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Impact of Energy Consumption on Economic Growth: An Empirical Investigation

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ABSTRACT

The study aims to investigate the impact of energy consumption on economic growth in India. The study uses annual data from 1980 to 2018. The study uses variables like GDP, Non-renewable energy consumption, renewable energy consumption and foreign direct investment. The study employs Descriptive Statistics, Correlation, and Fully Modified Ordinary Least Square method. Based on the estimated results of the correlation, it was found that all the factors have strong association to India's economic growth. According to the FMOLS statistics, an increase of 1% in the use of renewable energy leads to an increase of 0.59446 in economic growth. The results show that a 1% increase in both non-renewable energy use and foreign direct investment leads to increase economic growth by 0.564919 and 0.001739 respectively.

Keywords: Economic growth, Renewable energy consumption, Non-renewable energy consumption, FDI, FMOLS, India.

1. Introduction

Human activities over the last two centuries, notably in the nineteenth century, are said to be the principal cause of greenhouse gas (GHG) emissions and the accompanying climate-change dangers. These emissions have increased at a rapid rate since pre-industrial periods, causing an increase in world average air and ocean temperatures as well as a rise in sea levels. Climate change has a wide range of negative consequences for populations and plants. On the other hand, most greenhouse gas (GHG) emissions come from the energy used to make goods and services. Because GHGs are linked to energy use, any steps to reduce them will have an effect on economic growth. Understanding the relationship between energy and output is a

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good first step toward making policies that reduce emissions and keep the economy growing in a sustainable way. The role of energy on economic output, on the other hand, is not well understood yet, either in theory or in real life.

India's energy consumption has recently increased as a result of population expansion and economic development. According to the BP Statistical Review of 2019, India was the world's third-largest energy consumer in 2018, trailing only China and the United States, and its demand for energy continues to rise as a result of the country's dynamic economic growth, population growth, and modernization over the past several years. Following yearly inflation-adjusted GDP growth of around 8.2% between 2011 and 2016, India's GDP growth has slowed to around 5.0% in 2019, according to government figures and the World Bank. The slowdown was first caused by government-led demonetization and the goods and services tax reform, which were enacted between the end of 2016 and the middle of 2017, as well as a lack of private sector investment. In 2019, the economy faced a financial and loan crisis, as well as decreases in consumption and investment.

2. Review of literature

Apergis and Tang (2012) have tested the energy-led growth hypothesis for 85 selected countries across the world. Study period covered with yearly data from 1975 to 2017. All the data transformed into a natural logarithmic to induce stationary in variance-covariance matrix. They employed unit root test, Toda-Yamamoto-Dolado-Lutkepohl (TYDL) causality test and Logit regression model. The estimated results reveal that the mixed causality among the countries. The results confirm that developing and developed countries support the energy-led growth hypothesis compare to low-income countries.

Arouri et al. (2012) have examined the robustness of the evidence on predictability of energy consumption, CO2 emissions and economic growth in Middle East and North African countries. All the variables were measured yearly frequencies over the period 1981 to 2005. They employed Panel Unit root Test, Panel Cointegration and Error Correction Model. The results confirm that there is long-run equilibrium relationship, and energy consumption has

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positive impact on CO2 emissions. Their estimated results satisfy the Environmental Kuznets Curve (EKC) hypothesis in most selected countries. Finally, they suggest future reduction in CO2 emissions per capita increases economic growth in MENA countries.

Banday and Aneja (2019) investigate the causal relationship between energy consumption, gross domestic product and CO2 emission for BRICS (Brazil, China, India, Russia and South Africa) countries. They used yearly data for the period of 1990 to 2017. They employed Panel unit root test, Panel causality test and Bootstrap panel causality test. The estimated results reveal that a unidirectional causality from GDP to CO2 emissions for Brazil, China, India and South Africa, and no causality for Russia.

Hondroyiannis et al. (2002) investigated the predictability of energy consumption and economic growth in Greece. They have undertaken sample period from 1960 to 1996. In order to estimate models, they employed Error Correction Model (ECM) and Granger Causality model. The estimated result seems that there is a long-run equilibrium relationship among the variables and supported the endogeneity of energy consumption and economic growth.

Narayan and Prasad (2008) demonstrated long-run causality from electricity consumption to output in Australia from 1960 to 2002. These findings, however, differ from those of Chontanawat et al. (2008), who found no cointegration relationship or evidence of causality between per-capita energy consumption and per-capita GDP in Australia from 1960 to 2000.

3. Data and Methodology

The secondary data employed for the study during the period of 1980 to 2018. The data collected from WDI (World Development Indicators) World Bank. Here, the dependent variable is considered as economic growth and Non-renewable energy consumption, renewable energy consumption and foreign direct investment considered as independent variables.

The study employed descriptive statistics, correlations and Fully Modified Ordinary Least Square (FMOLS) method.

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Econometric model is given below.

$$ln(GDP_t) = \beta_o + \beta_1 ln(NRE_t) + \beta_2 ln(RE_t) + \beta_3 ln(FDI_t) + \varepsilon_t$$

Where,

GDP = Economic growth, NRE =Use of non-renewable energy

RE = use of renewable energy, FDI = Direct investment from abroad and

ε_t = disturbance term.

