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Achieving carbon neutrality in post COP26 in BRICS, MINT, and G7 economies: The role of financial development and governance indicators

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ABSTRACT

Pledges and commitments from governments of wealthy nations were made at the COP26 Glasgow summit, thereby rejuvenating hope among nations to confront the climate change challenge. Thus, the study examines the complementarity of financial development and carbon emissions, while accounting for the conditional influence of good governance under three disaggregated indicators – economic, institutional, and political governance for the BRICS, MINT, and the G7 economies. First, the study reveals that financial development depending on the adopted indicator has mixed effects on environmental pollution levels. Specifically, financial development triggers the highest pollution effect via domestic credit to the private sector compared to foreign direct investments, while financial development index reduces environmental pollution. Secondly, economic governance promotes environmental quality by reducing environmental pollution through quality regulation. Third, institutional governance through weaker rule of laws induces pollution, while the control of corruption antagonizes pollution levels. Furthermore, only the voice of accountability supports the pollution-mitigating effect of political governance. On a bloc-to-bloc comparative analysis, governance effectiveness promotes environmental pollution in all the three economic blocs albeit at different magnitudes while the voice of accountability exerts a significant desirable impact on pollution only in the G7 countries. Lastly, renewable energy and trade liberalization exerts a negative and positive influence on environmental degradation respectively.

1. Introduction

Currently, countries are increasingly being confronted with climate change issues, thus compelling governments around the globe to devise new measures for addressing the global menace. However, the problem has compounded over the past couple of decades. Since the first Conference of Parties (COP) in 1992, there have been three decades of climate negotiations, yet the frequency and severity of adverse climate consequences are still rising (Hill, 2021; Singh et al., 2021; Wang et al., 2021). Based on the continual commitment to improving environmental quality by governments, the Paris agreement accord was recently reaffirmed in Glasgow. The COP26 occurred at a critical time when extensive decarbonization is being demanded. Post covid, countries are engaged in economic recovery strategies, including contextualizing resource utilization under sustainable envelopes. However, there are still lingering pertinent questions that need to be answered such as "Do thriving financial markets and financial institutions harm the environment as they arguably aid development?".

Moreover, a recent climate change assessment has underlined the grave risks that climate change, global warming, and the related severe weather events pose to the globe, necessitating further investigations (Stern, 2022; Tao et al., 2022). Along with avoiding them and reducing

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them, offsetting carbon emissions is a crucial step in comprehensive climate action (Wang et al., 2022). Carbon neutrality has the potential to significantly reduce global warming, end the global energy crisis, and also improve air quality and human health. Achieving this may be considered an industrial revolution and a significant turning point in the history of humanity (Wang et al., 2020). Whether carbon neutrality is possible in the context of the existing energy system is still unknown. Hence four (4) policy framework threads support the contributions of this article: (i) the primary motivations for concentrating on and exploring three major economic blocs; (ii) broadening the scope of the financial development-carbon emissions link; (iii) assessing the significance of governance quality in enhancing environmental protection; and (iv) addressing identified gaps in the literature. The remainder of this section further expatiates the motivation of this study to the extant literature as outlined earlier.

First, most economies in BRICS, MINT, and the G7[1] economies are developed and linked with significant environmental deterioration. However, since production processes primarily rely on fossil fuels, mitigating carbon dioxide emissions in these economies seems unattainable (Emblemsvåg, 2022; Alola et al., 2021; Kaya et al., 2019; Alola and Onifade, 2022). In this regard, ascertaining how financial development (FD) and governance quality affect national environment quality is prudent within these advanced economies. Second, the outcomes of the limited studies on the nexus between FD and carbon emission have also been contradictory (Forson et al., 2017; Gossel, 2018; Krifa-Schneider et al., 2022). However, suggestions to improve funding mechanisms and promote financial cooperation to achieve the financial targets for sustainable green energy projects continue to motivate the activities of BRICS, MINT, and G7 nations among others. Another front of the argument suggests that the increase in financial growth has led to the growth of energy usage, thus, generating environmental concerns. Third, the role of governance can not be discounted under the framework of environmental Protection. Thus, the pollution-haven hypothesis showed that lax environmental regulations in the host nation might encourage additional foreign direct investment from businesses seeking to avoid expensive compliance with regulatory requirements in their home countries (Akram et al., 2022; Bouzahzah, 2022). This makes the involvement of good governance an essential tool to check financial development and promote sustainable development. However, it is often an ignored factor in the environmental quality debate. Additionally, institutional quality is critical to prompt the adoption of green energy sources, green investment, and friendly global commerce (Lin et al., 2019). When governmental organizations properly execute environmental laws and regulations, institutional quality promotes ecological quality.

In the contemporary world, a polluted environment is often seen as a major barrier to sustainable economic growth. Several studies have noted that environmental quality improvement is still necessary to achieve sustainable development (Zafar et al., 2020; Bekun et al., 2022; Gyamfi et al., 2022; Onifade and Alola, 2022). Additionally, the works of Usman et al. (2020) and Zafeiriou et al. (2022) support the idea that financial development (FD) and institutional mandates might be a catalyst for environmental protection. However, this remains a research gap since there is a lack of solid empirical data. Additionally, to best of the our knowledge, no research has been conducted to contrast this occurrence within the context of the three economic blocs (i.e. BRICS, MINT & G7).

Following the motivation of the study outlined above, three(3) strands of research gaps are identified: First, despite the expanding body of knowledge, it is still unclear whether financial development has a good or adverse impact on environmental deterioration. Second, this study broadens the scope of FD by expanding the proxies of financial development. Importantly, the current analysis uses a relatively new FD measure developed by the International Monetary Fund (IMF) in addition to two proxies from the world bank to provide a wholesome outlook on FD. Additionally, among the numerous innovative approaches, it is crucial to consider the role of the government in various policy alternatives when developing an environmental plan for mitigating carbon emissions. In closing this gap, this study would moderate the impact of good governance in mitigating the adverse effect or otherwise of financial development on the environment. In deepening the moderation effect, the study uses subset categories of governance metrics that would better inform policy engagement as espoused by (Omri and Ben Mabrouk, 2020). The last shortcoming in the literature is often the scope of the investigation which is either country-specific or solely on economic blocs. However, this work bridges this gap through a comparative analysis of the three major economic blocs mentioned earlier. Thus, this work opens up an important step toward addressing the ongoing financing disparity between mitigation and adaptation initiatives arising from the discussion at cop26 (Mountford et al., 2021). Moreover, this study demonstrates the effectiveness of governance in mitigating the harmful influence of financial boom on ecosystems.

The remainder of the paper is dedicated to the following sections: section 2 discusses theories underpinning the work, section 3 elaborates on the method to be used to test the hypothesis, section 4 presents the results and discusses its relevance, and section 5 concludes and renders policy recommendations.

