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Article

INSTITUTIONAL QUALITY AND ENVIRONMENTAL DEFICIT: AN INSIGHT FROM BRICS COUNTRIES

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Abstract: *This study examines the impact of institutional quality on the environmental deficit in BRICS countries. In this study, environmental deficit is depicted by the presence of carbon dioxide whereas economic growth (EG), foreign direct investment (FDI), trade openness (TO), urbanization, energy consumption (EC), and institutional quality index are used as explanatory variables. Panel data is used for the period between 1995-2017. The data on all the determinants of carbon emissions is collected from World Development Indicators (WDI) while data on the institutional quality index is collected from Worldwide Governance Indicators (WGI). For the empirical analysis, Auto Regressive Distributive Lag Model (ARDL) and pair-wise Granger Causality test (GC) are used. Further, co-variance analysis is also performed to check the possible correlation among the variables. The results indicate that the environment worsens off in the initial stages of economic growth and once a certain level is attained, it starts to improve. So, the findings validate the Environmental Kuznets curve (EKC) hypothesis in BRICS countries. The results of the Granger Causality test revealed the bidirectional causality from trade openness and foreign direct investment to carbon emissions while no Granger Causality exists between institutional quality and carbon emissions. The study suggests that BRICS countries should focus on sound institutional frameworks to attain high economic growth without deteriorating the environment.*

INTRODUCTION

Natural resources play a fundamental role in the upward shifting of the global economies by providing inputs to produce various goods and services. With the boom in industrial development, the amount of greenhouse gas (GHG) emissions is increasing due to the excessive use of these resources on a very large scale. This higher increasing rate of carbon emissions has changed the climate and the climatic environment has become hotter than in earlier decades (Dong et al., 2018).

LITERATURE REVIEW

Institution quality also gets distressed due to extreme environments over time (Lau et al., 2014; Zakaria and Bibi, 2019; Dutt, 2009; Cole, 2007; Ibrahim and Law, 2016; Usman et al., 2021). There are some determinants of

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institutions such as economic, social, and political freedom. The quality of institutions lessens environmental degradation regardless of whether the per capita income level is low (Panayotou, 1997). This implies the environment will improve with higher incomes in the future because institutional quality can lessen the environmental cost of high economic growth (Panayotou, 1997). The instinct is that when economic growth rises, environmental regulations increase in parallel (Yandle et al., 2004). Improving institutional quality would thus enable the empowering domain to the appropriation of synergistic arrangements, which in turn helps in improving economic growth. The quality of the environment can be upgraded if the public institutions could implement the policies and regulations regarding the environment. In this way, the quality of institutions is considered a key factor for upgrading the environment quality (Halkos & Tzeremes, 2013; Gani, 2012). BRICS is a group of five countries, namely Brazil, Russia, India, China, and South Africa with higher rates of economic growth in the world and have significant economic and political importance at the global level. In the world economy, BRICS economies can become a much larger force in less than 40 years than G6 and as well as by 2025 (Goldman, 2003). BRICS countries are enjoying higher rates of economic growth for the last two decades as depicted in Figure 1.

