one another. Isomorphism explains the factors that cause companies to look alike. According to DiMaggio and Powell (1983), there are three mechanisms of institutional isomorphism; notably, mimetic processes, normative pressures, and coercive isomorphism.

Mimetic isomorphism refers to the tendency of an organisation to imitate the practice of another organisation considered more superior in performance, structure, or results (DiMaggio and Powell, 1983). Normative isomorphic change is driven by professions and educational systems, whereby people from similar educational background apply the same approach in resolving issues. Coercive isomorphism is a process which originates from both the formal and informal pressures that one organisation wields on another organisation with which it is tied to through the cultural expectations in the society where the organisations operate (DiMaggio and Powell, 1983). Coercive isomorphic change stems from other organisations that an organisation is dependent upon, cultural expectations, government mandate, contract law, and financial reporting requirements (Chen and Cheng, 2020). In contextualising the institutional theory of isomorphism to the current study, coercive isomorphic factors such as the requirement to obey the rules of the society (Rule of Law), the need to comply with stakeholders' demand for carbon emissions reduction in the society (i.e., Voice & Accountability), the need to properly account for carbon footprint to demonstrate responsible corporate citizenship (Voice & Accountability), and the requirement to comply with government policies and regulation of private sector entities (Regulatory Quality/Government Effectiveness) will affect the carbon emissions practices of MNEs (Tilt, 1994; Schuster et al., 2020).

Coercive isomorphic change involves pressures on an organisation from other organisations which they are dependent upon and by cultural expectations from society (Voice & Accountability). Some are governmental mandates (Regulatory Quality); some are derived from contract law (e.g., social contract between organisations and the society) or financial reporting requirements (under Voice & Accountability). Further, MNEs facing similar environmental factors, including governance quality, may have a similar approach to carbon emissions management (Saqib et al., 2021).

### 2.2. Hypotheses development

According to the World Bank (2023), there are six dimensions of country governance quality (referred to as World Governance Indicators, WGI) that are critical for socio-economic development: (i) Control of Corruption; (ii) Voice & Accountability; (iii) Political Stability & Absence of Violence/Terrorism; (iv) Government Effectiveness; (v) Regulatory Quality; and (vi) Rule of Law. The World Governance Indicators have been reiterated in extant literature as important dimensions of country governance (e.g., Dragomir et al., 2021; Barry et al., 2022). The impact of the country governance mechanisms on carbon emissions performance is discussed as follows.

(a) Control of Corruption

Corruption involves dishonest or illegal behaviour involving a person (or persons) in a position of power. It is the abuse and misuse of power for self-wealth maximisation (Werlin, 2016). As defined by the World Bank (2023), Control of Corruption reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests. As suggested by the legitimacy theory, providing an enabling environment for private sector organisations to thrive (such as controlling corruption in the society) is critical for MNEs to fulfil their social contracts. Thus, jurisdictions characterised by high level of corruption/low control of corruption will provide an enabling environment and the motivation for organisations to circumvent environmental laws (Tawiah, 2023); thus, high emissions are overlooked since there may be no consequences (Ali and Isse, 2003). When public institutions are corrupt, this may contribute to carbon emissions since the existing institutional structures may not penalise such breach of environmental regulation (Houqe and Monem, 2016).

It is possible to circumvent environmental laws and environmental regulatory structure if there is corruption because corrupt government officials make this possible (Meyer-Sahling et al., 2018; Abdul-Baki et al., 2021). Thus, countries with institutionalised corruption and weak rule of law may have high emissions rates (Schuster et al., 2020). On the other hand, jurisdictions with high control over corruption will be able to hold organisations to account on environmental pollution because companies may not easily compromise institutional structures and legal systems emplaced to curb carbon emissions. In line with the institutional theory of coercive isomorphism, demanding high accounting disclosures on carbon emissions by organisations, as part of the regulation process, could discourage corrupt environmental practices (Malagueño et al., 2010; Cuadrado-Ballesteros et al., 2019). However, when public structure for monitoring environmental practices is compromised by corruption, private sector organisations may produce misleading reporting/information on their carbon footprint (Tawiah, 2023), and this may contribute to high carbon emissions rate. In sum, countries with high levels of corruption control (which implies low corruption level) may have low carbon emission levels. Studies have shown that high levels of corruption weaken public institutions and compliance with regulatory accounting information (Cuadrado-Ballesteros et al., 2019; Tawiah, 2023), and this may promote environmental degradation. Therefore,

**H1**. Control of Corruption has a significantly negative impact on the carbon emissions rate of MNEs.

(b) Voice & Accountability

Voice & Accountability represents an important dimension of country governance in environmental management (Wang et al., 2023). Voice & Accountability reflects perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and a free media (World Bank, 2023). Carbon emissions reduction has dominated public debate in recent times (Abrell et al., 2022). In jurisdictions where there is freedom of press, the public can express concerns, have an input in environmental governance, and make suggestions on environmental projects (Lavuri et al., 2023;Wang et al., 2023). To avoid public criticism, especially in jurisdictions with strong public opinion and freedom of expression, private sector organisations may be forced to take deliberate action in reducing carbon emissions to assuage public opinion (Yamineva and Liu, 2019). According to the legitimacy theory, environmental legitimacy is preserved through media coverage of environmental issues (Bansal and Clelland, 2004; Rupley et al., 2012). To close the 'legitimacy gap' as suggested by the legitimacy theory, MNEs will want to yield to the 'voice' or clamour of stakeholders for carbon emissions reduction to preserve corporate legitimacy. From the perspective of the institutional theory of isomorphism, the 'voice' of the public and stakeholders' demand for accountability/transparency on carbon emissions may coerce MNEs to be more responsible in reducing their carbon footprint (Lavuri et al., 2023). Studies have shown that environmental performance is positively associated with environmental media coverage (e.g., Aerts and Cormier, 2009; Rupley et al., 2012). Studies have also documented a positive association between voluntary environmental disclosure and negative media related to environmental fines (e.g., Brown and Deegan, 1998; Neu et al., 1998), implying that companies will rely on the media to correct negative opinions about environmental practice and correct public perceptions. Thus,

**H2**. Voice & Accountability has a significantly negative impact on the carbon emissions rate of MNEs.

(c) Political Stability and Absence of Violence/Terrorism

According to the WGI, Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism (World Bank, 2023). Countries that are politically stable provide a tranquil environment for companies to thrive and peacefully carry on business. Political Stability is also positively related to lower corruption (Lederman et al., 2005), suggesting that Political Stability lessens the tendency of companies to engage in corrupt environmental practices. From the angle of the legitimacy theory, when society provides a conducive environment for companies to thrive in terms of maintaining Political Stability as part of the social contract, organisations will want to 'give back' to society by addressing pressing environmental issues such as carbon emissions control. MNEs may, thus, be ethically bound to tackle emissions that are both directly (scope 1 and 2 emissions) and indirectly (i.e., scope 3 emissions) attributable to them. Studies have shown that Political Stability affects organisational practice (Pagano and Volpin, 2005; Mangena et al., 2012). Therefore,

**H3**. Political Stability has a significantly negative impact on the carbon emissions rate of MNEs.

(d) Government Effectiveness

The WGI refers to Government Effectiveness as perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (World Bank, 2023). The quality of policy formulation and implementation may affect the extent to which private sector entities address environmental issues such as carbon emissions management. From the perspective of legitimacy theory, private sector organisations will want to comply with relevant government policies on environmental management to demonstrate that they are responsible corporate citizens respecting social contracts (Aerts and Cormier, 2009). Meanwhile, compliance with social contract is a critical aspect of the legitimisation process (Bansal and Clelland, 2004; Rupley et al., 2012). From the standpoint of institutional theory of isomorphism, high level of government's commitment to enforcing public policies may compel companies to comply with extant environmental laws to avoid sanctions. Further, the credibility of government in committing to policies inspires public confidence that sanctions will be meted out on private sector organisations that breach environmental laws (Wang et al., 2023). This discussion informs the next hypothesis that;

**H4**. Government Effectiveness has a significantly negative impact on the carbon emissions rate of MNEs.

(e) Regulatory Quality

In the WGI framework, Regulatory Quality reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (World Bank, 2023). Regulatory Quality also encompasses the robustness of institutional frameworks that are responsible for implementation of environmental laws for the purpose of meeting policy targets (Yamineva and Liu, 2019; Bisdounis, 2023). Improvement in Regulatory Quality through the implementation of environmental policies that promote decarbonisation may be expected to deepen the commitment of MNEs to reducing carbon emissions (Urák et al., 2017; Yamineva and Liu, 2019). To fulfil their part of the social contract as suggested by the legitimacy theory, the society creates an enabling environment for organisations to conduct their businesses by implementing sound policies that benefit the private sector (Rothstein, 2015). To reciprocate the good actions of society/government, MNEs may address pressing environmental issues such as carbon emissions reduction. From the angle of institutional theory of isomorphism, companies will want to comply with environmental laws when Regulatory Quality is strong to avoid sanctions. Studies have shown that government regulation is a strong coercive isomorphic factor influencing managerial and organisational practice (e.g., Tilt, 1994; Schuster et al., 2020). Consequently,

**H5**. Regulatory Quality has a significantly negative impact on the carbon emissions rate of MNEs.

(f) Rule of Law

Rule of Law reflects perceptions of the extent to which citizens, agents, or the public have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence (World Bank, 2023). The strength of a legal system determines the success and extent of enforcement of the Rule of Law (Sweet and Sandholtz, 2023). Countries characterised by strong Rule of Law are likely to have private sector organisations complying with environmental protection laws covering carbon emissions management (Schuster et al., 2020; Wang et al., 2023). Arguing from the position of the legitimacy theory, MNEs will want to reduce carbon emissions to avoid violating their social contract of complying with the rules governing the operations of the society. MNEs will want to demonstrate that they are responsible corporate citizens by obeying the laws of the land. From the perspective of institutional theory of isomorphism, environmental legislations will naturally coerce MNEs to operate in a manner that complies with emissions reduction laws. Studies have shown that enforcement of laws is a strong coercive factor exerting influence on

organisational practices (Rupley et al., 2012; Ernstberger and Grüning, 2013; Barry et al., 2022). Hence,

**H6.** Rule of Law has a significantly negative impact on the carbon emissions rate of MNEs.

## 3. Methodology

### 3.1. Research design

The study adopts a quantitative research design, using panel data analysis. The study covers a 15-year period (2006–2020) spanning the MDGs and SDGs eras, across different countries. Such an approach allows for a robust analysis of the impact of diverse country governance characteristics on the environmental performance of MNEs. In addition, the use of a longitudinal research design covering many countries and companies enhances external validity and ensures the generalisability of results.

We focus on top global companies because of their universal impact, visibility, and socio-economic importance as MNEs. The Forbes 500 companies list was used as the sampling frame. The financial service firms (160) were excluded because the nature of their business and regulatory framework are different from those of the non-financial firms (Tingbani et al., 2020). Using this exclusion criterion, there were 340 non-financial firms in the Forbes 500 list. After deleting four firms with no environmental sustainability performance report on the DataStream/Refinitiv database from the list, the final sample comprises 336 firms from 42 industries and 32 countries. The data for the 336 non-financial firms covering the 15-year period amount to 4,550 firm-year observations of unbalanced panel data. A growing number of studies have used data extracted from the Refinitiv/DataStream databases in environmental accounting studies (e.g., Seaborn et al., 2020; Gull et al., 2023). To address limitation in data availability on scope 3 emissions disclosure among the Forbes 500 sample selection, and its potential impact on the validity of results in terms of creating self-selection bias, we employ the Heckman two-step sample selection model as detailed in section 5.3.

