Original Research Article

Can international Business Perspective Measure Sustainable Development of BRICS Countries? A Panel Data Analysis

Abstract

The level of international business is highly dependent on the numerous macroeconomic and sustainable development factors that play their respective roles in defining a developing nation's economic progress. While examining the long-term growth of an economy, the consistency of the performance of the various elements in terms of their sustainability is a crucial matter to investigate. Moreover, it is known that the sustainable development of an economy is strongly associated with environmental impacts. Finally, the focus on new development patterns must be the highest concern for emerging economies. Considering this, the current study speculates on the relationship between foreign direct investment and the interaction effect of carbon emissions and poverty with control variables such as per capita income and education in BRICS economies. It concentrates on panel data ranging from 1993 to 2019 to explore the association among the said variables. It identifies the unique and definite macroeconomic parameters that are crucial for encouraging foreign direct investment in different countries. Applying the Panel Auto Regressive Distributed Lag Model, the study finds a positive interaction effect between carbon emissions and poverty that focuses on improving foreign direct investment in the long run. In the short run, an increase in per capita income always proves that BRICS will demonstrate less dependence on FDI net flows. The most recent update from these countries demonstrates that the strategy for achieving future sustainable economic growth is clear and swift. Hence,it emphasises the requirement of separate and exclusive policy-making to promote long-term sustainable economic growth in BRICS.

Keywords: Sustainable Economics, International Business, BRICS, Panel Data, ARDL

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Introduction:

The current commercial production and consumption systems are not sustainable due to high environmental degradation in the economies. As a social institution, the industrial sector hasmade a major impact on polluting and exploiting the natural world. Increased water, air, and land pollution because of fast industrialization in many developing countries has prompted worries about the sustainability of the region's existing growth patterns. Because of this, many issues, including the supply chains and raising awareness of environmental obligations in developing countries need to be altered in policy, education, and the industrial regulationprocesses, products, and services.

Government policy making and industry in developing economies' main countries have started to address global issues like climate change and regional ones like pollution and the management of dwindling biological resources in recent years. These tendencies show how developing economiesare becoming more conscious of the connection between the region's long-term economic well-being and the way in which its environmental and human capital are utilised.

The crucial factor of industrialisation is the source of foreign direct investment (FDI). While industrialisation creates favourable impact on economic growth, the developing economies can also simultaneously experiencean adverse effect in the environment.Higher international money flows, better usage of advanced technology along with technical equipment used by organisations, industries, and companies contribute to climate change and have a negative effect on the environment. If environmental damage can be managed, it can attract more FDI. Thus, FDI will help boost national output as well as economic growth. Pollution Haven Hypothesis (PHH) (Taylor, 2005) shows that different countries' environmental restrictions affect the location of a company's location or industry, while Halo Hypothesis (Doytch,2012)pollution compares foreign companies' environmental performance to domestic partners rather than industrial sites. FDI from international corporations improves environmental standards in developing countries by bringing cleaner technologies and a better environmental management system.

While the debate between FDI, growth and sustainabilityarecontinuing a larger scale, the current study aims to find out the contribution of international business, popularly known as international trade, to the sustainable development of BRICS economies. In this respect, it establishes panel Auto Regressive Distributed Lag (ARDL) model to explore the association between the interaction effect of carbon dioxide emission (CO2)-poverty and foreign direct investment (FDI) for BRICS. It investigates the environmentalcondition of the economies by considering the joint effect of poverty with CO2 along with the control variables, such as, education and per capita income for the respective economies.

Literature Review:

FDI influences technology innovation in host nations. Researchers and policymakers have called FDI the main economic growth tool and a source of employment and technology transfer to its host nations. However, FDI may impact the environment. FDI boosts production but harms the environment. Production boosts host economies, but the environmental cost may outweigh the financial gains. Thus, many countries, especially those receiving foreign direct investment, have acknowledged the ecological cost of production processes. The available literatures on the above issue are explained below.