2. The theoretical underpinnings and empirical literature

The interest of researchers, academics, economists, and policymakers in financial development (FD) has increased significantly in recent decades (Huang et al., 2021; Lei et al., 2022). Due to the technical dissemination it creates, many studies have considered FD a positive factor for an economy (Nguyen et al., 2022; Ren et al., 2022; Ilham et al., 2022). The propensity of FD's to enable robust economic expansion makes them an intermediate factor in environmental sustainability under the framework of the environmental Kuznets curve (Jakada et al., 2022; Onifade, 2022; Usman and Balsalobre-Lorente, 2022). For a country to flourish both economically and socially, a thriving financial sector is crucial. It is also critical to assess how FD affects the environment. Several research exists on the relationship between FD and environmental quality, however, the findings are conflicting. Most often, FD is measured using domestic credit to the private sector, liquid liabilities, and deposited money (bank assets) as a percentage of GDP (Bilgili et al., 2020; Usman and Balsalobre-Lorente, 2022). According to the first body of research, FD considerably improves environmental sustainability by halting environmental deterioration. For example, Tamazian et al. (2009) and Zoaka et al. (2022) looked at how FD affected carbon emissions in the BRICS economies. The former discovered that by lowering carbon emissions, FD improves environmental quality. FD and environmental degradation were shown to have a favorable association, according to (Jalil and Feridun, 2011) and (Tang et al., 2022). Salahuddin and Alam (2015) discovered that FD has a moderating impact on carbon emissions in China (Dogan and Seker, 2016). also looked at the relationship between FD and environmental quality in 23 different nations. They discovered that FD promotes environmental quality by reducing environmental degradation using the FMOLS and DOLS methodology.

However, the complexity has been in how financial development is described and conformity for policy implementation. Some studies (Onyeisi et al., 2018; Patterson et al., 2017) define financial development as the ratio of domestic credit to the private sector to GDP. It is estimated that an increase in bank loans to the private sector adds to sectoral growth and output expansion. However, how businesses use this resource to supply through banks is critical. The influence of bank loans on carbon emissions has been described in two ways in extant literature. According to Nasir et at., domestic loan to the private sector negatively

[1] See Table 11 in the Appendix for the full list of countries in the BRICS, MINT, and G7 economies.

influences carbon emissions and increases pollution levels (Nasir et al., 2019). This infers exploitation of the natural resource for profiteering at the expense of the customer being exposed to pollution. Other studies ascertain a positive cohesion between bank capital injection into an economy and carbon emission since it instigates a green economy. A green economy follows the principle of the environmental Kuznets curve and abates carbon emissions.

A newly incorporated financial development is the FD index by IMF (Svirydzenka, 2016). It offers governments a comprehensive way to benchmark numerous aspects of their financial systems. However, it has not brought closure to the contradictory results on the FD-carbon (Iorember et al., 2020; Nathaniel, 2021; Shobande and Ogbeifun, 2022).

Another school of thought relates FD to the market openness to foreign direct investment (FDI), and this phenomenon associates it with contrary implications on the environment. Foreign direct investment, a component of FD, delivers cash, cutting-edge technology, and managerial expertise to a host nation, thereby advancing economic development and technological advancement(Rehman and Islam, 2022). Additionally, investments from multinational corporations typically create jobs for citizens of the host country. This boosts economic activities, with a resultant negative impact on the environment. Also, such economic expansions thrive on energy consumption, predominately fossil fuel. On the contrary, some academics argue that financial development may spur eco-friendly technical innovation (Hyun, 2022; Usman et al., 2022; Zhang et al., 2022). They observe that FD strives for a less polluted environment by providing eco-friendly items and promoting sustainability of regional, national, and global development. This phenomenon has sparked academic interest in determining the impacts of FD on the environment and their many consequences. In the case of France, Shahbaz et al. (2018) identified FDI as the primary source of environmental damage (Kivyiro and Arminen, 2014). found that the influence of FDI on the Sub-Saharan area is neither favorable nor adverse, leaving a substantial imprint. These studies omitted the critical financial growth and development variable with good governance indicators, which could help produce more robust outcomes.

A more robust competitive landscape is often coupled with solid governance or an enabling environment. While economic considerations remain the most important determinants of their financial development, variables dictating a welcoming FDI landscape are also important in the multinational corporation (MNC) decision process. As a result, these FDI scholarships have emerged.

The first strand emphasizes how institutions as a subset of governance affect foreign direct investment. Institutional regimes are the laws and values that guide and control people's behavior in an economy. They are thought of as national factors. As a result, they could influence the "*rules of the game*" for MNC operations and influence foreign investments. Additionally, the integrity of local markets is ensured by property rights, political stability, openness, and the absence of (or low levels of) corruption. Therefore, good institutions impact the likelihood of foreign investors receiving returns on their investments. Also, a buoyant economy thrives on a reliable set of rules of law. This makes the role of governance an essential component for stimulating financial development in a country. To this end, Krifa-Schneider and Matei (2010),.studying 33 developing countries, concluded that political stability induces financial development–FDI inflow. This was further endorsed by (Yakubu et al., 2021) and (Gao et al., 2022) for Egypt and China respectively.

Corruption, on the other hand, hinders financial progress. Corruption is often related to institutional weaknesses and is cited as a critical factor affecting FDI flows (Gossel, 2018; Appiah et al., 2022; Onody et al., 2022). In two competing perspectives, the role of corruption is called into doubt. On the one hand, corruption is seen as a "lubricant element" that might help to unblock any capital flow issues and therefore serves to "oil the wheels," allowing a relative attractiveness of FDI in an economy. On the other hand, corruption is a barrier that raises the expenses of MNCs and hence deters investors by acting as "sand in the wheels" of the economy. The next section addresses the debates around these two ideas.

Reviewing the relevance of governance to sustainable development is motivated by two main factors, namely, (i) the contemporary concern related to the pollution of the environment; (ii) poor governance issues connected with the management of the policy syndrome of environmental pollution; The factors are expanded chronologically in the subsequent paragraphs.

The first strand is predicated on poor governance strategy towards the transition to clean energy or accessing the policy implementation of the environmental Kuznets curve, which is also predicated on the prospect of accelerating growth to abate pollution under key metrics, Ceteris paribus. The Second strand highlights the need for governments to make policy decisions to direct resources into clean energy exploration and develop a green finance playbook. Given contemporary environmental protection requirements, environmental governance policies must be significantly revised to go beyond agreements and summits to include concrete actions like funding environmental projects.

