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Reassessing the Association Between Economic Growth and Environment: An Indian Case

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ABSTRACT

The standard of living of people is improving as the global economy grows and develops, but economic progress is frequently associated with environmental damage, either directly or indirectly. This paper attempt to answer the question whether GDP is granger causing CO₂ emission or CO₂ emission is granger causing GDP. The data for the study have been collected mainly from the secondary sources such as WB databank, research papers, government reports etc.

Key words: Environmental degradation, Carbon Emission, GDP, Environmental Kuznets curve

Introduction

It is evident that with the growth and development of the world economy the livelihood of the people is getting improved. But as we know for everything, we are doing has a cost and similarly for economic growth also we have to bear some costs in the form of environmental damage. Since 1850, different human activities have been releasing excess greenhouse gases which are damaging or hampering our environment. Stephen Montzka said there are four main greenhouse gases we have to worry about, namely Carbon Dioxide (CO₂), Methane, Nitrous Oxide (N₂O) and a group that contains Chlorofluorocarbons (CFCs) and their replacements. However, Montzka further stated that these four greenhouse gases are the ones "that we [humans] have direct control over."

We have empirical evidences that shows that with the initial stages of development of the states the level of environmental degradation or the environmental pollution increases but when the devel-

opment reaches a threshold level the level of pollution or degradation gradually declines. This relation is shown by the *Environment Kuznets Curve (EKC)* which is of 'Inverted-U' shape.

Literature Review

A paper by Jalil and Mahmud (2009) have tested the Environment Kuznets Curve for China over the period of 1971-2005, where they found that there is a unidirectional causality moves through economic growth to CO₂ emission. They also found that the energy consumption is another determinant that gives rise to the CO₂ emission.

Again Choi *et al.* (2010) have studied the existence of the environmental Kuznets curve (EKC) for carbon dioxide (CO₂) emissions and its causal relationships with economic growth and openness by using time series data (1971-2006) from China, Korea and Japan. They found that the Environment Kuznets Curve does not exist for Korea. Whereas China had an N-shaped Kuznets curve because the cubic model specification was statistically significant. This

curve was initially an inverted U-shaped curve, but after the turning point, it rises again. And lastly for Japan, the inverted N-shaped curve, which is unexpected, was statistically significant in terms of the relationship between GDP and CO₂ emissions. In terms of CO₂ emissions, there was no U-shaped EKC. Their results suggest that economic growth is not the only determinant that reduces environmental degradation.

Objectives

The objective of the paper is to analyze the causal relationship between CO₂ emission and economic growth.

Data and Methodology

The study is mainly based on the secondary sources of data. Data are collected from different secondary sources like World Bank databank, research papers, government reports etc.

In the paper we are mainly analyzing the causality between economic growth (GDP per capita) and carbon emission (Mt. per capita) for India. The time series data of these two variables for the period of 1960-2014 have been collected from the World Bank databank and is also transformed in *Natural Logarithm* form.

We checked the stationarity of these two data series by *Augmented Dickey Fuller (ADF)* test at 10% level of significance. If they are not stationary then we will difference them and again run ADF test. After this *the test of cointegration* is done to check the long run relationship between these variables. Further the granger causality test is employed to test the causality between the variables under consideration.

Results and Discussion

The result of the stationarity in Table 1 shows that both the variables are non-stationary at level and stationary at first difference. Thus, for further analysis the variables in their differenced form is used.

The *Johanson Cointegration test*, which will tell us about the long run association between the two variables DLGDP and DLC, result is shown in the Table 2.

The above table (Table 2) shows that the two variables DLC and DGDP are cointegrated as the probability value of None* is 0.0000(<0.1) which indicates that there exist at least one cointegrating equa-

Table 1. Test of stationarity

	LGDP	LC
At level	0.36	1.12
At First Difference	-6.41***	-7.59***

Note: * significant at 10% level, ** significant at 5% level, *** Significant at 1% level

tion, i.e., there exist a long run association between DLC and DGDP at 10% level of significance.

The following Normalized cointegrating coefficients shows that DLC and DLGDP are 77.45% (1: -0.774522; here we will neglect the '-' sign) cointegrated.

Therefore, we can now check the Granger Causality between these two variables (DLC and DLGDP) which will tell us which variable is moving first.

The *Granger Causality test* (for the variables LGDP and DLC) introduced by Engle –*Ganger* has been employed and the result is shown in the Table 3.

The above table shows that the Null Hypothesis of DLGDP does not Granger Cause DLC has not been accepted, thus, we will accept the Alternative hypothesis that DLGDP Granger Causes the DLC at 5% level of significance.

Again, the Null Hypothesis of DLC does not Granger Cause DLGDP has not been rejected at 5% level of significance. So, here we can conclude it by saying that there is a unidirectional long run causality between GDP Per Capita and CO₂ emission, where the GDP per capita is causing CO₂ emission to grow. In layman's language, the GDP moves 1st and it causes more CO₂ emission. In other words, there is a positive long run relationship between economic growth and increasing CO₂ emission for India (1960-2014).

Conclusion

Many studies have agreed with the existence of trade-off between Environmental quality and Economic growth. However, some studies again show that this trade-off exist until a certain level of growth, after reaching a certain threshold level of growth the economic growth takes care of the environmental quality. EKC shows this relationship.

We know about the 77% of cointegration between GDP Per capita and CO₂ emission per capita of India for the year of 1960-2014. Testing the Granger Causality let us know that there exists a unidirectional

Table 2. Test of Cointegration

Hypothesized No. of CE(s)	Eigen value	Trace	0.1 Statistic	Prob.** Critical Value
None *	0.524664	49.87665	13.42878	0.0000
At most 1 *	0.193808	11.20257	2.705545	0.0008
Normalized cointegrating coefficients (standard error in parentheses)				
	DLC 1.000000		DLGDP -0.774522	

Trace test indicates 2 cointegrating eqn(s) at the 0.1 level

* denotes rejection of the hypothesis at the 0.1 level

Table 3. Test of Granger Causality

Null Hypothesis	Observation	F Statistic
DLGDP does not Granger Cause DLC	52	2.84**
DLC does not Granger Cause DLGDP		0.98

Note: *significant at 10% level, ** significant at 5% level, *** Significant at 1% level

causality that goes through GDP per capita to per capita CO₂ emission. It means that the rise in GDP Per Capita is causing the Per Capita CO₂ Emission is increasing.

We can conclude that with the growth we always cannot expect the environmental quality to get better if the growth is not inclusive for all section of the people, because if the major proportion of the population is not able to adopt the green technologies for their day-to-day life, as it costs more, the environment quality will not improve.

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