Chowdhury and Anuradha (2020) and Ali, et. al, (2022) explored the need of Foreign direct investment (FDI) in the developing economies and also concluded that it could hurt the environment by causing more CO2 to be released into the air. There is a chance, though, that FDI reduces CO2 emissions through green innovation and makes the environment cleaner for BRICS economies.Yasmeen, et al (2022) and Vijayakumar, et. al, (2010) analyses BRICS FDI inflows using annual data from 1975 to 2007. Panel data research shows that Market size, Labour cost, Infrastructure, Currency value, and Gross Capital formation may affect BRICS FDI inflows.The same study has been extended by Lee, et, al., (2021).This research empirically evaluates sustainable relationships between inward and outward FDI, the R&D

UNDER PEER REVIEW

expenditure ratio, and CO2 emissions using balanced panel data from the BRICS. On the other hand,Prasad, et al, (2020) andHieu, et. al, (2022) explores that due to economic instability, scholars, practitioners, and regulators are focusing on sustainable achievement. Thus, the study explores how environmental, social, and governance (ESG) obligations and economic development including economic growth, net national income, rural healthcare infrastructure and FDI affect SDG successes in BRICS nations. The concept of innovation also plays a vital role in shaping the future growth in the developing nations. The environment as well is related to technical innovation as it causes ecological imbalance occasionally. With this respect,Melega, et al (2021) and Chaudhry, et. al, (2022)foreign direct investment in pollution haven economies is driven by technical advancement and strong environmental regulations in developed regions. This study examined FDI's role in developing nations.Goel, et al (2021) and Tabash, et. al, (2022) examines energy investment and economic growth. It examines how energy consumption, foreign investment, infrastructure development, tax revenue, human capital, international tourism revenue, and commerce volume affect economic growth. (Gyamfi, et. al, 2022) proves that Industrialization has enhanced the value of exploited natural resources due to technological improvement. Total reserves, technical innovation, FDI, and renewable energy can impact the environment.Muhammad, et al (2021) and Barış-Tüzemen, et al (2022) examine the relationship between foreign direct investment, economic growth, urbanization, energy use, and carbon emissions in BRICS countries from 1990 to 2014. EKC and PHH are supported by empirical data.Energy consumption increases carbon emissions, but urbanisation reduces them.Lu, et .al (2021) and Rahman(2021) explore the effects of age dependence ratio (young, elderly, and total age) and urbanisation on renewable and non-renewable energy consumption in Brazil, India, China, and South Africa using panel data from 1990 to 2019. Zhang, et al (2021) has studied in macroeconomics, but renewable energy has not. The study aims to provide new evidence on the relationship between EPU and renewable energy consumption (REC), which mediates BRIC FDI. Behera, et al. (2021) analyses BRICS economies' energy consumption that is driven by rapid urbanization, openness, and human development index growth. Due to outsourcing from developed nations, BRICS countries are under pressure to reduce high energy consumption.

Considering the above literatures, the current study finds the gaps as in any of the cited literatures, the interaction effect has not been contemplated. Also, the quantitative impact of poverty induced by valuation of carbon dioxide consumption has not been researched well beforehand. Thus, it mentions the objectives as follows:

The objective of the study, hence, can be defined as

- To find out the long run impact of the interaction effect between carbon emission (CO2)- poverty on FDI in BRICS.
- To find out the short run impact of the interaction effect between carbon emission (CO2)- poverty on FDI in BRICS.
- To find out the short run causality among the interaction effect between carbon emission (CO2)- poverty on FDI in BRICS.

The hypotheses according to the above objectives are framed below as:

- H_{01}: There is no long run impact of the interaction effect between carbon emission (CO2)- poverty on FDI in BRICS.

UNDER PEER REVIEW

- H_{02}: There is no short run impact of the interaction effect between carbon emission (CO2)- poverty on FDI in BRICS.
- H_{03}: There is no Pairwise Dumitrescu Hurlin Panel Causality among the interaction effect between carbon emission (CO2)- poverty on FDI in BRICS.

