Energy Consumption, Financial Development and Environmental Degradation: An Empirical Evidence from SAARC Countries

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Abstract

This study examines the correlation between environmental degradation, financial development, and energy consumption in the South Asian Association for Regional Cooperation (SAARC) region. Data covering the period of 1980 to 2022 have been utilized. For empirical estimation, the study applies the Hausman test and the Fixed Effect Model (FEM). The country-specific effects of energy consumption (EC) and financial development (FD) on total greenhouse gases (TGHG) have been checked. The dependent variable is environmental deterioration. TGHGs are used to illustrate ecological degradation. Foreign Direct Investment (FDI) and economic growth have been control variables. FEM results show that EC, Gross Domestic Product (GDP), and FDI all have a significant effect on environmental deterioration. In contrast, the link between FD and TGHG emissions is inverse, implying that FD reduces ecological damage. However, the Environmental Kuznets Curve (EKC) idea has been confirmed since, as GDP grows, pollution begins to drop in an inverted "U-shape." The Pollution Haven Hypothesis (PHH) has also been verified in certain SAARC countries. The findings have significance for governments in encouraging industries to participate in renewable energy projects and for financial institutions in determining how much to subsidize loans for such investment projects to reduce TGHG emissions, resulting in a slightly cleaner environment.

Keywords: Environmental Degradation, Total Greenhouse Gases, Energy Consumption, Financial Development.

Introduction

The air, land, water, forests, oceans, and all of the animals on this planet are all considered part of the natural environment. The environment influences our capacity to exist on the planet (Maurya et al., 2020). Comp composite crescendos of climatic and social upsurges affect an individual's psychological well-being (Zafarullah & Huque, 2018).

Environmental degradation indicates a broad scope of issues, like pollution, biodiversity and creature termination, deforestation and desertification, unnatural weather change, and more. Degradation of the climate happens when natural assets and biological systems are destroyed and natural life is cleared out. Environmental degradation has emerged as a significant issue worldwide with catastrophic consequences (Yilanci et al., 2020).

Technically, institutional, social, and economic activities contribute to environmental worsening. When the natural assets of the world are depleted, environmental degradation

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occurs. Our native species, plant life, wildlife, and microbes are everything compressed by greenhouse gases. When people discharge unsafe substances into the air, territory, water, and soil are impacted. Moreover, pesticides and fertilizers can pollute a region's water supply. The water we drink is polluted. The deterioration of our globe has a significant impact on people, and these harmful behaviors result in diseases and child fatalities (Choudhary et al., 2015).

Human health is directly in danger by environmental pollution, which causes a variety of diseases, including respiratory dysfunction, heart disease, and neuropsychological issues. It also contributes to climate change, the extinction of animal species, and global climate change. Hence, pollution harms humankind and the planet's natural species in ways that cannot be repaired. Maximum countries throughout the globe depend on customary energy assets to satisfy their energy demands because energy consumption is essential for economic development.

Exploiting these resources affects the ecosystem and leads to significant environmental degradation. Moreover, because we can only replenish these sources when they run out, their consumption will have a good effect on the ecosystem. As a result, there is a significant association between energy consumption and the provision of energy services. Consequently, looking at how energy consumption affects emissions is a reasonable task (Islam, 2022).

Energy accelerates macroeconomic performance and growth. It is crucial to a country's macroeconomic performance, but its impact on development and growth relies on the energy supply and demand and the nation's economic structure. There is no denying the significance of the energy industry for all states, but notably for emerging nations. Using non-renewable energy sources could lead to an energy resource shortage in the future, particularly in developing nations. Energy consumption needs to be decreased in production and consumption processes to solve environmental issues (Safdar et al., 2019).

There has been much examination of the association between power utilization, FD (financial development), and ecological degradation. According to earlier research, when energy consumption increases, economic development and economic progress occurs (Aqeel & Butt, 2001). Overusing energy damages the environment, which means that when energy consumption rises, growth accelerates, and the environment deteriorates, as shown by a few studies (Abid, 2015; Ahmad et al., 2005; Zhang & Gao, 2016).

