Foreign Direct Investment, Growth and the Environment: Evidences from India Since Liberalization

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Abstract—*India has adopted the liberalization policy in 1991 which has reduced the trade barriers and investment restrictions and increased the foreign direct investment (FDI) inflows and Gross Domestic Product (GDP) growth of the economy. At the same time it has increased the CO_2 emission and deteriorated the environment. This paper examines the direction of causality between FDI inflows, GDP and CO_2 by using Granger Causality test since liberalization. The findings of the paper revealed that there is only one uni-directional causality exists between GDP and CO_2. The direction of causality reveals that CO_2 is one of the major pollutants which deteriorates the environment is generated by the economic growth. While, there is no causality found between GDP and FDI, FDI and CO_2. The paper concludes the policy recommendations that will ensure environmental friendly investment and growth in India for future.*

Keywords: *Foreign direct investment, GDP, CO_2, Co-integration, granger Causality.*

1. INTRODUCTION

Foreign Direct Investment (FDI) is a type of investment that involves the injection of foreign funds into an enterprise that operates in a different country of origin from the investor. India embarked on an economic liberalization program that encompassed industrial and trade policy, financial sector reforms, liberalization and privatization in 1991. Till 1990s foreign investment was restricted in India and which resulted to slow economic growth. But the policy of liberalization opens up the gates of Indian market for foreign investment. India is one of those countries which give FDI an important role in the development process. FDI not only helps to generate the revenue but also increases the efficiency of the economy. India has scarcity in capital resource therefore, India and other countries of the world import capital and technology in the form of FDI with each other. Foreign investment in India increased with the help of greater mobility of capital, extensive privatization, cross-border mergers and acquisitions and greater globalization in production since 1991. FDI is often seen as an important catalyst for economic growth in the developing countries. The role of FDI in the growth process is

a topic of intense debate. One argument says that FDI plays very important role in economic growth of countries like India. FDI brings better technology, managerial skills, and new investment to the host country which further increases the economic growth. By absorbing the better technologies from developed countries, economic growth since the liberalization has increased in India. The other side of the argument says that the FDI may harm the growth process due to various macroeconomic instabilities such as terms of trade deterioration and balance of payments crisis.

Similar is the scenario with FDI and environment since liberalization. The increasing importance of FDI inflows since 1991 has changed the structure of Indian economy in terms of GDP and development but at the same time it is a debate that it has negative effects on environment. A two-way relationship can be seen between FDI and environment that may have negative and positive effects on Indian economy. One argument which found negative effects of FDI on environment says that investment may come to a region where environment protection norms are less strict. The foreign Investors outsource their pollution-intensive production where the expected cost of pollution abatement is significantly less. It is also found in many studies that the environmental legislations and monitoring are not rigorous in Developing countries like India therefore, they are more vulnerable to pollution intensive production and hamper environment. This argument is supported by many researches like, Copeland and Taylor (1994) & Chichilinsky (1994) found "more trade probably means more production, and that has historically meant more pollution. Moreover, as dirty industries have the tendency to migrate to countries with low wages and lax environmental standards, trade liberalization would have important consequences for the international distribution of polluting industries". Another theory which support the argument is pollution havens hypothesis which states that "the freer the trade and the movement of capital, the more is the shift of pollution intensive industry from countries of stringent environmental laws to countries with loose environmental

regulations". On the contrary, advocates of FDI argue that positive effects of FDI can be seen on the welfare of the host country through the transfer of environmental friendly techniques of production from developed countries and the FDI inflow increases international pressure to maintain environmental standards also rises. According to OECD (2001), FDI helps in the transfer of environmental friendly techniques that targets high environmental standards. Similarly, the endogenous growth theories also support strongly the role of FDI in promoting economic growth in host countries.