Data:

The data considered for the study are respectively FDI, CO2 Emissions, Poverty, GDP Per Capita, and Education. These are taken from world bank database. FDI is described as the net inflow of capital used to acquire a regulating interest in a company (ten percent or more of the voting stock) in a foreign economy. As represented in the balance of payments, it is the sum of equity capital, reinvested earnings, other long-term capital, and short-term capital. When divided by GDP, this series depicts the net inflows (new investment inflows minus disinvestment) of foreign investors into the host economy.Carbon dioxide emission from energy is defined as the use of fossil fuels like oil, gas, and coal in combustion-related activities in the economy. Poverty is measured as welfare relevant total factor productivity that perceives prices and quantities to the consumers. GDP per capita income is measured as Gross Domestic Product divided by midyear population. Gross value added by all resident producers in the economy plus product taxes and minus subsidies not included in product value is GDP. It does not include depreciation of manufactured assets or natural resource depletion. USD data. Education is based on human capital index, based on years of schooling, and returns to education.The study took data from 1994 to 2019 to conduct the analysis. Due to different specification of unit measurements, the variables have been considered as its logarithmic terms. The variables, here in the study, are depicted as l(FDI), l(CO2), l(POV), l(GDPPC), and l(EDU).At the first step, it explains the descriptive statistics that is shown in table 1.

Table 1: Descriptive Statistics of the Variables- l(FDI), l(CO2), l(POV), l(GDPPC), l(EDU)

Statistic	l(CO2)	l(EDU)	l(FDI)	l(GDPPC)	l(POV)
Mean	3.034202	0.382137	0.226892	3.529833	-0.343084
Median	3.079254	0.379379	0.276121	3.594485	-0.369932
Maximum	3.994251	0.535852	0.777221	4.203431	-0.055245
Minimum	2.375115	0.198011	-0.758103	2.539205	-0.606518
Std. Dev.	0.453866	0.088806	0.343571	0.445655	0.129348
Skewness	0.559969	0.066796	-0.639531	-0.608220	0.165898
Kurtosis	2.373419	2.009160	2.709650	2.350164	1.874173
Jarque-Bera	8.577411	5.206310	8.959916	9.906308	7.461859
Probability	0.013723	0.074040	0.011334	0.007061	0.023971

UNDER PEER REVIEW

Sum	379.2753	47.76709	28.36150	441.2291	-44.60091
Sum Sq. Dev.	25.54327	0.977916	14.63712	24.62746	2.158299
Observations	125	125	125	125	125

Methodology:

The objective of the study is to find the interaction effect of carbon dioxide emission along with poverty on foreign direct investment for BRICS economies. For this, the time series regression has been chosen. Also, considering the different levels of integration of the underlying variables, panel ARDL is the desired methodology as specified by Pesaran and Smith (1995) and Pesaran et al. (1999). The chosen model also concentrates on finding the short run as well as long run coefficients with the short run error correction term, which, proves the movement of the variables towards long run stability with significant parameters.

The above equation is used to find out the significant coefficients and their economic significance for short run as well as long run. The next section explains the results and their respective interpretations respectively.

Results and Interpretation:

After analysing the descriptive statistics, the next step is to define the data integration of underlying dataset. For this, the data are tested for panel unit root test. It chooses Im, Pesaran and ShinW-stat, Levin, Lin & Chu, ADF - Fisher Chi-square and PP - Fisher Chi-square to analyse the panel unit roots. Two tables,table 2 and table 3, extract the values of unit roots. Table 2 analyses the integration of all the variables at their levels and table 3 for the first difference.