Many variables, including energy consumption, foreign direct investment, industrialization, tourism growth, population, trade, urbanization, technological innovation, institutional quality, and agriculture, all contribute to environmental degradation. Another essential element that has attracted the attention of researchers is financial development (Charfeddine & Khediri, 2016; Shahbaz et al., 2013; Tamazian et al., 2009; Tamazian & Rao, 2010; Yuxiang & Chen, 2011).

Various theoretical and empirical studies have recently indicated the correlation between the progress of finance and carbon dioxide emissions for various countries. Researchers primarily concentrated on this relationship during the 2007–2008 global financial crisis (Kibria et al., 2021). Financial development influences the degradation of the environment in many ways. First, financial development encourages foreign direct investment (FDI) and boosts economic expansion, increasing the need for energy consumption (Mahalik et al., 2017). Second, the growth of the monetary segment and its successful financial intermediary process lead to an upturn in credit used for purchasing goods and services that use energy, harming the surroundings (Sadorsky, 2011). Thirdly, a modern monetary structure inspires investments that increase output potential, consume more energy, and harm the environment (Charfeddine & Khediri, 2016).

On the other side, Frankel and Romer (1999) suggest that developing nations are incentivized to use more cutting-edge and eco-friendly technology during the financial development process, thereby minimizing environmental effects. They also assert that financial growth

promotes businesses' ability to raise money and reduces expenses by implementing green technologies.

The countries of SAARC benefit the environment due to their diverse environments and natural resources (Hasnat et al., 2018). As a result of their transitional nature, SAARC members' environmental quality, lifestyle, and energy consumption are also interlinked (Sarker et al., 2019). These nations are growing faster than the rest of the globe, but lack of access to energy and hunger hinders their progress. India is the world's largest economy, with steady growth of more than 7% since 2013.

Numerous studies have questioned the applicability of the Environment Kuznet Curve and Pollution Heaven Hypothesis in SAARC nations. The depletion of biological resources, energy utilization, population density, urbanization, industry, trade, and FDI are just a few of the environmental degradation factors considered in previous research. Examining the special effects of energy consumption and the progress of finance on ecological degradation in selected SAARC nations makes this study unique and a significant contribution to all the previous studies.

Existing literature has used different proxies like emissions and ecological footprint for environmental degradation in case of SAARC countries (Balsalobre-Lorente et al., 2019; Hunjra et al., 2020; Islam, 2022; Khalid et al., 2021; Kibria et al., 2021; Latief et al., 2021; Pandey & Mishra, 2015; Waqih et al., 2019). Existing literature used only carbon dioxide emissions (metric tons per capita) as an alternative for environmental degradation, which is inadequate to apprehend the environmental effects (Ali et al., 2021; Saleem & Shujah-ur-Rahman, 2019). Total Green House Gases have been used as a substitute for environmental degradation. This novel use of the dependent variable of Total Green House Gases and EC and financial development makes this work a novel contribution to the existing literature.

The core objective of this work is to empirically discover the association between the utilization of energy, financial development, and environmental degradation in the SAARC region of Asia. This study's Specific objectives include examining the soundness of the EKC hypothesis and checking the authenticity of PHH in selected SAARC nations.

The rest of the paper is organized as follows: Section 2 presents a literature review. Section 3 is about the theoretical framework. The methodology and data are given in section 4. The findings and the discussion are presented in section 5. The conclusion and policy implications are presented in section 6.

Literature Review

This section presents a brief overview of existing literature on the association between energy consumption, development in finance, and environmental degradation.

Abbasi et al. (2023) analyzed the EKC, Pollution Halo, and PHH for various Asian nations from 1985 to 2020. The study utilized the ARDL approach for data estimation. Results point out that urbanization, per capita GDP, consumption of energy, and injection of FDI significantly affect emissions. In contrast, GDP square, per capita GDP, and FDI square have inverse effects on the dependent variable. Support for the existence of EKC and the Pollution Haven hypothesis for Asian countries has been found. Moreover, the Pollution Halo hypothesis was validated for Asian countries.

