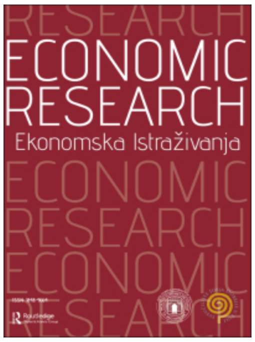

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Institutional factors-environmental quality nexus in BRICS: a strategic pillar of governmental performance

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ABSTRACT

A better understanding of the link between institutional factors and CO_2 emissions is essential for economists and policymakers. Therefore, this study explores the dynamic impact of institutional factors on carbon emissions in BRICS economies for the period from 1996 to 2019 by using the panel NARDL approach. We found that positive shocks in corruption and law & order and government stability have a negative impact on carbon emissions in the long-run. However, the negative shocks in corruption and law & order exert a positive impact on carbon emissions, while negative shocks in government stability and political stability have a negative impact on carbon emissions in the long-run. These findings confirm the significance of institutional factors in alleviating carbon emissions in BRICS countries since institutional factors not only influence pollution emissions directly but also indirectly through foreign direct investment and economic growth. The findings recommend that there is a need to strengthen institutions to promote green growth and a healthy sustainable environment.

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1. Introduction

According to environmentalists and scientists, the biggest menace our planet is facing right now is the issue of global warming due to enormous emissions of greenhouse gases, particularly, carbon (Ozturk & Acaravci, 2013; Ramanathan & Feng, 2009). The leaders of 196 countries gathered in Paris, in the year 2015, and signed an agreement called 'Paris Agreement on Climate Change. Under this agreement, the international community made a commitment to not let the average temperature rise above 2 degrees Celsius during the 21st century, so that, detrimental effects of global warming could be reduced (Alola & Nwulu, 2021; Oberthür & Ott, 2013; Ozturk, 2015). The fortune of the Paris pact and other environmental-related policies depends largely on

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the institutional factors in the respective countries (Salman et al., 2019). Institutions frame and systematize environmental strategies for mitigating CO_2 emissions. Institutions can be divided into different forms e.g. political, economic, administrative, and social etc. and are affected by various other factors (Goel et al., 2013; Nguyen et al., 2018).

Over the last few years, the researchers started to emphasize more on the impacts of institutional factors on environmental quality. Institutions design policies and strategies that can have a direct or indirect impact on environmental quality. Different proxies have been used by different studies for estimating the effects of institutional factors, however, the most common variable used by most of the studies is governance and its various forms such as political stability, corruption, and rule of law etc. which signify an operative and well-planned administrative arrangement (Abid, 2016; Buterin et al., 2017; Wawrzyniak & Doryń, 2020). A dynamic and active institutional structure can help to frame and implement environmental rules and regulations. A capable and stable government can build a corruption-free society and implement a strict rule of law in the country that would be beneficial in designing as well as enforcing the environmental policies in the society. On the other side, a weak and incapable institutional structure can allow the firms to breach rules and laws concerning environmental quality to maximize profit (Welsch, 2004). Moreover, the effects of reduced pollution due to a robust institutional framework can not only benefit the local population but the neighboring countries as well through the spillover effect (Hosseini & Kaneko, 2013). Independent and operational organizations aid to alleviate environmental contamination in the course of economic development (Lau et al., 2014). Conversely, fragile institutional framework, which is the main reason behind the low wealth generation in the developing economies, is a major hurdle in the way of designing and implementing environmental policies, embracing clean technologies, and building a renewable energy structure. Consequently, robust institutes are necessary and highly influential to curb environmental degradation in a country (Laegreid & Povitkina, 2018).