Table 2: Panel Unit Root Test of the Variables-l(FDI), l(CO2), l(POV), l(GDPPC), l(EDU) at Level

Variable Name	Methods	Statistic	Probability
l(FDI)	Levin, Lin & Chu t	(1.57)	0.06
	Im, Pesaran and Shin W-stat	(2.01)	0.02
	ADF - Fisher Chi-square	22.02	0.02
	PP - Fisher Chi-square	29.41	0.00
l(CO2)	Levin, Lin & Chu t	1.06	0.86
	Im, Pesaran and Shin W-stat	2.39	0.99
	ADF - Fisher Chi-square	3.43	0.97

UNDER PEER REVIEW

	PP - Fisher Chi-square	4.47	0.92
l(POV)	Levin, Lin & Chu t	-0.48965	0.3122
	Im, Pesaran and Shin W-stat	0.68155	0.7522
	ADF - Fisher Chi-square	6.88709	0.7361
	PP - Fisher Chi-square	2.16702	0.9949
l(GDPPC)	Levin, Lin & Chu t	(0.31)	0.38
	Im, Pesaran and Shin W-stat	1.64	0.95
	ADF - Fisher Chi-square	2.75	0.99
	PP - Fisher Chi-square	3.25	0.97
l(EDU)	Levin, Lin & Chu t	0.97	0.83
	Im, Pesaran and Shin W-stat	2.57	0.10
	ADF - Fisher Chi-square	7.67	0.66
	PP - Fisher Chi-square	18.64	0.05

Table 3:Panel Unit Root Test of the Variables-l(FDI), l(CO2), l(POV), l(GDPPC), l(EDU)at First Difference

Variable Name	Methods	Statistic	Probability
l(FDI)	Levin, Lin & Chu t	(4.00)**	0.00
	Im, Pesaran and Shin W-stat	(6.67) **	0.00
	ADF - Fisher Chi-square	59.56**	0.00
	PP - Fisher Chi-square	95.09**	0.00
l(CO2)	Levin, Lin & Chu t	(1.56) **	0.06
	Im, Pesaran and Shin W-stat	(2.88) **	0.00
	ADF - Fisher Chi-square	26.52**	0.00
	PP - Fisher Chi-square	56.60**	0.00
l(POV)	Levin, Lin & Chu t	-3.33812	0.0004

UNDER PEER REVIEW

	Im, Pesaran and Shin W-stat	-4.30930	0.0000
	ADF - Fisher Chi-square	37.7566	0.0000
	PP - Fisher Chi-square	39.1390	0.0000
l(GDPPC)	Levin, Lin & Chu t	(3.86) **	0.00
	Im, Pesaran and Shin W-stat	(3.20) **	0.00
	ADF - Fisher Chi-square	27.74**	0.00
	PP - Fisher Chi-square	39.49**	0.00
l(EDU)	Levin, Lin & Chu t	(1.97) **	0.02
	Im, Pesaran and Shin W-stat	(1.63) **	0.05
	ADF - Fisher Chi-square	15.88*	0.10
	PP - Fisher Chi-square	15.56	0.11

The above tables explain the data integration of the variables. Carbon dioxide emission (CO2 Em), poverty, education and GDP per capita income is proved to be integrated to I (1), whereas, FDI is proved to be integrated to I (0). The mixed results of data integration prove the necessity of conducting panel ARDL model.But, before proceeding for panel ARDL, the study checks the acceptance of fixed effect or the random effect model. It performs Hausman test to check the same. The result proves the Chi square value as 1.03 with probability 0.30, that, finally accept the hypothesis of appropriateness of the application of the random effect. The results of panel ARDL is specified in table 4 and table 5.