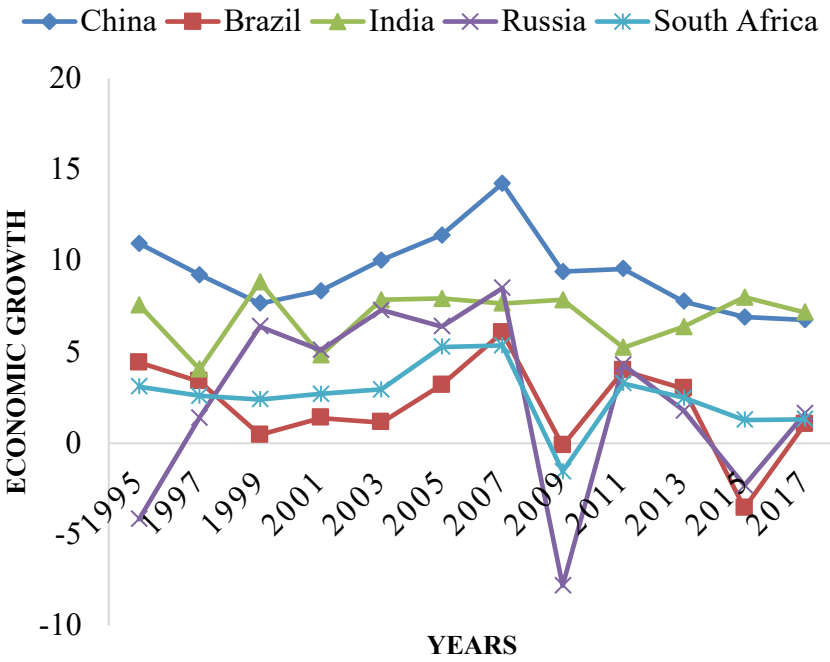

Figure 1: Economic Growth of BRICS Countries from 1995-2017

The present study examines the impact of institutional quality on the environment in BRICS countries using panel data for 1995-2017. Carbon emission is used for the measurement of environmental degradation (Usman et al., 2022). In the study, an index of institutional quality is used with numerous indicators of the environment as energy consumption, economic growth, urbanization, foreign direct investment, trade openness, and gross capital formation, as well as the index of institution quality, is also used with some variables as interaction terms. Moreover, in a recent work by Zakaria & Bibi (2019), Intisar et al., (2020) it is noticed that the development upgrading impacts of exchange transparency, remote direct speculation and vitality utilization are additionally improved when joined by integral approaches, for example, enhancements in institutional administration enveloping pervasiveness of peace, nature of the organization, nonappearance of debasement, and responsibility of open officials.

In like manner, if the institutional quality can likewise improve the effects of exchange on the situations, at that point institutional changes can bring both macroeconomic and ecological benefits for BRICS. Indeed, very little literature explains the effect of institutional quality on the environment and yet has received very little attention. The present study is an effort to fill this gap by exploring the effect of institutional quality on the environment in BRICS countries.

METHODOLOGY

Data and Data Sources

This study is based on a panel data analysis to check the impact of institutional quality on the environment. For the empirical estimation, panel data for 23 years from the period of 1995 to 2017 is selected. The data is collected from WDI, except variable Institutional Quality. The data for Institutional Quality is collected from Worldwide Governance Indicators (WGI).

In this study, Per Capita carbon emissions are used as an endogenous variable while GDP, trade openness, the square of GDP, foreign direct investment, institutional quality, urbanization, per capita energy consumption, the interaction term of GDP with institutional quality, the interaction term of per capita energy consumption with institutional quality, the interaction term of foreign direct investment with institutional quality and the interaction term of trade openness with institutional quality are used as explanatory variables in the study.

Analytical Framework

The general mathematical function to estimate the effect of institutional quality on the environmental deficit is given below:

$$PCO2 = \beta0 + \beta1GDP + \beta2GDP2 + \beta3TO + \beta4FDI + \beta5PENR + \beta6URB + \beta71Q + \mu$$

The symbols used in the model are defined below:

$\beta0$ is the intercept whereas $\beta1$, $\beta2$, $\beta3$, $\beta4$, $\beta5$, $\beta6$ and $\beta7$ are the parameters of coefficients;
μ is the error term;
PCO2 shows the per capita carbon emissions;
GDP is the per capita GDP growth;
GDP^2 is the square of the per capita GDP growth;
TO is an abbreviation of trade openness;
FDI is an abbreviation of foreign direct investment;
PENR shows the per capita energy consumption;
URB is urbanization;
IQ is an abbreviation of institutional quality.

Unit Root Tests

Before applying an econometric technique, the first step is to check the stationarity of the panel data. There are many different unit root tests are used to check the stationary of the data as Levin, Lin & Chu test (Levin et al., 2002), I'm, Pesaran and Shin W-stat (Im et al., 2003), ADF - Fisher Chi-square (Dickey & Fuller, 1979), PP - Fisher Chi-square (Phillips & Perron,1988) and Breitung t-stat (Breitung, 2001).

LLC Test

This test was proposed by Levin et al., (2002) and assumes first-order autoregressive parameters. It simplifies Quah's model to permit for heterogeneous serial correlation of error term and heterogeneity of individual deterministic effects.