In conclusion, FD may improve a country's economic growth and minimize the consequences of acute poverty and economic inequity, but it can have adverse implications on environmental quality and thus must be investigated (Ozturk and Ullah, 2022). Hence our study tries to understand this relationship to better inform policy decisions. The study is motivated by the current discussion on financial development and the paucity of empirical information on the critical relationship between financial inclusion, governance indicators, and environmental sustainability. The current work tries to fill this vacuum in the literature by offering numerous contributions. The study looks into the influence of financial inclusion on climate change and the role of good governance in mitigating it. The paper also considers the question of model uniformity. Finally, the analysis offers relevant policy implications for maintaining environmental sustainability and achieving financial success in three comparative economic blocs.

3. Methodology

The pledge made by developed nations to provide emerging nations with $100 billion annually fell short when they arrived in Glasgow. The Glasgow conclusion reiterates the commitment while expressing "regret" and exhorts wealthy nations to immediately meet the US$100 billion aim. Developed nations expressed confidence that the goal would be reached by 2023. It was what Mark Carney dubbed a "watershed" second. He claimed that prior to today, there was not enough money in the globe to finance the transformation. *"We draw the line right here, right now.* The $130 trillion is more than required to achieve a net-zero worldwide transition. He continued by saying that a portion of this wealth will be set aside for emerging and developing economies. This serves as a basis for this study to empirically substantiate events before and post COP26.

To analyze the impact of the different characteristics of financial development and governance quality, among other control variables, on CO_2 emissions from 1996 to 2020, the multivariate regression model which draws its motivation from earlier works (Awan and Azam, 2022; Azam et al., 2022) were used. We, therefore, specify the model 1 based on the considerations above.

$$\ln Co_{2_{it}} = a_0 + a_1 \ln FDI_{it} + a_2 \ln DCP_{it} + a_3 FDV + a_4 RQ_{it} + a_5 GE_{it} + a_6 Rul_{it} + a_7 CC + a_8 VOA_{it} + a_9 PS_{it} + a_{10} REN_{it} + a_{11} TR_{it} + a_{12} Y_{it} + \beta_{it} \quad (1)$$

The first model denotes the full sample and all variables without distinctions, where i = 1,.,18 indicates the targeted populace and t = 1996, …...,2020 represents the period that was covered and beta is the residuals. Furthermore, due to the distinction between the role and category of governance indexes, further investigation will be done, taking cognizance of their respective roles without the influence of other

governance indexes. Therefore, model 1 consists of governance indices proxied by economic governance (Asongu and Odhiambo, 2020), institutional governance (Zhang and Kim, 2022), and political governance (Patterson et al., 2017). Also, due to resource restrictions of the world's climate change, renewable energy, trade, and economic growth have become key feedstock for the financial development of various countries. It is, therefore, imperative that the amount of renewable energy in the current period increases per the level of development in the previous period. This is expected to boost trade and economic growth under the auspices of financial development. As a result, the FD-CO_2 nexus would be controlled in all models using these variables as shown in models 2 to 4.

$$\ln Co_{2_{it}} = a_0 + a_1 \ln FDI_{it} + a_2 \ln DCP_{it} + a_3 FDV + a_4 RQ_{it} + a_5 GE_{it} + +a_6 REN_{it} + a_7 TR_{it} + a_8 Y_{it} + \beta_{it} \quad 2$$

$$\ln Co_{2_{it}} = a_0 + a_1 \ln FDI_{it} + a_2 \ln DCP_{it} + a_3 FDV + a_4 Rul_{it} + a_5 CC_{it} + +a_6 REN_{it} + a_7 TR_{it} + a_8 Y_{it} + \beta_{it} \quad 3$$

$$\ln Co_{2_{it}} = a_0 + a_1 \ln FDI_{it} + a_2 \ln DCP_{it} + a_3 FDV + a_4 VOA_{it} + a_5 PS_{it} + +a_6 REN_{it} + a_7 TR_{it} + a_8 Y_{it} + \beta_{it} \quad 4$$

Thus, Equation (2) tests if economic governance mediates the relationship between financial progress and carbon neutrality, Equation (3) *tests if* institutional governance mediates the relationship between financial progress and carbon neutrality, while Equation (4) tests if political governance mediates the relationship between financial progress and carbon neutrality.

3.1. Data

We obtained data from the World Development Indicators (WDI), the International Monetary Fund (IMF), and the World Governance Indicators (WGI). The starting period is chosen based on the data available for governance indicators. The definition and origin of the variables are listed in Table 1. Given that a balanced panal data is employed for the study, missing values especially for the governance indicators were computed by using linear interpolation. This computation approach essentially helps in estimating possible intermediate observations between available data values through a straight line between two available adjacent values (Meijering, 2002; Cox, 2005).

3.1.1. Dependent variable

In governmental and intellectual circles, concerns about the earth's sustainability have gained increasing clout, especially considering the COPS' 26 reports that found no carbon dioxide emissions (CO2) reduction. The ecosystem continually suffers from the adverse effect of carbon emissions. Making it imperative to broaden policy formation. Hence our work uses Carbon emissions as a proxy for environmental degradation with the prospect of further understanding how financial development within economies can help abate the phenomenon.

Table 1
Description of dataset.

Variable	Variable Indicators	Index	Source
Environment Quality	CO_2 Emissions Per Capita	CO_2	WDI
Financial Development (FD)	Financial Development Index	FDI	IMF
	Domestic Credit To Private Sector As % Of GDP	DCP	WDI
	Foreign Direct Investment	FDV	WDI
Economic Governance	Regulation Quality	RQ	WDI
	Government Effectiveness	GE	WDI
Institutional Governance	Rule Of Law	RUL	WDI
	Control Of Corruption	CC	WDI
Political Governance	Voice And Accountability	VOA	WDI
	Political Stability	PS	WDI
Energy Source	Renewable Energy	REN	WDI
Trade Liberalizations	Trade percentage of GDP	TR	WDI
Economic Growth	GDP Per Capita (GDP)	Y	WDI

3.1.2. Independent variables

Financial Development: The Glasgow Financial Alliance for Net Zero revealed at the start of the COP26 Finance Day that it had persuaded over 450 companies from 45 nations to pledge to move their economies toward net-zero emissions. The companies oversee more than $130 trillion in private capital in total. This indicates the importance of fostering fiscal development within an economy targeted to reduce global emissions because a crucial campaign would require capital. Thus, following the works of Omri et al. (2021), we use two proposed variables, namely, the financial development index (FDI), and domestic credit to the private sector as % of GDP (DCPS) as proxies for financial development. The data for these variables were compiled from The WDI and IMF online databases.

Governance quality: The degree of climate remediation and sustainability is determined by the efficacy of a country's governance system and its quality. The model also includes a policy variable for governance quality, which works in conjunction with financial development to cut CO_2 emissions. As predictors of CO_2 emissions, the research considers six indicators of good governance identified in Table 1. For detailed information on the six indicators of governance, see table 12 in the Appendix. These indicators are divided into three categories: institutional governance, political governance, and economic governance. Good governance is likely to reduce carbon emissions.