### 3.2. Variables measurement and data sources

#### 3.2.1. Dependent variable

Carbon emissions performance was measured using scope 3 carbon emissions (i.e., Total $CO_2$ and $CO_2$ Scope 3 equivalent emission in tonnes) as the main measurement, as provided in the Refinitiv/DataStream database. Scope 3 includes emissions from contractor-owned vehicles, employee business travel (by rail or air), waste disposal, and outsourced activities—emissions from product use by customers, emissions from the production of purchased materials, emissions from electricity purchased for resale. The Refinitiv database follows a greenhouse gas (GHG) protocol for all emission classifications by type and includes the following gases in calculating total emissions: carbon dioxide ($CO_2$), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorinated compound (PFC), sulphur hexafluoride (SF6), and nitrogen trifluoride (NF3). The choice of scope 3 carbon emissions was informed by the consideration that it is a comprehensive measure of indirect carbon emissions as it captures all emissions indirectly generated by an organisation. Moreover, there have been calls to investigate environmental pollution from the standpoint of scope 3 emissions (Dijkstra--Silva et al., 2022). Prior studies have used carbon emissions rate as a proxy for carbon emissions performance (Baboukardos, 2017; Konadu et al., 2022).

To ensure the robustness of variable measurement, carbon emissions intensity (computed as the ratio of scope 3 carbon emissions to revenue) was used as alternative measure of carbon emissions performance in line with prior studies (Elsayih et al., 2021; Nuber and Velte, 2021). The use of carbon emissions to revenue ratio is easily comparable among companies and industries compared to the absolute value of carbon emissions (Luo et al., 2018). Both scope 3 carbon emissions rate and scope 3 carbon emissions intensity have a negative polarity, meaning that a lower carbon emissions rate and lower carbon emissions intensity connote better carbon emissions performance (Moussa et al., 2020).

#### 3.2.2. Independent variables

In line with prior studies (e.g., Cuadrado-Ballesteros and Bisogno, 2020; Tawiah, 2023), Country Governance Mechanisms were measured across six dimensions of Worldwide Governance Indicators (WGI) suggested by the World Bank; namely, Control of Corruption, Voice & Accountability, Political Stability, Government Effectiveness, Regulatory Quality, and Rule of Law. The Worldwide Governance Indicators (WGI), taken from the World Bank database and Transparency International, are a research dataset summarising the views on the quality of governance provided by many enterprise, citizen, and expert survey respondents in industrial and developing countries. These data are gathered from several survey institutes, think tanks, non-governmental organisations, international organisations, and private sector firms by the World Bank (World Bank, 2023). The indicators are based on over 30 underlying data sources reporting the perceptions of governance of many survey respondents and expert assessments worldwide (World Bank, 2023). Literature has emphasised these six dimensions as key indicators of governance quality in countries (Barry et al., 2022; Tawiah, 2023).

#### 3.2.3. Control variables

We include five corporate governance factors that may affect environmental performance as documented in literature; these are board meeting, board independence, board gender diversity, CEO duality, and ESG compensation (Liao et al., 2015; Elsayih et al., 2021). Further, five firm characteristics influencing the robustness of corporate environmental practice were included as control variables; revenue (firm size), market capitalisation, leverage, liquidity, and profitability (Tingbani et al., 2020). The variables were taken from the Refinitiv database and annual reports of companies. Noting that the United Nations Agenda 2030 may influence the decarbonisation policy of MNEs (United Nations, 2022a; 2022b), we also control for the effect of the SDGs by including a dichotomous variable to capture the MDGs/SDGs eras. Finally, owing to the international nature of the study, we control for country-level economic development (Nuber and Velte, 2021) using the Gross Domestic Product, taken from the World Bank database. A summary of the variable definitions and measurements is provided in Table 1.

### 3.3. Model specification

The panel data regression model is specified in equation (1) as follows:

$$CEP_{it} = \beta_0 + \beta_1\, CoC_{it} + \beta_2\, VAC_{it} + \beta_3\, PLS_{it} + \beta_4\, GEF_{it} + \beta_5\, REQ_{it} + \beta_6\, RoL_{it} + \beta_7\, BMT_{it} + \beta_8\, BIN_{it} + \beta_9\, BGD_{it} + \beta_{10}\, CEO_{it} + \beta_{11}\, COM_{it} + \beta_{12}\, REV_{it} + \beta_{13}\, MKT_{it} + \beta_{14}\, LEV_{it} + \beta_{15}\, LIQ_{it} + \beta_{16}\, PRF_{it} + \beta_{17}\, ERA_{it} + \beta_{18}\, ECD_{it} + \epsilon_{it} \quad \text{(Eq. 1)}$$

Where CEP represents carbon emissions performance of firm *i,* at time *t,* $\epsilon it$ represents the stochastic error term, and other variables are defined and measured as detailed in Table 1.

The regression model development is underpinned by the legitimacy theory and institutional theory of isomorphism that country governance variables influence carbon emissions performance of private-sector organisations (Rupley et al., 2012; He et al., 2013). The inclusion of the firm-level governance variables in the model is based on literature and stakeholder-agency theory suggesting that corporate governance mechanisms influence environmental performance (Liao et al., 2015; Elsayih et al., 2021). Firm characteristics were also included in the

**Table 1**
Measurement of variables.

| | Variables/Acronym | Measurement/Supporting literature | Data source(s) |
|---|---|---|---|
| 1 | Carbon emissions performance (scope 3 emissions), CEP | Carbon emissions rate measured as natural log of scope 3 carbon emissions in metric tonnes (Baboukardos, 2017; Konadu et al., 2022). Carbon emissions intensity computed as the ratio of scope 3 carbon emissions to revenue (Elsayih et al., 2021; Nuber and Velte, 2021). | DataStream/Refinitiv database |
| 2 | Control of Corruption, CoC | Perceptions of the extent to which public power is exercised for private gain. Measured by the Corruption Perception Index as provided by Transparency International ( Cuadrado-Ballesteros et al., 2019; Tawiah, 2023). A high corruption index implies high level of controlling corruption (which implies low corruption level). | Transparency International database |
| 3 | Voice & Accountability, VAC | Perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Voice & Accountability Index provided by the World Bank (2023). | World Bank database |
| 4 | Political Stability, PLS | Perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. Index as provided by the World Bank (2023) | World Bank database |
| 5 | Government Effectiveness, GEF | Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Government Effectiveness Index provided by the World Bank (2023). | World Bank database |
| 6 | Regulatory Quality, REQ | Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Regulatory Quality Index provided by the World Bank (2023). | World Bank database |
| 7 | Rule of Law, RoL | Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement. Rule of Law Index provided by the World Bank (2023). | World Bank database |
| ***Firm Governance (control)*** | | | |
| 8 | Board Meeting, BMT | Number of board meeting held in a year (Nuskiya et al., 2021; Disli et al., 2022). | DataStream/Refinitiv database/Company Annual reports |
| 9 | Board Independence, BIN | Ratio of Non-executive Directors (NEDs) to board size (Elsayih et al., 2021; Disli et al., 2022). | |
| 10 | Board Gender Diversity, BGD | Ratio of Female directors to board size (Nadeem et al., 2020) | |
| 11 | CEO duality, CEO | If Chairman also serves as the CEO = 1, otherwise = 0 (Nuskiya et al., 2021). | |
| 12 | ESG Compensation, COM | If executive pay is linked to ESG performance = 1, otherwise = 0 (Lu and Wang, 2021). | |
| ***Firm characteristics (control)*** | | | |
| 13 | Firm Size, REV | Natural log of Revenue ( Ahmad and Zabri, 2015; Peel, 2018). | DataStream/Refinitiv database/Company Annual reports |
| 14 | Firm Market Presence, MKT | Natural log of Market capitalisation (Elsayih et al., 2021). | |
| 15 | Firm Leverage, LEV | Ratio of Total Debt to Total Assets (Elsayih et al., 2021) | |
| 16 | Firm Liquidity, LIQ | Ratio of current assets to current liabilities (Tingbani et al., 2020). | |
| 17 | Firm Profitability, PRF | Return on Total Assets (ROTA) ratio (Doni et al., 2021). | |
| 18 | ***MDGs/SDGs Eras,*** ERA | Dummy Variable of '0' for MDGs period (2006–2015); otherwise, '1' for SDGs period (2016–2020). | Researchers' conceptualisation |
| 19 | Economic Development, ECD | Natural log of Gross Domestic Product (GDP) ( Nuber and Velte, 2021). | World Bank database |

model as control variables based on literature and resource-based view theory that resource availability affects quality of corporate environmental practice (Tingbani et al., 2020; Oyewo et al., 2023).

### 3.4. Data analysis and regression model validation method

Descriptive statistics, multiple regression with fixed effect analysis, instrumental variable (two-stage least squares regression, 2SLS) regression, propensity score matching (PSM), and Heckman two-step sample selection model were applied to analyse panel data for the study.

Various methods were used to assess regression model validity ((Bose et al., 2023; Gull et al., 2023; Tawiah et al., 2022): (a) comparisons of models' calculations and results for multiple regression performed to assess the consistency of beta coefficients, effect size, and statistical significance of the impact of independent variables on the dependent variables; (b) comparisons of models' coefficients of determination ($R^2$) and predictions with theory; (c) gathering and incorporating new data such as the use of instrumental variables to check model predictions and alleviate endogeneity concerns; (d) cross-validation/data splitting by conducting sub-sample analysis (i.e., assessing impact of country governance on carbon emissions performance based on (i) industry emissions intensity/environmental sensitivity; (ii) MDGs and SDGs Eras; and (iii) geographical regions); and (e) assessment of sample selection Bias by running a selection and main model in line with Heckman two-step sample selection procedure.

## 4. Results

### 4.1. Descriptive statistics

The descriptive analysis of variables, disaggregated into industry

carbon-intensity (Table 2), MDGs/SDGs eras (Table 3), and geographical regions (Table 4), shows that carbon emissions performance of MNEs differ notably across these aspects. The country governance and corporate governance mechanisms are also different based on these classifications. Taken together, heterogeneities in carbon emissions performance and country governance provide a rich context for examining the subject in the current study.

### 4.2. Multicollinearity test

The correlation matrix in Table 5 shows that none of the correlation coefficients between the independent variables is up to 0.80. Therefore, multicollinearity is not a serious concern as the correlation coefficients are generally low among the variables (Tabachnick et al., 2007).

### 4.3. Baseline result: impact of country governance on carbon emissions performance

The baseline result on the impact of country governance on carbon emissions performance, using both carbon emissions rate and carbon emissions intensity as proxies for carbon emissions performance, is presented in Table 6.