The general form of the Levin, Lin & Chu test

$$\tilde{y}it = \Delta yit - \sum_{j=1}^{pi} \beta ij \Delta \gamma i,t-j - X'it\delta$$

They advance a process to estimate the hypothesis that every time series contains a unit root compared to the alternative hypothesis by using pooled t-statistic of the estimator, that the data is stationary. Consequently, the LLC test undertakes homogeneous autoregressive coefficients between individual and test the null hypothesis against the alternative hypothesis.

IPS Test

The IPS test was proposed by Im et al., (2003) and they viewed that regression with pool data as a system of N individuals and for these N regressions, it is based on the combination of independent DF tests.

The mathematical form of the IPS test is as under:

$$\Delta\gamma it = \alpha yit - 1 + \sum_{j=1}^{pi} \beta ij \Delta\gamma it - j - X'it\delta + \varepsilon it$$

The null and alternative hypotheses of IPS can be written as:

$$H_0 = \alpha_i = 0, \text{ for all i}$$

$$H_1: \begin{Bmatrix} \alpha i = 0 \text{ for } i = 1,2,\dots,N1 \\ \alpha i < 0 \text{ for } i = N+1, N+2,\dots,N \end{Bmatrix}$$

This test does not allow only non-normality, serial correlation, and heteroskedasticity but it also allows for lag coefficients and heterogeneity of trends under the alternative hypothesis of no unit root.

Auto-Regressive Distributive Lag Model (ARDL)

The decision of the estimation technique is much dependent on the results of the unit root results. If all the variables are stationary at level then we used the fixed-effect model or random effect model in panel data. With the stationarity of variables at I (0), many studies support to use Pooled Ordinary Least Square method (OLS) for the estimation of results. On contrary, when all the variables are stationary at I(1) then the cointegration technique is used. But when some variables of the study are stationary at I(0), while the others are at I(1); in this situation, the Auto Regressive Distributive Lag model (ARDL) is used.Hence, the unit root results of the study show that there are mixed results of both tests as LLC and IPS. So, based on the unit root results, ARDL is used to check the long-run and short-run results of the model. The Auto-Regressive Distributive Lag model (ARDL) is proposed by Pesaran et al., (1999) as:

$$yt = \beta 0 + \beta 1 yt - 1 + \dots\dots\dots\dots + \beta pyt - p + \alpha 0 xt + \alpha 1 xt - 1 + \alpha 2 xt - 2 + \dots\dots\dots\dots + \alpha qxt - q + \varepsilon t$$

ARDL model is a very popular method that is commonly used in econometrics. The reason for the popularity of the ARDL model is the analyzing the long-run and short cointegration among different variables. Long-run estimates can be calculated as:

$$PCO2 = d0 + \sum_{j=1}^{m} d1\, GDP_{t-j} + \sum_{j=0}^{n} d2\, GDP2_{t-j} + \sum_{j=0}^{o} d3\, TO_{t-j} + \sum_{j=0}^{p} d4\, FDI_{t-j} + \sum_{j=0}^{q} d5\, PENR_{t-j} + \sum_{j=0}^{r} d6\, URB_{t-j} + \sum_{j=0}^{s} d7\, IQ_{t-j} + \mu 1_t)$$

In the above equation, d depicts long-run elasticities. In the same way, short-run estimates of ARDL for the model are estimated as:

$$\Delta PCO2 = i0 + \sum_{j=1}^{m} i1\, \Delta GDP_{t-j} + \sum_{j=0}^{n} i2\, \Delta GDP2_{t-j} + \sum_{j=0}^{o} i3\, \Delta TO_{t-j} + \sum_{j=0}^{p} i4\, \Delta FDI_{t-j} + \sum_{j=0}^{q} i5\, \Delta PENR_{t-j} + \sum_{j=0}^{r} i6\, \Delta URB_{t-j} + \sum_{j=0}^{s} i7\, \Delta IQ_{t-j} + \Psi 1\, ECM_{t-j} \mu 1_t)$$

In the above equations, i represents short-run elasticities, and Δ first difference operator while Ψ's are the speed of adjustments if the negative sign converges to the long-run dynamics. ECM is the error correction term.