Table 4: Results of Panel ARDL- Long Run: Dependent Variable- l(FDI), Independent Variable-l(CO2)*l(POV)

Variable	Coefficient	t- Statistic	Probability
l(CO2)* l(POV)	1.559427	7.200866	0.0000

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Table 5: Results of Panel ARDL- Short Run:Dependent Variable- l(FDI), Independent Variable- l(CO2)*l(POV)

Variable	Coefficient	t- Statistic	Probability

UNDER PEER REVIEW

C	3.471770	1.754693	0.0830
Δl(FDI_1)	0.143970	6.512081	0.0000
Δl(CO2)* l(POV)	-1.735772	-0.914566	0.3630
Δl(CO2_1)* l(POV_1)	0.502668	1.154779	0.2515
Δl(CO2_2)* l(POV_2)	0.432902	0.695679	0.4886
Δl(CO2_3)* l(POV_3)	-2.118678	-0.911766	0.3645
l(GDPPC)	-0.691845	-3.136858	0.0024
l(EDU)	1.608748	0.624662	0.5339
ECT	-0.903405	-3.142139	0.0023

Table 6: Results of Panel ARDL- Short Run: Country Specific Outcomes

BRAZIL			
Variable	Coefficient	t- Statistic	Probability
C	1.185947	2.272801	0.1076
Δl(FDI_1)	0.199243	11.76026	0.0013
Δl(CO2)* l(POV)	-0.394611	-0.946648	0.4137
Δl(CO2_1)* l(POV_1)	-0.509129	-1.997063	0.1397
Δl(CO2_2)* l(POV_2)	-1.489292	-8.752318	0.0031
Δl(CO2_3)* l(POV_3)	-0.618119	-2.919578	0.0615
l(GDPPC)	-0.314168	-5.282826	0.0132
l(EDU)	5.394300	3.746620	0.0332
ECT	-1.450511	-29.85813	0.0001
RUSSIA			
Variable	Coefficient	t- Statistic	Probability
C	11.32222	0.547434	0.6222
Δl(FDI_1)	0.160894	3.243174	0.0477
Δl(CO2)* l(POV)	2.119516	7.161745	0.0056
Δl(CO2_1)* l(POV_1)	-0.271026	-0.557667	0.6160

UNDER PEER REVIEW

Δl(CO2_2)* l(POV_2)	1.303906	3.590451	0.0370
Δl(CO2_3)* l(POV_3)	1.000870	2.293237	0.1056
l(GDPPC)	-1.370968	-4.752383	0.0177
l(EDU)	-7.676368	-0.082602	0.9394
ECT	-0.992636	-14.22575	0.0008
INDIA			
Variable	Coefficient	t- Statistic	Probability
C	1.547920	2.281013	0.1068
Δl(FDI_1)	0.164900	2.619675	0.0790
Δl(CO2)* l(POV)	-0.604385	-0.712259	0.5277
Δl(CO2_1)* l(POV_1)	1.650567	2.798087	0.0680
Δl(CO2_2)* l(POV_2)	1.024843	1.424003	0.2496
Δl(CO2_3)* l(POV_3)	0.131657	0.183451	0.8661
l(GDPPC)	-0.871662	-1.053234	0.3696
l(EDU)	6.387600	0.137901	0.8991
ECT	-0.346085	-7.327747	0.0053
CHINA			
Variable	Coefficient	t- Statistic	Probability
C	0.906097	0.301456	0.7828
Δl(FDI_1)	0.126214	1.438866	0.2458
Δl(CO2)* l(POV)	-0.771783	-6.897068	0.0062
Δl(CO2_1)* l(POV_1)	1.389948	8.641737	0.0033
Δl(CO2_2)* l(POV_2)	-0.528093	-2.425578	0.0937
Δl(CO2_3)* l(POV_3)	0.248842	1.957630	0.1452
l(GDPPC)	-0.118882	-7.093112	0.0058
l(EDU)	-0.153585	-0.017117	0.9874
ECT	-0.145475	-2.041094	0.1339
SOUTH AFRICA			
Variable	Coefficient	t- Statistic	Probability