The result (Table 6) shows that Control of Corruption and Voice & Accountability are significantly and negatively associated with carbon emissions using both carbon emissions rate and carbon emissions intensity as measures of carbon emissions performance. The result

**Table 2**
Descriptive Analysis of Variables based on Industry Carbon Intensity.

| Variable | Industry | N | Mean | Std. Deviation | F ratio |
|---|---|---|---|---|---|
| Scope 3 Carbon Emissions in Metric tonnes (Emissions Rate) | Non-carbon-intensive industries | 1,251 | 1,993,502.32 | 7,486,186.86 | 86.111*** |
| | Carbon-intensive | 3,299 | 31,100,474.03 | 110,838,745.56 | |
| | Total | 4,550 | 23,097,656.09 | 95,347,008.73 | |
| Scope 3 Carbon Emissions to Revenues ratio (Emissions Intensity) | Non-carbon-intensive industries | 1,251 | 54.82 | 346.02 | 61.818*** |
| | Carbon-intensive | 3,299 | 527.82 | 2,116.99 | |
| | Total | 4,550 | 397.77 | 1,823.92 | |
| Control of Corruption | Non-carbon-intensive industries | 1,251 | 70.45 | 12.37 | 15.208*** |
| | Carbon-intensive | 3,299 | 68.61 | 14.82 | |
| | Total | 4,550 | 69.12 | 14.211 | |
| Voice & Accountability | Non-carbon-intensive industries | 1,251 | 82.52 | 12.98 | 7.866*** |
| | Carbon-intensive | 3,299 | 81.17 | 15.08 | |
| | Total | 4,550 | 81.54 | 14.54 | |
| Political Stability | Non-carbon-intensive industries | 1,251 | 65.35 | 14.23 | 4.635** |
| | Carbon-intensive | 3,299 | 66.47 | 16.05 | |
| | Total | 4,550 | 66.16 | 15.58 | |
| Government Effectiveness | Non-carbon-intensive industries | 1,251 | 89.33 | 7.64 | 7.720*** |
| | Carbon-intensive | 3,299 | 88.46 | 10.00 | |
| | Total | 4,550 | 88.70 | 9.42 | |
| Regulatory Quality | Non-carbon-intensive industries | 1,251 | 88.23 | 9.66 | 8.848*** |
| | Carbon-intensive | 3,299 | 87.15 | 11.33 | |
| | Total | 4,550 | 87.45 | 10.90 | |
| Rule of Law | Non-carbon-intensive industries | 1,251 | 88.69 | 8.33 | 15.576*** |
| | Carbon-intensive | 3,299 | 87.16 | 12.75 | |
| | Total | 4,550 | 87.58 | 11.72 | |
| Board Meeting | Non-carbon-intensive industries | 1,251 | 7.85 | 4.063 | 22.529*** |
| | Carbon-intensive | 3,299 | 8.80 | 6.640 | |
| | Total | 4,550 | 8.54 | 6.056 | |
| Board Independence | Non-carbon-intensive industries | 1,251 | 0.79 | 0.19 | 27.583*** |
| | Carbon-intensive | 3,299 | 0.75 | 0.24 | |
| | Total | 4,550 | 0.76 | 0.23 | |
| Board Gender Diversity | Non-carbon-intensive industries | 1,251 | 0.19 | 0.12 | 47.327*** |
| | Carbon-intensive | 3,299 | 0.16 | 0.12 | |
| | Total | 4,550 | 0.17 | 0.13 | |
| CEO Duality | Non-carbon-intensive industries | 1,251 | 0.53 | 0.49 | 0.377 |
| | Carbon-intensive | 3,299 | 0.52 | 0.50 | |
| | Total | 4,550 | 0.53 | 0.49 | |
| ESG Compensation | Non-carbon-intensive industries | 1,251 | 0.27 | 0.44 | 9.464*** |
| | Carbon-intensive | 3,299 | 0.32 | 0.46 | |
| | Total | 4,550 | 0.31 | 0.46 | |
| Revenue (Million' USD) | Non-carbon-intensive industries | 1,251 | 47,130.57 | 63,009.48 | 0.73 |
| | Carbon-intensive | 3,299 | 48,861.10 | 60,234.05 | |
| | Total | 4,550 | 48,385.30 | 61,007.64 | |
| Market Capitalisation (Million' USD) | Non-carbon-intensive industries | 1,251 | 85,016.92 | 155,014.27 | 21.08*** |
| | Carbon-intensive | 3,299 | 65,741.60 | 113,380.20 | |
| | Total | 4,550 | 71,045.29 | 126,488.09 | |
| Leverage | Non-carbon-intensive industries | 1,251 | 0.24 | 0.16 | 16.506*** |
| | Carbon-intensive | 3,299 | 0.26 | 0.14 | |
| | Total | 4,550 | 0.26 | 0.15 | |
| Current Ratio (Liquidity) | Non-carbon-intensive industries | 1,251 | 1.44 | 1.17 | 18.435*** |
| | Carbon-intensive | 3,299 | 1.63 | 1.30 | |
| | Total | 4,550 | 1.58 | 1.27 | |
| Return on Total Assets | Non-carbon-intensive industries | 1,251 | 0.11 | 0.08 | 47.053*** |
| | Carbon-intensive | 3,299 | 0.08 | 0.07 | |
| | Total | 4,550 | 0.09 | 0.07 | |
| GDP 1: GDP per capita (Million' USD) | Non-carbon-intensive industries | 1,251 | 46,551.13 | 14,304.54 | 26.988*** |
| | Carbon-intensive | 3,299 | 43,907.30 | 15,697.40 | |
| | Total | 4,550 | 44,634.21 | 15,370.92 | |

***$p < 0.01$, **$p < 0.05$.

**Table 3**
Descriptive Analysis of Variables based on the MDGs and SDGs Eras.

| Variable | Industry | N | Mean | Std. Deviation | F ratio |
|---|---|---|---|---|---|
| Scope 3 Carbon Emissions in Metric tonnes (Emissions Rate) | MDGs Era | 2,912 | 17,667,780.29 | 78,324,945.07 | 26.380*** |
| | SDGs Era | 1,638 | 32,750,768.62 | 119,196,845.41 | |
| | Total | 4,550 | 23,097,656.09 | 95,347,008.73 | |
| Scope 3 Carbon Emissions to Revenues ratio (Emissions Intensity) | MDGs Era | 2,912 | 256.15 | 1,067.83 | 49.280*** |
| | SDGs Era | 1,638 | 649.52 | 2,667.88 | |
| | Total | 4,550 | 397.77 | 1823.92297 | |
| Control of Corruption | MDGs Era | 2,912 | 70.17 | 14.37 | 44.809*** |
| | SDGs Era | 1,638 | 67.25 | 13.73 | |
| | Total | 4,550 | 69.12 | 14.21 | |
| Voice & Accountability | MDGs Era | 2,912 | 82.59 | 14.37 | 42.768*** |
| | SDGs Era | 1,638 | 79.67 | 14.67 | |
| | Total | 4,550 | 81.54 | 14.54 | |
| Political Stability | MDGs Era | 2,912 | 67.54 | 14.92 | 64.074** |
| | SDGs Era | 1,638 | 63.71 | 16.41 | |
| | Total | 4,550 | 66.16 | 15.58 | |
| Government Effectiveness | MDGs Era | 2,912 | 88.46 | 9.73 | 5.471*** |
| | SDGs Era | 1,638 | 89.14 | 8.83 | |
| | Total | 4,550 | 88.70 | 9.42 | |
| Regulatory Quality | MDGs Era | 2,912 | 87.03 | 10.95 | 11.613*** |
| | SDGs Era | 1,638 | 88.18 | 10.79 | |
| | Total | 4,550 | 87.45 | 10.90 | |
| Rule of Law | MDGs Era | 2,912 | 87.83 | 11.81 | 3.746* |
| | SDGs Era | 1,638 | 87.13 | 11.54 | |
| | Total | 4,550 | 87.58 | 11.72 | |
| Board Meeting | MDGs Era | 2,912 | 8.57 | 6.49 | 0.257 |
| | SDGs Era | 1,638 | 8.48 | 5.19 | |
| | Total | 4,550 | 8.54 | 6.05 | |
| Board Independence | MDGs Era | 2,912 | 0.76 | 0.24 | 5.737** |
| | SDGs Era | 1,638 | 0.77 | 0.18 | |
| | Total | 4,550 | 0.76 | 0.22 | |
| Board Gender Diversity | MDGs Era | 2,912 | 0.14 | 0.11 | 444.217*** |
| | SDGs Era | 1,638 | 0.22 | 0.13 | |
| | Total | 4,550 | 0.16 | 0.12 | |
| CEO Duality | MDGs Era | 2,912 | 0.54 | 0.49 | 7.607*** |
| | SDGs Era | 1,638 | 0.50 | 0.50 | |
| | Total | 4,550 | 0.53 | 0.49 | |
| ESG Compensation | MDGs Era | 2,912 | 0.32 | 0.46 | 5.108** |
| | SDGs Era | 1,638 | 0.28 | 0.45 | |
| | Total | 4,550 | 0.31 | 0.46 | |
| Revenue (Million' USD) | MDGs Era | 2,912 | 45,423.13 | 59,073.07 | 19.146*** |
| | SDGs Era | 1,638 | 53,651.39 | 63,983.94 | |
| | Total | 4,550 | 48,385.30 | 61,007.64 | |
| Market Capitalisation (Million' USD) | MDGs Era | 2,912 | 55,697.09 | 67,504.46 | 121.612*** |
| | SDGs Era | 1,638 | 98,292.34 | 187,527.01 | |
| | Total | 4,550 | 71,045.29 | 126,488.09 | |
| Leverage | MDGs Era | 2,912 | 0.25 | 0.15 | 44.614*** |
| | SDGs Era | 1,638 | 0.28 | 0.14 | |
| | Total | 4,550 | 0.26 | 0.15 | |
| Current Ratio (Liquidity) | MDGs Era | 2,912 | 1.63 | 1.41 | 15.716*** |
| | SDGs Era | 1,638 | 1.48 | 0.98 | |
| | Total | 4,550 | 1.58 | 1.27 | |
| Return on Total Assets | MDGs Era | 2,912 | 0.09 | 0.07 | 20.023*** |
| | SDGs Era | 1,638 | 0.08 | 0.07 | |
| | Total | 4,550 | 0.09 | 0.07 | |
| GDP 1: GDP per capita (Million' USD) | MDGs Era | 2,912 | 41,913.17 | 13,303.62 | 268.389*** |
| | SDGs Era | 1,638 | 49,471.61 | 17,471.01 | |
| | Total | 4,550 | 44,634.21 | 15,370.92 | |

***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

supports the full acceptance of H1 and H2. Going by the effect size of the coefficients under both measures of carbon emissions performance, the result suggests that Control of Corruption is the strongest determinant of carbon emissions reduction by MNEs. This connotes that countries that can control the misuse of public resources for private gains (control corruption) are able to compel companies to minimise environmental pollution through carbon emissions (Houqe and Monem, 2016; Cuadrado-Ballesteros et al., 2019). Control of Corruption is also critical to ensuring compliance with environmental laws (Schuster et al., 2020). The result provides empirical evidence to buttress the argument that jurisdictions characterised by high level of corruption/low control of corruption will provide an enabling environment and the motivation for organisations to circumvent environmental laws (Tawiah, 2023), and high emissions may be overlooked since there may be no consequences for environmental pollution (Ali and Isse, 2003). The result buttresses the criticality of maintaining the decency and integrity of public institutions to realise net zero targets.

Voice & Accountability also emerged as a notable governance factor diminishing carbon emissions rate. This suggests that MNEs will want to reduce carbon emissions not directly attributable to them (scope 3 emissions) to preserve corporate legitimacy (Rupley et al., 2012; Wang et al., 2023). The result could also connote that the voice or say of citizens generally compel companies to be environmentally compliant (Lavuri et al., 2023), as non-compliance with best practice in environmental sustainability may incur public wrath and invoke negative publicity for an organisation (Brown and Deegan, 1998; Neu et al.,