RESULTS

Descriptive Statistics of the Study

Variables	Mean	Median	Maximum	Minimum	Standard Deviation	Skewness
PCO2	5.716593	4.980314	12.78498	0.841937	4.039995	0.227656
FDI	2.293967	2.130168	5.978862	0.229456	1.367052	0.35931
GDP	4.790429	4.823966	14.23139	-7.79999	3.898004	-0.49019

IQ	-0.22726	-0.20435	0.470056	-0.85587	0.384115	0.190013
GDP²	38.01053	26.01052	202.5324	0.015829	37.35947	1.449368
PENR	2093.963	1515.174	5167.012	385.0919	1464.445	0.723644
TO	0.434723	0.467444	0.728654	0.156356	0.143342	-0.21642
URB	58.04594	60.077	86.309	26.607	19.84625	-0.24222
TO*IQ	-0.10733	-0.08583	0.254677	-0.59392	0.203847	-0.08953
PENR*IQ	-671.129	-125.639	1177.444	-3802.88	1451.632	-1.01862
GDP*IQ	-1.46919	-1.06998	5.884002	-8.55877	2.689597	-0.37877
FDI*IQ	-0.6227	-0.38153	2.214008	-3.33484	1.055835	-0.48695

Table 1: Descriptive Statistics of the Variables

Covariance Analysis of the Study

Variables	**PCO2**	**FDI**	**GDP**	**INST**	**PENR**	**URB**	**TO**	**GDP²**	**TO*IQ**	**PENR*IQ**	**GDP*IQ**	**FDI*IQ**
PCO2	1											

FDI	-0.15	1										
	0.098	-----										
GDP	-0.27	0.25	1									
	0.002	0.00	-----									
IQ	-0.21	-0.1	-0.25	1								

	0.021	0.03	0.005	-----							
PENR	0.953	-0.1	-0.34	-0.350	1						
	0	0.26	0.000	0.0001	-----						
URB	0.399	0.12	-0.56	0.0921	0.538	1					
	0	0.18	0	0.3273	0	-----					
TO	0.683	-0.1	0.108	-0.156	0.545	-0.091	1				
	0	0.22	0.249	0.0953	0	0.3285	-----				
GDP^2	-0.18	0.35	0.801	-0.467	-0.238	-0.508	0.186	1			
	0.044	0.00	0	0	0.010	0	0.045	-----			
TO*IQ	-0.25	-0.19	-0.25	0.9787	-0.394	0.0113	-0.218	-0.468	1		

	0.006	0.03	0.006	0	0	0.9038	0.019	0	----		
PENR*IQ	-0.53	-0.07	0.050	0.8750	-0.708	-0.2683	-0.241	-0.136	0.891	1	
	0	0.41	0.595	0	0	0.0037	0.0093	0.146	0	-----	
GDP*IQ	0.039	-0.3	-0.79	0.6328	0.0364	0.33067	-0.191	-0.745	0.641	0.370	1
	0.675	0	0	0	0.6989	0.0003	0.0404	0	0	0	-----
FDI*IQ	-0.19	-0.3	-0.43	0.82649	-0.251	0.164896	-0.198	-0.627	0.797	0.654	0.737	1
	0.039	0	0	0	0.0067	0.0782	0.033	0	0	0	0	-----

Table 2: Correlation Matrix of Selected Variables of the Study

The above table shows the correlation values as well as the probability values among the variables. It is clearly shown from the table that most variables such as GDP, FDI, IQ, FDI*IQ, PENR*IQ, $GDP^{2,}$ and TO*IQ have a negative correlation with carbon emissions whereas some variables have a positive correlation with carbon emissions namely, PENR, URB, TO and GDP*IQ. The variable FDI has a weak negative correlation with CO2 but its p-value is significant at a 10%level of significance. In the same way, the variable GDP also has a weak negative correlation with CO2 with a value of -0.27 but has a significant probability value at one unit level of significance. Another variable IQ also has a weak negative and significant correlation with CO2. The variables PENR, TO and URB have a very strong positive, strongly positive, and moderate correlation with CO2 respectively. The variable GDP^2 has a weak negative and significant correlation with CO2. Also, the variables FDI*IQ, PENR*IQ, TO*IQ have weak negative, very weak negative, and weak negatives correlation with CO2 respectively. Lastly, the variable GDP*IQ has a weak positive correlation with CO2 that is not according to the theory.

Stationarity Results

This section represents the stationary results of the study for all the variables. In this regard, the two tables present the results of two unit root tests LLC Test and IPS respectively.