There is harmony among theorists and empirics on one common point with regards to the link between institutional factors and environmental quality that income can influence this relationship (Khan et al., 2021). Any country's economic performance is largely dependent on the level of institutional development and a country that has strong administrative and institutional factors can effectively control the spread of environmental pollutions (Lau et al., 2014). Hence, the difference in institutional qualities across various countries is based on the variations in incomes among the countries, the countries which have a higher level of income are expected to have more sophisticated and developed institutional structures as compared to the institutional structure of low-income countries (Treisman, 2000). However, it is expected, the response of corruption to an increase in income may be different as compared to the response of other institutional factors to the same level of increase in income (Saha & Gounder, 2013). Purcel (2019) discovered that the effect of political constancy on environmental degradation fluctuates as per the scale of development. The countries with a higher level of income also have a strong institutional framework that attracts more foreign direct investment (FDI), which can shrink CO_2 emissions via the technology effect. Conversely, the low-income countries with fragile and ineffective institutional factors may impede the inflow of FDI, which will hurt the economic growth as well as environmental quality (Ekwueme et al., 2021; Saint Akadiri et al., 2021). However, some academics have contradictory opinions and contend otherwise. Larraín and Tavares (2004) claim that countries with feeble organizations might entice more FDI because financiers can influence the administrative system to hurry up legal authorization for constructing an overseas plant and easily bypass the strict instructions and protocols. Thus, previous studies conclude that strong institutions contribute to CO_2 emissions mitigation while weak institutions do not limit the rise of CO_2 emissions (Abid, 2016; Acheampong et al., 2021; Khan & Rana, 2021; Salman et al., 2019; Wawrzyniak & Doryń, 2020).

In the existing literature, the majority of the studies focused on one single variable of the institutional quality, while most have neglected the combined role of institutional factors in determining the environmental quality of a country. Some recent studies have used the variables of corruption and rule of law while examining the role of institutional factors on environmental quality (Arminen & Menegaki, 2019; Godil et al., 2021; Le & Ozturk, 2020; Yasin et al., 2021). However, given the complex nature of the relationship between institutions and the environment and the use of the single dimension by most of the researchers has not provided us with conclusive results. Hence, in this study, our focus is on the composite set of institutional factors that can affect the environmental quality in emerging BRICS economies. The selection of emerging economies is based on the rationale that the economic and institutional structure of these economies is in the developmental phase, hence, they can provide us with clear insight into the institution-environment nexus. Moreover, all the previous studies in this context have relied on the symmetry assumption which suggests that a positive shock in institutional factors may reduce the CO_2 emissions while the negative shock may increase the CO_2 emissions. Contrariwise, the asymmetry assumption implies that if a positive shock reduces the CO_2 emissions a negative shock may increase, decrease, or even have no effect on the CO_2 emissions. However, we have applied non-linear Panel-ARDL techniques which will present a better picture in front of us that whether our variables follow the symmetric or asymmetric path. Unlike previous studies, this one employs non-linear ARDL models to explore long -and short-run asymmetries. This study endeavors policy suggestions for preserving the environment in the present world.

The rest of the study is organized in the form of sections. In the next section, we provide the definition and sources of data alongside the methods of estimation. In the third section, we shed light on the estimates attached to our variables. Finally, we conclude the study in section four.

2. Model, methods and data

Since the formative work by North (1990), institutions have been found to be significant to environmental quality in institutional theories. Institutions articulate and regulate rules and regulations in the economy by limiting CO_2 emissions (Salman et al., 2019). A bulk of empirical literature highlighted the role of institutions for better environmental quality (Abid, 2016; Hosseini & Kaneko, 2013; Wawrzyniak & Doryń, 2020). Following a specification by Abid (2016) and Laegreid and Povitkina (2018), we develop an econometric model to study the long-run impacts of institutional factors on CO_2 emissions:

$$CO_{2,it} = \alpha_0 + \alpha_1 IF_{it} + \alpha_2 GDP_{it} + \alpha_3 EC_{it} + \alpha_4 FDI_{it} + \mu_{it} \tag{1}$$