3.1.3. Control variables

Three different factors were employed to regulate the relationship between FD and CO2. Our model considers financial development as a promoter of clean energy investments, which has the potential to offset some pollution from emissions. The majority of this advanced economics' industrialization objective, which frequently equates to environmental destruction, might be reduced by increased trade openness. Additionally, trade openness facilitates simple access to renewable energy sources or adopting technological innovations that may be environmentally favorable. Economic expansion is also considered to identify how it mediates this relationship.

3.2. Econometric modeling and procedures

Based on the above-discussed arguments, we propose the following model to examine the influence of the various aspects of financial development and governance quality, among other control variables, on CO_2 emissions in BRICS, MINT, and G7 over the period 1996–2020. We adopt the time series model of (Omri et al., 2021) and transform it into a panel data model to suit our study.

To ensure the viability of our data and model framework, a series of preliminary tests are considered. **(a)** We used the sample adequacy test to test the chosen data reliability and viability to represent enough threshold for analysis. We also used a scree plot to represent the graphical normality of the data; **(b)** the CD test was performed to investigate the cross-sectional dependence effect among the variables. In other words, the CD test examines the spill-over effect among countries; **(c)** We applied the 2 s-generation unit root tests. This is because applying the first-generation panel unit root may yield spurious estimates; (d) the Westerlund cointegration was then used. The latter was to ascertain the plausibility of long-run estimation. The cointegration examines the possibility of long-run association among variables. High correlation coefficients between independent factors and dependent variables may indicate multicollinearity difficulties in the model. As a result, we constructed a correlation matrix to check for such deficiency. We performed the long-run parameter estimations after the rigorous preliminary testing. The pool OLS-fixed model was then used to test the central hypothesis, and Prais–Winsten regression with panel-corrected standard error estimation was used for the comparison analysis. This

was done with the understanding that heteroskedasticity and autocorrelation in Panel Data needed to be corrected.

4. Results and discussion

Prior to the estimation of the main results of the study, a series of pre-estimation procedures were performed to ascertain the suitability of the dataset for the model estimation. To begin with, we performed the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test (BS) to investigate the importance of the study variables as proposed by the determining factors of CO_2 emissions (Table 2). The results presented in Table 2 reveal that the estimated outcomes are within acceptable ranges. Fig. 1 presents the scree plot for the principal component analysis (PCA) and it supports that the independent variables are relevant in determining the dependent variables of the study.

Further, we present the descriptive statistics in Table 3. The results as shown in Table 3 and presented for the full sample, as well as each of the economic blocs considered in this study. Subsequently, we performed the pairwise correlation analysis to determine multicollinearity intensity. The result reveals statistical significance among all the variables under consideration. The result also shows that majority of the correlation relationship between the independent variables and CO_2 emissions is negative with a few positive interactions (see Table 4).

4.1. The cross-sectional dependence and unit root test

As part of the estimation procedure, the CD test was performed to examine the spill-over effect between our variables of interest to this study. Evidence of cross-sectional dependence among the study variables is an indication of the fact that a change in any of the variables in one country could affect those in another country. Given that the estimated variables of the CD test are statistically significant, we conclude that cross-sectional dependence exists in the dataset (Table 5). Further, we performed the unit root test to investigate the order of integration of the dataset (Table 5). The results reveal that all variables are stationary at the first difference, indicating that the variables are all of the order I (1). We then proceed to investigate the slope confidence and the cointegration among variables. The results are presented in Tables 6 and 7 respectively.

4.2. Long-run empirical analysis

The study employed the fixed effects model to investigate the environmental nexus between FD, government, and CO_2 emissions for the full sample following the result displayed in Table 7. Given that all the variables are log-transformed, the estimated outcomes can be interpreted as elasticities or expressed in terms of percentages. To ensure that we ascertain the exact impact of governance indicators on environmental pollution, we disaggregate the government indicator into economic, institutional, and political governance.

A number of interesting findings are presented in Table 7. The first strand of results reveals that financial development has a mixed effect on environmental pollution. Specifically, the financial development index shows a negative effect on environmental pollution, and this ranges from 4.58% to 6.20% at a 1% level of significance. This outcome provides contrary evidence to the results of Omri et al. (2021). However, a closer look at the impact of the other two indicators of financial development reveals contrary evidence such that financial development is also seen to exert a significant positive effect on environmental pollution. The latter assertion is supported by the positive impact of domestic credit to the private sector on environmental pollution with impacts ranging from 2.55% to 3.97%. This implies that a percentage increase in domestic credit to the private sector aggravates environmental pollution by 2.55%–3.97%. Similarly, foreign direct investment as an indicator of FD corresponds positively with a relatively small increment in environmental pollution, as the result suggested that a 1% increase in foreign direct investment will account for between 0.06% and 0.07% increase in environmental pollution. These strands of evidence thus support the conclusion of Omri et al. (2021).

Table 2
Test of sampling adequacy.

KMO and Bartlett's test	
Kaiser–Meyer–Olkin measure of sampling adequacy	0.844
Bartlett test of sphericity	
Chi-square	6246.343
Degrees of freedom	78
p-value	0.000

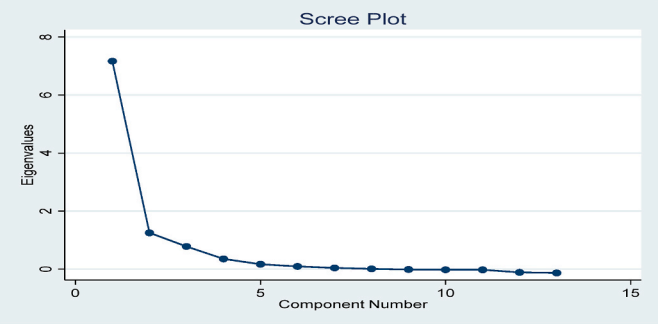

Fig. 1. Scree plot of PCA.

The second strand of empirical evidence reveals that economic governance promotes environmental quality by reducing environmental pollution through quality regulation. As seen in Table 7, a percentage increase in regulatory quality will cause an increase in environmental quality following a reduction in carbon emission of between 2.00% and 3.08% at a 1% level of significance. On the other hand, economic governance may also lead to environmental pollution via the channel of poor governance depending on governance effectiveness. From the results, a percentage increase in governance effectiveness will result in a corresponding increase in environmental pollution of between 1.05% and 1.56%. Third, the result established that the effect of institutional governance on environmental pollution depends on the type of indicator under consideration. Explicitly, rule of law was found to exert a significant positive impact on environmental pollution with a range between 0.58% and 1.04% while the coefficient of control of corruption suggests a decreasing effect on environmental pollution, with a range of 1.33%–2.18% at a 1% level of significance. Regarding the fourth strand of empirical evidence, the result suggests that political governance only mitigates environmental pollution when the voice of accountability is given credence in the governance system of a country. Thus, the estimated outcome for voice and accountability posits a significant negative effect on environmental pollution.