**Table 4**
Descriptive Analysis of Variables based on Geographical Regions.

| Variable | Geographical Region | N | Mean | Std. Deviation | F ratio |
|---|---|---|---|---|---|
| Scope 3 Carbon Emissions in Metric tonnes (Emissions Rate) | America | 2,020 | 14,982,449.57 | 72,925,470.26 | 27.821*** |
| | Asia Pacific | 1,310 | 14,406,392.83 | 60,131,289.25 | |
| | Western Europe | 1,093 | 47,919,676.19 | 142,740,688.00 | |
| | Europe and Central Asia (ECA) | 71 | 50,438,873.23 | 194,462,439.64 | |
| | Middle East and North Africa | 56 | 828.14 | 3,518.55 | |
| | Total | 4,550 | 23,097,656.09 | 95,347,008.73 | |
| Scope 3 Carbon Emissions to Revenues ratio (Emissions Intensity) | America | 2,020 | 355.1345 | 2196.88 | 8.836*** |
| | Asia Pacific | 1,310 | 253.6197 | 1144.78 | |
| | Western Europe | 1,093 | 661.0367 | 1733.85 | |
| | Europe and Central Asia (ECA) | 71 | 531.3469 | 1977.50 | |
| | Middle East and North Africa | 56 | 0.05 | 0.24 | |
| | Total | 4,550 | 397.77 | 1,823.92 | |
| Control of Corruption | America | 2,020 | 72.25 | 6.31 | 578.953*** |
| | Asia Pacific | 1,310 | 61.17 | 17.80 | |
| | Western Europe | 1,093 | 76.53 | 9.87 | |
| | Europe and Central Asia (ECA) | 71 | 26.23 | 3.12 | |
| | Middle East and North Africa | 56 | 51.79 | 10.08 | |
| | Total | 4,550 | 69.12 | 14.21 | |
| Voice & Accountability | America | 2,020 | 83.19 | 6.13 | 3658.798*** |
| | Asia Pacific | 1,310 | 76.43 | 9.57 | |
| | Western Europe | 1,093 | 92.34 | 5.18 | |
| | Europe and Central Asia (ECA) | 71 | 20.61 | 2.19 | |
| | Middle East and North Africa | 56 | 7.84 | 6.99 | |
| | Total | 4,550 | 81.54 | 14.54 | |
| Political Stability | America | 2,020 | 61.59 | 9.33 | 474.151*** |
| | Asia Pacific | 1,310 | 73.36 | 16.64 | |
| | Western Europe | 1,093 | 70.40 | 14.20 | |
| | Europe and Central Asia (ECA) | 71 | 19.77 | 4.00 | |
| | Middle East and North Africa | 56 | 38.54 | 18.67 | |
| | Total | 4,550 | 66.16 | 15.58 | |
| Government Effectiveness | America | 2,020 | 90.44 | 6.22 | 845.500*** |
| | Asia Pacific | 1,310 | 87.46 | 8.51 | |
| | Western Europe | 1,093 | 90.95 | 6.56 | |
| | Europe and Central Asia (ECA) | 71 | 46.40 | 5.67 | |
| | Middle East and North Africa | 56 | 64.91 | 12.76 | |
| | Total | 4,550 | 88.70 | 9.42 | |
| Regulatory Quality | America | 2,020 | 89.92 | 5.99 | 1062.674*** |
| | Asia Pacific | 1,310 | 84.21 | 10.88 | |
| | Western Europe | 1,093 | 91.41 | 6.52 | |
| | Europe and Central Asia (ECA) | 71 | 37.78 | 3.24 | |
| | Middle East and North Africa | 56 | 59.67 | 9.34 | |
| | Total | 4,550 | 87.45 | 10.90 | |
| Rule of Law | America | 2,020 | 90.31 | 6.93 | 1652.891*** |
| | Asia Pacific | 1,310 | 84.66 | 8.59 | |
| | Western Europe | 1,093 | 91.50 | 7.30 | |
| | Europe and Central Asia (ECA) | 71 | 23.62 | 3.05 | |
| | Middle East and North Africa | 56 | 61.88 | 6.34 | |
| | Total | 4,550 | 87.58 | 11.72 | |
| Board Meeting | America | 2,020 | 8.05 | 3.44 | 178.699*** |
| | Asia Pacific | 1,310 | 8.65 | 5.55 | |
| | Western Europe | 1,093 | 8.45 | 4.064 | |
| | Europe and Central Asia (ECA) | 71 | 25.63 | 29.38 | |
| | Middle East and North Africa | 56 | 3.50 | 5.01 | |
| | Total | 4,550 | 8.54 | 6.05 | |
| Board Independence | America | 2,020 | 0.85 | 0.09 | 810.200*** |
| | Asia Pacific | 1,310 | 0.53 | 0.24 | |
| | Western Europe | 1,093 | 0.86 | 0.17 | |
| | Europe and Central Asia (ECA) | 71 | 0.74 | 0.17 | |
| | Middle East and North Africa | 56 | 0.88 | 0.22 | |
| | Total | 4,550 | 0.76 | 0.22 | |
| Board Gender Diversity | America | 2,020 | 0.20 | 0.09 | 487.177*** |
| | Asia Pacific | 1,310 | 0.07 | 0.09 | |
| | Western Europe | 1,093 | 0.23 | 0.13 | |
| | Europe and Central Asia (ECA) | 71 | 0.04 | 0.06 | |
| | Middle East and North Africa | 56 | 0.01 | 0.02 | |
| | Total | 4,550 | 0.17 | 0.12 | |
| CEO Duality | America | 2,020 | 0.70 | 0.45 | 169.250*** |
| | Asia Pacific | 1,310 | 0.49 | 0.50 | |
| | Western Europe | 1,093 | 0.30 | 0.46 | |
| | Europe and Central Asia (ECA) | 71 | 0.03 | 0.16 | |
| | Middle East and North Africa | 56 | 0.09 | 0.29 | |
| | Total | 4,550 | 0.53 | 0.49 | |
| ESG Compensation | America | 2,020 | 0.37 | 0.48 | 129.677*** |
| | Asia Pacific | 1,310 | 0.09 | 0.28 | |

(*continued on next page*)

**Table 4** (*continued*)

| Variable | Geographical Region | N | Mean | Std. Deviation | F ratio |
|---|---|---|---|---|---|
| | Western Europe | 1,093 | 0.45 | 0.49 | |
| | Europe and Central Asia (ECA) | 71 | 0.28 | 0.45 | |
| | Middle East and North Africa | 56 | 0.02 | 0.13 | |
| | Total | 4,550 | 0.31 | 0.46 | |
| Revenue (Million USD) | America | 2,020 | 46,606.69 | 64,997.66 | 7.488*** |
| | Asia Pacific | 1,310 | 45,423.71 | 55,757.89 | |
| | Western Europe | 1,093 | 54,242.37 | 58,909.97 | |
| | Europe and Central Asia (ECA) | 71 | 73,799.80 | 50,702.51 | |
| | Middle East and North Africa | 56 | 35,282.69 | 67,600.41 | |
| | Total | 4,550 | 48,385.30 | 61,007.64 | |
| Market Capitalisation (Million USD) | America | 2,020 | 91,474.80 | 157,045.72 | 34.602*** |
| | Asia Pacific | 1,310 | 45,837.55 | 67,980.53 | |
| | Western Europe | 1,093 | 60,172.16 | 50,601.90 | |
| | Europe and Central Asia (ECA) | 71 | 60,108.69 | 50,551.58 | |
| | Middle East and North Africa | 56 | 149,635.08 | 462,830.60 | |
| | Total | 4,550 | 71,045.29 | 126,488.09 | |
| Leverage | America | 2,020 | 0.28 | 0.16 | 28.372*** |
| | Asia Pacific | 1,310 | 0.23 | 0.14 | |
| | Western Europe | 1,093 | 0.25 | 0.12 | |
| | Europe and Central Asia (ECA) | 71 | 0.20 | 0.15 | |
| | Middle East and North Africa | 56 | 0.19 | 0.09 | |
| | Total | 4,550 | 0.26 | 0.15 | |
| Current Ratio (Liquidity) | America | 2,020 | 1.71 | 1.59 | 35.137*** |
| | Asia Pacific | 1,310 | 1.63 | 1.07 | |
| | Western Europe | 1,093 | 1.22 | 0.47 | |
| | Europe and Central Asia (ECA) | 71 | 2.41 | 1.99 | |
| | Middle East and North Africa | 56 | 1.46 | 0.88 | |
| | Total | 4,550 | 1.58 | 1.27 | |
| Return on Total Assets | America | 2,020 | 0.10 | 0.07 | 30.930*** |
| | Asia Pacific | 1,310 | 0.08 | 0.07 | |
| | Western Europe | 1,093 | 0.07 | 0.07 | |
| | Europe and Central Asia | 71 | 0.14 | 0.08 | |
| | Middle East and North Africa | 56 | 0.09 | 0.10 | |
| | Total | 4,550 | 0.09 | 0.07 | |
| GDP 1: GDP per capita (Million USD) | America | 2,020 | 53,178.76 | 8,575.22 | 730.651*** |
| | Asia Pacific | 1,310 | 31,223.80 | 16,112.29 | |
| | Western Europe | 1,093 | 45,720.90 | 12,127.92 | |
| | Europe and Central Asia (ECA) | 71 | 24,014.45 | 4,052.05 | |
| | Middle East and North Africa | 56 | 55,061.02 | 8,611.00 | |
| | Total | 4,550 | 44,634.21 | 15,370.92 | |

***$p < 0.01$.

1998). MNEs may, therefore, be forced to take deliberate action in reducing carbon emissions not directly attributable to them to assuage public opinion to gain stakeholders confidence and legitimise their existence (Bansal and Clelland, 2004; Yamineva and Liu, 2019). MNEs may yield to the 'voice' or clamour of stakeholders for carbon emissions reduction to close the 'legitimacy gap'. The result extends studies on the positive impact of environmental media coverage on corporate environmental performance (e.g., Brown and Deegan, 1998; Neu et al., 1998; Aerts and Cormier, 2009; Rupley et al., 2012).

Political Stability and Government Effectiveness consistently have significant positive impact on carbon emissions performance under both models using emissions rate and emissions intensity as dependent variables. The result supports the rejection of H3 and H4. This suggests that scope 3 emissions are predominant when there is political stability, absence of violence/terrorism, and no political pressure. The significant positive association between Government Effectiveness and scope 3 carbon emissions suggests that high-quality policy formulation and implementation (characterising effective government) may not necessarily reduce carbon emissions—especially if government policies and commitment to such policies do not sufficiently address scope 3 emissions. Stated differently, countries with effective government policies may experience high emission rates if government policies do not sufficiently cover or satisfactorily address carbon emissions (Yamineva and Liu, 2019; Bisdounis, 2023).

Regulatory Quality and Rule of Law have negative but insignificant impacts on scope 3 carbon emissions. Therefore, H5 and H6 are rejected. The negative but insignificant impact of Regulatory Quality suggests that although the formulation of sound policies can reduce carbon emissions, such regulations have not appreciably impacted scope 3 emissions possibly because regulations on emissions are not strong enough (Rupley et al., 2012; Yamineva and Liu, 2019). This presents additional evidence that governments of nations may not be doing enough to achieve net zero in terms of strengthening Regulatory Quality (Bisdounis, 2023). This argument is buttressed by the result that the impact of Rule of Law is negative but not statistically and economically significant. In essence, although the quality of contract enforcement (including social contract between organisations and the society as suggested by the legitimacy theory) can reduce carbon emissions of MNEs, Rule of Law is unable to significantly diminish scope 3 emissions, perhaps because laws on carbon emissions are not strong or robust enough (Houqe and Monem, 2016; Schuster et al., 2020).

Taken together, the negative impact of Control of Corruption, Voice & Accountability, Regulatory Quality, and Rule of Law on scope 3 emissions (Table 6) empirically validates the institutional theory of isomorphism/coercive isomorphism that pressure forces organisations to reduce carbon emissions (DiMaggio and Powell, 1983; Chen and Cheng, 2020). Further, the significant negative impact of Voice & Accountability on carbon emissions validates the legitimacy theory that companies will generally want to achieve decarbonisation targets to preserve corporate legitimacy and gain stakeholders' acceptance by yielding to stakeholders' 'voice' for more action on climate change (Haniffa and Cooke, 2005; Dragomir et al., 2021).