The relationship between GDP and environmental degradation cannot be left without discussion as the relationship between environmental quality and economic growth is puzzling. During recent decades, it has been observed that economic activity strongly increased worldwide. In that same period there was a substantive increase in CO_2 emissions (Quadrelli & Peterson, 2007; Raupach et al., 2007). The historical and statistical evidences show that economic growth and CO_2 emissions have a strong link over time. Hence, faster economic growth is associated with faster increase in emissions. Furthermore, it is likely that policies to cut emissions also cut profits and are actively opposed by business interests. This debate is supported by the theory of Environmental Kuznets Curve (EKC) hypothesis. According to this theory as income increases, emissions level also increases but after a threshold level of income is reached, emissions begin to decline. In case of India, this theory is apt, due to the increase in economic activities income increased since 1991; the environmental degradation also grew. Since economic activity requires energy, and CO_2 is the primary source of energy in the production process, therefore, there is a strong correlation between the intensity of economic activity and the volume of annual CO_2. On the contrary, some economists suggest that at some given income level there is a turning point where greater GDP growth implies lesser environmental degradation. In the support of this argument Raupach et al. (2007) also found that both total and per capita CO_2 emissions have been generally grew in all countries of the world during the 20th century but there have been many short-term fluctuations over the long-term growth of emissions. It is also found that in the long run of economic growth, emissions of CO_2 will likely to drop with economic growth.

Thus in the light of theoretical background of the three variables it is clear that the relationship between FDI, GDP and environment ($CO_{2)}$ cannot be neglected or passed over. The argument shows that both positive and negative effects exist and the picture will be clearer with the help of empirical analysis. The objective of this paper is to see the long run causal relationship among the variables (GDP, CO_2 and FDI inflows) since liberalization. The paper will deal with the 4 sections like, the trends of these variables since liberalization, followed by review of previous literature of similar and

different model. Then the empirical investigation of these variables will be performed with the help of an econometric model. The last part of the paper will be conclusion to adopt the cleaner technology for production without compromising the growth and FDI inflows.

2. BACKGROUND AND TRENDS SINCE 1990S IN INDIA

The figure 1 (Given in Appendix) shows the patterns of GDP growth in India since 1990. It is clearly visible from the figure that the GDP growth has been increasing since 1990 from around 326.60 Billion US$ to 1872.84 billion US$ in 2011. The rate of growth has shown an upward trend since then. That was the time when India was quickly recovering from the 1991 crisis and the stabilization effort was followed. The trend of GDP shows a declining trends after 2010 it was recorded 1710.90 billion US$. The main reason of the decline in the India's growth rate was the financial crisis of 2008 has resulted lowered the growth rate from But the high rate of growth has not been sustained and declined to 7 percent in 2011-12 (1841.70 billion US$).

The figure 2 (Appendix) reveals the trends of FDI inflows since 1990. The FDI patterns reveal some volatility and this was due to the change in the major structural reforms along with significant liberalization of the international trade and exchange rate policies. In 1990 just a year before the adoption of LPG policy by India it was recorded 0.07% of GDP. The inflows of FDI rose since then till 1998. It is clear from the figure that in year 2000 it was recorded 0.75% of GDP. The fluctuating ups and downs trend of FDI inflow is till 2004. After 2006 FDI inflows took an exponential jump of 2% of GDP in 2006 and further to 3.5% of GDP in 2008. The major reason behind the increase in FDI was FDI policy with retailing in India. Before 2006, FDI was not authorized in retailing. In year 2010 when the world economies recovered but continue to be fragile and uncertain the FDI inflow was recorded 2% of GDP in 2011 and further decline to 1.3% of GDP in 2012. The figure reveals the uneven patterns of FDI inflows since 1991. FDI inflows in India flowed mainly in services sector (average of 41%) followed by manufacturing sector (around 23%) and mainly routed through Mauritius (with an average share of 43% from last five years) followed by Singapore (Around 11%). India is one of the most attractive locations of FDI in developing countries.