UNDER PEER REVIEW

C	2.396671	1.096000	0.3532
Δl(FDI_1)	0.068600	3.429750	0.0415
Δl(CO2)* l(POV)	-9.027597	-1.912868	0.1517
Δl(CO2_1)* l(POV_1)	0.252981	0.049751	0.9634
Δl(CO2_2)* l(POV_2)	1.853146	0.514681	0.6423
Δl(CO2_3)* l(POV_3)	-11.35664	-3.212621	0.0489
l(GDPPC)	-0.783543	-2.951981	0.0599
l(EDU)	4.091793	1.055168	0.3688
ECT	-1.582317	-34.80391	0.0001

The above table (table 4) signifies that in long run there exists positive influence of the interaction effect between carbon emission and poverty on FDI in BRICS economies. The value of the coefficient is 1.56 which is significant at five percent level. Thus, we accept H_{11} to confirm the fact that higher carbon dioxide emission along with higher level of poverty increase the dependency towards FDI flows in these economies. Table 5 analyses the short run performances of the variables in common and table 6 measures the country specific short run outcomes. As the results are mixed proving few countries are affected from CO2 and few not, on average, we accept H_{02}.It also demonstrates that increasing GDP per capita will effectively reduce economies' dependency on FDI. Thus, it is proved that in short run, the control variables also play vital roles in determining the level of FDI. Table 5, in additionto the above results, specifies that per capita income plays a crucial role in determining the level of FDI flows in the countries. The result shows that if a home country grows with higher level of per capita income, the requirement of FDI goes down (0.69) eventually.Finally, it also proves that higher values of previous period FDI enhance current period reliance on FDI. In short run, the model has 90.03 chance to correct itself fromshort run disturbances and move towards long run stable situation. The error correction term showing the significant percentage also ensures the long run direction of causality from the combine effect of the two variables - carbon dioxide emission and poverty on FDI in the BRICS countries.

In the next step, the study finds out the short run panel granger causality among the variables. The results are shown in below table 6.

Table7: Results of Pairwise Dumitrescu Hurlin Panel Causality Tests:

Null Hypothesis	W -Statistic	Z bar Statistic	Probability
l(CO2)* l(POV)does not homogeneously cause l(FDI)	1.56260	-0.59791	0.5499

UNDER PEER REVIEW

l(FDI)does not homogeneously cause l(CO2)* l(POV)	4.78471	2.26600	0.0235

The above table proves that in short run FDI homogeneously causes carbon dioxide emission along with poverty in the BRICS economies as the W statistic value is 4.78 and Z bar statistic value is 2.27 with probability 0.02, thus, confirming the acceptance of H_{13}.

The study graphically finds out the graph of actual, fitted and residual of the underlying variables in the model.

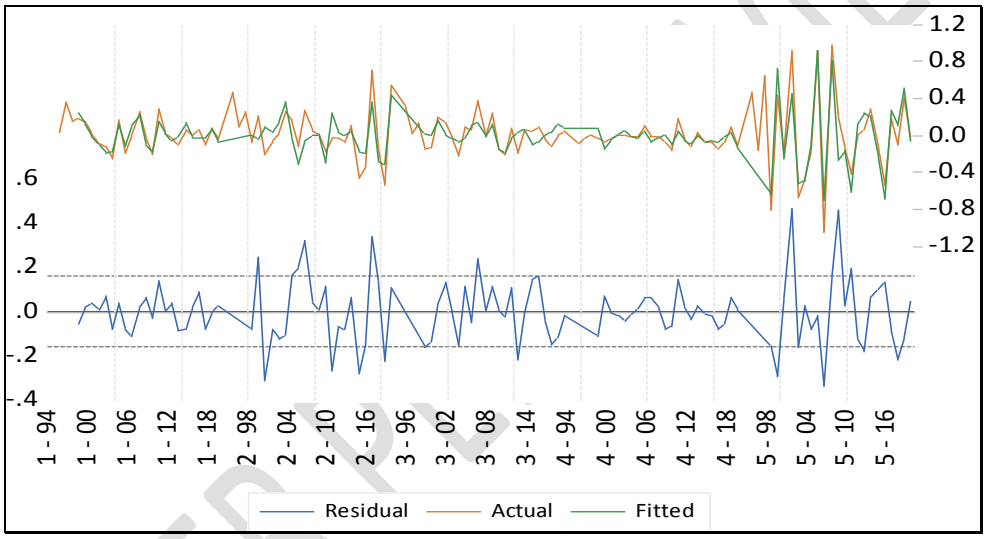

Figure 1: Residual, Actual and Fitted Graph

The graphic above (figure 1) indicates that the actual and fitted graphs are almost identical, proving the model's correctness.