**Table 5**
Correlation and multicollinearity test.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control of Corruption (1) | 1 | | | | | | | | | | | | | | | | |
| Voice & Accountability (2) | .652** | 1 | | | | | | | | | | | | | | | |
| Political Stability (3) | .480** | .575** | 1 | | | | | | | | | | | | | | |
| Govt Effectiveness (4). | .722** | .765*** | .686** | 1 | | | | | | | | | | | | | |
| Regulatory Quality (5) | .674** | .794** | .627** | .720*** | 1 | | | | | | | | | | | | |
| Rule of Law (6) | .745** | .719** | .628** | .744** | .724** | 1 | | | | | | | | | | | |
| Board Meeting (7) | −.075** | −.099** | −.052** | −.127** | −.147** | −.175** | 1 | | | | | | | | | | |
| Board Independence (8) | .116** | .148** | −.256** | .019 | .136** | .091** | −.081** | 1 | | | | | | | | | |
| Board Gender diversity (9) | .292** | .327** | −.096** | .223** | .275** | .271** | .004 | .430** | 1 | | | | | | | | |
| CEO Duality (10) | .037* | .012 | −.107** | .078** | .027 | .093** | −.055** | .033* | .054** | 1 | | | | | | | |
| ESG Compensation (11) | .164** | .180** | −.051** | .072** | .107** | .114** | .047** | .286** | .278** | .034* | 1 | | | | | | |
| Revenue (12) | −.009 | −.002 | −.031* | −.024 | −.017 | −.031* | .095** | .053** | .076** | −.031* | .106** | 1 | | | | | |
| Market Capitalisation (13) | .092** | .009 | −.151** | .005 | .023 | .013 | .033* | .198** | .240** | .045** | .138** | .529** | 1 | | | | |
| Leverage (14) | .039** | .044** | −.025 | .058** | .088** | .066** | .059** | .069** | .072** | .041** | .053** | .002 | −.059** | 1 | | | |
| Liquidity (15) | −.034* | −.094** | −.079** | −.091** | −.116** | −.101** | −.069** | −.103** | −.100** | .009 | −.077** | −.253** | −.046** | −.211** | 1 | | |
| Profitability (16) | −.041** | −.056** | −.142** | −.087** | −.080** | −.077** | −.053** | .075** | .037* | .051** | −.029 | −.109** | .268** | −.234** | .227** | 1 | |
| Eco Devt, GDP (17) | .746** | .290** | .146** | .486** | .490** | .485** | −.017 | .272** | .373** | .121** | .198** | .059** | .213** | .098** | −.014 | −.062** | 1 |

***p < 0.01, **p < 0.05, *p < 0.10.

**Table 6**
Baseline Regression Results on impact of Country Governance Mechanisms on Carbon Emissions Performance.

| Variables | Scope 3 Emissions Rate | Scope 3 Emissions Intensity |
|---|---|---|
| Control of Corruption | −.021*** (.006) | −.022*** (.006) |
| Voice & Accountability | −.015** (.006) | −.014** (.005) |
| Political Stability | .007** (.003) | .006* (.003) |
| Government Effectiveness | .018** (.008) | .018** (.008) |
| Regulatory Quality | −.006 (.007) | −.008 (.007) |
| Rule of Law | −.006 (.013) | −.007 (.012) |
| ***Firm Governance (control)*** | | |
| Board Meeting | .003 (.004) | .004 (.005) |
| Board Independence | .408*** (.153) | .448*** (.152) |
| Board Gender diversity | −.684*** (.230) | −.719*** (.229) |
| CEO Duality | −.052 (.055) | −.034 (.054) |
| ESG Compensation | −.036 (.037) | −.047 (.037) |
| ***Firm characteristics (control)*** | | |
| Revenue | .505*** (.158) | −.345** (.155) |
| Market Capitalisation | .220** (.111) | .177 (.110) |
| Leverage | .001 (.002) | .001 (.002) |
| Liquidity | .027 (.031) | .025 (.031) |
| Profitability | −.006 (.003) | −.004 (.003) |
| ***Period (MDGs/SDGs)*** | .174*** (.055) | .197*** (.054) |
| Economic Development ***(control)*** | 5.018*** (.536) | 4.777*** (.533) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| $\mathbf{R^2}$ | 28.97% | 24.18% |
| **N** | 4,550 | 4,550 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

### *4.4. Impact of country governance on carbon emissions performance based on industry emissions intensity/environmental sensitivity*

Country governance factors may impact carbon-intensive and non-carbon-intensive companies differently because MNEs operating in environmentally sensitive industries are subject to more regulation and public scrutiny owing to the nature of their business (Baboukardos, 2017; Oyewo et al., 2023). To further examine the influence of country governance factors on carbon emissions performance based on emissions intensity, additional analysis was carried out. Using the classification applied in prior studies (e.g., Baboukardos, 2017), the sample was split into carbon-intensive and non-carbon-intensive industries and the regression analysis was rerun using scope 3 emissions rate as the main measure of carbon emissions performance (Table 7), and scope 3 emissions intensity as alternative measure for the purpose of evaluating the robustness of the result (Table 8).

The results in Table 7 show that, in carbon-intensive industries, Control of Corruption and Rule of Law have significant negative impact on carbon emissions rate, while the impact of Voice & Accountability is negative but not statistically significant. While the impact of Government Effectiveness is positive and significant, Political Stability and Regulatory Quality have no significant impact on carbon emissions. The emergence of Rule of Law as the strongest determinant of carbon emissions reduction in carbon-intensive industries (Table 7) suggests that coercive isomorphic factors exert strongly on MNEs to achieve decarbonisation targets in line with institutional theory of isomorphism (DiMaggio and Powell, 1983; Schuster et al., 2020). The result is also consistent with literature that strong legislation on carbon emissions is required to coerce MNEs to do more in achieving net zero emissions (Chen and Cheng, 2020; Sweet and Sandholtz, 2023).

In non-carbon-intensive industries, Control of Corruption, Voice & Accountability, and Regulatory Quality have significant negative impact on carbon emissions rate. The impact of Political Stability and Rule of Law is positive and significant, whilst Government Effectiveness has no impact on carbon emissions (Table 7). The emergence of Regulatory Quality as the foremost determinant of carbon emissions rate buttresses

**Table 7**
Impact of Country Governance Mechanisms on Carbon Emissions Performance based on Industry Carbon emissions Intensity using Scope 3 Emissions Rate.

| Variables | DV: Scope 3 Emissions Rate | |
|---|---|---|
| | **Carbon-intensive industries** | **Non-carbon-intensive industries** |
| Control of Corruption | −.016** (.007) | −.031*** (.009) |
| Voice & Accountability | −.010 (.007) | −.033*** (.010) |
| Political Stability | .003 (.004) | .019*** (.005) |
| Government Effectiveness | .019** (.009) | .019 (.013) |
| Regulatory Quality | .007 (.009) | −.041*** (.012) |
| Rule of Law | −.030* (.015) | .065** (.025) |
| ***Firm Governance (control)*** | | |
| Board Meeting | .003 (.005) | .007 (.008) |
| Board Independence | .509*** (.195) | .354 (.233) |
| Board Gender Diversity | −.603** (.295) | −.924*** (.352) |
| CEO Duality | .030 (.071) | −.190** (.084) |
| ESG Compensation | −.058 (.046) | .046 (.060) |
| ***Firm characteristics (control)*** | | |
| Revenue | .707*** (.191) | .096 (.283) |
| Market Capitalisation | .198 (.136) | .329* (.192) |
| Leverage | .003 (.003) | −.003 (.003) |
| Liquidity | .046 (.045) | .014 (.040) |
| Profitability | −.008* (.004) | .008 (.007) |
| ***Period (MDGs/SDGs)*** | .049 (.068) | .490 (.090) |
| Economic Development ***(control)*** | 6.121*** (.668) | 3.170*** (.889) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| $R^2$ | 29.44% | 34.96% |
| **N** | 3,299 | 1,251 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

**Table 8**
Impact of Country Governance Mechanisms on Carbon Emissions Performance based on Industry Carbon emissions Intensity using Scope 3 Emissions Intensity.

| Variables | DV: Scope 3 Emissions Intensity | |
|---|---|---|
| | **Carbon-intensive industries** | **Non-carbon-intensive industries** |
| Control of Corruption | −.017** (.008) | −.031*** (.009) |
| Voice & Accountability | −.009 (.007) | −.034*** (.011) |
| Political Stability | .002 (.004) | .018*** (.004) |
| Government Effectiveness | .020** (.009) | .019 (.013) |
| Regulatory Quality | .005 (.009) | −.039*** (.012) |
| Rule of Law | −.031** (.015) | .065** (.025) |
| ***Firm Governance (control)*** | | |
| Board Meeting | .004 (.005) | .007 (.008) |
| Board Independence | .563*** (.194) | .347 (.234) |
| Board Gender Diversity | −.676** (.293) | −.888** (.352) |
| CEO Duality | .053 (.070) | −.186** (.084) |
| ESG Compensation | −.076* (.046) | .048 (.060) |
| ***Firm characteristics (control)*** | | |
| Revenue | −.102 (.187) | −.859*** (.283) |
| Market Capitalisation | .148 (.134) | .313 (.193) |
| Leverage | .002 (.003) | −.004 (.003) |
| Liquidity | .034 (.044) | .018 (.040) |
| Profitability | −.007* (.004) | .010 (.006) |
| ***Period (MDGs/SDGs)*** | .084 (.067) | .483*** (.091) |
| Economic Development ***(control)*** | 5.753*** (.661) | 3.182*** (.890) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| $R^2$ | 25.07% | 29.30% |
| **N** | 3,299 | 1,251 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

the argument that coercive isomorphic factors also exert strongly on MNEs operating in non-carbon-intensive industries to achieve net zero (Ernstberger and Grüning, 2013; Barry et al., 2022).

In sum, the ability of Control of Corruption to influence scope 3 emissions significantly and negatively in both carbon-intensive and non-carbon-intensive industries (Table 7) reiterates the importance of strong institutional framework in checkmating corrupt environmental practices (Cuadrado-Ballesteros et al., 2019; Tawiah, 2023). Further, the emergence of Rule of Law as the strongest driver of carbon emissions reduction in carbon-intensive industries and the appearance of Regulatory Quality as the strongest driver of carbon emissions reduction in non-carbon-intensive industries establish that strong legislation is critical in compelling MNEs to tackle carbon emissions (Sweet and Sandholtz, 2023; Wang et al., 2023).

The result in Table 8 is generally consistent with Table 7 in terms of the impact of the country governance factors on carbon emissions performance, the control variables, and the effect size of the coefficient of determination ($R^2$). Specifically, Control of Corruption and Rule of Law have significant negative impact on carbon emissions intensity in carbon-intensive industries, whilst Control of Corruption, Voice & Accountability, and Regulatory Quality have significant negative impact on carbon emissions intensity in non-carbon-intensive industries. This establishes that the result in Table 7 is robust to alternative measure of carbon emissions performance.

In comparing the results for both industries (Table 7), Control of Corruption is able to exert more influence on carbon emissions in the non-carbon-intensive industries ($b = -0.031$, $p < 0.01$) than in the carbon-intensive industries ($b = -0.016$, $p < 0.05$) because of the higher rate of Control of Corruption in the non-carbon-intensive industries (M = 70.45%) in comparison to the carbon-intensive industries (M = 68.61%), as shown in Table 2. The result reinforces the argument that more Control of Corruption is likely to reduce scope 3 emissions, thus supporting the call for strong institutional mechanisms to be in place to control corrupt environmental practices. Relatedly, Voice & Accountability has more impact on decarbonisation in the non-carbon-intensive industries ($b = -0.033$, $p < 0.01$) than in the carbon-intensive industries ($b = -0.010$, $p > 0.10$) because of higher level of Voice & Accountability in the non-carbon-intensive industries (M = 82.52%) in comparison to the carbon-intensive industries (M = 81.17%; Table 2). The result also reiterates the importance of public opinion and comments in shaping environmental practice of companies (Aerts and Cormier, 2009; Rupley et al., 2012). The result supports the argument that MNEs will generally commit to reducing carbon emissions indirectly attributable to them to satisfy the public and preserve corporate legitimacy as suggested by the legitimacy theory (Suchman, 1995; Dragomir et al., 2021).

Political Stability has no significant impact on carbon emissions reduction in both industries perhaps because of the generally average rate of Political Stability in carbon-intensive (M = 66.47%) and non-carbon-intensive (M = 65.35%) industries (Table 2). Although Government Effectiveness is generally high in countries where MNEs in carbon-intensive (M = 88.46%) and non-carbon-intensive (M = 89.33%) industries operate (Table 2), high level of Government Effectiveness is unable to significantly influence carbon emissions reduction possibly because policy formulation and implementation on carbon emissions is weak (Dragomir et al., 2021; Deloitte, 2022).