Later, Islam (2022) checked the influence of the development of finance (FD) on releases utilizing yearly panel data from 1980 to 2018. EKC was also tested for existence. The study used the pooled mean group method, generalized least squares estimates, and second-generation unit root and co-integration tests. The findings showed that FD, energy usage, and per capita income positively impacted environmental degradation. The EKC hypothesis was verified as pollution begins to decline in an inverted "U shape with the increase in per capita income."

Tanveer et al. (2022) estimated the relationship between energy consumption and emissions from carbon dioxide in Pakistan. Data were collected from 1976 to 2019. ARDL and NARDL procedures were utilized for empirical testing. As indicated by the results of NARDL, both direct and negative shocks to energy consumption fundamentally supported pollution emissions in the short run. Nonetheless, over time, Pakistan's emissions have extraordinarily decreased due to adverse shocks and are minimally impacted by positive shocks. The study suggested that the public authority should focus on clean energy creation programs to energize the utilization of environmentally friendly energy.

Later, in another study, Ghouse et al. (2021) assessed the correlation between carbon outflows, foreign sources' direct investment, open trade with all nations, and the growth of Pakistan's economy. Data for this analysis was gathered from the year 1972 to 2011. A fully Modified OLS (FMOLS) approach was used to check the long-term effect among the variables. Results of co-integration regression demonstrated the long-term relationships between economic growth and control variables such as domestic investment, labor force, and other independent variables. The interaction terms of carbon dioxide emissions with FDI and emissions with trade openness were positively correlated with the explained variable. In contrast, the correlation between carbon excretion and foreign direct investment is not associated with a dependent variable in the long term. In contrast, the carbon outflows and open trade with all nations strongly correlate with the dependent variable.

Latief et al. (2021) investigated the economic factors of carbon emissions and the dynamic causative relations of CE with foreign direct investment, growth of the economy, and additional economic elements. This study used a panel co-integration test, Dynamic Ordinary Least Squares (DOLS), and Vector Error Correction Model (VECM) for analysis. The study's panel results reinforced the existence of a one-way causative connection between economic expansion (EG) and carbon emissions (CE). It was found that urban population and energy consumption are causally related to carbon emissions (CE).

Amjad and Manzoor (2020) searched the correlation between Pakistan's development in finance and changes in the country's environment. This study used the dataset from the period 1980 to 2014. ARDL method was used to monitor the long-term association and the short-run correlation among the given variables. A causal link was investigated using Granger causal testing. According to study findings, there was a unifacial correlation between the excretion of carbon and the financial development index. However, Pakistan's financial development will ultimately influence the environment. However, in the other model, financial development also affected the environment.

Balsalobre-Lorente et al. (2019) looked at the relationship between direct investment through foreign sources and ecological footprint. The time frame was between 1990 and 2013. It employed a panel data model, and an experimental structure was based on the Pollution Haven Hypothesis (PHH). Empirical findings verified an inverted-U connection between direct investment through foreign sources and the ecological footprint using Fully Modified Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) methods. EKC theory for the selected nations was supported. The study validated that the usage of renewable energy, process of urbanization, and ecological footprint were all negatively associated with the ecological footprint.

Appiah (2018) checked the causal correlation between the outflow of energy consumption and Ghana's GDP using data from 1960 to 2015. Toda Yamamoto tests, Johansen co-integration, and Autoregressive Distributed Lag (ARDL) bound tests were used for analysis. Granger's causality results demonstrated the correlation between energy consumption, growth, and excretion.

Zhang et al. (2017) tested the Environmental Kuznets Curve for ten newly industrialized countries. Independent variables include trade openness, GDP in the actual term, and overall

energy consumption. Data were taken from 1971 to 2013. Results showed that trade in all countries has a harmful and substantial impact on CO2 excretion. In contrast, GDP, in a real sense, and energy utilization have a constructive impact on carbon outflows. A causal relation has been found among the variables in the short run. In the long run, the Error Correction Terms demonstrated feedback links between outflows, GDP in a real sense, and all other variables.