Variables	At Level				At 1st Difference			
	$\eta_{c,}$	P-Value	$\eta_{c,t}$	P-Value	η_{c}	P-Value	$\eta_{c,t}$	P-Value
PCO2	-0.285	0.387	-0.5626	0.2868	-2.8020	0.002*	-1.767	0.038**
IQ	0.112	0.544	-0.1391	0.4447	-3.9882	0.000*	-3.655	0.000*
GDP	-2.941	0.001*	-2.7742	0.0028*	-8.2971	0.000*	-6.752	0.0000*
GDP^2	-2.133	0.016*	-1.9872	0.023**	-8.4107	0.000*	-7.102	0.0000*
TO	-1.789	0.036*	-0.5368	0.2957	-3.0146	0.001*	-2.257	0.0120*
PENR	-0.609	0.2712	0.0824	0.5329	-2.6194	0.004*	-2.225	0.0130*
URB	-0.944	0.1724	-2.3368	0.0097*	-1.0300	0.1515	-0.198	0.4215
FDI	-1.007	0.156	-0.7979	0.2125	-4.8377	0.000*	-3.380	0.0004*
GDP*IQ	-1.752	0.039*	-1.4164	0.07***	-6.0416	0.000*	-4.803	0.0000*
FDI*IQ	-0.198	0.4214	-0.4171	0.3383	-2.8221	0.002*	-1.652	0.049**
TO*IQ	-0.406	0.3421	-0.2663	0.3950	-2.9205	0.001*	-2.663	0.0039*
PENR*IQ	-0.580	0.2808	1.7219	0.9575	-2.6541	0.004*	-2.504	0.0061*

Table 3: Stationarity Results of LLC Test

Note: ηc represents the intercept, ηc,t represents the Trend and intercept;
*,**,*** represents the level of significance at one unit, 5%, and 10% respectively.

Table 3 is shows the stationary results of all the variables of the study using the Levin, Lin & Chu test. The Table shows the t.statistics and p-values with both intercept and with Trend and intercepts at the level as well as 1st difference for all the variables. The p-value of the variable PCO2 is insignificant at the level with both intercept and with Trend and intercept but it is significant at 1st difference at 5% level of significance that is the indication of rejecting the null hypothesis and acceptance of alternative hypothesis hence, the null hypothesis is the data has a unit root. Further, the variables IQ, FDI*IQ, TO*IQ, PENR*IQ, FDI, and PENR are also insignificant at level with both intercept and Trend and intercept but all these are significant at 1st difference at one unit and 5% respectively. Moreover, the p-values of the remaining variables as GDP*IQ, URB, TO, GDP, and GDP^2 are significant at the level as well as at 1st difference. So, on the base of the results of the Levin, Lin & Chu test it is shown that some variables are stationary at 1st difference as well as some variables are significant at level.

Variables	At Level				At 1st Difference			
	$\eta_{c,}$	P-Value	$\eta_{c,t}$	P-Value	η_{c}	P-Value	$\eta_{c,t}$	Sig.
PCO2	1.6747	0.9530	-0.3587	0.3599	-3.3608	0.000*	-1.7488	0.0402**
IQ	-0.674	0.2501	0.1643	0.5653	-4.1045	0.000*	-3.3914	0.0003*
GDP	-2.504	0.0061*	-1.4682	.07***	-7.8446	0.000*	-6.4787	0.0000*
GDP^2	-2.346	0.0095*	-1.2765	0.1009	-8.1156	0.000*	-6.8718	0.0000*
TO	-1.071	0.1420	0.1833	0.5727	-3.3037	0.000*	-2.5411	0.0055*
PENR	1.745	0.9596	-0.2668	0.3948	-3.2602	0.000*	-1.3849	0.08***
URB	3.028	0.9988	-1.6322	0.051*	0.12262	0.5488	0.72416	0.7655
FDI	-1.718	0.04**	-0.5603	0.2876	-5.2014	0.000*	-3.7478	0.0001*
GDP*IQ	-1.985	0.02**	-0.7589	0.223	-6.2314	0.000*	-5.0125	0.0000*
FDI*IQ	-0.877	0.1902	0.0260	0.510	-4.7009	0.000*	-3.5108	0.0002*
TO*IQ	-0.626	0.2656	-0.4028	0.343	-3.1003	0.001*	-2.3518	0.0093*
PENR*IQ	-0.198	0.4213	1.0486	0.852	-2.871	0.002*	-1.810	0.035**

Table 4: Stationary Results of I'm, Pesaran & Shin W – Stat Test

Note: ηc represents the intercept, ηc,t represents the Trend and intercept.
*,**,*** represent the level of significance at one unit, 5%, and 10% respectively.