The figure 3 (Appendix) shows the trends of CO_2 from 1990-2010, the carbon emission level has increased since then. Even before and after the liberalization i.e. from 1950 to 2008, India has experienced a dramatic growth in fossil-fuel CO_2 emissions averaging 5.7% per year and it became the world's third largest fossil-fuel CO_2-emitting country. The emission data of India reveals that CO_2 emission increased very rapidly from just 690,577 kt (kilo ton) in 1990 to 1,186,663 kt in 2000, which is just double in number. In year

2010 the carbon emission was recorded 2,008,823 kt which is again an exponential growth since 2000. The major source of Fossil-fuel emissions in India is largely from coal burning. According to IPCC, to reach the target of emission cut, the annual global CO2 emissions have to be reduced to 20 Gigatons of CO2 by the year 2050 and to 10 Gigatons of CO2 by the year.

3.   REVIEW OF LITERATURE

The literature review draws attention to analyze the relationship between GDP, FDI and environment (CO_2) by different academicians and researchers. The relationship between economic growth and foreign direct investment has been intensively analyzed empirically over the past two decades, some studies found positive impacts and some detects negative relationship between the variables. Like, Alfaro *et al.* (2004) draw attention to financial markets as they find that FDI promotes economic growth in economies with sufficiently developed financial market. Bengoa and Sanchez-Robles (2003) found in their research that there is a positive correlation between FDI and economic growth, but in order to receive the long- term benefit of FDI inflows host countries require human capital, economic stability and liberalized markets. Chakraborty and Basu (2002) explored the co integrating relationship between net inflow of FDI, real GDP, unit cost of labor and the proportion of import duties in tax revenue for India with the method developed by Johansen and Juselius (1990). In a research Borensztein *et al.* (1998) find that FDI helps in raising growth, but only in countries where the labour force has achieved a certain level of education. He also argues that there is a positive effect of FDI when a country is sufficiently rich in terms of per capita income.

On the contrary, Using data on 80 countries for the period 1979-98, Durham (2004) fails to identify a positive relationship between FDI and economic growth and suggested that instead the effects of FDI are contingent on the 'absorptive capability' of host countries. Similarly, Chakraborty and Basu (2002) said that in case of India GDP is not Granger caused by FDI, and it runs more from GDP to FDI. Few researches found mixed results like, Hsiao and Shen(2003) found the two way relationship between FDI and growth and support feedback relationship between FDI and GDP. Similarly, Kulwinder Singh (2005) in his study examines the beginning and development (economic and political) trends of FDI in two sectors (industry and infrastructure). The result shows the mixed picture and impact of the reforms in India on the policy environment.

The literature related to the next important concern of this paper is the impact of FDI inflow on environment. Some studies which believe in the positive effects of FDI on environment are like, Golub (2009) found that Asian countries have generally high levels of restriction on FDI while European and South American countries have low restrictions

and this largely extends to green FDI sectors, For example, India has fairly high overall FDI restrictions, but low restrictions on both measures of green FDI. A research by OECD (2005) found that the market opening and liberalization of trade in environmental services has the potential to yield important economic and environmental benefits. Similarly, Mukhopadhya and Chakraborty (2005) constructed an index of pollution terms of trade for India. Their results indicate that India produces goods that are more environmentally friendly than goods it imports. The finding of Eskeland and Harrison (1997) says that FDI reduces pollution in developing countries through their use of more environmental friendly techniques of production as they are "significantly more energy efficient and use cleaner types of energy than local firms"(Aliyu 2005).

The Studies which finds mixed and negative effects of FDI inflow on environment are as follows. Like, Pao and Tsai (2011) examined the effect of FDI on CO_2 emissions by using a panel co-integration technique for Russia, Brazil, India and China (1980-2007). They conducted a Granger causality test that showed that there is a two way relationship between FDI and CO_2 emissions. Gupta (2004) also examined the impact of India's trade and investment liberalization on the environment using the case study of the automobile sector. Study takes advantage of this unique database to examine environmental effect of trade liberalization for the entire manufacturing sector across India. Levinson and Keller (2001) estimated the effect of changing environmental standards on patterns of international investment by examining FDI to the US and differences in pollution abatement cost across US states and found evidence that raising pollution costs has a moderate deterrent effect on foreign investment. Shreyasi Jha from World Bank says that increasing move towards free trade in countries with weak environmental policies has raised concerns about the adverse environmental consequences of trade liberalization policies. These concerns arise from the assumption that trade liberalization policies that stimulate economic growth may simultaneously lead to a worsening of environmental quality due to relatively stringent environment regulations or increased production and exports from dirty industries.