Shahbaz et al. (2016) explore the correlation among energy usage, carbon emissions, and country growth in a panel of Next-11 nations. The primary purpose of this analysis was to see the association between these factors in all Next-11 countries using data from 1972 to 2013. Time-varying Granger causality was used. This study found the growth of an economy which is the source of emissions in Bangladesh and Egypt. Economic growth in the Philippines, Turkey, and Vietnam pushes energy consumption, whereas in South Korea, energy consumption drives economic growth. Outcomes exposed a unidirectional time-varying Granger causation going from the growth of an economy to carbon outflows in Indonesia and Turkey.

Al-Mulali et al. (2015) observed the connection of different types of variables: environmental degradation, urbanization and trade in all countries, growth of an economy, financial development, and energy consumption. Pedroni co-integration test indicates the long-period correlation amongst the variables under consideration. FMOLS results exposed that economic progression, financial development, and urbanization increase carbon excretion in the long term. This research revealed that only trade in all countries could reduce carbon emissions.

Pao and Tsai (2011) addressed the effects of development in finance (FD) and the progress of an economy on environmental degradation in BRIC countries (except Russia) between 1992 and 2007 between the years 1980 and 2007. Results confirm the Environmental Kuznets Curve theory since carbon excretion, in the long run, tends to be elastic when it comes to consuming energy and inelastic concerning FDI. Causality outcomes demonstrated a significant bidirectional correlation between emissions and FD.

Farhani and Ozturk (2015) examined links between Tunisia's carbon outflows, GDP in real sense, consumption of energy, development in finance, trade with all countries, and urbanization using data from 1971 to 2012. ARDL-bound technique for co-integration and ECM were employed to investigate the long-term connection. A positive correlation between development in finance and environmental contamination indicated that Tunisia's development in finance has come at the price of environmental degradation. Real GDP and emissions had a positive monotonic association. This displayed that the given data did not support the EKC hypothesis.

Shahbaz et al. (2014) discovered the presence of EKC in Tunisia. This study utilized the yearly data dated from 1971 to 2010. ARDL tests are used to check the correlation among variables in the long run, and VECM is used to discover the trend of interconnection among the explained and explanatory variables. Innovative Accounting Method (IAA) was utilized to assess the robustness of this research. Results revealed a long-run association between the variables and the existence of EKC.

Ozturk and Acaravci (2013) looked at links between the excretion of carbon, energy consumption, trade between the countries, economic growth, and financial development in Turkey using data from 2007. Data for the analysis was gathered through WDI. ARDL, error correction, and Granger tests were used for analysis purposes. The bound F-test was utilized for co-integration. Conclusions presented a long-term relationship between the dependent and independent variables. Results indicated that a rise in the ratio of international trade to gross domestic product causes an increase in the excretion of carbon as a per capita ratio. Over the long term, development in finance has an insignificant impact on carbon outflows. EKC hypothesis' applicability to the Turkish economy was validated.

Sharif and Raza (2016) determined the association between urbanization, growth in the country's economy, and the excretion of carbon in Pakistan. Data for the period of 1972 to 2013 was used. ARDL test, Johansen and Juselius structural break tests, and Gregory and Hansen structural break tests were used. These approaches establish the validity of the long-term positive interaction of carbon outflows with urbanization. The study used FMOLS and DOLS estimators, and the findings supported the validity of the long-run coefficients. Variance Decomposition Method (VDM) results show an informal correlation between urbanization and the excretion of carbon. Consequently, it was highlighted that specific measures, such as requiring the government of Pakistan to devote a more significant amount of its budget to environmental protection and energy-saving techniques.

Shahzad et al. (2014) empirically explored the correlation between the economy's growth, energy consumption, excretion of carbon, and trade openness. The empirical investigation utilized annual data from 1973 to 2011. A co-integration connection is observed with the use of the ARDL method. Vector Error Correction (VEC) determined the short-term association for all the variables separately. There was a two-way causal correlation among the variables. Trade openness also increases the consumption of energy. Consuming energy and development in the country's finances has a bifacial correlation. Alternative energy supplies are used to overcome or solve these problems for more growth. The introduction of conservation strategies is required to reduce energy resource spillovers and wastage and efficiently utilize limited energy resources.

