Impacts of Energy Production, Environmental Pollution, Healthcare expenditure, FDI on the Economic Growth

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Abstracts: The aim of this research is to investigate the dynamic association among energy production (P), foreign direct investment (FDI), healthcare expenditures (H), environmental degradation (E) and economic growth (GDP). This study uses a balanced panel of Selected Southern Asian territories such as Bangladesh, Sri-Lanka, India, Nepal and Pakistan, data covering from 2005 to 2020. This research applied panel vector auto-regression (PVAR) approach in order to explore the relationships. The outcome demonstrates that environmental degradation and healthcare spending have a significant and direct relationship. Meanwhile, high energy production also contributes to environmental loss.

Keywords: Energy production, foreign direct investment, Environmental degradation, Healthcare spending, and Economic growth.

INTRODUCTION

South Asia has the world's most complex and incredibly hard energy grid. These economies must have access to energy in order to develop and prosper. The need of reducing greenhouse gases simultaneously preserving growth and achieving sustainable economic growth has emphasized in recent work on energy-growth concerns. The effects of climate change could reduce annual global GDP growth by 5%. This proportion could rise to 20% if immediate and essential actions are not taken. The seventh SDG, which specifically discusses pure, economical, and contemporary energy sources from both emerging and advanced countries, is where this research is seeking to focus its attention. The rapid expansion in urbanizations, economies, and rising standard of life are the determinants of rising energy needs in emerging Asia (EIA, 2022). In South Asia, coal makes up a significant portion of the overall energy mix. The region is struggling to strike a balance between the goals of rapid economic expansion, meeting the increase in energy consumption, and enhancing a sustainable environment.

According to WHO (World Health Organization), no fewer than 4 million fatalities all over the globe are assessed to be straightforwardly connected with openness to outside air contamination (Castells-Quintana et al., 2021). Carbon dioxide represents the most prevalent GHG that degrades the environment and harms human health as a result of climate change, among many other reasons (Danish et al., 2018). Additionally, environmental deterioration and economic expansion have a favourable influence on health spending (Siti Khalijah, 2015 and Bedir, 2016). Somewhat recently, it has been seen that an ascent in sicknesses and mortality rates is related with air contamination (Khoshnevis Yazdi and Khanalizadeh, 2017).

Since environmental challenges came into economists' focus, researchers' focus on foreign investment and environmental challenges has grown (Khan et al., 2020; and Wiedmann and Lenzen, 2018). Numerous researchers have added foreign investment to the empirical inspection of ecological contamination, however these examinations have been conflicting (Wiedmann and Lenzen, 2018; Wang and Lee, 2017; and Bilgen, 2014). This, thusly, calls for additional empirical investigation. Recently, analysts and policymakers have recently expressed concern about the interaction between foreign direct investment, environment, and economic prosperity (Gozgor et al., 2018; Ahmed et al., 2024; Li et al., 2024; Boamah et al., 2020; Bhattacharya et al., 2017; and Qi et al., 2022). The adverse effects of pollution also rise as the economy expands (Haibo et al., 2019; and Ayamba et al., 2019).

While focusing on economic advantages, foreign investment should be led with the SDGs plan to attain the sustainable economic growth in South Asia. Therefore, this research inspects the causal association among energy production (P), foreign direct investment (FDI), healthcare expenditures (H),

The International Journal of Learner Diversity and Identities
Volume 31, Issue 1, 2024, http://ijldi-cgrn.com/

ISSN: 2327-0128 (Print), ISSN: 2327-2627 (Online)

Environmental damage (E) and economic growth (GDP) and their influence on sustainable economic growth for south Asian nations from 2005-2020. Besides, the remainder of the paper is structured as: The previous literature is discussed in Section 2, the methodology is covered in Section 3, the empirical findings are examined in Section 4, and the conclusion is wrapped up in Section 5.