Literature and previous empirical papers that analyze the co-evolution of emissions and GDP includes York's (2012) paper is motivated by the strong implicit assumption of symmetry in the relationship between emissions and GDP. He finds the relationship between emissions and GDP is stronger during periods of economic growth relative to decline. Similarly, Doda (2012) provides a statistical analysis of emissions-GDP relationship at business cycle frequencies in a wide and long panel. Using a macroeconomic strategy the main conclusions are that the time series for the cyclical component of emissions is more volatile than that for the cyclical component of GDP. Akbostanci *et al.* (2009) found monotonic and increasing relationship at the national level by examining the relationship between CO_2, SO_2 and PM10 emissions, energy

consumption and economic growth in Turkey at two levels. However, they found an N shaped curve at the level of provinces which do not support EKC. The empirical work of Schmalensee et al. (1998) adopts a more flexible model to evaluate the effect of income on carbon emissions and also finds evidence of an inverted-U shape curve for a sample of 141 countries for period 1950 to1990. Lastly, Selden and Song (1994) investigated the relationship for GDP per capita and four air pollutants SPM, SO_2, oxides of nitrogen (NOx), and carbon monoxide (CO).

4. DATA SOURCES AND RESEARCH METHODOLOGY

In order to analyze the long run relationships in this paper, three variables are chosen: GDP growth, FDI and CO_2. FDI inflows and GDP is used as a proxy for economic growth while, annual Co_2 emission is used as a proxy for pollution. The data for GDP, CO_2 and FDI inflows are collected from the World Bank database. The time frame taken for study is 1990 to 2010. The data collected for various variables (FDI, GDP, CO_2) are firstly presented in their graphical forms to show the time series trends since 1990 (Figure 1, 2 and 3 Appendix) and later taken into the log forms. In order to check the stationarity of the variables the Augmented Dickey-Fuller test is used and further Johansen Co-integration technique is used to establish long run relationship among the variables. Granger causality test is used to test the direction of causality between FDI and GDP, FDI and CO_2, GDP and CO_2.

Granger causality is a statistical concept of causality proposed a time-series data based approach in order to determine causality. The causality determines the direction of the relationship among variables (Like if x is a cause of y, then the value of *x* should be useful to forecast y). The model used for analysis is taken from the paper of Danladi and Akomolafe (2013) is presented below:

$LGDP_t = a_0 + \sum_{j=1}^{n} a1\, LGDP_{t-1} + \sum_{j=1}^{n} a2\, LFDI_{t-1} + u_{1t}$
$LGDP_t = b_0 + \sum_{j=1}^{n} b1\, LGDP_{t-1} + \sum_{j=1}^{n} b2\, LCO_{2t-1} + u_{2t}$
$LFDI_t = c_0 + \sum_{j=1}^{n} c1\, LFDI_{t-1} + \sum_{j=1}^{n} c2\, LGDP_{t-1} + u_{3t}$
$LFDI_t = \delta0 + \sum_{j=1}^{n} \delta1\, LFDI_{t-1} + \sum_{j=1}^{n} \delta2\, LCO_2{}_{t-1} + u_{4t}$
$LCO_{2t} = \rho_0 + \sum_{j=1}^{n} \rho1\, LCO_{2t-1} + \sum_{j=1}^{n} \rho2\, LGDP_{t-1} + u_{5t}$
$LFDI_t = \sigma_0 + \sum_{j=1}^{n} \sigma1\, LCO_{2t-1} + \sum_{j=1}^{n} \sigma2 LFDI_{t-1} + u_{6t}$
Here, (LGDP, LFDI etc = log, a_0, b_0, c_0 etc = constants and u= error terms).