Regulatory Quality impacts carbon emissions rate significantly and negatively in non-carbon-intensive industries ($b = -0.041$, $p < 0.01$) but not in carbon-intensive industries ($b = 0.007$, $p > 0.10$) because of stronger Regulatory Quality in non-carbon-intensive industries (M = 88.23%) in comparison to the carbon-intensive industries (M = 87.15%; Table 2). The result re-echoes the importance of regulation in promoting decarbonisation. The result also aligns with literature that coercive isomorphic factors promote environmental performance (e.g., Ernstberger and Grüning, 2013; Barry et al., 2022). Rule of Law has a significant negative impact on carbon emissions in carbon-intensive industries ($b = -0.030$, $p < 0.10$) but a significant positive impact in non-carbon-intensive industries ($b = 0.065$, $p < 0.05$). This could possibly be linked to stronger enforcement of environmental laws on companies operating in high polluting industries generating more carbon emissions due to the nature of their business (Elsayih et al., 2021).

### 4.5. Impact of country governance on carbon emissions performance in the MDGs and SDGs eras

Considering that Agenda 2030 implores governments of nations as critical partners to do more in achieving the SDGs (Erin et al., 2022), it is conceivable that governance quality may impact carbon emissions performance differently in the MDGs and SDGs eras (United Nations, 2022a; 2022b). The baseline result shows that the MDGs/SDGs era dichotomy significantly impacts carbon emissions performance (Table 6). Further analysis was carried out to assess the impact of the MDGs/SDGs eras using carbon emissions rate as the dependent variable. The result of the analysis is reported in Table 9.

From the result in Table 9, Control of Corruption and Regulatory Quality have significant negative impact on carbon emissions rate in the MDGs era. However, the impact of Voice & Accountability is negative but not statistically significant. In the SDGs era, the governance factor influencing decarbonisation shifted to Voice & Accountability. This suggests that, whilst the MDGs era started the groundwork in sensitising MNEs towards committing to reducing their carbon footprint, the clamour for decarbonisation gained prominence in the SDGs era as documented in SDG 13 on action for climate change.

The impact of Control of Corruption shifted from significantly negative in the MDGs era ($b = -0.017$, $p < 0.05$) to insignificantly positive in the SDGs era ($b = 0.009$, $p > 0.10$) because of a decline in the control of corruption between the MDGs era (M = 70.17%) and the SDGs era (M = 67.25%) in Table 3. Although Government Effectiveness improved slightly between the MDGs (M = 88.46%) and SDGs eras (M = 89.14 %; Table 3), the impact is not appreciable in reducing carbon emissions, suggesting that government's commitment to improving public policy may not have seriously focused on carbon emissions reduction.

In the SDGs era, the impact of Regulatory Quality and Rule of Law is negative but not statistically significant (Table 9). The impact of Regulatory Quality on carbon emissions changed from a significant negative influence in the MDGs era ($b = -0.018$, $p < 0.10$) to an insignificant negative impact in the SDGs era ($b = -0.003$, $p > 0.10$), although there is slight improvement in the Regulatory Quality between the MDGs (M = 87.03%) and SDGs (M = 88.18%) era (Table 3). The result suggests that Regulatory Quality may not have focused specifically on carbon emissions reduction. Thus, there is the need for more action by the governments of nations to tighten regulation on environmental pollution in the aspect of carbon emissions. However, the impact of Rule of Law on carbon emissions rate shifted from positive in the MDGs era ($b = 0.016$, $p > 0.10$) to negative in the SDGs era ($b = -0.030$, $p > 0.10$). Although the negative impact of rule of law on carbon emissions is not statistically significant, it is commendable that the impact shifted from positive to negative between the MDGs and SDGs eras. This suggests that robust enforcement of environmental laws has the potential of lowering carbon emissions of MNEs. Overall, the inability of other country governance factors to notably impact carbon emissions reduction in the SDGs era when compared to the MDGs era reveals that the governments of nations have done little in the way of improving governance quality to meet net zero emissions target as argued in literature (Rupley et al., 2012; Yamineva and Liu, 2019; Bisdounis, 2023).

**Table 9**
Impact of country governance mechanisms on carbon emissions performance in the MDGs and SDGs eras.

| Variables | DV: Scope 3 Emissions Rate | |
|---|---|---|
| | MDGs Era | SDGs Era |
| Control of Corruption | −.017** (.008) | .009 (.010) |
| Voice & Accountability | −.014 (.010) | −.016* (.009) |
| Political Stability | .007* (.004) | .004 (.004) |
| Government Effectiveness | .035*** (.011) | .010 (.008) |
| Regulatory Quality | −.018* (.009) | −.003 (.009) |
| Rule of Law | .016 (.019) | −.030 (.020) |
| ***Firm Governance (control)*** | | |
| Board Meeting | −.009 (.006) | .003 (.003) |
| Board Independence | .392** (.180) | −.047 (.230) |
| Board Gender Diversity | −.133 (.335) | −.771** (.313) |
| CEO Duality | −.123* (.072) | .104 (.081) |
| ESG Compensation | −.040 (.047) | .031 (.044) |
| ***Firm characteristics (control)*** | | |
| Revenue | .722*** (.266) | .314 (.197) |
| Market Capitalisation | .163 (.163) | .236 (.144) |
| Leverage | 3.430 (.003) | .001 (.002) |
| Liquidity | .073 (.051) | −.025 (.033) |
| Profitability | −.009* (.005) | −.007* (.004) |
| Economic Development ***(control)*** | 6.011*** (.723) | 3.978*** (.947) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| **$R^2$** | 18.35% | 11.84% |
| **N** | 2,912 | 1,638 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

### 4.6. Impact of country governance on carbon emissions performance in geographical regions

Acknowledging that governance quality differs by countries and geographical regions (World Bank, 2023), and as also evidenced by empirical analysis (Table 4), we disaggregate the impact of country governance on carbon emissions performance into geographical regions to closely examine how jurisdictional characteristics affect commitment of MNEs to decarbonisation. Additional analysis was carried out by splitting the sample into five regions, notably America, Asia Pacific, Western Europe, Europe and Central Asia (ECA), and Middle East and North Africa (MENA) regions. However, considering the limited number of firms, countries, and firm-year observations in the ECA and MENA regions (Table 2), the analysis was restricted to the America, Asia Pacific, and Western Europe regions. The analysis was performed using carbon emissions rate as measure of carbon emissions performance, and the result is reported in Table 10.

The result in Table 10 shows that, in the America region, Control of Corruption has a significant negative impact on carbon emissions rate, whilst the impacts of Voice & Accountability, Government Effectiveness, and Regulatory Quality are negative but not statistically significant.

In the Asia Pacific region, Control of Corruption has a significant negative impact on carbon emissions rate. In the Western Europe region, Voice & Accountability and Rule of Law have significant negative impact on carbon emissions rate, whilst the impact of Control of Corruption is negative but not statistically significant. In sum, whilst Control of Corruption emerged as the strongest determinant of carbon emissions in the America and Asia Pacific regions, Rule of Law emerged as the strongest determinant in the Western Europe region. Control of Corruption exerts a negative impact on carbon emissions rate because of the generally high level of Control of Corruption in the three regions (Table 4).

Comparing the impact of Voice & Accountability on carbon emissions across the three regions, it has the greatest influence in the Western Europe region, and this is not unconnected to the result that Voice & Accountability is the strongest in the region (M = 92.34%) in comparison to the America (M = 83.19%) and Asia Pacific (M = 76.43%) regions (Table 4). Although Voice & Accountability is also somewhat high in the America region, the negative but insignificant impact of Voice & Accountability on carbon emissions in the America region suggests that the level of Voice & Accountability would have to be very high to motivate MNEs to commit to reducing scope 3 emissions. The same is true of the Asia Pacific region (with a relatively low Voice & Accountability score in comparison to the America and Western Europe regions), which accounts for its inability to affect decarbonisation in MNEs.

Whereas Government Effectiveness is generally high across the America (M = 90.44%), Asia Pacific (M = 87.46%), and Western Europe (M = 90.95%) regions (Table 4), Government Effectiveness is unable to significantly impact carbon emissions in the three regions (Table 10).

**Table 10**
Impact of Country Governance Mechanisms on Carbon Emissions Performance based on Geographical Regions.

| Variables | DV: Scope 3 Emissions Rate | | |
|---|---|---|---|
| | **America** | **Asia Pacific** | **Western Europe** |
| Control of Corruption | −.022* (.012) | −.055*** (.012) | −.004 (.010) |
| Voice & Accountability | −.007 (.018) | .010 (.012) | −.031** (.014) |
| Political Stability | .021* (.011) | .018** (.008) | .003 (.004) |
| Government Effectiveness | −.001 (.023) | .038*** (.012) | .007 (.015) |
| Regulatory Quality | −.024 (.016) | .028 (.017) | .001 (.013) |
| Rule of Law | .020 (.036) | .012 (.022) | −.040* (.023) |
| ***Firm Governance (control)*** | | | |
| Board Meeting | .022** (.008) | .001 (.008) | −.005 (.007) |
| Board Independence | .086 (.478) | .739** (.286) | .269 (.202) |
| Board Gender Diversity | −.042 (.407) | −2.751** (.623) | −.411 (.338) |
| CEO Duality | .100 (.105) | −.064 (.085) | −.066 (.102) |
| ESG Compensation | −.086 (.059) | .151 (.104) | −.046 (.055) |
| ***Firm characteristics (control)*** | | | |
| Revenue | 1.309*** (.287) | .188 (.369) | .232 (.242) |
| Market Capitalisation | −.057 (.190) | .046 (.235) | .238 (.182) |
| Leverage | −.006* (.003) | .010* (.005) | .001 (.004) |
| Liquidity | .043 (.037) | −.006 (.075) | .117 (.095) |
| Profitability | −.007 (.005) | .008 (.009) | −.012* (.006) |
| ***Period (MDGs/SDGs)*** | .396** (.148) | −.064 (.109) | .019 (.088) |
| Economic Development ***(control)*** | 5.863*** (1.806) | 5.582*** (1.071) | 4.827*** (.843) |
| Firm Effect | YES | YES | YES |
| Year Effect | YES | YES | YES |
| $\mathbf{R^2}$ | 35.93% | 37.30% | 24.69% |
| **N** | 2,020 | 1,310 | 1,093 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

The result buttresses the contention that government's commitment to addressing carbon emissions appears to be low. This is also true for Regulatory Quality, in which Regulatory Quality is generally high across the America (M = 89.92%), Asia Pacific (M = 84.21%), and Western Europe (M = 91.41%) regions (Table 4) but does not significantly impact carbon emissions reduction (Table 10).

Although Rule of Law is also high in the America (M = 90.31%), Asia Pacific (M = 84.66%), and Western Europe (M = 91.50%) regions (Table 4), its impact is negative and statistically significant in only the Western Europe region (b = −0.040, p < 0.10; Table 10). This implies that it is not the mere existence of functional Rule of Law that enhances carbon emissions performance, but the laws should focus on environmental protection to compel compliance to achieve net zero emissions. The notable impact of Rule of Law in Western Europe could be traceable to strong environmental protection and emissions law in those jurisdictions (Bisdounis, 2023).

## 5. Robustness check for endogeneity and sample selection bias

Corporate governance variables were introduced as control variables because corporate governance mechanisms affect environmental performance (Elsayih et al., 2021; Nuber and Velte, 2021). However, board gender diversity consistently emerged as a significant driver of carbon emissions performance (Tables 7–9). Literature suggests that simultaneity could occur between board gender diversity and environmental performance (Tingbani et al., 2020; Konadu et al., 2022). Therefore, to alleviate any potential endogeneity between board gender diversity and carbon emissions performance, we carry out a robustness check using the two-stage least squares (2SLS)/instrumental variable (IV) regression (Ullah et al., 2021) and propensity score matching (Tawiah et al., 2022). To check for robustness of results for sample selection bias, the Heckman two-step sample selection model was employed.The results of robustness check for endogeneity and sample selection bias are presented in this section.