LITERATURE REVIEW

Environment, in a strict sense, entails the influence on human survival and advancement. Environmental difficulties are the deterioration of environmental protection or ecological harm brought on by human or natural activity (Andrée et al. (2019)). Sun et al. (2019) additionally divided environmental issues into primary and secondary categories. Environmental issues brought on by natural processes are classified as primary issues, and those brought on by human actions are classified as secondary issues. Carbon emissions are produced explicitly or implicitly during the production of a variety of goods (Sarkodie and Owusu, 2021; Liang et al., 2023; and Jacobson et al., 2019).

Environmental deterioration, which is mostly brought on by GHG (greenhouse gases), is the most dangerous risk to life. Global climate change is primarily caused by an increase in GHG concentration (Zhang et al. 2017).

This harms the climate as well as human wellbeing bringing about an expansion in numbers of deaths. This further effects the efficiency of work, economic growth, industrial production in a nation (Borhan et al. 2018; and Allen et al. 2016). Further, economic growth and ecological degradation are favourably connected with healthcare consumption (Siti Khalijah, 2015; and Bedir, 2016). This demonstrates that in the underlying periods of development, the nation's generally make progress toward more manufacturing at the expense of environmental contamination. Simultaneously, it additionally harms human health that upsurges the healthcare consumption brought about by the country (Wang et al. 2019). Somewhat recently, it has been seen that an ascent in death rates and illnesses is related with air contamination (Yahaya et al. 2016; and Khoshnevis Yazdi and Khanalizadeh, 2017).

There have been numerous prior attempts to assess the relationship between energy consumption and productivity expansion (Luqman et al., 2019; Mukhtarov et al., 2022; Iksan et al., 2022; and Liu et al., 2012; Liu et al., 2023; Qing et al, 2024; and Chen et al, 2022). However, some researchers have looked at the influences of FDI on the ecosystem. For instance, using the Wavelet approach, June et al. (2018) inspected the positive and significant impact of FDI on environmental deterioration from 1982-2016 in China. Also, by employing Sys-GMM and GMM approach, Kaya et al. (2017) investigated that incoming investment from foreign countries upsurges pollution in the environment. Conversely, the exploration by Tang and Tan (2015) concludes that FDI has little influence on environmental damage. While Singhania and Saini (2021) employ dynamic panel data for emerging and advanced nations and concluded that FDI harms the environment as it boosts pollutants emissions to the environment. Omri and Hadj (2020), the research looks at how innovation in technology and good governance work along with FDI to reduce carbon discharges in 23 emerging nations between 1996 and 2014. Furthermore, the empirical findings arrived at the GMM method give the following conclusions: First, FDI inflows have a beneficial impact on carbon pollution, whereas improving governance and technical innovation have a detrimental effect on Carbon emission.

In accordance with the sustainable environmental agenda in the age of globalization, Xue et al. (2024) investigated the impacts of financial development, sustainable economy, and energy demand, across south Asian nations. They employed the ARDL technique and used the panel annual data starting in 1980 through 2018. The overall findings demonstrate that energy consumption has a favourable impact on long-term economic expansion. The significance of energy production, healthcare costs, and carbon dioxide discharge in the OECD economies has discussed by Yan et al. (2024). The results demonstrate a bidirectional relationship between carbon discharges and healthcare costs, but a negative association between energy production and health care spending.

METHODOLOGY

The Vector Autoregression (as of now VAR) approach has been frequently used in macroeconomics analysis to assess the impact of policy recommendations on the macroeconomic indicators since Sims' (1980) landmark publication. Holtz-Eakin et al. (1988) proposed the panel form of the VAR framework, which has since been frequently applied in empirical investigations.