Jalil and Feridun (2011) tested the effects of development in finance, growth in the country's economy, and energy consumption on environmental contamination in China. Data for this study covers a period from 1953 to 2006. ARDL bounds testing was utilized to examine the long-term association between the dependent and independent variables that are positively influenced. Findings showed that the coefficient of FD has a negative sign that shows an adverse effect of development on the country's finances and environmental degradation. The study's results also supported the existence of EKC in China.

Theoretical Framework

Early in the 1990s, Grossman and Krueger (1991) published an essay that studied the ecologically sound effects of the North American Free Trade Agreement (NAFTA) and asserted that economic expansion would worsen the environment. This work marked the beginning of the environmental-growth literature. A hypothesized correlation between several ecological factors and income (per person) was the Environmental Kuznets Curve (EKC). Early economic expansion is accompanied by an increase in pollution releases and a reduction in ecological quality. However, after per capita income reaches a specific level, which varies depending on several factors, the trend is reversed, and economic growth improves the environment. It implies that per capita emissions and income follow a reversed U-shaped curvature.

Panayotou (1993) developed the term Environmental Kuznets Curve (EKC), similar to Kuznets' theory. EKC denotes the upturned U-shaped link concerning economic development and environmental deterioration. This implies that environmental pollution rises initially and decreases as income levels rise.

Later, Grossman and Krueger (1995) made a reduced form relation between (per-income-pita) and various environmental variables, including sulfur dioxide, particulate matter, water quality indices, and pollution of rivers. A study discovered evidence that, up until a certain point in development, environmental quality degrades with economic development, but as development continues, environmental quality starts to increase. The authors discovered significant proof of a reversed U-formed link concerning income (per capita) and environmental deterioration in several environmental quality metrics, particularly sulfur dioxide. This suggested that whereas

environmental quality declines in lower-income per capita nations due to economic expansion, environmental quality rises in higher-income per capita countries. The "peak turning points" of the reversed U connection between per capita income and pollution are also examined by Grossman and Krueger (1995).

Two theories, the (PHH) and the Pollution Halo Effect Hypothesis, explain how foreign direct investment affects environmental performance. Pollution haven theory holds that FDI draws overseas polluting businesses to developing nations because of their lenient environmental restrictions, which lower the quality of the environment. Therefore, emerging nations are transformed into "pollution havens." According to the Pollution Halo Theory, FDI promotes advanced technology industries that assist the environment in developing nations.

Agreeing with the Pollution-Halo Hypothesis, foreign businesses tend to transmit ecologically beneficial technologies to the host nation via investment by adhering to international environmental standards. In this case, FDI might have either a positive or negative impact, which could cause the environment to either improve or worsen (Pao & Tsai, 2011; Waqih et al., 2019).

According to the Scale Impact Hypothesis, foreign businesses work at full capability in the developing nation. Foreign Direct Investment significantly boosts the local economy, negatively affecting ecological quality Pao and Tsai (2011).

Data and Methodology

Data and Variables Description

This investigation employed total greenhouse gases (kt of carbon dioxide equivalent) as a stand-in for the environmental indicator. Data on economic growth (constant 2010 U.S. dollars), FDI (net inflows as a percent of GDP), and energy usage (kg of oil equivalent per head) have been utilized. The IMF index development related to finance ranges from 0 to 1 and is used to measure financial development data. The study used total greenhouse gases as a dependent variable, as well as consumption of energy, development in the country's finances, growth in the country's economy, and FDI as independent variables. Economic growth and FDI are used as control variables. This study examined the correlation between the consumption of energy, development in the country's finance, and environmental deterioration in five SAARC member countries such as Bangladesh, India, Nepal, Pakistan, and Sri Lanka, using data from 1980 to 2022. Bhutan, Afghanistan, and Maldives are also SAARC-affiliated nations but were omitted because of the non-availability of data.