Finally, the outcome for the control variables indicates a negative influence of renewable energy and economic growth on environmental pollution. A percentage increase in renewable energy and economic growth will account for a decrease in environmental pollution by between 0.14% to 0.22% and 0.51%–0.60% respectively. This finding points to the undeniable beneficial environmental roles of renewable energy which have been emphasized and supported in many other extant empirical studies (Balsalobre-Lorente et al., 2018; Erdoğan et al., 2021; Balsalobre-Lorente et al., 2022; Gyamfi et al., 2021; Erdoğan et al., 2022; Ali and Amfo, 2021; Ali et al., 2022; Ali et al., 2022; Radmehr et al., 2022). The outcome of economic growth, on the other hand, contradicts the findings of (Ali and Amfo, 2021; Ali and Anufriev, 2020; Ali et al., 2022; Radmehr et al., 2022). However, trade liberalization on the other hand exerts a positive impact on pollution. Trade liberalization accounts for an increase in the environmental deterioration of about 0.85%–1.31% with every percentage increase in trade levels. Thus, the

Table 3
Description of Data for full Sample BRICS, MINT AND G7.

Variable	lnCo2	lnFDI	lnDCP	lnFDV	lnRG	lnGE	lnRUL	lnCC	lnVOA	lnPS	lnREN	lnTR	lnY
Full sample													
Obs.	400	400	400	388	400	400	400	400	400	400	400	399	399
Mean	−0.843	0.926	5.987	0.425	1.244	1.241	1.143	1.213	1.07	0.707	2.595	4.975	31.117
Std. Dev.	0.728	0.086	0.136	0.989	0.244	0.261	0.318	0.312	0.365	0.542	0.996	0.11	0.106
Min	−2.214	0.745	5.735	−6.394	0.528	0.574	0.381	0.535	−0.084	−1.6	−0.159	4.726	31.038
Max	0.793	1.063	6.283	2.544	1.628	1.605	1.565	1.664	1.467	1.342	4.486	5.265	31.543
BRICS													
Obs.	125	125	125	125	125	125	125	125	125	125	125	125	125
Mean	−0.106	0.893	5.965	0.595	1.076	1.096	0.956	1.029	0.835	0.58	2.828	4.936	31.102
Std. Dev.	0.681	0.036	0.109	0.72	0.112	0.117	0.151	0.158	0.434	0.26	0.973	0.094	0.086
Min	−1.572	0.821	5.796	−1.584	0.903	0.817	0.584	0.697	−0.084	−0.106	1.115	4.726	31.039
Max	0.793	0.963	6.216	1.681	1.348	1.389	1.177	1.354	1.257	1.009	3.985	5.115	31.438
MINT													
Obs.	100	100	100	95	100	100	100	100	100	100	100	99	100
Mean	−0.799	0.822	5.838	0.417	1.041	0.988	0.824	0.908	0.859	0.106	3.245	4.993	31.054
Std. Dev.	0.301	0.043	0.049	0.73	0.19	0.202	0.19	0.175	0.187	0.597	0.84	0.086	0.01
Min	−1.558	0.745	5.735	−2.602	0.528	0.574	0.381	0.535	0.109	−1.6	2.193	4.77	31.038
Max	−0.29	0.911	5.974	1.383	1.267	1.223	1.115	1.193	1.104	0.857	4.486	5.265	31.075
G7													
Obs.	175	175	175	168	175	175	175	175	175	175	175	175	174
Mean	−1.394	1.009	6.087	0.302	1.481	1.488	1.46	1.518	1.359	1.141	2.056	4.992	31.164
Std. Dev.	0.368	0.034	0.095	1.242	0.084	0.101	0.101	0.126	0.047	0.116	0.791	0.126	0.126
Min	−2.214	0.891	5.913	−6.394	1.267	1.159	1.142	1.148	1.263	0.78	−0.159	4.748	31.063
Max	−0.658	1.063	6.283	2.544	1.628	1.605	1.565	1.664	1.467	1.342	3.125	5.224	31.543

results further corroborate the environmental challenges that have been increasingly induced by rising trade in our globalizing world as supported by several studies (Alola, 2019; Balsalobre-Lorente and Leitão, 2020).

4.3. Comparative analysis of the three economic blocs

Tables 8–10 present the comparative analysis of the impact between our variables of interest on environmental pollution among the three economic blocs (BRICS, MINT, and G7 economies). The results from Table 8 show the comparative analysis between the three economic blocs for economic governance. The result reveals that the impact of political governance on environmental pollution varies from one economic bloc to the other. Indeed, financial development index exerts a negative impact on environmental pollution in BRICS and G7 economies without any statistical impact in MINT economies. Additionally, domestic credit to the private sector aggravates environmental pollution in two of the three blocs (BRICS and MINT) without any significant impact in the G7 countries. On the other hand, foreign direct investment only impacts negatively BRICS countries. For economic governance, the results reveal that regulatory quality exerts a negative impact on environmental pollution in BRICS countries while impacting positively on pollution in G7 nations. On the contrary, governance effectiveness promotes environmental pollution in all the three economic blocs albeit at different magnitudes.

With regards to the role of political governance in mitigating environmental pollution, the result in Table 9 suggests that the voice of accountability only exerts a significant impact on pollution in G7 countries with no significant impact recorded in BRICS and MINT economies. On the contrary, whereas political stability mitigates pollution in BRICS economies, it deteriorates the environment in both MINT and G7 countries. Finally, the comparative analysis for institutional governance as shown in Table 10 reveal that rule of law only exerts a positive impact on pollution in the BRICS economies, whereas the coefficient of control on corruption suggests no significant effect on environmental pollution for all economic blocs. Regardless, the coefficient of overall institutional governance suggests a negative effect on pollution in BRICS economies but a positive impact in G7 nations.