Where the left-hand side of the variable is carbon dioxide (CO_2) emissions which are determined by the right-hand side of the variables such as institutional factors (IF), GDP per capita (GDP), energy consumption (EC), foreign direct investment (FDI), and μ_{it} is a random error term. Equation (1) is a long-run model, which illustrates only long-run estimates. However, we are interested in both the short-run and long-run estimates and the best way to get closer to our objective is to describe specification (2) in the format known as error correction specification as shown below:

$$\begin{aligned}\Delta CO_{2,it} = {} & \gamma + \sum_{p=1}^{n1} \gamma_{1p}\ \Delta CO_{2,\ it-p} + \sum_{P=0}^{n2} \gamma_{2p}\ \Delta IF_{it-p} + \sum_{p=0}^{n3} \gamma_{3p}\ \Delta GDP_{it-p} \\ & + \sum_{p=0}^{n4} \gamma_{4p}\ \Delta EC_{it-p} + \sum_{p=0}^{n4} \gamma_{5p}\ \Delta FDI_{it-p} + \pi_1 CO_{2,it-1} + \pi_2 IF_{it-1} \\ & + \pi_3 GDP_{it-1} + \pi_4 EC_{it-1} + \pi_5 FDI_{it-1} + \mu_{it}\end{aligned} \tag{2}$$

Pesaran et al. (1999) described equation (2) as panel linear ARDL. It demonstrates both the short and long-run estimates. The estimates of the first differenced (Δ) variables provide the short-run results and the estimates π_2-π_4 normalized on π_1 provide the long-run results. However, the long-run results are considered genuine only if they are co-integrated and the co-integration among the variables is confirmed through the negative and significant estimate attached to ECM_{t-1}. In order to get the estimate of ECM_{t-1} first, we generate a series of residuals labelled as ECM by using equation (2). We then replace the lagged value of this series (ECM_{t-1}) in equation (2) in place of the lagged-level variables and estimate the new equation with the same number of lags as used originally. The size of the estimate attached to ECM_{t-1} describes the speed of adjustment towards long-run equilibrium. This method has the advantage that it can estimate efficiently for the small number of observations. Moreover, this technique can take care of the integrating properties of the variables i.e. we should not worry about whether the variable is stationary at level or first difference because it can accommodate the mixture of variables with I(0) and I(1).

Our main aim is to see the response of CO_2 emissions to the asymmetric changes in institutional factors. To that end, partial sum procedures proposed by Shin et al. (2014) is used to breakdown variables into their positive and negative components as depicted beneath:

$$IF^{+}_{it} = \sum_{n=1}^{t} \Delta IF^{+}_{it} = \sum_{n=1}^{t} \max\ (\Delta IF^{+}_{it},\ 0)\ \ (3a)$$

$$IF^{-}_{it} = \sum_{n=1}^{t} \Delta IF^{-}_{it} = \sum_{n=1}^{t} \min\ (\Delta IF^{-}_{it},\ 0)\ \ (3b)$$

In the above equations (3a & 3b) IF^{+}_{t} represent the positive shock or change in institutional factors respectively. Conversely, IF^{-}_{t} represent the negative shock or change in institutional factors respectively. In the next step, we substitute the variables of IF with the variables created through partial sum procedure and the resulting equation (4) is called the panel NARDL model of Shin et al. (2014).

$$\Delta CO_{2,it} = \alpha_0 + \sum_{k=1}^{n} \beta_{1k} \Delta CO_{2,it-k} + \sum_{k=0}^{n} \beta_{2k} \Delta IF^{+}_{it-k} + \sum_{k=0}^{n} \delta_{3k} \Delta IF^{-}_{it-k} + \sum_{k=0}^{n} \delta_{4k} GDP_{it-k} + \sum_{k=0}^{n} \delta_{5k} EC_{it-k} + \sum_{k=0}^{n} \delta_{6k} FDI_{it-k} + \omega_1 CO_{2,it-1} + \omega_2 IF^{+}_{it-1} + \omega_3 IF^{-}_{it-1} + \omega_4 GDP_{it-1} + \omega_5 EC_{it-1} + \omega_6 FDI_{it-1} + \mu_{it}\ \ (4)$$

The specification (4) is panel nonlinear ARDL and the latest version of panel linear ARDL (2) model, hence, it can be estimated in the same way as the symmetric panel ARDL model (4) and subject to the same cointegration and diagnostic tests. The Hausman test is used to confirm the NARDL-PMG or NARDL-MG models are sufficient for this empirical analysis. In the end, we check causality in a non-linear framework by conducting the panel causality test of Hatemi-J (2012).