Discussion:

Industrialisation improves the productivity and enhances the production process by utilising advanced technology in both short and long run. As. industries use more labour in the developing countries, the surplus agricultural labours can be easily absorbed by industries to increase national GDP.While industrialisation has its own benefits, it also eventually damages the environment. To be specific, the cost benefit analysis of CO2 emission and industrialisation caused by FDI is a much-neededargument.Accordingly, the current study concentrates finding the rationale behind the association between CO2 emission paired with poverty and FDI in the BRICS.The concept of poverty arises from the fact that in developing economies, both per capita income and income disparity are below threshold.Hence, the idea

of this study is also to combine the industrialisation with income inequality and CO2 emission.

The significance of the results shows that in long run carbon dioxide emission (CO2) coupled with poverty has a positive impact on FDI. Thus, to experience the benefits of FDI, it is evident that the developing economies will not be able to evade environmental degradation.It will also have a significant impact on the poverty and level of income inequality. The study also proves in the short run, if, per capita income increases, there will be lesser FDI inflows in the host countries. The dependency on FDI, thus, can be curtailed if income level accelerates in BRICS economies. This can, for the time being, reduce the environmental hazards in the short run. Though, the necessity for FDI is still an essential factor that requires to be acknowledged if these countries are to achieve any kind of sustainable development in long run.

Mixed results are generated from country-specific short-term outcomes, confirming that certain economies with lower carbon consumption attract higher levels of FDI while a few do the opposite.Also, the result of Pairwise Dumitrescu Hurlin Panel Causality Test ensures that FDI causes CO2 emission in short run, that, ultimately creates higher dependence on FDI. Hence, less dependence on FDI will reduce the environmental hazard in the economy. Moreover, the evidence from the results across the BRICS states shows that raising GDP per capita will effectively reduce the economies' reliance on FDI.Finally, the concentration of improving GDP per capita income needs to be given the highest priority to diminish the reliance on foreign funds which, in turn, will ultimately improve the environmental condition in these economies.

Conclusion:

Investment is very important in the development of the economy and is the main factor of economic growth. Increasing investment leads to a rise in GDP and national revenue. Furthermore, it causes economic growth and general wellbeing to rise. The role of foreign direct investment (FDI) in fostering economic expansion is getting intensified progressively. Both the home and host countries anticipate private capital to play a pivotal role in future economic growth. Although countries are typically open to foreign investors, the nature of each country’s distinct sustainable and economic legislation makes the political environment more difficult or easier to access. In addition to considering the political circumstances, one needs to examine the global ecosystem. As it has been established that higher FDI inflows will inevitably ignore the environmentalatmosphere, the emerging economies can accordingly emphasize the alternatives to boost per capita income and improve sustainability of their economic development to ensure long run economic growth, stability, and income equality in BRICS economies.

Limitation:

The study has considered the limited period of data that are publicly available for the study from world bank. The study would have been stronger with more data.

Managerial Implication:

One of the biggest challenges faced by BRICSis switching from fossil-fuel-based electricity to renewable energy, which is more expensive.Financial challenges include higher

UNDER PEER REVIEW

infrastructure, start-up, and operational costs compared to fossil-fuel-based energy projects. Thus, a stable financial system that efficiently manages price discovery, financing, market liquidity, and risk is essential. Financial institutions provide cash and credit to families, legal organisations, individuals by increasing their consumption and production capability that is the highest priority for the developing economies.

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