### 5.1. Robustness check using two-stage least squares regression

In performing the two-stage least squares regression, five variables were applied as the instrument for board gender diversity as suggested by literature (Tingbani et al., 2020; Konadu et al., 2022).

(i) Board size;
(ii) Strictly independent directors ratio, measured as the ratio of independent directors to total board size;
(iii) Executive director (ED) gender diversity measured as the ratio of female executive directors to total number of executive board members;
(iv) Board nationality diversity measured as the ratio of directors from foreign nationalities to total board size;
(v) ED nationality diversity, measured as the ratio of executive board members from foreign nationalities to total number of executive board members;

These variables were selected as the instrument (IV) for board gender diversity for two reasons. First, they influence the overall composition of female board directors in relation to the total board size (i.e., board gender diversity) in the sense that (a) the presence of independent directors may facilitate the appointment of more female board directors given that the level of board gender diversity should be reasonable before board gender diversity can appreciably influence environmental performance (Nuber and Velte, 2021), hence the inclusion of strictly independent directors ratio as IV; (b) the number of female executive directors ultimately contributes to the total number of female directors on the board (Nadeem et al., 2020), hence the inclusion of Executive director (ED) gender diversity as IV; and (c) appointing directors from diverse nationality increases the chances of female board representation at executive management and non-executive directorship levels to achieve board diversity (Rao and Tilt, 2016; Gull et al., 2023), thereby informing the inclusion of board nationality diversity and ED nationality diversity as IVs. Second, there is no theoretical reasoning to believe that these instrumental variables would have a direct impact on scope 3 carbon emissions rates. These two conditions satisfy the conceptual definition of instrumental variable (Ullah et al., 2021).

To test the validity of the instruments, we employ the Anderson canonical correlation LM statistic for the Under-identification test and Stock–Yogo weak ID analysis for weak identification test (Stock and Yogo, 2005). Whilst the under-identification test examines whether instrumental variables are less powerful than the endogenous/instrumented variable, the weak identification test examines whether instrumental variables are an appropriate replacement for the endogenous variables in the regression equation. The Anderson canon. corr. LM statistics is statistically significant for Scope 3 Emissions Rate (329.88, p < 0.01) and Scope 3 Emissions Intensity (325.67, p < 0.01), confirming that the model is not under-identified. The Cragg Donald Wald F statistics for Scope 3 Emissions Rate (64.893) and Scope 3 Emissions Intensity (63.784) is greater than the Stock–Yogo weak ID test critical values (19.28, 11.12, 6.76, 5.15, 29.18, 16.23, 11.72, 9.38) in all cases. The result establishes that there is no weak identification problem. Both tests confirm that the instrumental variables are valid predictors for the endogenous variables in the regression equation. The result of the instrumental variable regression is presented in Table 11.

The result (Table 11) shows that Control of Corruption and Voice & Accountability are significantly and negatively associated with carbon emissions using both carbon emissions rate and carbon emissions intensity as measures of carbon emissions performance. The result supports the full acceptance of H1 and H2. Political Stability and Government Effectiveness have significant positive impact, whilst the impact of Regulatory Quality and Rule of Law is negative but not

**Table 11**
Robustness Check Result on impact of Country Governance Mechanisms on Carbon Emissions Performance using Two-stage least squares Regression.

| Variables | Scope 3 Emissions Rate | Scope 3 Emissions Intensity |
|---|---|---|
| Control of Corruption | −.022*** (.006) | −.023*** (.006) |
| Voice & Accountability | −.015** (.006) | −.013** (.006) |
| Political Stability | .005** (.003) | .003 (.004) |
| Government Effectiveness | .020** (.008) | .020** (.008) |
| Regulatory Quality | −.013 (.009) | −.013 (.009) |
| Rule of Law | −.009 (.013) | −.009 (.013) |
| ***Firm Governance (control)*** | | |
| Board Meeting | .005 (.004) | .005 (.004) |
| Board Independence | .541*** (.186) | .558*** (.185) |
| Board Gender Diversity (instrumented) | −2.045* (1.156) | −1.792* (1.169) |
| CEO Duality | −.044 (.057) | −.030 (.055) |
| ESG Compensation | −.022 (.039) | −.034 (.038) |
| ***Firm characteristics (control)*** | | |
| Revenue | .325 (.218) | −.483** (.217) |
| Market Capitalisation | .256** (.115) | .205* (.114) |
| Leverage | .001 (.003) | .001 (.002) |
| Liquidity | .028 (.031) | .027 (.031) |
| Profitability | −.006 (.004) | −.004 (.003) |
| ***Period (MDGs/SDGs)*** | .231*** (.073) | .241*** (.073) |
| Economic Development ***(control)*** | 6.043*** (.970) | 5.594*** (.984) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| **$R^2$** | 27.69% | 23.38% |
| **N** | 4,550 | 4,550 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

**Table 12**
Robustness Check Result on impact of Country Governance Mechanisms on Carbon Emissions Performance using Propensity Score Matching.

| Variables | Scope 3 Emissions Rate | Scope 3 Emissions Intensity |
|---|---|---|
| Control of Corruption | −.020*** (.006) | −.021*** (.006) |
| Voice & Accountability | −.013** (.006) | −.012* (.006) |
| Political Stability | .008** (.003) | .007** (.003) |
| Government Effectiveness | .018** (.008) | .018** (.008) |
| Regulatory Quality | −.004 (.007) | −.006 (.007) |
| Rule of Law | −.010 (.013) | −.012 (.013) |
| ***Firm Governance (control)*** | | |
| Board Meeting | .002 (.004) | .003 (.004) |
| Board Independence | .586*** (.199) | .581*** (.199) |
| Board Gender Diversity (pscore) | −.568* (.304) | −.506* (.305) |
| CEO Duality | −.033 (.056) | −.042 (.056) |
| ESG Compensation | −.016 (.040) | −.022 (.040) |
| ***Firm characteristics (control)*** | | |
| Revenue | .564*** (.156) | −.275* (.156) |
| Market Capitalisation | .240** (.113) | .201* (.113) |
| Leverage | .001 (.002) | .001 (.002) |
| Liquidity | .018 (.032) | .020 (.032) |
| Profitability | −.005 (.003) | −.003 (.004) |
| ***Period (MDGs/SDGs)*** | .283*** (.092) | .291*** (.092) |
| Economic Development ***(control)*** | 4.660*** (.516) | 4.444*** (.516) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| **$R^2$** | 28.77% | 24.37% |
| **N** | 4,550 | 4,550 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

statistically significant. This is consistent with the baseline result in Table 6.

The coefficient of determination for the model with scope 3 emissions rate as the dependent variable in Table 11 ($R^2 = 27.69\%$) has a comparable effect size with that of Table 6 ($R^2 = 28.97\%$) for scope 3 carbon emissions rate. This is also true for the alternative measure of carbon emissions performance using scope 3 carbon emissions intensity with $R^2 = 23.38\%$ (Table 11) and $R^2 = 24.18\%$ (Table 6), respectively, for the baseline result and instrumental variable regression. In sum, the consistency of the result in Table 11 with the baseline result (Table 6) confirms that the result is robust to endogeneity and alternative measurements of carbon emissions performance.

### 5.2. Robustness check using propensity score matching

To further address potential endogeneity concerns with respect to simultaneity between carbon emissions management and board gender diversity, propensity score matching with regression analysis was employed (Peel, 2018; Tawiah et al., 2022). Using the median score of board gender diversity at 17.0%, firms were divided into the treatment group (i.e., firms with above-median gender diversity scores) and the control group (i.e., firms with median/below-median gender diversity scores). Thereafter, the propensity scores (i.e., probability of being assigned to a treated/control group) were generated by regressing the control variables (i.e., firm governance variables and firm characteristics) on the binary categorisation of board gender diversity (code '0' for control group, and code '1' for treatment group). This procedure eliminates the potential endogeneity issue, whilst also minimising likely model misspecification (Tawiah et al., 2022). The propensity scores generated by the process were then substituted for board gender diversity, and the regression was rerun using scope 3 emissions rate and scope 3 emissions intensity as the measure of carbon emissions performance. The result from the analysis is presented in Table 12.

The result in Table 12 shows that Control of Corruption and Voice & Accountability have significant negative impact on carbon emissions using both carbon emissions rate and carbon emissions intensity as measures of carbon emissions performance. The result supports the full acceptance of H1 and H2. Political Stability and Government Effectiveness have significant positive impact, whilst the impact of Regulatory Quality and Rule of Law is negative but not statistically significant. This is consistent with the baseline result in Table 6.

The coefficient of determination for the model with scope 3 emissions rate as the dependent variable in Table 12 ($R^2 = 28.77\%$) has a comparable effect size with the baseline result in Table 6 ($R^2 = 28.97\%$). This is also true for the alternative measure of carbon emissions performance using scope 3 carbon emissions intensity with $R^2 = 24.37\%$ (Table 12) and $R^2 = 24.18\%$ (Table 6). Taken together, the consistency of the PSM result in Table 12 with the baseline result in Table 6 establishes that the result is robust to endogeneity and the alternative measurement of carbon emissions performance.

### 5.3. Treatment of sample selection bias

After excluding non-financial firms on the Forbes 500 list with no carbon emissions disclosure/environmental sustainability performance report, the study analysed empirical evidence from 336 MNEs over a 15-year period resulting in analysis of 4,550 firm-year observation. Results may be affected by self-selection bias as regression model specified in equation (1) and the ensuing regression analysis are based on scope 3 disclosure.

To check for robustness of results for sample selection bias, the Heckman two-step sample selection model was employed in line with prior studies (Khan et al., 2023; Bose et al., 2023). In the first stage of the Heckman procedure (i.e., the selection model), a probit model is developed for a firm's decision to disclosure scope 3 emissions, as specified in equation (2):

$$\Pr(CEP_DISC)_{it} = \mu_0 + \mu_1 CoC_{it} + \mu_2 VAC_{it} + \mu_3 PLS_{it} + \mu_4 GEF_{it} + \mu_5 REQ_{it} + \mu_6 RoL_{it} + \mu_7 BMT_{it} + \mu_8 BIN_{it} + \mu_9 IND_BGD_{it} + \mu_{10} CEO_{it} + \mu_{11} COM_{it} + \mu_{12} REV_{it} + \mu_{13} MKT_{it} + \mu_{14} LEV_{it} + \mu_{15} LIQ_{it} + \mu_{16} PRF_{it} + \mu_{17} ERA_{it} + \mu_{18} ECD_{it} + \epsilon_{it} \quad \text{(Eq. 2)}$$

In equation (2), *CEP_DISC* is the dependent variable which is measured as a binary indicator variable for scope 3 emissions disclosure. If scope 3 emissions are disclosed in a year, a code of '1' is assigned, while non-disclosure takes a value of '0'. Several variables are included in equation (2) based on the baseline model in equation (1). Furthermore, IND_BGD (industry board gender diversity rate) is included in the first stage/selection model in equation (2) as the instrumental variable for firm-level board gender diversity to satisfy the exclusion restriction criteria. Firm's industry board gender diversity rate was used as the instrument for board gender diversity in line with prior studies (Solal and Snellman, 2019; Xie et al., 2023). A firm's industry board gender diversity rate was computed as the average level of board gender diversity in the industry where a firm operates (Liu et al., 2014; Solal and Snellman, 2019). The rationale for firm's industry board gender diversity rate as the instrumental variable for board gender diversity in equation (2) are that: (i) a firm's board gender diversity rate may be correlated with the industry rate, given that the firm's board gender diversity is used in the computation of peer/industry average; (ii) there is no theoretical reasoning to believe that the industry average board gender diversity rate would have a direct impact on the carbon emissions performance of an organisation. These two conditions satisfy the conceptual definition of an instrumental variable. In essence, firm's industry board gender diversity rate was substituted for/used as the instrument for board gender diversity in the selection model (first step), and all covariates were included in the model. All variables are defined in Table 1. The regression model in equation (2) was run based on data from all the 340 non-financial firms (whether they disclosed scope 3 emissions information or not) for the 15-year period under investigation, resulting in 5,100 firm-year observations to take care of selection bias.