For empirical investigation, data has been taken for time period 1996 to 2019 for BRICS countries including Brazil, Russia, India, China, and South Africa. Table 1 provides a discussion on complete definitions of variables and sources of data. Data on carbon emissions is sourced from the World Bank and this variable is measured as CO_2 emissions (kt). Institutional factors are measured through corruption index, law & order, government stability, and political stability. Data on all these institutional factors have been sourced from ICRG except political stability. The corruption index ranges from 0 to 6 where 0 stands for totally corrupt and 6 means no

Table 1. Definitions and data sources.

Variables	Symbol	Definitions	Sources
CO2 emissions	CO2	CO_2 emissions (kt)	World bank
Corruption index	Corruption	Corruption index ranges from 0 (totally corrupt) to 6 (not corrupt)	ICRG
Law and order	LAO	Law and order index ranges from 0 to 6	ICRG
Government stability	GS	government stability index ranges from 0 to 12	ICRG
Political Stability	PS	Political Stability and Absence of Violence/Terrorism: Percentile Rank	WGI
GDP per capita	GDP	GDP per capita (constant 2010 US$)	World bank
Energy consumption	EC	Energy use (kg of oil equivalent per capita	World bank
Foreign direct investment	FDI	Foreign direct investment, net inflows (% of GDP)	World bank

Source: Worldwide Governance Indicators (WGI), International Country Risk Guide (ICGR), World Bank.

corruption. Law and order also range from 0 to 6 and government stability index range from 0 to 12. In these scales, highest value represents good quality of institutions and lowest value is for bad quality institutions. Data for political stability is taken from WGI and it is measured in percentile rank. To control the effects of institutions on CO_2 emissions, we have used GDP per capita, energy consumption, and FDI as control variables. GDP per capita, energy consumption, and FDI are key determinants of CO_2 emissions (Haug & Ucal, 2019; Aslam et al., 2021). Data on GDP per capita, energy use, and foreign direct investment is sourced from the World Bank. GDP per capita is taken at constant 2010 US$. Energy use is measured as kg of oil equivalent per capita. Foreign direct investment is measured as net inflows as a percent of GDP.

3. Empirical results

First of all, we apply three different panel unit root tests to confirm whether our variables are stationary at level or first difference because the application of NARDL requires that none of the variables in the model should be I(2). For that purpose, we have applied three-panel unit root tests Levin, Lin, and Chin (LLC), Im, Pesaran, and Shin (IPS) and ADF-Fisher. The results of these tests are reported in Table 2, which states that most of the variables are stationary at level with all three tests except CO_2, GS and EC. After confirming that our variables are either I(0) or I(1) we can now apply NARDL and maximum two lags are imposed as our data is annual. For selecting an appropriate number of lags we have applied Akaike Information Criterion (AIC).

Our estimation strategy involves that four different variables of institutional quality are included in the carbon emission functions of BRICS economies, results of which are conveyed in Table 3. For that purpose for institutional factors have been taken such as corruption, law and order, government stability, and political stability. In this perspective, four separate models have been regressed. Model 1 explored the nexus between corruption and CO_2 emission, model 2 investigated the association between law and order and CO_2 emission, model 3 examined the relationship between government stability and CO_2 emission, and the last model explored the impact of political stability on CO_2 emission. Cointegration test (ECM_{t-1} and Kao) are stated in Table 3, with few other diagnostic tests. The estimated coefficients of ECM(-1) and Kao-integration are negatively significant which authorizes that long-run estimates i.e. CO_2,

Table 2. Panel unit root testing.

	LLC			IPS			ADF		
	I(0)	I(1)		I(0)	I(1)		I(0)	I(1)	
CO2	−0.434	−7.503***	**I(1)**	−0.507	−4.357***	**I(1)**	−0.605	−7.494***	**I(1)**
Corruption	−7.255***		**I(0)**	−2.348**		**I(0)**	−2.235**		**I(0)**
LAO	−4.791**		**I(0)**	−2.029	−3.717***	**I(1)**	−1.395*		**I(0)**
GS	−0.7014	−6.325***	**I(1)**	−2.008	−5.088***	**I(1)**	−1.305*		**I(0)**
PS	−5.398**		**I(0)**	−2.352***		**I(0)**	−2.246**		**I(0)**
GDP	−4.568**		**I(0)**	−2.081*		**I(0)**	−1.491*		**I(0)**
EC	−0.324	−5.989**	**I(1)**	−0.801	−4.240***	**I(1)**	−0.113	−7.110***	**I(1)**
FDI	−5.211**		**I(0)**	−2.200*		**I(0)**	−1.776*		**I(0)**

Note: ***$p < 0.01$; **$p < 0.05$; and *$p < 0.1$.
Source: Authors' Calculations.

