



Research Article

Nexus between Economic Growth and Environmental Degradation: An Analysis from Developing Countries

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Abstract

Naturally, human beings unceasingly search for change and are involved in small or huge commercial actions that are intended to achieve the fundamental needs and protect their interests in any credible way. Considering the significance of the environment, we have emphasized the economic factors, human development, and energy consumption affecting environmental degradation in developing nations. We have used data from 2001 to 2022 and employed the fixed effect method for the analysis. The study results showed that energy consumption and human development resulted in more environmental degradation in developing countries. The results also showed that economic growth and trade openness tended to increase environmental degradation. The study suggested more improvement in the environment in these economies. There should be more usage of safe and clean energy in production processes for a clean environment. Furthermore, the Government should provide more educational facilities and jobs to different segments of the population for their higher earnings and improved living standards. Finally, there is a dire need for more provision of energy resources for more growth, production, and welfare in these Asian countries.

Keywords: Energy consumption, Human development, Environmental degradation, Developing countries.

Introduction

Human beings are reminiscent of change and are involved in economic actions for their survival in different ways. Individuals from both industrialised and emerging nations have a relaxed approach to uses that are not environmentally friendly, for example, air conditioners, automobiles, fuel generators, houses, and apartments that have informal apparatuses that could lead to increased energy demand. Since energy production is non-renewable, it could damage the environment by increasing the ratio of CO₂ emissions in the atmosphere. Numerous studies support that the growth of the biosphere's temperature is associated with Greenhouse gases (Galli et al., 2012). Wackernagel and Rees (1998) familiarized the idea of ecological footprint to gauge the collective burden of individuals' use on the environment. The intention of the ecological footprint is dependent on six land usage groups to follow the compression of human feasting, specifically grazing ground for farm animals, woodland, cropland (food and fiber requirements), sea, carbon footprint, and developed land (human infrastructure growth).

As stated by the Global Footprint Network, our environmental requirements for resource use and land

engagement have even now surpassed the carrying capacity of the earth. Therefore, humans have been breathing in ecological overshoot conditions since 1970, which can lead to ecological degradation, resource reduction, and even failure of the environment (Ewing & Cervero, 2010). In the main stream of ecological works, CO₂ emissions are utilised showing environmental dilapidation, however it simply signifies a slight part of ecological deprivation (Al-Mulali et al., 2015). Ecological footprint is an internationally similar, complete, and dependable gauge of ecological impact, and it has in recent times been favoured over CO₂ emissions as it can disclose the effect of human activities on the ecosystem regarding soil, air, and water (Al-Mulali & Ozturk, 2015; Hassan et al., 2019).

The human ecological footprint refers to the mutual effect of human doings, which can be restrained concerning the zone of bio-productive land, the water required to produce goods used up, and the subsequent waste produced. More basically, it can be pronounced as the influence on the atmosphere that results from the manufacture of commodities (i.e., goods and services) to ease an obligatory existence (Rashid et al., 2018). Considering the significance of the environment for growth and development, we have checked the impact of energy consumption, human development, economic growth, and trade openness on ecological degradation in selected developing countries. This contribution will provide policies for further development and an improved environment.

Research Questions

1. How does energy consumption affect ecological degradation?
2. Does human development affect environmental degradation?
3. How does economic growth affect environmental degradation?
4. How does trade openness influence ecological degradation in developing countries?

Significance of the Study

A lot of studies highlight that major factors such as inflation, industrialization, foreign direct investments, exports, etc., affect growth and the environment. However, we have highlighted the significance of energy consumption, human development, economic growth, and trade openness on environmental degradation in selected developing countries.

Research Hypotheses

The major hypotheses are presented as:

1. H₁: Energy consumption and environmental degradation are positively related.
2. H₂: The higher the human development, the higher the environmental degradation.
3. H₃: There is a positive relationship between economic growth and environmental degradation.
4. H₄: Trade openness will lead to an increase in environmental degradation.