In the second step of the Heckman procedure, board gender diversity (at the firm-level) was entered in the regression model with all covariates, using emissions rate as the dependent variable in the main model in equation (3):

$$CEP_{it} = \alpha_0 + \alpha_1\, CoC_{it} + \alpha_2\, VAC_{it} + \alpha_3\, PLS_{it} + \alpha_4\, GEF_{it} + \alpha_5\, REQ_{it} + \alpha_6\, RoL_{it} + \alpha_7\, BMT_{it} + \alpha_8\, BIN_{it} + \alpha_9\, BGD_{it} + \alpha_{10}\, CEO_{it} + \alpha_{11}\, COM_{it} + \alpha_{12}\, REV_{it} + \alpha_{13}\, MKT_{it} + \alpha_{14}\, LEV_{it} + \alpha_{15}\, LIQ_{it} + \alpha_{16}\, PRF_{it} + \alpha_{17}\, ERA_{it} + \alpha_{18}\, ECD_{it} + \alpha_{19}\, IMR_{it} + \epsilon_{it} \quad \text{(Eq. 3)}$$

All variables are as defined in Table 1. The inverse Mills ratio (IMR) generated in regression model in equation (2) is included as control variable in the second step of the Heckman procedure to account for self-selection bias in equation (3). The results of the analysis are reported in Table 13.

Results in Table 13 for the main model show that Control of Corruption and Voice & Accountability have significant negative impact on carbon emissions rate; Political Stability and Government Effectiveness have significant positive impact, whilst Regulatory Quality and Rule of Law have negative but no statistically significant impact on carbon emissions rate. The inverse Mill's ratio (Lambda coefficient = 0.659) is not statistically significant ($p = 0.122 > 0.10$), which establishes that self-selection bias is not a problem. Taken together, results in Table 13 are consistent with results in Table 6, establishing that the baseline result is robust to self-selection bias and endogeneity.

**Table 13**
Heckman two-step sample selection results on the impact of country governance mechanisms on carbon emissions performance.

| Variables | Step 1 (Selection Model) DV: Scope 3 Emissions Disclosure | Step 2 (Main Model) DV: Scope 3 Emissions Rate |
|---|---|---|
| Control of Corruption | −.008** (.003) | −.020*** (.006) |
| Voice & Accountability | −.025*** (.003) | −.010* (.009) |
| Political Stability | .002 (.001) | .006** (.003) |
| Government Effectiveness | .021** (.008) | .030*** (.011) |
| Regulatory Quality | −.056* (.009) | −.010 (.015) |
| Rule of Law | −.034 (.008) | −.016 (.012) |
| ***Firm Governance (control)*** | | |
| Board Meeting | .009* (.003) | .002 (.006) |
| Board Independence | −.277** (.117) | .037 (.156) |
| Board Gender Diversity (industry average.) | −.420*** (.132) | |
| Board Gender Diversity | | −.838** (.251) |
| CEO Duality | −.057 (.047) | .108* (.055) |
| ESG Compensation | −.448** (.049) | −.291** (.114) |
| ***Firm characteristics (control)*** | | |
| Revenue | .050 (.065) | 1.090*** (.078) |
| Market Capitalisation | .185*** (.070) | .340*** (.099) |
| Leverage | .003 (.001) | .001 (.002) |
| Liquidity | .001 (.020) | −.039 (.027) |
| Profitability | −.005* (.003) | −.018*** (.004) |
| ***Period (MDGs/SDGs)*** | .121** (.032) | .109** (.013) |
| Economic Development ***(control)*** | 1.118*** (.203) | .115 (.370) |
| Inverse Mills ratio (IMR) | | .659 (.426) |
| Firm Effect | YES | YES |
| Year Effect | YES | YES |
| **N** | 5,100 | 5,100 |

Standard error in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10.

## 6. Discussion

The results show that, at the aggregate level, Control of Corruption and Voice & Accountability are significantly and negatively associated with carbon emissions rate. The ability of Voice & Accountability to significantly diminish carbon emissions rate suggests that there is an increasing awareness on the need to address climate change challenges (Lavuri et al., 2023; Shahbaz et al., 2023). From the use of gasoline for powering vehicles, and the use of coal for heating buildings, to the use of fossil fuel for running production plants in large industrial settings, the burning of fossil fuel through various domestic and industrial activities generates greenhouse gas emissions such as carbon dioxide and methane, which negatively affect the ecosystem. Emissions levels continue to rise despite the increasingly reported consequences of climate change (Huang et al., 2023). However, there are now ongoing efforts to seriously address these issues. A case in point is the agenda for COP 28 (i.e., 28th meeting of the Conference of the Parties, COP, to the UNFCCC), in which dramatically cutting carbon emissions level is a key focus (United Nations, 2023), thus reiterating the growing clamour for climate action.

The negative but insignificant impact of Regulatory Quality and Rule of Law on carbon emissions rate suggests that regulations can assist in achieving net zero targets. As the debate on carbon emissions reduction intensifies at the world scene, it may be expected that legislations and their enforcements will be strengthened at country and/or regional levels to achieve global emissions reduction targets. The claim on collective efforts in tackling carbon emissions at transnational level is evidenced by the fact that, at the time of writing, the first-ever global stocktake on climate action will conclude at COP 28. The global stocktake is a process for countries and stakeholders to assess whether they are collectively making progress towards meeting the goals of the Paris Climate Change Agreement.

In carbon-intensive industries, Control of Corruption and Rule of Law have significant negative impact on carbon emissions rate, while the impact of Voice & Accountability is negative but not statistically significant. However, in non-carbon-intensive industries, Control of Corruption, Voice & Accountability, and Regulatory Quality have significant negative impact on carbon emissions rate. The ability of Control of Corruption to influence scope 3 emissions significantly and negatively in both carbon-intensive and non-carbon-intensive industries reiterates the importance of strong institutional framework in checkmating corrupt environmental practices. Control of Corruption and

Regulatory Quality have significant negative impact on carbon emissions rate in the MDGs era. The impact of Voice & Accountability is negative but not statistically significant. In the SDGs era, the governance factor influencing decarbonisation shifted to Voice & Accountability. This is another empirical evidence buttressing the claim that there are now ongoing efforts to seriously address carbon emissions issues.

At the geographical region, whilst Control of Corruption emerged as the strongest determinant of carbon emissions in the America and Asia Pacific regions, Rule of Law emerged as the strongest determinant in the Western Europe region. Although Rule of Law is also high across the America, Asia Pacific, and Western Europe regions, its impact is negative and statistically significant in only the Western Europe region. This implies that it is not the mere existence of potent rule of law that enhances carbon emissions performance, but that such laws must be focused on ensuring compliance with environmental regulations. As governments of nations will be taking a decision on the global stocktake at COP 28 (United Nations, 2023), which can be leveraged to accelerate ambition in their next round of climate action plans due by 2025, it may be expected that an area of top priority will be to strengthen environmental laws and finance projects /initiatives on climate change, amongst other issues.

## 7. Conclusion

This study investigates the impact of country governance on carbon emissions performance of private sector organisations using empirical evidence from 336 top multinational entities (MNEs). The results show that, at the aggregate level, Control of Corruption and Voice & Accountability are significantly and negatively associated with carbon emissions rate. Whilst Political Stability and Government Effectiveness have significant positive impact on carbon emissions rate, the impact of Regulatory Quality and Rule of Law is negative but insignificant. Overall, empirical evidence supports the conclusion that the existing institutional environment is not sufficient to deliver the net zero transition. However, there are now ongoing efforts to seriously address these issues. A case in point is the agenda for the 28th meeting of the Conference of the Parties to the UNFCCC (COP 28), in which dramatically cutting carbon emissions level is a key focus.

The study is unique by contributing to knowledge in four ways. First, it examines the impact of country governance mechanisms on firm-level carbon emissions performance of private sector organisations, particularly with reference to scope 3 emissions. Whilst studies examining the impact of country-level/public governance factors on environmental issues are limited, the study is different from related studies by focusing on scope 3 emissions. Meanwhile, studies on carbon emissions management have predominantly examined scope 1 and scope 2 emissions because of the challenges of measuring and obtaining data for scope 3 emissions (Nuber and Velte, 2021; Konadu et al., 2022). However, it is important to conduct an inquiry into scope 3 emissions because controlling scope 3 emissions provides greater opportunity for organisations to address carbon emissions issues more comprehensively— for many businesses, scope 3 emissions account for more than 70 percent of their carbon footprint (Deloitte, 2022). Second, by adopting a longitudinal study outlook, the study presents evidence on how country governance mechanisms impact carbon emissions performance of MNEs differently in the MDGs and SDGs eras. Related studies examining the subject did not disaggregate results in this manner (e.g., Tilt, 1994; Neu et al., 1998; Yamineva and Liu, 2019). With the SDGs set to expire by 2030, the study provides empirical evidence on the efforts that governments of countries are making to achieve decarbonisation targets through improvements in country governance quality in the pre- and post- SDGs eras. Third, whereas related prior studies did not decompose results by countries/geographical regions (e.g., Rupley et al., 2012; Yamineva and Liu, 2019), the current study adopts a cross-country approach to present empirical evidence that the impact of country governance on carbon emissions performance of MNEs is contextual and varies across jurisdictions/geographical regions as suggested by institutional theory (DiMaggio and Powell, 1991; Saqib et al., 2021). Finally, the paper contributes to the debate on the actualisation of Agenda 2030, because presenting empirical evidence on the impact of country governance mechanisms on carbon emissions reduction—particularly scope 3 emissions, as documented in the current study—is an important discourse in the realisation of the SDGs.

The study recommends that there should be more coordination, strategic planning, and delivery monitoring in government institutions to achieve decarbonisation targets. Considering that the achievement of Agenda 2030 requires that countries design and implement programmes appropriate to their environment, some countries have started taking actions aimed at delivering net zero in their jurisdictions. Other countries—especially developing countries—that are yet to develop policies/publish roadmaps for boosting emissions abatement activities should do so as a matter of urgency. This is because reducing carbon emissions, and generally combating environmental pollution at the global level, require concerted effort by all nations of the world. The current study examines the impact of country governance mechanisms on carbon emissions performance of top multinational entities (MNEs) on the Forbes list which are predominantly based in developed countries. The findings from the current study may, therefore, not be generalisable to indigenous companies or companies operating in developing countries. Future studies may analyse evidence from developing countries to increase knowledge on the influence of country governance on carbon emissions performance of private sector organisations. Such studies should also enhance the generalisability of the results in this area of research. Considering that large-sized organisations (the focus of the current study) differ from small- and medium-scale enterprises in terms of size, governance structure, stakeholder pressure, resources availability, and degree of government regulation, amongst other considerations, future studies may examine the impact of country governance on the carbon emissions performance of small and medium-sized organisations. Financial institutions were also excluded in the current study. However, as financial institutions are increasingly committing to sustainability initiatives in recent times, it is important to investigate the influence of country governance mechanisms on the environmental/carbon emissions performance of financial institutions. As there are three mechanisms of institutional isomorphism—notably, mimetic processes, normative pressures, and coercive isomorphism—the current study examines the impact of coercive isomorphic factors on carbon emissions performance. Future studies may investigate the impact of mimetic processes and normative pressures on carbon emissions management.

## CRediT authorship contribution statement

**Babajide Oyewo:** Writing - original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Venancio Tauringana:** Writing - review & editing, Supervision. **Vincent Tawiah:** Writing - review & editing, Methodology. **Oluseyi Aju:** Writing - review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

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