5. RESULTS OF EMPERICAL ANALYSIS

Stationarity: The first and foremost step of the analysis concerns the stationarity of the variables, the unit root test is conducted for the variables using Augmented Dickey-Fuller test. It is the first and foremost condition of Granger Causality that the series have to be covariance stationary (Danladi & Akomolafe, 2013). None of the variables (GDP, FDI and CO_2)

are stationary at level. The MacKinnon (1996) one sided *p-values* for the Augmented Dickey-Fuller (ADF) test are 0.997, 0.4313 and 0.9621 at 1%, 5% and 10% significance level are explained in the Table 1 of the appendix. Moreover t-statics of Augmented Dickey Fuller Test for the variable GDP, FDI and CO_2 are less than the critical values at 1% and 5% level. All of the variables became stationary at second difference, with the *p-values* of ADF tests are 0.0120, 0.000, and 0.0095 respectively.

Co-integration: The second stage of analysis involves testing for the existence of a long-run equilibrium relationship among the variables (GDP, FDI and CO_2) with the help of Johansen Co-integration test. The co-integration test is very significant, it helps to determine whether the variables under study have the tendency to move together (converge) in the long run. Table 2 of appendix represents the results of Johansen co-integration test and explains that there exists one co-integration equation at 5% level of significance with the p-values of 0.0658 for $r \leq 1$. While at none and $r \leq 2$ the null hypotheses was rejected at 5% level of significance. The rejection of null hypotheses means that the co-integration equation exists and secondly there does not exist even two co-integration equation among the variables. Thus the existence of co-integration implies that there is only one long-run equilibrium relationship existing between the variables.

After determining the stationarity and existence of the long run relationship among the variables through Jaohnson co-integration further analysis such as the Granger causality test can be now applied. According to Danladi & Akomolafe (2013), "If a set of variables are co-integrated, the effects of a shock to one variable spread to the others, possibly with time lags, so as to preserve a long-run relationship between the variables".

Causality: Granger-Causality test helps in identifying whether there is a causal relationship between variables. In other words it means that whether one variable is a cause for the occurrence of the other variable. The result for the causal relationship is explained in Table 3 in the appendix. The results obtained from the test clearly shows that there is no causality between FDI and GDP. Similarly no Causal relationship found between FDI and CO_2. However there is a unidirectional (One way) causal relationship found between GDP and CO_2 as against a bi-directional causality. Since the relationship is uni-directional this means that the causality doesn't run from Co_2 and GDP. Gross domestic product (GDP) is the market value of all officially recognized final goods and services produced within a country in a year, or other given period of time. This suggests that as the economic activities increases in the country (India), the rate of pollution (CO_2) is likely to increase. In India the production of goods and services helps in increasing the GDP as well as it is increasing the carbon emission level which further deteriorates the environment. The relationship between emissions and

GDP grows as the economy moves through periods of economic growth.

Findings of York's (2012), Peters et al (2012), Jotzo et al (2012), Narayan *et al.* (2010), Fodha *et al.* (2010), Chebbi *et al.* (2009), Akbostanci *et al.* (2009), Sari and Soytas (2009), Mehrara (2007), Grossman and Krueger (1993, 1995), and Selden and Song (1992) found the similar positive long run relationship between GDP and CO2 emissions and supports the result.

6. CONCLUSIONS

FDI plays a crucial role in the development of Indian Economy. It also helps in the growth of GDP of the country and has shown increasing trends since 1991. Globalization has leaded both positive and negative effects on the environment through the emission of CO_2. This paper has attempted to investigate the causal relationship between the three variables FDI, GDP (economic growth) and CO_2 emission (environment) between 1990 and 2010. The empirical results of Co-integration analysis and Granger-Causality test showed that long run relationship and causality among the variables exists. But, the Granger Causality test certainly explains that there is no causality between FDI and CO_2 emission, GDP growth and FDI. The long run unidirectional causal relationship between GDP and CO_2 means GDP growth Granger causes CO_2 emission in India since 1990. The positive relationship between GDP and CO_2 in long run supports the EKC hypothesis, as income increases, emissions increase as well but after a threshold level of income, emissions begin to decline. Since India is in transition phase the economic growth (GDP), with income increase with the rising environmental degradation (higher CO_2 emission).