Table 3. Institutional factors and CO2 emissions in BRICS.

	Panel ARDL-PMG estimates							
	(1)		(2)		(3)		(4)	
Variable	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat
Long-run								
CORRUPTION_POS	−0.224***	6.703						
CORRUPTION_NEG	−0.037**	2.442						
LAO_POS			−1.645*	1.766				
LAO_NEG			−0.477	0.861				
GS_POS					−0.012**	2.041		
GS_NEG					0.024**	2.349		
PS_POS							0.001	0.022
PS_NEG							0.005**	2.017
GDP	−0.094***	7.522	−0.204	1.081	−0.016	1.385	−0.049***	5.513
EC	2.317***	3.982	1.151**	2.553	2.253***	15.15	2.015***	6.145
FDI	−1.256***	4.611	−2.563	0.998	−0.313	1.638	−1.749***	5.561
Short-run								
D(CORRUPTION_POS)	−0.011	0.215						
D(CORRUPTION_POS(-1))	0.020	1.046						
D(CORRUPTION_NEG)	0.027*	1.875						
D(CORRUPTION_NEG(-1))	0.013	0.530						
D(LAO_POS)			0.087*	1.779				
D(LAO_POS(-1))			−0.013	0.250				
D(LAO_NEG)			−1.129	1.041				
D(LAO_NEG(-1))			−2.238	0.983				
D(GS_POS)					−0.005	0.598		
D(GS_NEG)					−0.010*	1.915		
D(PS_POS)							0.006***	2.896
D(PS_POS(-1))							−0.002	0.896
D(PS_NEG)							−0.007**	2.262
D(PS_NEG(-1))							0.001	0.431
D(GDP)	0.001	0.056	−0.013	0.729	−0.006**	2.078	−0.001	0.091
D(GDP(-1))	0.011	0.678	−0.012	1.592			0.007	0.495
D(EC)	−0.026	0.060	0.764***	3.996	0.487**	2.066	0.223	0.507
D(EC(-1))	−0.344*	1.688	0.348	1.575			−0.226	0.660
D(FDI)	0.123	0.599	−0.038	0.090	0.488	1.254	0.027	0.098
D(FDI(-1))	−0.599**	1.966	−0.219	0.573			−0.414	1.326
C	−0.548	1.631	−0.329	0.478	−0.271	0.894	0.086	0.226
Diagnostics								
ECM(-1)	−0.377**	2.564	−0.247**	2.414	−0.264*	1.873	−0.295*	1.752
Log likelihood	271.3		273.2		245.7		271.1	
Kao-cointegration	−3.125***		−2.621***		−2.564***		−2.922***	
Wald-LR	5.824***		3.621*		3.567*		9.775***	
Wald-SR	1.255		2.987*		1.268		1.398	
Hausman-test	0.354		1.034		0.987		0.897	

Note: ***$p < 0.01$; **$p < 0.05$; and *$p < 0.1$. Table 3 gives estimates for non-linear equation (4).
Source: Authors' Calculations.

Corruption (LAO, GS, PS), GDP, EC, and FDI are cointegrated meaning that they are valid and genuine. The Hausman test also confirmed the appropriate model for estimates is the NARDL-PMG model

