



## Investigate the Relationship between Economic Growth and Environmental Quality in D8 Member Countries

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**Abstract:** In recent years the impact of economic growth on environmental quality has attracted the attention of many scholars and experts. The second half of the 1990s, researchers have attempted to identify factors affecting the relationship between economic growth and environmental hazards and use them in models. One of the items that gives examined this relation is Environmental Kuznets Curve, which shows an inverse U-shaped relationship between environmental pollution and economic growth. This curve shows that economic growth destroys the environment in low-income levels, but when the income increases, harmful environmental impacts reduced. For this purpose, present study examined the relationship between economic growth and environmental quality in D8 member countries, including Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan and Turkey using panel data model in the period 1975-2012. The results show that the Environmental Kuznets Curve hypothesis is confirmed the studied countries.

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### 1. Introduction:

Nowadays economic growth is one of the main challenges of the world and the few indicators to measure the economic progress (Kawata, 2011, 43). This concept is the main target of most of the government's economic policies. However, rapid economic growth is usually caused serious losses to the environment (due to the increased use of natural resources). Hence, there is the potential conflict between economic growth and environmental policies, so environmental hazards arising from economic activity has become a controversial issue. According to this issue in recent decades some of the environmentalists do not agree with free trade and economic growth at the expense of environmental degradation (Dinda, 2005, 405). On the other hand, some experts believe that to achieve a cleaner environment and the eradication of poverty, economic growth is necessary. So gradually the issue of the conflict between economic growth and environmental quality turned into the one of the topics discussed in the field of environmental economics (Pazhouyan and Morad, 2007, 142). Pollution and waste materials into

the environment resulting from human activities are causing harm to plants, animals and ecological systems. Emission of pollutants in the air, dump them in rivers and absorbed them by soil imports Irreparable damage to human welfare such as increase in diseases or mortality, reduction in entertainment and so on. The consequences of excessive use of natural resources environmental degradation and climate change in the past two decades has led researchers to attempt to examine the relationship between pollution emission and economic growth (Kawata, 2011, 44). Public attention to environmental issues took place during the 1960s and the main focus was on industrial pollution. Generally, pollution includes air pollution, water pollution, noise pollution and pollution from waste. Among these air pollution is one of the phenomena of the last century. The most important air pollutants include carbon monoxide, carbon dioxide, sulfur oxides, particulate matter and ozone in the air. Carbon dioxide is one of the main gases that contribute to climate change and global warming and as such is known as cross-border pollution. 60 percent of the greenhouse gases caused

by carbon dioxide emissions. This gas is among a variety of other gases creating a high share of air pollution (Lopez et al, 2009, 21). Therefore, this study attempts to examine the relationship between economic growth and environmental quality in the D8 member countries.

## 2. Theoretical Principles and Previous Studies:

In the recent two decades the relation between the development level of societies and the amount of access to environmental standards and in other interpretation, environmental considerations has been in the spotlight of the researchers. Also in the field of economy, this subject has been focused on by a specific idea. One of the subjects in this field that has allocated different researches to itself is the relation between the income level and the environment destruction. The status of shaping of different researches in this field show that in recent decades, there have been two main ideas about this which have ultimately come into a third idea (Pazhouyan and Lashagrizadeh, 2010, 170).

The first idea which is called “the anti-growth theory” says that; economic growth necessarily causes environment destruction. Because it means injecting more staple and energy to the economic system and subsequently producing more residues, so economic growth not only in terms of scarcity of resources, but also in terms of increase of the residues and being more than the capacity of the natural environment causes some dangers which causes the damaging or destruction of the systems that are necessary for life and decreases welfare (Lopez et al, 2009, 26).