Methodology

Study proposes following given in equation 1:

$$TGHG = f(EC, FD, FDI, GDP) \quad (1)$$

where TGHG is total greenhouse gases; EC is energy consumption; FD is financial development; FDI is foreign direct investment and GDP is gross domestic produt.

Environmental Kuznets Curve (EKC) has been postulated in following equation:

$$TGHG = f(EC, FD, FDI, GDP, GDP^2) \quad (2)$$

Transforming the above equations into econometric models, gives the following:

$$\ln TGHG_{it} = \beta_0 + \beta_1 EC_{it} + \beta_2 FD_{it} + \beta_3 FDI_{it} + \beta_4 GDP_{it} + \beta_5 GDP_{it}^2 + \mu_{it} \quad (3)$$

where FDI is Foreign Direct Investment (PHH term); GDP^2 is square of GDP **(**EKC term**),** μ_{it} is Error Term, t = Time span i = Countries or cross-section. Literature shows that energy consumption, FDI and GDP have positive association with environmental degradation. While financial development and GDP^2 have negative association with environmental degradation.

Equation of FEM can be composed as follow:

$$y_{it} = \beta_0 + \beta x_{it} + \mu_{it} \quad (4)$$

where y is dependent variable; and x_{it} are explanatory variables.

General form of the models are given below:
To test Environmental Kuznets Curve (EKC) theory, following equation has been estimated:

$$\ln TGHG_{it} = \beta_0 + \beta_1 EC_{it} + \beta_2 FD_{it} + \beta_3 FDI_{it} + \beta_4 GDP_{it} + \beta_5 GDP_{it}^2 + \mu_{it} \quad (5)$$

Results and Discussion

This study investigates the association among energy use, development in finance and degradation of environment in selected SAARC countries namely: Bangladesh, India, Nepal, Pakistan, and Sri Lanka. Data analysis is carried out covering time span of 1980–2022. Study employed panel data analysis for five specific SAARC nations. The Fixed Effect Model has been employed to achieve the goals. This section also discusses the results of the redundant fixed effect test and the Hausman specification (Fixed Effect vs. Random Effect Model) test. The influence of consumption of energy and development in finance on total greenhouse gases in nominated SAARC states has also been assessed.

Table 1: Summary statistics

Variables	Mean	Median	Std. Dev.	Maximum	Minimum	Observations
lnTGHG	11.76	11.69	1.57	15.03	9.76	195
EC	351.73	350.29	125.01	636.57	104.86	195
FD	0.21	0.19	0.09	0.49	0.07	195
FDI	0.71	0.54	0.72	3.66	-0.09	195
GDP	281.77	99.00	512.0	2800.00	4.20	195
GDP^2	340286	9801	1137329	7840000	17.64	195

Note. Author's own calculations

Table1 provides summary statistics for each variable. The results of correlation matrix are presented in Table 2 which indicates linear relationship among variables.

Table 2: Correlation Matrix Table

Series	lnTGHG	EC	FD	FDI	GDP	GDP^2
lnTGHG	1.000					
EC	0.274	1.000				
FD	0.679	0.633	1.000			
FDI	0.221	0.543	0.651	1.000		
GDP	0.724	0.538	0.757	0.424	1.000	
GDP^2	0.556	0.479	0.612	0.367	0.944	1.000

Note. Author's own calculations

Table 2 shows correlation matrix of variables. Results of the Hausman test to check if the coefficients analyzed by the FEM and the REM are identical or not are given in table 3. Based on p-value, the null hypothesis is rejected, supporting the FEM to be, more appropriate.

Table 3: **Correlated Random Effects: The Hausman Test**

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross-section random	6368.242	4	0.000

Note. Author's own calculations

Table 4: Result of Redundant Fixed Effects Test

Test	Statistic	d.f.	Prob.
Cross-section F	1292.611	(4,185)	0.000

Note. Author's own calculations

Table 4 depicts the results of redundant fixed effects test. Results firmly reject the null hypothesis that the POLS is an applicable model, and hence the FEM. Also, it demonstrates the presence of significant individual effects (cross-section-specific effects).