Literature Review

Much of the literature shows the importance of investments, inflation, industrialization, information, communication, and technology in affecting growth, development, and environmental degradation. But we have pointed out few studies showing the role of energy consumption, growth, human development, education, exports, financial development and trade openness on environmental degradation in developing and developed nations of the world. Grossman and Krueger (1995) used panel data and validated the inverted U-shaped EKC. Their findings indicated that poor economies hardly managed environmental pressure with increasing developmental stage in the initial phases.

Lee (2005) focused on energy usage and growth in underdeveloped nations by using data from 1975 to 2001. The author has used the OLS techniques and the long-run cointegration method for the study. It was found that long-run and short-run causalities run from energy consumption to GDP, but not vice versa. The study concluded that energy conservation would harm the growth of underdeveloped economies. Kohler (2013)

found a relationship between growth and carbon emission in Africa. The study result showed a positive relationship between growth and emission with foreign trade in that economy. Niu et al. (2013) focused on how power consumption affected human development by using panel data from 50 countries from 1990 to 2009. The result concluded a two-way causal relationship between electricity consumption and GDP per capita and HDI. Ozturk and Acaravci (2013) focused on the influence of energy usage on carbon emissions by using data from 1960 to 2007 in Turkey and used the ARDL method. The result showed a link between energy consumption and CO₂ emission within the framework of the EKC hypothesis.

Al-mulali et al. (2015) also emphasized factors affecting environmental degradation. They used data from 93 economies and applied the fixed effect method and the GMM technique. The result highlighted an inverted U-shaped relationship between the ecological footprint and GDP growth, which represented the EKC hypothesis in upper-middle and high-income nations but not in rich economies. The result also showed that energy consumption, urbanization, and trade increased ecological damage. Ahmad et al. (2016) used data from 1971 to 2014 in India. They checked how energy usage affects CO₂ emissions. The result pointed out that energy consumption led to an increase in the CO₂ emissions in that economy. Ozturk et al. (2023) CO₂ and energy consumption on the income group of the countries. It was found that energy consumption and ecological footprint were moving in tandem. The EKC, though, was validated in upper-middle and upper-income countries.

Hassan et al. (2019) extracted data from 1971 to 2014 and found a relationship between energy consumption and footprint consumption. They used the ARDL model for this analysis. The study findings showed that economic growth increased the ecological footprint, which contributed to environmental degradation. Furthermore, biocapacity also increased the ecological footprint and contributed to environmental degradation. Ahmed and Wang (2019) used data from 1971 to 2014 in India. The study findings showed that human capital and energy consumption led to an increase in ecological degradation. Hung (2021) examined the causal relationship between China's economic growth, renewable energy, and HDI by using data from 1990 to 2019. And found a two-way relationship between economic growth and HDI in different time and frequency domains.

Majeed et al. (2021) emphasized the effects of energy usage along with growth on ecological eminence for Pakistan by using data from 1971 to 2014. The result showed that aggregate consumption revealed that only negative shocks significantly affected the ecological footprint. It was also found that an increase in oil consumption deteriorated the environment. Hao (2022) checked the effect of renewable energy consumption, human development, and economic growth on climate change from 105 countries by using data from 1990 to 2019. The author used the VAR and GMM methods. It was found that in high-income and upper-middle-income countries, industrialization tended to increase the CO₂ emissions, while FDI had a negative effect on the CO₂ emissions, which supported the pollution halo hypothesis. Finally, the result showed that trade and energy usage tended to reduce emissions in middle-income economies. Roy (2024) investigated the impact of factors affecting environmental degradation based on data from 1990 to 2016 in India. It was found that FDI, RE, and GDP negatively affected the ecological footprint consumption in the long term. One-way causation passed from GDP to FDI and NR; TA to FDI and RE.

Methodology

In this section, we have used data from 2001 to 2022 from developing countries and found the relationship between environmental degradation and economic factors, energy usage, and human development. We have focused on the major factors that enhanced environmental degradation in selected developing countries. Data on the major factors were taken from WDI. We have used ecological footprint consumption as the dependent variable. However, energy consumption, human development, economic growth, and trade openness were considered as explanatory variables for this analysis. We have also used the fixed effect method to investigate the factors affecting environmental degradation in developing countries.