In this research, we adopt a PVAR (Panel VAR) model proposed by Abrigo and Love, 2016, to inspect the causal association among energy production, foreign direct investment (FDI), healthcare

expenditures, CO2 emissions 1 and economic growth. Meanwhile, there are couple of reasons for employing this approach to scrutinize the association between energy production, pollution, FDI, growth and healthcare cost. Abrigo and Love (2016) showed that homogenous PVAR of series 'p' containing panel-specific impacts for 'k' factors can be depicted as bellow:

$$Y_{it} = A_1 Y_{it-1} + A_2 Y_{it-2} + \cdots + A_P Y_{it-P} + BX_{it-1} + u_i + e_{it} \quad \ldots\ldots (1)$$

Whereas; $i \in \{1, 2, 3, \ldots\ldots, N\}$, $t \in \{1,2,3, \ldots . T_i\}$

Where, e_{it} and u_i are vectors of reliant factor-particular idiosyncratic errors and panel fixed effects; Y_{it} is a vector of dependent factors; X_{it} is a vector of independent covariates; and t he parameter matrices are A and B. The residuals' characteristics can be characterized as:

$$\mathrm{E}(e_{it}) = 0, \ \sum = \mathrm{E}(e_{it} e'_{it}) = \ and \ \mathrm{E}(e_{it} e'_{it}) = 0 \text{ for all } t > s.$$

To take into account cross-sectional volatility in the estimation, Abrigo and Love (2016) recommended utilising fixed effects. Due to the possibility of biased findings whenever N is large due to the existence of lag dependent factors just on the right-hand side, Equation (1) could not be estimated by employing OLS. Whenever T is constant and N is enormous, Abrigo and Love (2016) hypothesised that GMM evaluations would produce reliable results for the PVAR framework. This research inspects the causal association among energy production, foreign direct investment (FDI), healthcare expenditures, CO_2 emissions[2] and economic growth. This study uses a balanced panel of Selected Southern Asian territories such as Bangladesh, Sri-Lanka, India, Nepal and Pakistan, data covering from 2005 to 2020. All the data are acquired through "Energy Information Administration" (EIA) and "World Development Indicator" (WDI).

RESULTS AND DISCUSSION:

Empirical Results

Descriptive statistics for CO2 discharge, life expectancy, healthcare expenditure, FDI, population growth rate, energy production, for South Asian economies are stated in table-1. The mean value of energy production (P) comprises of the maximum mean value 50.001, healthcare expenditure is 8.9, while and GDP second uppermost mean value 41.44, the mean value for CO2 emanation is 26.06 which need to be condensed. The mean value of FDI inflow is 11.86. The mean value of the population growth (G) is lowermost in all the factors that is 0.04.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
P	50.001	28.123	0.123	98.409
H	8.900	2.039	4.204	15.107
E	26.061	5.165	5.091	47.031
G	0.0405	0.070	-0.100	0.019
FDI	11.865	4.067	0.04	23.69
GDP	41.444	4.914	11.98	70.908

The investigation variable's correlation matrixes is established in table 2. The value of FDI, healthcare, CO2 discharge, energy production, and population growth recommended weak relationship while with GDP, a strong positive link is reported, which indicates that an upsurge in FDI, Energy Production, and healthcare spending improves economic growth.

Table-2: Correlation Matrix

	GDP	FDI	H	G	E	P
GDP	1					
FDI	0.56	1				
H	0.68	0.29	1			
G	0.49	0.12	0.71	1		
E	0.56	0.43	0.69	0.56	1	
P	0.76	0.43	0.73	0.51	0.67	1

[1] Whereas, carbon emanation is used as a proxy for environmental degradation.

[2] Whereas, carbon emanation is used as a proxy for environmental degradation.

Table-3: Cross-sectional Dependency analysis

Variables	**CD test**	**Probability**
GDP	96.032	0.00
FDI	97.031	0.00
H	96.089	0.00
G	97.543	0.00
E	96.981	0.00
P	97.231	0.00

This inspection also explore the existence of cross-sectional reliance inside the panel data-set by utilizing the CD analysis proposed by Pesaran (2015) which is reported in Table 3. Even though, cross-sectional reliance is shown by the CD test results in Table 3, and extensive research demonstrates that a first-generation unit root analysis give inaccurate outcomes when the panel exhibits cross-sectional reliance. In order to do this, this research uses CIPS analysis (second-generation assessment of panel unit root) proposed by Pesaran (2007). The outcome findings are shown in Table 4.

