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Nexus of Economic Growth and Environmental Degradation in India Environmental Kuznets Curve (EKC) Approach

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Abstract
Environmental Pollution is an important issue in the process of Economic Growth. The deterioration of environment begins to have direct impact on the quality of human life, or even a threat to the survival of human being. This paper is aimed at investigating whether there exists the famous inverted U shape relationship between per capita GDP and CO_2 emissions as hypothesized by Environmental Kuznets Curve (EKC). For this purpose time series data for aforesaid factors along with FDI and Population density has been taken for the period 1991-2014 from the World Development Indicators. The findings of the paper revealed that there is 'U' shaped relationship between per capita CO_2 emissions and per capita GDP. The paper concludes that, at Indian condition the EKC hypothesis has failed to explain the inverted relationship between per capita CO_2 emission and GDP.
Keywords: Co-integration, Granger Causality, EKC and India.

1. Introduction

Over the last two decades changes in government policies like privatization, liberalization and globalization has given a new boost and opportunity to economy to work freely. As a result, economy starts growing at faster rate. But these reforms had created a tremendous pressure on environment resources like forest, land, water, and air. These changes have made the market too competitive that nobody has time to think about public properties like environment and its resources. Being a public good, improvement in environment is the responsibility or business of everybody but everybody thinks why me, which results in nobody. Means, everybody is there to pollute environment but nobody is there to protect it or to clean it. Increasing population, industrialization, laissez-faire economics, poverty and urbanization are also some of the other factors responsible for environmental degradation.

Sustainable Development is most common phrase used by the world economics. Sustainable Development means economic development with ecological sustainability. According to Brunt land commission 1987, " sustainable development means meeting the needs of present generation without compromising the needs of future generation". But if we see the reality every economy is concern about its GDP. GDP defines sum total of economic production of goods and services on the basis of transaction in the domestic market in a year. Calculation of GDP ignores the cost of depleting the environment resources. Every economy wants to beats the other economy and wants to be at top. Not only economies but individuals are also running after each other to attain higher ranking in competitive market, ignoring what damages they are causing to environment and its resources, which will indirectly affect their health. Failure of Kyoto protocol project is one example. This project fails because it imposes limit to the economic growth in reduce carbon emission.

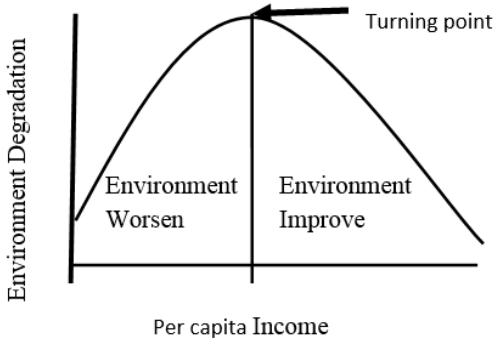
But have you ever think about: What environment gives us and what we are giving back to environment? What is the carrying capacity of environment? What will be the future, if natural resources depletion and environment degradation is done in the same way? Can we move ahead to economic growth with sustainability? Which sector of the economy is creating more of environment degradation is it poor countries; developing countries or developed countries? Related to this, different schools of economist have given different view. Some says microeconomic policies itself will promote environment sustainability, some ecological economist such as Daly (1996) has suggested that growth should be limited rather than exponential growth to attain sustainable economic scale as resources are limited.

The past decade has seen all trends of environmental degradation accelerate such as greenhouse gas emissions, deforestation, loss of biodiversity. Such patterns of environmental destruction have been driven by increased economic activity, of which FDI has become an increasingly significant contributor. Flows of natural resource based commodities and investment are predicted to rise faster than economic output in future. It is therefore critical to understand the environmental effects of private investment and identify appropriate responses (Nick and Richard, 1999).The Indian economy has attaining continuous growth in the past mostly due to its success in raising international trade which now accounts for approximately 200% of Gross Domestic Product (GDP). The inflow of substantial foreign direct investment (FDI) and a robust capital market are the key elements that supported India's economic growth. India emerged the most attractive investment destination in the world for the next three years, may lead to a increase FDI inflows in computer software and hardware, trading, service, automobile and telecommunication sectors. Similarly India plan to cut carbon emissions by 33 to 35 percent from 2005 base levels by 2030 through the adoption of about 40 percent electric power installed

capacity from non-fossil fuel based energy resources by 2030 with help of transfer of technology and low cost international finance and also by Creating an additional carbon sink of 2.5 to 3 billion tones of CO_2 equivalent through additional forest and tree by 2030. India is third emitter of CO_2 in the world followed by China and USA. This paper is aimed at investigating the two most important benefits and costs of foreign direct investment in the Indian context that is GDP growth and the environmental degradation. The non-linear model examines the relationship between foreign direct investment and environmental degradation in India during 1991 to 2014.

1.1. Environmental Kuznets Curve(EKC)

In 1955, Nobel laureate Simon Kuznets gave a famous hypothesis an inverse 'U' shaped income- inequality relationship named as Kuznets Curve. In this hypothesis according to Kuznets, at initial level income inequality increases as income rise and reach to peak where average income level is attained and further declines with increase in income level. Later economist Grossman and Krueger in 1995 found this hypothesis can be used in context of environment representing the income-pollution relationship and it was named as " Environmental Kuznets Curve". Environmental degradation and income per capita. In EKC hypothesis contends that pollution increases initially as a country develops its industry and thereafter declines after reaching a certain level of economic progress which is known as Threshold level(Figure). Inflection point is that point where the environment degradation is at its peak and after that it shows a downfall with further increase in real per capita GDP.