4. Empirical Findings

Table -1. Descriptive Statistics

	GDP	***NRE***	***RE***	***FDI***
Mean	27.47362	2.358427	0.100212	-1.059029
Median	27.45792	2.368826	0.027011	-0.469546
Maximum	28.67009	3.339788	1.142566	1.286618
Minimum	26.41224	1.173610	-0.659452	-5.958398
Std. Dev.	0.678507	0.644976	0.535228	1.815762
Skewness	0.141386	-0.122378	0.316754	-0.796553
Kurtosis	1.808728	1.888157	1.925850	2.666454
Jarque-Bera	2.436018	2.106163	2.527088	4.305019
Probability	0.295819	0.348861	0.282651	0.116192
Sum	1071.471	91.97865	3.908281	-41.30212
Sum Sq. Dev.	17.49414	15.80775	10.88583	125.2857
Observations	39	39	39	39

The mean values of economic growth, Non-renewable energy consumption, renewable energy consumption and foreign direct investment are 27.47362, 2.358427, 0.100212and -1.059029respectively. The Jarque- Bera and probability are also significant. It states that the skewness is observed to be left long tailed for all the variable in the study. Hence, the data is normally distributed.

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Table- 2. Correlation Results

Variables	*GDP*	*NRE*	*RE*	*FDI*
GDP	1.000000	0.994155	0.990879	0.876529
NRE	0.994155	1.000000	0.979423	0.897208
RE	0.990879	0.979423	1.000000	0.841486
FDI	0.876529	0.897208	0.841486	1.000000

The results of the correlation between Economic growth, Non-renewable energy consumption, renewable energy and foreign direct investment are reported in Table 2. It explains the relationship among the variables. It is clearly observed that Non-renewable energy consumption (0.994155), renewable energy consumption (0.990879) and foreign direct investment (0.876529) are positively correlated with economic growth. From the table, the study concludes that the variables are highly significant and positive associated with economic growth.

Table 3: Results of Fully Modified Ordinary Least Square (FMOLS)

Dependent Variable: GDP				
Method: Fully Modified Least Squares (FMOLS)				
Variable	***Coefficient***	***Std. Error***	***t-Statistic***	***Prob.***
NRE	0.564920	0.128763	4.387294	0.0001
RE	0.594465	0.122035	4.871264	0.0000
FDI	0.001739	0.015845	0.109773	0.9132
C	26.08520	0.305837	85.29126	0.0000
R-squared	0.995381			

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The findings of fully modified ordinary least square (FMOLS) suggest that consumption of non-renewable energy, consumption of renewable energy, and foreign direct investment all contribute positively to economic growth. According to the findings, an increase of 0.59446 percentage points in economic growth is associated with an increase of 1% in the usage of renewable energy. According to the findings, an increase of 1% in the consumption of non-renewable energy and in foreign direct investment corresponds to an increase in economic growth of 0.564919 and 0.001739 respectively.

5. Conclusion

The main aim of the paper is to investigate the impact of non-renewable energy consumption, renewable energy consumption and foreign direct investment on economic growth in India during the study period of 1980 to 2018. The estimated results from the correlation identified that all the variables have strong association relationship with respect to economic growth in India. The FMOLS data show that a 1% increase in the use of renewable energy leads to increase economic growth by a 0.59446. The results show that a 1% increase in non-renewable energy consumption and foreign direct investment results in increases in economic growth of 0.564919 and 0.001739, respectively.

6. References

Apergis, N., & Tang, C. F. (2013). Is the energy-led growth hypothesis valid? New evidence from a sample of 85 countries. ***Energy Economics,*** *38*, 24-31.

Arouri, M. E. H., Youssef, A. B., M'henni, H., & Rault, C. (2012). Energy consumption, economic growth and CO2 emissions in Middle East and North African countries. ***Energy policy,*** *45*, 342-349.

Hondroyiannis, G., Lolos, S., & Papapetrou, E. (2002). Energy consumption and economic growth: assessing the evidence from Greece. ***Energy economics***, *24*(4), 319-336.

Ozturk, I., & Acaravci, A. (2010). CO2 emissions, energy consumption and economic growth in Turkey. ***Renewable and Sustainable Energy Reviews,*** *14*(9), 3220-3225.

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Ozturk, I., Aslan, A., & Kalyoncu, H. (2010). Energy consumption and economic growth relationship: Evidence from panel data for low- and middle-income countries. ***Energy Policy,*** *38*(8), 4422-4428.

Paul, S., & Bhattacharya, R. N. (2004). Causality between energy consumption and economic growth in India: a note on conflicting results. ***Energy economics,*** *26*(6), 977-983.

Paul, S., & Bhattacharya, R. N. (2004). Causality between energy consumption and economic growth in India: a note on conflicting results. ***Energy economics,*** *26*(6), 977-983.

Rajeev, S. (2010). India's Energy Security. *IIM Bangalore Research Paper*, (305).

Ramakrishna, G. O. L. L. A. G. A. R. I., & Rena, R. (2013). An empirical analysis of energy consumption and economic growth in India: are they causally related?