Table 5: Results of Fixed Effect Model dependent Variable: lnTGHG

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	10.71	0.04	230.84	0.000
EC	0.002	0.00	16.42	0.000
FD	0.21	0.10	2.00	0.045
FDI	0.02	0.01	2.69	0.007
GDP	6.26	2.32	2.69	0.007
R^2	0.99		**F-statistic**	29284.939(0.000)

Note. Author's own calculations

Table 5 shows the results of FEM in a linear model. It shows that all variables have statistically significant and positive effect on the explained variable which is (lnTGHG).

Table 6: Results of Fixed Effect Model Dependent Variable: lnTGHG

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	10.75	0.04	218.38	0.000
EC	0.002	0.00	15.62	0.000
FD	-0.45	0.12	-3.70	0.000
FDI	0.02	0.01	2.37	0.018
GDP	7.78	8.63	9.01	0.000
GDP^2	-2.28	2.73	-8.35	0.000
R^2	0.99		**F-statistic**	14201.29(0.000)

Note. Author's own calculations

Results of the FEM of the non-linear model are shown in table 6. The EC and GDP coefficients both are significant at 1% level, and have positive impact on TGHG. The coefficient of FD has a negative and significant value. An upsurge in the financial development index's value decreases environmental deterioration by 0.45%. It implies that financial institutions may make loans to businesses which are environment friendly.

Positive and significant coefficient of EC demonstrates its positive impact on ecological degradation. Because the majority of SAARC nations rely on non-renewable energy sources rather than renewable (environmentally friendly) energy sources to help economic actions, but these resources generate significant environmental pollution. The coefficient of FDI is statistically significant at a 1% level of significance and positive, specifying that foreign direct investment increases GHG emissions in selected SAARC nations and validates the PHH in selected SAARC nations.

At the 1% level of significance, the GDP coefficient is positive and significant. Increases in per capita income increase the quantity of commodities and services produced in the economy,

resulting in polluting gases being released into the surrounding environment. Furthermore, since 1980s, the SAARC nations have been transitioning from cultivation to up-to-date business and economics. As a result, the rate of industrialization and urbanization has enhanced so worsening the environment.

Contrariwise, The GDP squared coefficient is negative as well as significant at the one percent level of significance, indicating that as economic activity grows, income (per capita) rises, resulting in higher living standards, access to better healthcare, and the provision of additional services. Now at this level of development, safety precautions and environmental quality control are required in the economic compass that aids in the reduction of greenhouse gas emissions. The negative and substantial value of the coefficient of squared GDP confirms this phenomenon. It suggests that the squared GDP reasons greenhouse gases on the way to reduce. This shows, when GDP rises, it adopts a transposed shape, which confirms the EKC theory in the selected SAARC nations.

Table 7: Results for Energy Consumption in selected SAARC countries dependent Variable lnTGHG

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	10.73	0.0762	140.86	0.000
BGD--EC_BGD	0.002	0.0004	5.03	0.000
IND--EC_IND	-0.003	0.0008	-4.29	0.000
NEP--EC_NEP	0.006	0.0004	15.08	0.000
PAK--EC_PAK	0.004	0.0003	11.95	0.000
SRI--EC_SRI	0.0005	0.0002	2.12	0.034
R^2	0.99		F-statistic	4056.371

Note. Author's own calculations

The fixed effect result for energy consumption in nominated SAARC nations is shown in table 7. According to economic theory, the coefficient of consumption of energy is statistically significant and positive for all selected nations, and energy consumption causes environmental deterioration. However, the value of coefficient for India is statistically significant and negative. It shows that increasing energy consumption by one unit reduces environmental deterioration by 0.003 percent in India due to the utilization of environmentally friendly or renewable energy sources.

In case of Bangladesh, the coefficient of consumption off energy is positive, suggesting that one unit rise in energy consumption causes a 0.02 percent upsurge in TGHG releases. In the same way, the coefficient of consumption of energy is positive in Nepal, Pakistan, as well as in Sri Lanka, indicating that one unit rise in energy absorption upsurges degradation of environs by 0.06, 0.004 and 0.0005 percent in that order.