In the other side of this spectrum there is a second idea which is called “the economic growth theory”. This group believe that economic growth is the only way to provide the wealth required to protect the environment, so instead of being a threat, economic growth can help refine the quality of the environment. Step by step that economic growth causes the increase of products and services the motivations of protecting the environment become a high priority and its importance in political schedules becomes more, and different methods like replacing the resources, technological inventions and changing the request method by comparative price change are formed to protect the environment. The conflict between these two ideas and basic differences in their reasoning alongside empirical evidence of each of these groups caused the advent of a third idea in the 1990 decade which says; the relation between economic growth and environment quality, positive or negative, in the development process is not stable, actually, this relation is reverse when income reaches a specific amount. Such a relation is known as an

upside-down “U” in economic growth texts and “environmental Kuznets curve” or “Environmental Transition Hypothesis” in environmental fields. This relation has got its name from Simon Kozents (1955), the winner of Nobel prize for being the first one to discover the relation between the income level and the distribution of income as an upside-down “U”. In recent years many researches have been done about the relation between economic growth and pollution (Dinda, 2004, 437).

In general, for studying the theoretical basis of the relation between economic growth and environment, we can sort them out this way: The first group, contains the studies which focus on the requirement part of the economy and the features of the preference of the consumer specially the income capacity of environmental products. In these studies, that have mostly been considered the factor of use about the relation of growth and environment, pollution has been inserted as a required factor and is formed by using. The factors which affect the relation of growth and environment in these samples contains the scale of the economic activity of the consumer’s preference between usage and pollution decrease (Mc Connell, 1997, 385).

The effect of scale on pollution alongside controlling other factors, has been an increasing uniform function from income. The act of economic activity’s scale getting bigger with the amount of resources being used, also producing more residues cause the environment destruction.

Therefore, the effect of scale on pollution is positive. The preference of the consumers towards pollution decrease can be an effective factor on improving the quality of the environment in the process of economic growth.

According practical studies done, like Khana (2002) and Kristrom (1996) it has been defined that environmental products have been normal and the income capacity for these products is bigger than one. According to the environmental products being normal and luxe, it is expected that people’s preference in high income levels with the levels of economic growth being traversed, lead to having a healthier environment, which’s result is the decrease of pollution in high income levels. The second group contains the studies that lay on the supplying part of the economy. In these studies, in which the factor of production in the relation of growth and environment has been considered, pollution has been used as an input in the function of production or has been created as an externality in the process of production. The factors effective on the relation of growth and environment in these samples are the effect of scale, the structural effect and the intensity of effluence of the pollution (Lopez and Mitra, 2000).

The structural changes which accompany the economic growth effect the environment quality by changing the structure of the economic activity to parts with less or more pollution intensity. In lower income levels the prevailing transfer is the transfer from agriculture to industry. And its result is increase of the pollution intensity; but in high income levels the prevailing transfer is from industry to services which causes the increase of air pollution intensity. So the share of industry changes in GDP can show the structural changes. As the share of industry in the combination of economic activities first increases and then decreases, the environmental pollution also first increases and then decreases by the growth of income and in this case we can see the reverse between income and the environment (Panayotou, 2000).

The intensity of pollution effluence in samples of suppliers, affected by resources of economic growth, political and technological effect. In the first levels of development, countries grow by accumulation of physical capital and at the next levels development continues by acquisition of manpower. So with accumulation of physical capital in the first levels of economic growth, pollution increases, too. And with growth of average income, transfer of economy from industry to services and using manpower instead of physical capital, pollution decreases, too; because according to Rybczynski theory, in international business, accumulation of manpower capital causes the growth of clean(environmental) industries. And this leads the resources from polluted section to clean section and in this case we can see the stable relation between income and pollution (Pazhouyan and Lashgarizadeh, 2010, 172).

Also the intensity of pollution effluence can be affected by political effect which means environmental rules and requirements that are applied by the government. In lower levels of economic activities, the anti-pollution laws are almost useless and have a very small effect on pollution decrease; because for setting up a law-based system for pollution decrease it is needed to spend money. In lower levels of income, tendency to pay money for pollution decrease is less than the specified amount. In this situation there is no point in setting up a law-based system and also without such a system, pollution will surely increase with economic growth; but in higher income levels and after reaching an income threshold, the intensity of pollution effluence decreases and in the step of decreasing the pollution, anti-pollution policies have been applied or intensified. So it is expected that with economic growth and increase of incomes, the intensity of pollution decrease because of ordaining and applying environmental laws (Copeland and Taylor, 2004, 43).