Table 4 is showing the stationary results of all the variables of the study using the I'm, Pesaran & Shin W-Stat test. The Table shows the t.statistics and p-values with both intercept and with Trend and intercepts at the level as well as 1st difference for all the variables. The p-value of the variable PCO2 is insignificant at level but it is significant at 1st difference at 5%. Further, the variables IQ, FDI*IQ, TO*IQ, PENR*IQ, FDI, and PENR are also insignificant at level with both intercept and Trend and intercept but all these are significant at 1st difference at one unit, 5%, and

10% respectively. Moreover, the p-values of the remaining variables as GDP*IQ, URB, TO, GDP, and GDP^2 are significant at the level as well as at 1st difference. The only variable URB is just significant at level with Trend and intercept but insignificant at 1st difference. So, on the base of the results of the I'm, Pesaran & Shin W-Stat it is shown that some variables are stationary at 1st difference, as well as some variables, are significant at level.

On the base of the results of both unit root tests, it is confirmed that the results of stationary through both tests for all variables are almost the same. Also, the results of both tests are showing that some variables are stationary at 1st difference and some variables are stationary at both level as well as 1st difference.

Long Run and Short Run Results of ARDL

Table 5 reports the long-run and short-run results of the study using the Auto Regressive Distributive Lag Model (ARDL).

Variables	Coefficients	Standard Deviation	t-Statistic	Prob.*
IQ	-0.253445	0.019100	-13.26907	0.0000
GDP	0.023538	0.002595	9.069939	0.0000
GDP^2	-0.002342	0.000228	-10.26723	0.0000
TO	-0.388737	0.028711	-13.53966	0.0000
PENR	0.002219	3.05E-05	72.65251	0.0000
URB	0.084070	0.002337	35.97415	0.0000
FDI	0.032354	0.002324	13.92368	0.0000

Table 5: Long Run Results of ARDL

The Table is showing the variables, coefficients values, Std. error, t-statistic, and probability values of the coefficients. The results of the ARDL are showing that all the variables have a highly significant association with PCO2. In overall estimated results, the main focus is on the variable of institutional quality. The estimated coefficient value of the IQ is negative as well as highly significant at one unit level of significance and it is implying that a 1 point increase in IQ score leads to a 0.253445 unit decrease in PCO2. This result indicates that better quality institutions improve the environment whereas; poor quality institutions degraded the environment. This result is inlined with the finding of (Zhang et al., 2016; Ibrahim & Law, 2016), and (Zakaria & Bibi, 2019) that environment improves with better institutional quality and is degraded with more corruption. The coefficient value representing the variable GDP is positive and highly significant at one unit level of significance that is implying that one unit enhance in GDP leads to a 0.023538 unit increase in the PCO2. This finding is not inlined with the theory of economic growth and carbon emissions decoupling. This result indicates that economic growth in BRICS countries is happening at the cost of a polluted environment. A square term of GDP is also used in the model to check the curvilinear effect of GDP on CO2. The coefficient value of variable GDP^2 is negative but highly significant at one unit and indicates that one unit increase in the GDP^2 leads to 0.002342 units decrease in PCO2. This result indicates that a threshold level of growth is attained the amount of carbon emissions decreases. It shows that there is an inverted U-shaped relationship between economic growth and carbon emissions in BRICS countries and validates the hypothesis of the Environmental Kuznets Curve (EKC) in BRICS countries (Usman & Makhdum, 2021). This result supports the finding (Grossman & Krueger, 1995). Moreover, the coefficient value representing the variable URB is positive and highly significant at one unit that is implying that a one-unit increase in URB leads to a 0.084070 unit increase in the PCO2. Foreign direct investment is a measure of financial openness and the coefficient value representing the variable FDI is also positive as well as highly significant at one unit level of significance that is implying that 1 unit increase in FDI leads to 0.032354 units increase in the PCO2. These results are consistent with the finding (Behera & Dash, 2017) that urbanization and FDI have a positive and significant link with CO2 emission and environmental degradation. Also, the pollution Heaven hypothesis of foreign direct investment holds in BRICS countries.