Cointegration tests approve that we can discuss our long-run results. The estimated coefficients of Corruption_POS, LAO_POS, and GS_POS are significant and negative suggesting that as the control of corruption, law and order, and governmental stability improve by one point the CO_2 emissions reduce by 0.224%, 1.645%, and 0.012% respectively. However, the estimated coefficient of PS_POS is positive but insignificant. From these estimates, we deduce that positive shock in the variables of institutional quality improves the environmental quality because it closes the door for corrupt practices and the efficiency of environmental laws increased manifold due to transparent and strict government control. Moreover, the LAO_POS has the largest estimate which confirms that better law and order situation makes the economy flourishing, therefore, the firms adopt more efficient, eco-friendly, and innovative production techniques and consume more renewable energies that decrease the level of CO_2 emissions in the economy. Moreover, on the consumption side the demand for energy-efficient products also increases as the per capita income in the economy increases. Furthermore, as the people become more affluent they become more educated and aware about the hazardous effects of environmental pollution, thus striving to make the environment better. On one side, institutions play a crucial role in pacing the growth of economy, on the other side, institutional development is key to control environmental pollution (Lau et al., 2014). However, the efficacy of institutional development in controlling environmental pollution depends on the level of economic development i.e. higher the level of income in a country the more advanced will be the institutional structure and the more effective it will be in curbing CO_2 emissions and vice versa (Treisman, 2000).

Now, we will see how the CO_2 emissions respond to the negative shock in environmental pollution. ˋThe estimated coefficients of Corruption_NEG is negatively significant suggesting that a 1 percent decline in control of corruption increases the CO_2 emissions by 0.037%. If the corrupt practices prevail in society firms and businesses which are polluting the environment can bribe and influence the environment regulatory bodies, thus causing the CO_2 emissions to rise due to breach of environment-related laws (Hu et al., 2020; Welsch, 2004). On the other hand, the estimated coefficient of the LAO_NEG is insignificant and the coefficients of GS_NEG and PS_NEG are positively significant. The positive estimates attached to negative shocks implies that a 1 point fall in government and political stability reduces the CO_2 emissions by 0.024% and 0.005% respectively. However, if we compare the estimates of positive and negative shocks the estimates are larger in the case of positive shocks implying that positive shocks in government and political stability helps to reduce CO_2 emissions more as compared to negative shocks.

The above findings also confirm the asymmetric impact of positive and negative shocks in government and political stability on the CO_2 emissions in BRICS economies. Our argument is further strengthened by the significant estimates of the WALD-L in the case of government and political stability. Likewise, the WALD-L is significant for both Corruption and LAO also confirming the asymmetric effects of these variables on CO_2 emissions. Though in the case of Corruption both the positive and negative shocks have the same sign but the size of the estimates are significantly different. Similarly, the positive shock in the case of LAO is significant while the negative shock is insignificant which an indication of asymmetry is also.

Now we will discuss the long-run estimates of the control variable briefly. The estimates of GDP is negatively significant when we chose Corruption and PS as proxies of institutions, whereas insignificant when we chose the LAO and GS. This means that a 1% improvement in GDP reduces the CO_2 emissions by 0.094% in the corruption model and 0.049% in PS model, implying that GDP in BRICS economies has reached to the level where it has started to benefit the environment due to more advanced and sophisticated technologies. The estimated coefficients of EC are significant and positive in all four models and the estimates are 2.317%, 1.151%, 2.253%, and 2.015%. Conversely, the FDI helps to reduce the CO_2 emissions by 1.256% and 1.749% in the Corruption and PS models, and the effects of FDI are not noticeable in the LAO and GS models.

In short-run the positive shocks in the variables of institutional quality are either insignificant (Corruption, GS) or positive (LAO, PS). On the other side, the estimate of negative shock is positive in the case of Corruption, insignificant in the case and LAO, and negative in the case of GS and PS. Hence, we can conclude that in the short-run the results are inconclusive for the main variables and the same is true for the control variables.

Finally, the results of panel granger causality are provided in Table 4. To avoid longevity in our results, we discuss the results of our main variables only. The results suggest that one-way causality is running from CO_2→Corruption_POS, LAO_POS→ CO_2, LAO_NEG→ CO_2, and CO_2→GS_NEG. However, we did not find evidence of bidirectional causality between institutions and CO_2 emissions.