5. Conclusion and policy implication

5.1. Conclusion

This study investigates the financial development-government nexus from an environmental perspective across BRICS, MINT, and G7 economies. A comparative analysis of the variations in environmental impact was also examined across the three economic blocs by employing robust approaches to examine the panel dataset spanning 1996 to 2020. The outcome of the study is summarized into three strands. The first strand of the empirical outcome of this study reveals that financial development exerts mixed effects on environmental pollution when financial development index, domestic credit to the private sector, and foreign direct investment are considered. Specifically, the result revealed that the highest pollution-triggering effect is more visible from domestic credit to the private sector with lesser pollution impacts observed from foreign direct investment. On the other hand, the financial development index shows a cushioning effect on environmental pollution. The second strand of empirical evidence reveals that economic governance promotes environmental quality by reducing environmental pollution through quality regulations. However, on the other hand, economic governance aggravates environmental pollution through non-effective governance systems. Thirdly, the environmental impacts of institutional governance are dependent on the type of indicator. We obtained pollution-inducing evidence for the weaker rule of law, while the control of corruption cushions pollution level. Regarding the fourth strand of empirical evidence, the result suggests that political governance only mitigates environmental pollution when the voice of accountability is given credence in the governance system of a country. Furthermore, the comparative bloc-to-bloc analysis shows that governance effectiveness promotes environmental pollution in all the three economic blocs albeit at different magnitudes while the voice of accountability only exerts a significant desirable impact on pollution in G7 countries with no significant impact recorded in BRICS and MINT economies.

5.2. Policy implication

Following the findings, some recommendations for policymakers of these economic blocs stand out. It is imperative to note that the mixed effect of financial development as made evident by its proxies both in the full sample and the individual economic blocs have some policy

Table 4
Pairwise correlation matrix.

	lnCo2	lnFDI	lnDCP	lnFDV	lnRG	lnGE	lnRUL	lnCC	lnVOA	lnPS	lnREN	lnTR	lnY
lnCo2	1												
lnFDI	−0.466***	1											
lnDCP	−0.198***	0.812***	1										
lnFDV	0.022	−0.004	−0.104*	1									
lnRG	−0.535***	0.857***	0.664***	0.0234	1								
lnGE	−0.423***	0.864***	0.746***	−0.000	0.945***	1							
lnRUL	−0.511***	0.876***	0.716***	−0.064	0.932***	0.950***	1						
lnCC	−0.517***	0.858***	0.724***	−0.008	0.950***	0.959***	0.973***	1					
lnVOA	−0.531***	0.602***	0.326***	−0.118*	0.744***	0.680***	0.764***	0.740***	1				
lnPS	−0.325***	0.765***	0.654***	0.008	0.810***	0.845***	0.789***	0.807***	0.559***	1			
lnREN	0.063	−0.542***	−0.473***	0.038	−0.547***	−0.557***	−0.438***	−0.448***	−0.239***	−0.511***	1		
lnTR	−0.005	0.093	−0.102*	0.232***	0.243***	0.213***	0.125*	0.147**	0.0999*	0.118*	−0.156**	1	
lnY	−0.143**	0.513***	0.647***	0.013	0.345***	0.406***	0.381***	0.359***	0.0306	0.318***	−0.271***	−0.348***	1

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 5
CD test and panel unit root test.

	Breusch-Pagan LM	CIPS(0)	CIPS (1)	CADF(o)	CADF (1)
lnCo2	1700.994***	−1.373	−4.027***	0.867	−4.739***
lnFDI	1316.180***	−2.946***	−5.275***	−5.634***	−9.648***
lnDCP	1339.706***	−1.895	−3.229 ***	−4.642*	−4.642***
lnFDV	186.1991***	−3.038***	−3.038***	−1.350*	−9.609***
lnRG	490.895***	−1.382	−4.357***	1.949	−5.262***
lnGE	967.775***	−1.370	−4.775***	2.563	−7.617***
lnRUL	585.209***	−1.433	−4.220***	1.329	−7.098***
lnCC	698.472***	−0.949	−3.482***	1.933	−4.486***
lnVOA	550.528***	−1.862	−3.699 ***	−0.515	−4.192***
lnPS	579.959***	−2.214**	−5.018***	−0.837	−7.829***
lnREN	1615.873***	−0.584	−4.057***	5.133	−4.640***
lnTR	1092.973***	−1.703	−3.815***	−1.236	−5.649***
lnY	2376.843***	−2.428***	−4.691***	−0.506	−5.841***

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 6
Westerlund homogenous slope.

		Delta		P-value
		35.932***		0.000
adj.		48.016***		0.000
Westerlund Cointegration test				
Statistic	Value		z-value	P-value
Gt	−2.820***		4.640	0.000
Ga	−10.405**		2.398	0.008
Pt	−11.497***		5.740	0.000
Pa	−8.916***		4.222	0.000

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

relevance. First, the mitigating effect of the financial development index on environmental pollution, both in the full sample and the individual economic blocs suggest that countries with higher financial development index have higher environmental quality. From the foregoing, it is important for policymakers to incorporate financial development strategies into national environmental policy instruments, especially for those in MINT countries. Second, the positive effect of domestic credit to the private sector on environmental pollution is an indication that such credit facilities to the private sector should be prioritized by policymakers of all the three economic blocs. That is such credit facilities should be limited to private entities that are environmentally conscious and have incorporated environmental mitigation strategies into their operations. This is to ensure that such credit facilities do not support operations that antagonize environmental quality.

Furthermore, the outcome of economic governance creates sufficient grounds for the following policy recommendations. First, the positive effect of regulatory quality on positive environmental externalities in the full sample is an indication that governments and global policymakers must strengthen global governance systems with regard to global environmental regulations via the incorporation of environmental regulations into mainstream governance structures of global organizations and institutions. With regards to the individual economic blocs, the mitigating effect of regulatory quality in BRICS countries is an indication that regulatory quality improves environmental quality. It is thus recommended that policymakers of MINT and G7 countries must toughen their environmental control and regulations to discourage the growth of environmentally detrimental investment havens. Also, it is highly recommended that the economic blocs should put in place and strengthen any existing policy frameworks to ensure better accountability in environmental project execution and the public administrations for environmental gains. This is much more crucial especially for

Table 7
Fixed effect results of the full sample using CO_2 as the dependent variable.