BRICS countries are big energy importers in the world that's why energy consumption is growing in these countries. The coefficient value representing the variable PENR is positive and highly significant at one unit that is implying that a 1 unit increase in PENR leads to a 0.002219 unit increase in the PCO2. This result is in line with Tamazian et al., (2009) and Zakaria & Bibi, (2019) which is that energy consumption increases carbon emissions. Lastly, the coefficient value representing the variable TO is negative but highly significant at one unit level of significance that is implying that a 1 unit increase in TO leads to a 0.388737 unit decrease in the PCO2. This result is consistent with the finding of (Ibrahim & Law, 2016). The estimated results also indicate the composition effect and the technique effect of trade openness in the BRICS countries.

Variable	Coefficient	Standard Deviation	t-Statistics	Probability*
COINTEQ01	-0.717260	0.353103	-2.031306	0.0478
D(PCO2(-1))	0.052844	0.078883	0.669909	0.5061
D(PCO2(-2))	-0.021617	0.050970	-0.424116	0.6734
D(PCO2(-3))	0.021161	0.087805	0.241004	0.8106
D(IQ)	0.644512	0.429616	1.500205	0.1401
D(GDP)	-0.034340	0.018154	-1.891633	0.0646
D(GDP^2)	0.002654	0.002023	1.311811	0.1958
D(TO)	0.180047	0.278412	0.646693	0.5209
D(PENR)	0.001789	0.000889	2.012058	0.0498
D(URB)	-1.047305	0.706574	-1.482230	0.1448
D(FDI)	0.001042	0.016978	0.061371	0.9513
C	-2.211984	0.954776	-2.316758	0.0248

Table 6: Short Run Results of ARDL

The above Table 6 represents the short-run results using ARDL. The Table is showing the variables, coefficients values, Std. error, t-statistic, and probability values of the coefficients. The results of the ARDL are showing that the coefficient value of COINTEQ01 is negative as well as significant at a 5% level of significance but the coefficient value is too high and it is implying that the model will converge annually from short run to long run with a speed of 0.717260% with the change in PCO2, IQ, GDP, GDP^2, TO, PENR, URB, and FDI. Further, most variables are insignificant only, D(PENR) and D(GDP) are significant at 5% and 10% respectively.

CONCLUSION

This study examines the impact of institutional quality on the environment in BRICS countries. The results of the study indicate that initially environment worsens with economic growth and then it starts to improve. So, the results of the study validate the Environmental Kuznets curve (EKC) hypothesis in BRICS countries.

Moreover, the estimated results indicate that energy consumption and urbanization also deteriorate the environment in the BRICS countries. Likewise, FDI has a positive and significant impact on the environment and a 1 unit increase in foreign direct investment deteriorates the environment by 0.032 units. Also, the pollution Heaven hypothesis of foreign direct investment holds in BRICS countries. Further, the results show that trade openness and institutional quality have a negative and significant effect on the environment and 1 point improvement in institutional quality score will decline the pollution by 0.253 units. The results also indicate that the composition effect and the technique effect of trade openness hold in the BRICS countries.

Recommendations

On the base of the results, the study suggests some policy recommendations for concerned policymakers and governments to help in decision making. The suggestions are as follows:

1. The BRICS countries are enjoying a higher rate of economic growth at the cost of declining environmental quality. Therefore, to maintain the current growth rate these countries should focus on energy-efficient policies to lower the pollution level. In the case of foreign direct investment, the BRICS countries should have to adopt the pollution Halo hypothesis of foreign direct investment to encourage the foreign environment-friendly industries to invest in these countries which will benefit the environment in these countries.
2. Moreover, the BRICS countries should have to introduce the technique effect and composition effect of trade openness rather than the scale effect by helping to import environment-friendly technologies.
3. Also, to protect the environment these countries should have to impose environmental protection conventions on the import and export of goods.
4. Hence, based on the results of the study, the joint effect of all the determinants of carbon emissions with institutional quality is positive on the environment so, the BRICS countries should have to make sound institutional frameworks to improve their environment and maintain the growth rate.

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