4. Conclusions and policy implications

The primary objective of the study is to investigate the dynamic effect of institution factors on carbon emissions in BRICS economies for time period ranging from 1996 to 2019. We tested the asymmetric impact of institutional factors on CO_2 emissions by adopting NARDL estimation method. The empirical results show that asymmetric relationships exist between institutional factors and carbon emissions in the short-run and long-run. It is found that positive components of corruption and law & order have a significant and negative impact on carbon emissions in the long-run. Findings also reveal that positive shocks in government stability exert negative impact on carbon emissions but negative shock in government stability has also negative impact on carbon emissions in the long-run. In contrast, positive shock in political stability has no impact on carbon emission, hence negative shock in political stability has a significant negative impact on carbon emissions in the long-run. Empirical findings show that institutional factors, economic growth and foreign direct investment lead to reduction in carbon emissions in the long-run. However, energy consumption leads to an upsurge in pollution emissions concluding that increase in consumption of energy results in increased carbon emissions.

The short-run findings infer that positive shocks in law & order and political stability lead to an upsurge in pollution emissions in BRICS countries. However, negative shock in corruption has negative impact on carbon emission but negative shocks in government stability and political stability have positive impact on carbon emissions in the short-run. In government stability regression, GDP has negative impact on carbon emissions revealing that increase in economic growth results in a reduction of carbon emissions in the short-run. Energy consumption results in increasing carbon emissions in law & order and government stability regressions in the short-run. FDI has no significant impact on carbon emissions in the short-run.

Table 4. Asymmetric panel causality test results.

Null Hypothesis	W-Stat	Prob.	**Null Hypothesis**	W-Stat	Prob.	Null Hypothesis	W-Stat	Prob.	**Null Hypothesis**	W-Stat	Prob.
CORRUPTION_POS → CO2	2.465	0.880	LAO_POS → CO2	3.82	0.001	GS_POS → CO2	4.207	0.104	PS_POS → CO2	4.091	0.126
CO2 →CORRUPTION_POS	6.437	0.000	CO2 → LAO_POS	1.655	0.488	CO2 → GS_POS	3.989	0.149	CO2 → PS_POS	3.448	0.325
CORRUPTION_NEG → CO2	3.51	0.300	LAO_NEG → CO2	2.756	0.034	GS_NEG → CO2	3.945	0.160	PS_NEG → CO2	3.390	0.350
CO2 → CORRUPTION_NEG	2.349	0.958	CO2 → LAO_NEG	1.764	0.404	CO2 → GS_NEG	5.497	0.007	CO2 → PS_NEG	1.448	0.478
GDP → CO2	1.483	0.499	GDP → CO2	0.430	0.374	GDP → CO2	1.483	0.499	GDP → CO2	1.483	0.499
CO2 → GDP	5.394	0.007	CO2 → GDP	2.780	0.029	CO2 → GDP	5.394	0.007	CO2 → GDP	5.394	0.007
EC → CO2	6.948	0.000	EC → CO2	5.360	0.000	EC → CO2	6.948	0.000	EC → CO2	6.948	0.000
CO2 → EC	3.58	0.257	CO2 → EC	2.859	0.022	CO2 → EC	3.58	0.257	CO2 → EC	3.58	0.257
FDI → CO2	2.929	0.568	FDI → CO2	2.152	0.174	FDI → CO2	2.929	0.568	FDI → CO2	2.929	0.568
CO2 → FDI	3.241	0.401	CO2 → FDI	4.290	0.000	CO2 →FDI	3.241	0.401	CO2 → FDI	3.241	0.401
CORRUPTION_NEG → CORRUPTION_POS	6.359	0.001	LAO_NEG → LAO_POS	2.926	0.020	GS_NEG → GS_POS	7.718	0.000	PS_NEG →PS_POS	5.402	0.008
CORRUPTION_POS → CORRUPTION_NEG	7.223	0.000	LAO_POS → LAO_NEG	2.829	0.027	GS_POS → GS_NEG	5.593	0.005	PS_POS → PS_NEG	8.143	0.000
GDP → CORRUPTION_POS	3.361	0.362	GDP → LAO_POS	0.994	0.873	GDP → GS_POS	2.603	0.788	GDP → PS_POS	1.552	0.534
CORRUPTION_POS →GDP	8.537	0.000	LAO_POS → GDP	2.273	0.136	GS_POS → GDP	2.734	0.704	PS_POS → GDP	5.857	0.003
EC → CORRUPTION_POS	5.428	0.008	EC → LAO_POS	1.147	0.970	EC → GS_POS	1.699	0.619	EC → PS_POS	5.408	0.008
CORRUPTION_POS → EC	4.151	0.114	LAO_POS → EC	9.137	0.000	GS_POS → EC	4.655	0.045	PS_POS → EC	1.983	0.797
FDI → CORRUPTION_POS	2.396	0.926	FDI → LAO_POS	0.220	0.247	FDI → GS_POS	3.2	0.439	FDI → PS_POS	2.736	0.703
CORRUPTION_POS → FDI	1.939	0.769	LAO_POS → FDI	6.373	0.000	GS_POS → FDI	5.958	0.002	PS_POS → FDI	2.353	0.955
GDP → CORRUPTION_NEG	4.106	0.123	GDP → LAO_NEG	3.157	0.009	GDP → GS_NEG	1.858	0.717	GDP → PS_NEG	1.78	0.668
CORRUPTION_NEG → GDP	3.019	0.535	LAO_NEG → GDP	1.139	0.978	GS_NEG → GDP	3.589	0.269	PS_NEG → GDP	6.074	0.001
EC → CORRUPTION_NEG	1.312	0.409	EC → LAO_NEG	1.626	0.512	EC → GS_NEG	3.639	0.252	EC → PS_NEG	0.901	0.241
CORRUPTION_NEG → EC	3.595	0.267	LAO_NEG → EC	2.554	0.064	GS_NEG → EC	4.905	0.027	PS_NEG → EC	3.603	0.265
FDI → CORRUPTION_NEG	2.405	0.920	FDI → LAO_NEG	1.911	0.306	FDI → GS_NEG	5.129	0.016	FDI → PS_NEG	2.192	0.936
CORRUPTION_NEG → FDI	4.403	0.073	LAO_NEG → FDI	4.671	0.000	GS_NEG → FDI	4.354	0.080	PS_NEG → FDI	3.424	0.335
EC → GDP	4.422	0.063	EC → GDP	1.991	0.251	EC → GDP	4.422	0.063	EC → GDP	4.422	0.063
GDP → EC	1.516	0.517	GDP → EC	0.302	0.291	GDP → EC	1.516	0.517	GDP → EC	1.516	0.517
FDI → GDP	3.435	0.313	FDI → GDP	1.248	0.858	FDI → GDP	3.435	0.313	FDI → GDP	3.435	0.313
GDP → FDI	2.903	0.583	GDP → FDI	1.418	0.688	GDP → FDI	2.903	0.583	GDP → FDI	2.903	0.583
FDI → EC	5.396	0.007	FDI → EC	4.850	0.000	FDI → EC	5.396	0.007	FDI → EC	5.396	0.007
EC → FDI	4.585	0.046	EC → FDI	4.198	0.000	EC → FDI	4.585	0.046	EC → FDI	4.585	0.046