Another effective factor on pollution effluence intensity is technology which affects the pollution amount in two ways. First is the fact that with technology improvement and using new technologies, production functions will need less environmental products or the fact that as a compliment of production commodity, will have less pollution; which means commodity production with less pollution of environment. Second is the fact that with technology improvement there can be a pollution decrease, too. And it can cause that these industries work more useful and get rid of the residues with less costs and the result of both technology improvement effects is the decrease of pollution intensity (Dinda, 2005, 420).

According to the mentioned cases it can be concluded that in studies which focus on the supplying part of the economy, the roles of variables like political variables, technological variables, the share of industry changes in GDP and the accumulation of physical or manpower capitals, are very important in determining environmental situation during the economic growth process (Pazhouyan and Lashgarizadeh, 2010, 173).

The third group of researches done about the study of the factors that are effective on the relation of growth and environment, are those which focus on both sections of requirement and supplying of economy. In these studies, pollution has been imported in both functions of being required and production and the factors effective on pollution are the effect of scale, preferences, technology and politics.

Ketabforoush et al (2015) have evaluated the impact of ICT on the quality of the environment in Iran 7 countries in the Persian Gulf area in the period 2005 to 2012 using panel data methods. The results show that telephone lines as ICT indicators have negative and significant effect, GDP per capita variable positive effect and concentration of population and GDP per capita squared had a negative effect on quality of the environment. Also it should be noted, the obtained results have approved the environmental Kuznets curve hypothesis.

Mei Ong and Kun Sek (2013) in a study have paid the impact of ICT on east Asian economic growth using panel data set from 1970-2008 in the three income groups: high, medium and low. The results showed that the variables of trade and inflation have very little effect on the quality of the environment. FDI also has a negative effect on the quality of the environment in low and middle-income countries.

Ahmed and Ridzuan (2013) have examined the interaction effect economic growth and environmental quality in the period 1975 to 2006. The



paper found out that labour, capital and telecommunications investment have positive relationship towards GDP. Thus, the study concludes that ICT has played an important role as engine of growth for sustainable development in ASEAN5 and ASEAN5+3 countries.

Hepburn and Bowen (2012) in a study investigated the relationship between economic growth, environment and climate change in the period 2008-2012. The results showed that, when sustained economic growth is desirable, that does not lead to detrimental effects on the environment.

Kawata (2011) has investigated the effect of the environment from economic growth by 2 priorities; natural environment and the opportunity cost of protecting the natural environment. Results indicate that the second factor plays a significant role in improving the quality of the environment.

Constantini and Martini (2010) in a study that examined the effect of internet, fixed and mobile phones per 1000 people to release various contaminants. The results showed that the index of ICT has a positive impact on various contaminants including CO<sub>2</sub>.

Zhang and Cheng (2009) have analyzed the relationship between energy consumption, carbon dioxide emissions and economic growth in China. The results indicate that the energy consumption and carbon dioxide emissions have no significant relationship with the country's economic growth.

Annette (2009) has tried to analyze and explain how effects of technology on the environment. The results show the use of recycled and renewable technology to produce its positive effects on the environment, although that increases the amount of mercury entering the factories and having different destructive effects on the environment.

Lopez et al (2009) examined the effect of combining public spending on environmental quality and has shown that increasing public spending in areas such as the environment and communications are reduced CO<sub>2</sub> emissions.

Ang (2007) has explored the dynamic causal relation between carbon dioxide emissions, energy consumption and production in France during the years 1960-2000. The results show that economic growth due to long-term energy consumption and environmental pollution, and a one-way causal relationship between the energy consumption is set to increase production in the short term. The findings also show that an increase in energy use, carbon dioxide emissions will increase.

Alam et al (2007) in their study have paid the effect of environmental factors during the years 1971 to 2005 in Pakistan. The main findings of this study

suggest that the increase in GDP and energy intensity increased environmental pollution.

### 3. Research Methodology:

#### 3.1. Estimation Method:

Panel data is data from a (usually small) number of observations over time on a (usually large) number of cross-sectional units like individuals, households, firms, or governments. In other words, panel data analysis is a method of studying a particular subject within multiple sites, periodically observed over a defined time frame. With repeated observations of enough cross-sections, panel analysis permits the researcher to study the dynamics of change with short time series.