Variable	Governance	Economic Governance			Institutional Governance			Political Governance		
	Gov	EG	RG	GE	IG	RUL	CC	PG	VOA	PS
lnFDI	−5.066***	−4.576***	−4.518***	−7.115***	−6.197***	−5.770 6***	−5.425***	−6.638***	−6.524***	−8.944***
	(-5.47)	(-5.83)	(-5.95)	(-7.52)	(-8.74)	(-7.72)	(-6.56)	(-5.13)	(-7.51)	(-6.61)
lnDCP	2.971***	2.580***	3.133***	3.565***	3.971***	3.340***	3.764***	2.549***	2.604***	3.160***
	(-5.00)	(-4.76)	(-5.4)	(-6.28)	(-7.48)	(-5.42)	(-6.81)	(-5.59)	(-4.08)	(-6.31)
lnFDV	0.059*	0.0476	0.0455	0.043	0.068**	0.024	0.047	0.017	0.019	0.0462
	(-1.78)	(-1.28)	(-1.24)	(-1.12)	(-2.14)	(-0.62)	(-1.43)	(-0.46)	(-0.46)	(-1.21)
lnRG	−2.496***	−3.0761***	−2.0016***							
	(-3.02)	(-4.35)	(-8.15)							
lnGE	1.558***	1.3175**		−1.054***						
	(-2.81)	(-2.13)		(-5.91)						
lnRUL	0.581**				0.971**	−1.038***				
	(-2.57)				(-2.71)	(-18.43)				
lnCC	−1.568**				−2.182***		−1.329***			
	(-2.46)				(-5.36)		(-10.13)			
lnVOA	0.0596							−0.570***	−0.554***	
	(-0.47)							(-12.56)	(-11.38)	
lnPS	0.2457							0.0508		−0.057
	(-1.54)							(-0.25)		(-0.29)
lnREN	−0.166***	−0.208***	−0.215***	−0.194***	−0.160***	−0.146***	−0.151***	−0.143***	−0.147***	−0.172***
	(-5.32)	(-8.47)	(-6.74)	(-5.29)	(-5.47)	(-4.49)	(-5.07)	(-7.25)	(-4.71)	(-5.88)
lnTR	1.078***	1.1611***	1.313***	1.099**	0.9054***	0.8528**	0.9077**	0.518	0.5223	0.7233*
	(-3.52)	(-3.91)	(-4.43)	(-2.67)	(-2.85)	(-2.37)	(-2.69)	(-1.44)	(-1.5)	(-1.86)
lnY	−0.361	−0.2098	−0.1927	−0.030	−0.6023*	−0.2347	−0.5128*	−0.5293*	−0.5532	0.0219
	(-1.59)	(-0.54)	(-0.58)	(-0.09)	(-2.06)	(-0.74)	(-1.91)	(-1.83)	(-1.55)	−0.07
Constant	−5.469	−8.579	−12.915	−18.326*	−2.707	−10.869	−4.923	4.879	5.196	−15.286
	(-0.71)	(-0.73)	(-1.43)	(-1.74)	(-0.31)	(-1.18)	(-0.61)	−0.51	−0.51	(-1.52)
No. of Observations	386	386	386	386	386	386	386	386	386	386
R-Squared	0.512	0.491	0.473	0.401	0.454	0.415	0.447	0.408	0.408	0.372
F Statistic	725.171	586.053	497.312	394.309	433.077	635.853	518.473	2770.063	2531.94	475.064

Note * 0.10 ** 0.05 *** 0.01 t stat in parenthesis.

Table 8
Prais–Winsten comparative analysis of economic governance on financial development-Carbon emission nexus: Dependent Variable Carbon.

Categorized	BRICS			MINT			G7		
	Economic Governance			Economic Governance			Economic Governance		
	EG	RG	GE	EG	RG	GE	EG	RG	GE
lnFDI	−5.413***	−5.779***	−6.535***	−1.146	0.168	−1.175	−1.085**	−1.104**	−0.747**
	(-6.41)	(-6.59)	(-6.81)	(-1.28)	(-0.27)	(-1.31)	(-2.21)	(-2.11)	(-2.20)
lnDCP	1.937***	2.510***	1.410***	1.298*	−0.200	1.323*	−0.084	0.026	−0.047
	(-4.55)	(-6.24)	(-3.11)	(-1.91)	(-0.29)	(-1.95)	(-0.25)	(-0.07)	(-0.19)
lnFDV	−0.026	−0.033*	−0.047**	−0.019	−0.017	−0.021	0.000	0.001	0.000
	(-1.48)	(-1.73)	(-2.20)	(-0.98)	(-1.25)	(-1.10)	(-0.09)	(-0.29)	(-0.03)
lnRG	−1.641***	−1.191***		−0.145	0.030		0.07	0.355*	
	(-4.07)	(-3.36)		(-0.59)	−0.17)		(-0.35)	(-1.8)	
lnGE	1.016***		0.345	1.143***		1.093***	0.619***		0.289*
	(-2.61)		(-0.84)	(-3.31)		(-3.23)	(-3.03)		(-1.93)
lnREN	−0.274***	−0.259***	−0.246***	0.008	−0.240***	0.026	−0.07	−0.082	−0.154***
	(-6.74)	(-6.55)	(-6.41)	(-0.08)	(-3.13)	(-0.26)	(-1.38)	(-1.62)	(-3.59)
lnTR	1.967***	2.047***	2.752***	0.700**	0.433**	0.702**	−0.359	−0.281	−0.164
	(-4.65)	(-4.55)	(-5.22)	(-2.44)	(-1.96)	(-2.44)	(-1.32)	(-1.01)	(-0.77)
lnY	−1.769***	−1.656***	−0.594	−16.714***	−19.856***	−16.509***	0.532**	0.574***	0.327
	(-3.95)	(-3.67)	(-1.38)	(-3.79)	(-4.75)	(-3.74)	(-2.52)	(-2.74)	(-1.34)
Constant	39.950***	33.549**	2.563	507.126***	615.522***	500.466***	−15.491**	−17.331**	−9.899
	(-3.00)	(-2.53)	(-0.2)	(-3.75)	(-4.83)	(-3.7)	(-2.15)	(-2.43)	(-1.27)
No. of Observations	125	125	125	94	94	94	167	167	167
R-Squared	0.656	0.642	0.653	0.278	0.269	0.273	0.72	0.704	0.754
F Statistic									

Note * 0.10 ** 0.05 *** 0.01 t stat in parenthesis.

the MINT and BRICS economies as the voice of accountability only exerts a significant desirable impact on pollution only in the G7 nations.

Thirdly, considering the negative impact of renewable energy use on pollution levels across the three blocs the authority needs to leverage renewable energy production for a better environment by investing more in renewable technologies and providing adequate support for more research to further develop their renewable energy production capacity. Lastly, the three blocs must be conscious of the pollution-triggering effect of trade, and the authority need to ensure that fair trade deals are negotiated with trading partners in view of ecological protection and overall sustainability of the environment.

Table 9
Prais–Winsten comparative analysis of Political governance on financial development -carbon emission nexus.