Note: $^{***}p < 0.01$; $^{**}p < 0.05$; and $^{*}p < 0.1$.
Source: Authors' Calculations.

The results of the study suggest several policy implications for policymakers. By improving the level of institutional factors in BRICS economies may considerably improve the environmental standards. As a result, policymakers should tighten their hold on corruption and effectively enforce environmental regulations to ensure a clean climate. In terms of the institutional quality policy, political forces should take serious steps to bring about considerable institutional reforms that might help the country's clean energy, green economic growth, and environmental quality. The political forces should correct the institutions, while these institutions should maintain the democratic character of the political regime. Coping with the policy, legal, and institutional framework can diminish climate change by lowering carbon emissions. Both institutional quality and democracy could be improved by minimizing corruption, strengthening the rules of law, and rising government efficiency. A better institutional and democratic environment should strengthen the environmental legislation in the country because the momentum of twin forces can implement environmental regulations more effectively. Promoting a clean environment is always a political decision, as well as a policy priority. Therefore, the findings recommend that policymakers should focus on making the democratic forces more sustainable or even improving them for the sake of stronger clean energy consumption and higher economic growth.

In short, the impact of institutional factors on green economic growth and environmental quality is wide open for reflection and research in developing economies. A similar analysis can be useful to other dimensions of the political regime and institutional quality.

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