The combination of time series with cross sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions (Gujarati, 2003). Some more advantages of panel data as given for example Since panel data relate to individuals, firms, states, countries, etc. over time, there is bound to be heterogeneity in these units. The techniques of panel data estimation can take such heterogeneity explicitly into account by allowing for individual-specific variables. By studying the repeated cross section of observations, panel data are better suited to study the dynamics of change. Panel data can better detect and measure effects that simply cannot be observed in pure cross-section or pure time series data. By making data available for several thousand units, panel data can minimize the bias that might result if we aggregate individuals or firms into broad aggregates. Panel data analysis endows regression analysis with both a spatial and temporal dimension.

The spatial dimension pertains to a set of cross-sectional units of observation. These could be countries, states, counties, firms, commodities, groups of people, or even individuals. The temporal dimension pertains to periodic observations of a set of variables characterizing these cross-sectional units over a particular time span. There are several types of panel data analytic models. There are constant coefficients models, fixed effects models, and random effects models etc. The Constant Coefficients Model has constant coefficients, referring to both intercepts and slopes. In the event that there is neither significant country nor significant temporal effects, we could pool all of the data and run an ordinary least squares regression model. This model is also called the pooled regression model.

The Fixed Effects Model would have constant slopes but intercepts that differ according to the cross-sectional (group) unit—for example, the country. Although there are no significant temporal effects, there are significant differences among countries in

this type of model. While the intercept is cross-section (group) specific and in this case differs from country to country, it may or may not differ over time. The Random Effects Model assumes a regression with a random constant term (Greene, 2003). One way to handle the ignorance or error is to assume that the intercept is a random outcome variable. The random outcome is a function of a mean value plus a random error. But this cross-sectional specific error term which indicates the deviation from the constant of the cross-sectional unit must be uncorrelated with the errors of the variables

**3.2. Data and Statistics:**

The statistical society of this study are 8 countries of the D8 group, including Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan and Turkey. The period has been used 1975-2012. This is the time series data collected from WDI2015. According to the theoretical framework presented in this section attempts to relationship between economic growth and environmental quality in the context of Environmental Kuznets Curve (EKC). To search for EKC in D8 member countries econometric model is extracted from the patterns provided by Grossman and Krueger (1995) and Atil (2011):

$$\ln CO_{2it} = \alpha_i + \beta_1 \ln GDP_i + \beta_2 \ln (GDP_i)^2 + \varepsilon_{it} \quad (1)$$

$\ln CO_{2i}$ : natural logarithm gas emissions per capita CO<sub>2</sub> (in tonnes)

$\ln GDP_i$ : Log GDP per capita of country i

$\ln (GDP_i)^2$ : square log GDP per capita of country i

$\varepsilon_i$ : including the error.

Also, as can be seen, according to the hypothesis of EKC variable square LnGDP also included in the model. According to this hypothesis, there is an inverse U-shaped relationship between GDP per capita and indicators of environmental degradation, so that in the early stages of economic growth, the increase in GDP per capita with more environmental destruction, but of a threshold level then, increase economic growth improves the quality of the environment.

In relation to the above model can be pre-judged, based on the following formula:

A)  $0 > \beta_1$  and  $0 < \beta_2$ : In this case, the equation can be expressed in the form of a U-shaped relationship.

B)  $0 < \beta_1$  and  $0 > \beta_2$  The equation for a hump-shaped relationship (U reverse) is given, the maximum function curve shows the point of return. This curve is the Environmental Kuznets Curve.

**4. Research Findings:**

**4.1. Stationary of the variables Test:**

To test the hypothesis stationary variables, we used Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. The results of the reliability of variables is provided in Table (1).

Table 1. Results of ADF and PP tests for variables:

Test	ADF (Prob)	PP (Prob)
Variable	With intercept	With intercept
LnCO <sub>2</sub>	0/0017	0/0000
LnGDPP	0/0000	0/0000
Ln(GDPP) <sup>2</sup>	0/0002	0/0259

Sources: research findings

Based on the results presented in Table 1 hypothesis stationary variables using both ADF and PP test statistics show that all variables are static at the level model.