Table 4: Panel Unit root analysis

GDP	Constant and trends	Constant
FDI	- 1.897	- 2.249
H	- 1.967	- 2.498
G	- 1.325	- 2.098
E	- 1.215	- 2.137
P	-1.435	- 2.652
First differences		
GDP	- 3.098 ***	- 3.123***
FDI	- 3.218 ***	- 3.347 ***
H	- 3.229 ***	- 3.398***
G	- 3.087 ***	- 3.410 ***
E	- 4.098 ***	- 4.105***
P	- 4.109***	- 4.321***

Note: *** denotes significance level at 1 percent

The observation in Table 4 suggest that all factors are not stationary at the level because Ho cannot be ruled out at a 1% level of significance for any of the variables. These findings suggest that it is advisable to employ all variable first differences in econometric inspections. This inspection employed Andrews and Lu's (2001) procedure as reported in below table 5. Besides, this study uses panel VAR sets in view of three slacks of the multitude of factors. The reliable value of panel VAR inclines toward the invertible adaptation of the modulus value, likewise viewed as the normalized condition for consistency (Abrigo and Love 2016; Hamilton (1994); Lutkepohl (2005); and Brüggemann and Lütkepohl (2006)).

Table-5: Panel VAR optimal moment and model selection criteria

Lag	CD	J	p-value	MBIC	MAIC	MQIC
1	1	84.909	0.169	-305.359	-63.987	-159.065
2	1	54.096	0.309	-205.801	-46.012	-111.125
3	1	15.000	0.961	-116.100	-34.301	-68.002

The table 6 demonstrates that the value of every modulus is not as much as unity, which fulfills the consistency state of every modulus. This assessment upholds what is going on of the reliability of eigenvalues.

Table 6: Main Estimation of Panel VAR

Response of	Response to					
	GDP	H	E	P	G	FDI
$GDP_{t-1.}$	0.29***	0.23***	0.43***	0.49***	0.31**	0.21***
	0.00	0.01	0.00	0.00	0.05	0.00
$P_{t-1.}$	0.12**	0.032*	0.50***	0.19***	-0.001*	0.314***
	0.05	0.07	0.00	0.00	0.09	0.001
$H_{t-1.}$	0.13**	0.091***	0.121***	0.491	0.051	0.436
	0.05	0.01	0.01	0.66	0.23	0.23
$E_{t-1.}$	-0.22***	0.410***	0.02**	0.010	-0.01***	0.071
	0.00	0.00	0.05	0.89	0.00	0.21
$G_{t-1.}$	0.03***	0.502***	0.233	1.504	0.051	0.584**
	0.00	0.00	7.983	0.981	0.123	0.05
$FDI_{t-1.}$	0.17***	0.494	0.361	0.032	0.031	0.104**
	0.00	0.45	0.23	0.76	0.95	0.03
No of Countries		5	5	5	5	5

Standard errors informed in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CONCLUSION

The purpose of this research is to inspect the link between energy production, foreign direct investment, healthcare expenditure, CO2 emission, and economic growth for Southern Asia from 2005-2020. First-order lag panel VAR is appropriate for the econometric investigation of models, according to the model's selection requirement and optimal moment. The outcomes of the panel VAR coefficients showed that all indicators have a cause and effect relationship, and that there is a direct and bidirectional association between GDP and healthcare spending as well as between environmental degradation and healthcare spending.

This study will efficiently give suggestions and for further research to various researchers, for the betterment of environmental quality the theoretical and empirical based practical suggestions will be provided by this study. To be well definite, this analysis also has some limitations. For future analysis, this study is also not free from limitations under the discussion of the EKC framework.

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