Model Specifications

The model is given as:

$$\text{LECFPC} = \beta_0 + \beta_1 \text{LENUSE}_{it} + \beta_2 \text{HDINDEX}_{it} + \beta_3 \text{LGDP}_{it} + \beta_4 \text{TROPN}_{it} + u_{it} \quad (1)$$

LECFPC= the natural logarithm of per capita ecological footprint consumption

LENUS= Log energy use per capita (kt)

HDINDEX= Human Development Index (life expectancy at birth, literacy rate, and living standard)

LGDP= Log GDP per capita \$ US

TROPN= Exports and imports of goods and services (% of GDP)

it = (time trend)

ui = (error term)

Results and Discussion

Table 1. Descriptive statistics

Variables	Mean	Standard deviation	Minimum	Maximum
ECFPCON	1.6167	0.9317	0.5732	3.7203
ENUSE	957.9819	773.1846	153.5601	3060.387
HDINDEX	0.6554	0.1045	0.454	0.849
GDPPC	8366.292	4003.546	2803.555	21011.62
TRADOPN	57.1586	28.2027	25.3062	144.8809

Table 1 indicates that, on average, ecological footprint consumption is 1.6167 percent, with a range of 0.5732 to 3.7203. It indicates large variations. On average, energy consumption per capita is 957.9819 percent. It has also been observed that, on average, the human development index is 0.6554 percent with a standard deviation of 0.1045 percent. However, on average, economic growth is 8366 percent in selected Asian countries. Finally, trade openness is 57.1586 percent in these countries.

Empirical Estimations

The chi-square value is 113.19, and its probability is 0.000. So we used fixed effects here.

Table 2. Fixed effect results.

Variables	Coefficients, Standard Errors and t-values
LENUS	0.5967* 0.603 (9.90)
HDINDEX	0.2196 * 0.0796 (2.76)
LGDP	0.1518* 0.0511

	(2.97)
TRADOP	0.0007 *
	0.0002
	(3.77)
C	2.0289
	0.0779
	(26.04)
F-Statistics	237.92
Probability	0.0000
R-Square within	0.90
R-Square Between	0.92
R-Square Overall	0.91

T-values are in parentheses; * $p < 0.1$.

Table 2 shows fixed effects results. Energy consumption is a very important factor affecting environmental degradation in developing countries. More usage of energy results in more ecological footprint consumption in the economies. It has been observed that a one percent increase in energy consumption resulted in an increase in ecological footprint by 0.5967 percent in developing countries. Our finding is favoured by Majeed et al. (2021).

Human development is the chief factor affecting the environment. More education, production, and earnings result in more productive activities in developing countries. The result showed that a unit increase in the human development index has caused more environmental degradation by 0.2196 percent. Highly educated human capital is involved more in earning activities, which may lead to more ecological footprint consumption and more environmental degradation. The result is inconsistent with the study by Hao (2022).

Economic growth may also lead to environmental degradation in developing economies. More investments and more productive activities result in a more usage environment, which deteriorates the environment. People from urban areas are involved in earning and productive activities, which results in more ecological footprint consumption. The result indicated that a one percent increase in economic growth resulted in a 0.1618 percent increase in ecological footprint consumption by 0.1618 percent. The result is supported by Hao (2022). Trade openness also causes more ecological footprint consumption and more environmental degradation in the concerned economies. The reason may be that more investments and industrialization by the educated and skilled population, especially from urban areas, have increased environmental degradation. The finding is supported by Roy (2024).

Conclusions

We have focused on the economic factors, human development, and energy consumption affecting the environmental degradation in selected developing nations. We have used data from 2001 to 2022 for the analysis. Ecological footprint consumption was used as the dependent variable, and energy consumption, human development, economic growth, and trade openness were taken as independent variables in this analysis. The study findings pointed out that energy consumption and human development resulted in more

environmental degradation in developing countries. Moreover, economic growth and trade also seemed to be increasing ecological footprint, consumption, and environmental degradation in the analysis.

Based on the findings, the study recommends further improvement in the environment. There should be more usage of safe and clean energy for a safe and clean environment. All this will result in more and longer human survival or existence. There should be more provision of energy resources for more growth, production, and welfare in developing countries.

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