Categorized	BRICS			MINT			G7		
	Political Governance			Political Governance			Political Governance		
	PG	VOA	PS	PG	VOA	PS	PG	VOA	PS
lnFDI	−6.094***	−6.434***	−6.260***	−0.629	0.053	−0.462	−0.953*	−0.957*	−0.995*
	(-6.23)	(-5.65)	(-7.59)	(-0.64)	−0.07	(-0.49)	(-1.66)	(-1.91)	(-1.92)
lnDCP	2.989***	1.702***	2.991***	1.768**	0.287	1.372*	0.120	0.089	0.015
	(-7.2)	(-6.31)	(-7.19)	(-2.23)	(-0.39)	(-1.86)	(-0.35)	(-0.26)	(-0.04)
lnFDV	−0.035*	−0.052**	−0.031*	−0.045**	−0.021	−0.041*	0.002	0.002	0.001
	(-1.76)	(-2.25)	(-1.68)	(-1.99)	(-1.35)	(-1.89)	(-0.42)	(-0.50)	(-0.24)
lnVOA	−0.066	−0.047		0.154	−0.092		1.646***	1.065***	
	(-0.52)	(-0.37)		−0.94	(-0.60)		(-3.86)	(-2.8)	
lnPS	−0.708***		−0.701***	0.144***		0.117**	0.512***		0.311**
	(-4.41)		(-4.39)	(-2.64)		(-2.25)	(-3.39)		(-2.38)
lnREN	−0.241***	−0.233***	−0.253***	−0.135*	−0.241***	−0.165**	−0.024	−0.080	−0.070
	(-5.17)	(-5.12)	(-6.25)	(-1.80)	(-3.37)	(-2.30)	(-0.51)	(-1.62)	(-1.44)
lnTR	1.966***	2.705***	1.958***	0.695**	0.494**	0.650**	−0.528*	−0.319	−0.228
	(-4.3)	(-5.16)	(-4.26)	(-2.3)	(-2.04)	(-2.24)	(-1.89)	(-1.20)	(-0.88)
lnY	−1.618**	−0.854	−1.3783***	−19.764***	−19.792***	−18.887***	0.801***	0.667***	0.740***
	(-2.34)	(-1.28)	(-3.45)	(-4.43)	(-4.61)	(-4.32)	(-4.13)	(-3.51)	(-3.61)
Constant	29.306	9.437	21.991*	599.993***	610.564***	575.395***	−26.303***	−21.492***	−22.648***
	(-1.39)	(-0.45)	(-1.81)	(-4.41)	(-4.67)	(-4.31)	(-3.97)	(-3.34)	(-3.26)
No. of Observations	125	125	125	94	94	94	167	167	167
R-Squared	0.719	0.648	0.716	0.214	0.225	0.192	0.692	0.711	0.707
F Statistic									

Note * 0.10 ** 0.05 *** 0.01 t stat in parenthesis.

Table 10
Prais–Winsten regression comparative analysis of institutional governance on financial development -carbon emission nexus.

Categorized	BRICS			MINT			G7		
	Institutional Governance			Institutional Governance			Institutional Governance		
	IG	RUL	CC	IG	RUL	CC	IG	RUL	CC
lnFDI	−5.382***	−5.617***	−6.415***	−0.324	−0.194	−0.135	−1.186**	−0.797**	−0.764**
	(-6.00)	(-6.05)	(-6.87)	(-0.34)	(-0.23)	(-0.15)	(-2.40)	(-2.11)	(-2.31)
lnDCP	1.538***	0.934***	2.221***	1.018	0.894	0.768	−0.141	−0.088	−0.040
	(-3.26)	(-2.88)	(-4.35)	(-1.41)	(-1.27)	(-1.08)	(-0.40)	(-0.30)	(-0.17)
lnFDV	−0.000	−0.005	−0.047**	−0.027	−0.026	−0.024	0.001	0.001	0.000
	(-0.05)	(-0.34)	(-2.17)	(-1.37)	(-1.41)	(-1.34)	(-0.25)	(-0.28)	(-0.11)
lnRUL	1.469***	1.205***		−0.021	−0.036		0.068	0.218	
	(-3.92)	(-3.49)		(-0.09)	(-0.16)		(-0.25)	(-1.14)	
lnCC	−0.807**		−0.472	0.025		−0.012	0.583***		0.207
	(-2.17)		(-1.25)	(-0.1)		(-0.06)	(-2.67)		(-1.54)
lnREN	−0.377***	−0.413***	−0.210***	−0.227***	−0.233***	−0.228***	−0.063	−0.142***	−0.162***
	(-6.99)	(-8.26)	(-3.93)	(-2.74)	(-2.87)	(-3.11)	(-1.20)	(-3.13)	(-3.75)
lnTR	1.8629***	2.0529***	2.4982***	0.5721*	0.5469*	0.5287*	−0.4345	−0.200	−0.1526
	(-4.46)	(-4.64)	(-4.92)	(-1.89)	(-1.94)	(-1.89)	(-1.53)	(-0.84)	(-0.74)
lnY	−0.8149	−0.3437	−1.0857**	−20.1085***	−20.3295***	−20.2503***	0.5842***	0.4444*	0.2955
	(-1.48)	(-0.63)	(-2.21)	(-4.34)	(-4.43)	(-4.67)	(-2.72)	(-1.89)	(-1.14)
Constant	12.1709	−0.0812	14.921	615.8793***	623.5432***	621.8317***	−16.2561**	−12.9660*	−8.8494
	(-0.75)	(-0.00)	(-1.06)	(-4.33)	(-4.44)	(-4.69)	(-2.19)	(-1.69)	(-1.07)
No. of Observations	125	125	125	94	94	94	167	167	167
R-Squared	0.603	0.604	0.642	0.152	0.166	0.18	0.722	0.752	0.747
F Statistic									

Note * 0.10 ** 0.05 *** 0.01 t stat in parenthesis.

CRediT authorship contribution statement

Elvis Kwame Ofori: Data curation, Writing, Formal analysis, and, revision. **Stephen Taiwo Onifade:** Writing, Formal analysis, and, revision. **Ernest Baba Ali:** Writing, and, revision. **Andrew Adewale Alola:** Writing – review & editing, and Corresponding. **Jin Zhang:** Supervision.

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.

APPENDIX

Table 11
List of Countries

BRICS	MINT	G7
Brazil	Mexico	Canada
Russia	Indonesia	France
India	Nigeria	Germany
China	Turkiye	Italy
South Africa		Japan
		United Kingdom (U.K)
		United States (USA)

Table 12
Governance indicators and their definitions

Governace indicators	Definitions
Political stability (no violence)	"Political stability/no violence (estimate): measured as the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional and violent means, including domestic violence and terrorism"
Voice & Accountability	"Voice and accountability (estimate): measures the extent to which a country's citizens are able to participate in selecting their government and to enjoy freedom of expression, freedom of association and a free media".
Government Effectiveness	"Government effectiveness (estimate): measures the quality of public services, the quality and degree of independence from political pressures of the civil service, the quality of policy formulation and implementation, and the credibility of governments' commitments to such policies"
Regulation Quality	"Regulation quality (estimate): measured as the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development".
Control of corruption	"Control of corruption (estimate): captures 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"
Rule of Law	"Rule of law (estimate): captures 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, property rights, the police, the courts, as well as the likelihood of crime and violence"

Note: The six aggregate indicators of governance used in this study are in their standard normal units, ranging from approximately −2.5 to 2.5, with higher values corresponding to better outcomes.

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