Table 8: Results for Financial Development SAARC; Dependent Variable: lnTGHG

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.59	0.09	112.72	0.00
BGD-FD_BGD	-0.25	0.63	-0.40	0.68
IND- FD_IND	-1.86	0.43	-4.30	0.00
NEP- FD_NEP	3.86	0.90	4.27	0.00
PAK- FD_PAK	-0.17	0.42	-0.41	0.68
SRI- FD_SRI	-3.40	0.66	-5.15	0.00
R^2	0.99		**F-statistic**	2195.99

Note. Author's own calculations

The fixed effect result for financial development in selected SAARC nations is shown in table 8. For India and Sri Lanka, the financial development coefficient is negative and statistically significant, and according to the economic model, financial growth reduces environmental deterioration. The coefficient finding for Nepal is positive and statistically significant. It suggests that a unit rise in the financial development index increases environmental degradation by 3.86 percent, implying that financial organizations may be issuing finances to companies and venture capitalists for environmentally unfriendly businesses. While the coefficient of FD (financial development) for Pakistan and Bangladesh is statistically insignificant, the value of the coefficient of FD is negative, indicating that financial development reduces TGHG emissions in both nations and shows that one unit upsurge in the financial development index minimizes ecological greenhouse gasses by 0.17 and 0.25 percent, respectively.

Conclusion

The objective of this study is to examine the correlation between environmental degradation, financial development, and the consumption of energy. FDI, GDP, and GDP squared have been employed as control variables. The present study uses panel data from 1980–2022 for selected SAARC nations: Bangladesh, India, Nepal, Pakistan, and Sri Lanka. After applying the Hausman specification test, the fixed effects model for both linear and non-linear models has been employed for estimation.

Results show that over time, energy consumption is positively associated with TGHG in certain nations. In selected SAARC nations, one unit increase in energy consumption resulted in a 0.002 percent increase in the degradation of the environment. On the other side, the financial development index has a favorable effect on the degradation of the environment. In selected SAARC nations, one unit upsurge in financial development resulted in a 0.45 percent decrease in environmental degradation.

The Pollution Haven Hypothesis (PHH) is supported by the findings that FDI positively and substantially influenced environmental degradation in several SAARC countries. Environmental damage increases by 0.02 percent for every unit increase in FDI. The GDP coefficient is favorable and significant at the one percent significance level. The amount of goods and services generated within an economy via various types of raw materials increases with a rise in per capita income, leading to harmful atmospheric emissions.

Additionally, the squared GDP coefficient is negative and substantial at a one percent level, indicating that as the economy grows, per capita income rises along with improved living standards, health care, and other services. At this level of development, safety precautions and quality control become required in the economic compass that aids in reducing greenhouse gas emissions. This phenomenon is authenticated by the squared GDP's negative value and substantial coefficient, which suggests that the squared GDP causes greenhouse gases to decrease.

The study determines that the consumption of energy has a positive impact on environmental degradation in chosen SAARC states. Meanwhile, development in the country's finance improves the environment quality in the sample states. Consequently, enlightening the value of development in the nation’s finances will help lessen ecological degradation, and the GDP growth rate will also rise. Therefore, some strategies ought to be devised to improve the monetary section and improve environmental quality in selected SAARC states. It is critical to increase the contribution of clean energy sources to overall energy consumption to improve the environmental quality in selected SAARC nations. There is a need to inspire businesses towards environment-friendly production techniques, invent energy-saving production, and capitalize on green technologies to mitigate greenhouse gases in selected SAARC nations.

This shows that when GDP rises, it adopts a transposed shape, which confirms the EKC theory in the selected SAARC nations. The findings are comparable to those of prior studies (Acaravci & Ozturk, 2010; Jalil & Feridun, 2011; Lean & Smyth, 2010; Panayotou, 1993; Saboori & Sulaiman, 2013; Selden & Song, 1994; Shafik & Bandyopadhyay, 1992).

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