1.2. Methodological Issues

The study uses the non-linear model to examine the relationship between per capita GDP and environmental degradation in India during 1991 to 2014. Besides, the long run growth impact of per capita GDP inflow on CO_2 emissions is due to be important.

The model is:

$$CO_2 = f(Y, Y^2, FDI, PD)$$

where, Y is per capita GDP , FDI is foreign direct investment, PD is population density.

Equation of the model is:

$$\log CO_{2t} = \alpha_0 + \alpha_1 \text{IogGDP}_t + \alpha_2 (\text{IogGDP}_t)^2 + \alpha_3 \log FDI_t + \alpha_4 \log PD_t + e_t$$

where, CO_{2t} is Carbon dioxide in year t; Y_t is Gross Domestic Product per capita in year t; FDI_t is foreign direct investment in year t and PD_t is population density in year t.

In this equation, whenever the coefficient of the logY is positive and that of Y2 is negative; it indicates the existence of the EKC hypothesis. All data used in this study have been taken from the secondary source i e World Development Indicators for the period 1991to 2014. The analysis starts by testing the stationarity of the available data using conventional time series unit root test by using Augmented Dickey Fuller (ADF) test. Then, co-integration test will be used once the stationarity of all data is detected. The Johansen co-integration test has been used in order to see if there exists a long run relationship between the variables. And also granger causality test is used to test the direction of causality between FDI and GDP, FDI and CO_2 emission , GDP and CO_2 emission and Population and CO_2 emission.

1.3. Analysis and Interpretation of Results

The result indicates that all of the data for India are stationary after the first difference for ADF Unit root test. These result confirmed that the model meet the requirement to proceed with panel Co-integration test. Once all series are confirmed to be categorizing as stationary, the Johansen Co-integration test is used to test whether the dependent variable and all the independent variables in all the equations exhibit fundamental long-run relationship among each other. The results for Johansen Co-integration test shown that the value of trace statistic and max-eigen value for India are larger than the 5% critical value. Therefore, we accepting the null hypothesis of four co-integrating vector found in the long run.

To determine the direction of causality between the variables used Granger causality test, it shows that there is PD& CO2 and GDP and CO2 having the bi-directional causality . The direction of causality reveals that

CO2 is one of the major pollutants which deteriorates the environment is generated by the economic growth and Population density and in same way CO_2 is cause of PD and GDP. While, there is no causality found between GDP and FDI, FDI and CO2 . Table 1 below shows the result of the coefficient of each variable.

Table 1: Long-run Elasticities

	India
Constant	-3.20***
GDP	-2.29**
GDP^2	0.41***
FDI	0.02
Population Density	2.49***
Adjusted R^2	0.98
F-Value	459.46
DW Statistic	1.96

Note: *** and ** denote significant at the 1%, and 5% significance levels, respectively.

From the adjusted R square, F statistic and Durbin-Watson statistic test, we can see the model is well fit. And most of the coefficients show expected signs and high significance. In case of pollutant CO2 the anticipated EKCs is not found to exist. The coefficient of logGDP is -2.29 and log GDP^2 is 0.41. This fallows 'U' shape instated of inverted 'U' shape curve for India. The result indicates that increase in economic growth will lead to decreases in pollution at Indian condition. India has experienced rapid economic growth in recent years, that growth can lead to strong advancement in living standards if be handled well without any excessive adverse effect on environmental quality. Persistent growth in material consumption and resource usage will lead to serious long term harm to the environment. This rapid economic growth, however, has come with a huge cost to the environment. The deterioration of environment begins to have direct impact on the quality of human life, or even a threat to the survival of mankind. Therefore, environmental regulation needs to be stringent and strengthened in order to have the harmonized development. The appropriate assessment of the environmental resources is the key to sustainability. Awareness, faculty, finance, infrastructure, research and marketing (Affirm), is a framework of the government's approach. In order to brace the effect of atmosphere change, India will implement policies to protect economic growth and development factors, as well as moderate strategies to decrease emission of greenhouse gases.

For India, the empirical results show that Population Density is significant determinant of the pollutant. Likewise, a 1% increase in Population Density will lead to a rise in CO_2 by 2.49% and respectively. The result of the study shows the sustained growth of Population Density is one of the important causes of environmental degradation in India. This is true as human activities have contributed to the release of pollutants into the atmosphere which are a threat to health and the natural ecosystem, and also add to the greenhouse effect (Kennedy, 1999). We should have perfect the Population growth policy and environmental protection laws. The coefficient of FDI on pollution is positive. This shows that the more FDI the society has the higher pollution.

Conclusion

The study examines the relationship between pollution and economic growth for India from 1991 to 2014. Gross Domestic Product per capita was included in the study to explain the EKC in India. The expected EKCs are not found to exist at Indian contest, since the EKC hypothesis is not supported in the case of CO2 emission, but India is like just hatched egg i.e India emerging from developing nation to developed nation, for this it necessary to exploit the environmental resource. These kind of action will cause the environmental degradation. There may be possibility to exist EKC hypothesis in future. This can be manage by strict Environmental policies, control of population growth and by diverting the FDI in public private entraprises. For Indian condition Precaution is better than cure.

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