**4.2. F-Limer and Hausman Tests Results:**

Table 2 shows that the value of F test statistic using fixed effects would be more appropriate. Houseman also test statistic indicates the suitability of the method for estimating the fixed effects model.

Table 2. Results of F- Lymr and Houseman test of the estimated model

Test	F- Lymr Test	Houseman Test
Statistics	155/7043	49/0568
Prob	0/0000	0/0000

Sources: research findings

**5. The results of estimation and analysis of findings:**

According to this, the model of economic growth on environmental quality in D8 member states results using fixed-effects panel data is presented in Table 3. According to this, the model of economic growth on environmental quality in D8 member countries results using fixed-effects panel data is presented in Table 3. The estimated coefficients show the relationship between the explanatory variables and the dependent variable and the coefficients signs indicate a positive or negative impact on the quality of the environment. The results are shown in Table 3.

Table 3. Results the effect of economic growth on environmental quality in D8 member countries

Variable	Coefficie nt	T statistics	Prob
LnGDPP	1/0927	6/126 5	0/000 0
(LnGDPP)^ 2	-0/0389	- 3/0157	0/002 8
R <sup>2</sup> =9562		R <sup>2</sup> <sub>bar</sub> =9549	
D-W=2/2532			

Sources: research findings

As you can see, the coefficient of gross domestic product per capita is positive and equal to 1/09. This means that a one percent increase in GDP per capita, the growth in emissions of CO<sub>2</sub>, 1/09 percent increase. This shows that pollution levels published by increasing per capita income increases. Increasing environmental degradation stems from two reasons. First, in the early stages of economic growth, given high priority national production and employment levels, as abundant natural resources and energy used to achieve high economic growth. Second, due to low per capita income, the firms are unable to pay for pollution reduction. On the other hand, obtained coefficient for the square of GDP per capita is negative and equal to -0/038. In other words, with continued economic growth in D8 member countries will decrease environmental degradation. This means that with increasing incomes, D8 member countries have attempted to import new technologies that are environmentally friendly, creates less pollution. Also, as can be seen in the R<sup>2</sup> estimated model is 0/95, which this shows that the explanatory power of the independent variable.

## 6. Conclusion:

One of the issues of economic growth, the issue of environmental crisis, which has greatly increased in recent years in scientific circles. The occurrence of acid rain, global warming, ozone depletion, extinction of some animal species and..., all things that point out the importance of environmental issues in recent decades. This phenomenon is not only economic growth, but also have to face the risk of human survival. This is while the country's share in pollution vary but the threat of pollution produced by the same residents. Most economic projects in the field of environmental economics, for it have been that the correlation between environmental degradation and economic growth for developing countries who will investigate this issue is of great importance. Some empirical evidence shows that the relationship between environmental degradation and economic

growth Camelcase shape. In other words, the environmental degradation increases with economic growth. This increase continues until it reaches the reversal point curve. Back then point curve, with reduced economic growth and environmental degradation. This Camel case curved shape because of his resemblance to Kuznets curve - the relationship between income inequality and income levels shows - called the Environmental Kuznets Curve.

The first study Environmental Kuznets hypothesis was that in 1991 by Grossman and Krueger, research in this area grew rapidly. But empirical evidence in all the studies do not support the hypothesis Environmental Kuznets. The cause of this issue depends on the type of pollution indices, functional form, econometrics and explanatory variables (independent) into the regression, terms and theories in the period considered. However, economic activity involves the use of resources. According to the law of thermodynamics leads to the generation of waste and waste resources.

Environmental Kuznets hypothesis suggests that at low levels of development of countries to parallel with the growth, increasing environmental degradation. In contrast, in developed countries, economic growth with reduced environmental damage. This study examined the effect of economic growth on environmental quality in D8 member countries in the period 1975-2012 using panel data model. The results showed that economic growth will have a positive effect on carbon dioxide emissions. However, the square GDP per capita significant negative effect on carbon dioxide emissions. Also Environmental Kuznets Curve hypothesis was confirmed in this study.

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