In the case of India, against the expected view that the causal relationship exit between FDI and economic growth, No relationship was established within the given time frame in the analysis. This shows firstly, that the share of FDI in percentage of GDP is very little in case of India like it was recorded just 1.31% in 2012, which grew from 0.02% in 1991. This little share of FDI in GDP became a crucial reason not to draw any long run relationship among the two variables. Secondly, The inflows of Foreign institutional investment in recent year has grew at faster rate as compare to FDI inflows, which is another reason of no causality between GDP and FDI. Similarly, No causality is found between FDI and CO_2 this may be another contradictory empirical result. Since it has been argued in academic and international debates that inflows of FDI deteriorates the environment in developing countries where environmental laws are less stringent. But in case of India, the reason of no causal relationship is because FDI inflows is more in the services (around 41%) followed by manufacturing sectors (around 23%). Services are non-polluting sectors of the economy and manufacturing sectors in which FDI inflows is more are telecom, construction sector,

automobile, metallurgical industry etc which are again less emitting industries of the Indian economy.

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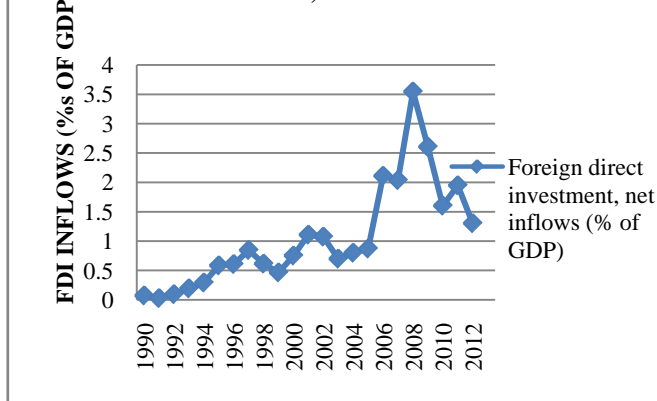
7. APPENDIX

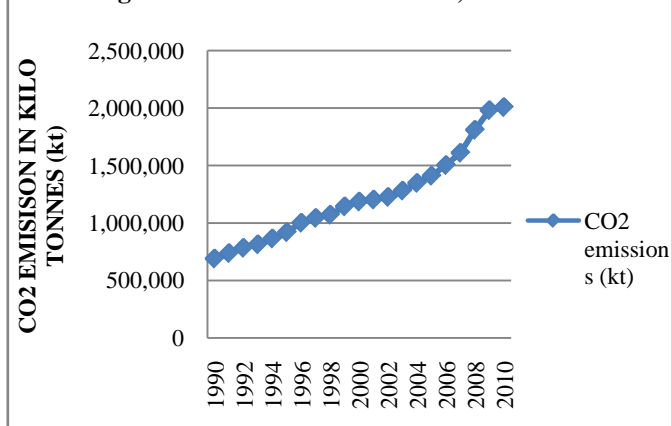**Figure 1. Trends of GDP in India, 1990-2012**
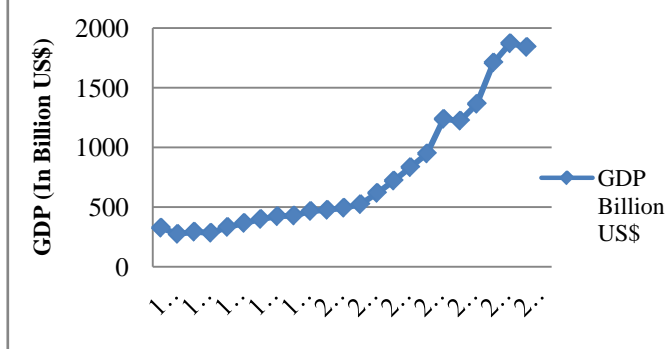
Source: Based on data from World Bank database.

Figure 2. Trends of FDI inflows in India, 1990-2012

Source: Based on data from World Bank database.

Figure 3. CO2 emission in India, 1990-2010

Source: Based on data from World Bank database.

Table 1: Result of Unit root test

VARIABLE	AUGMENTED DICKEY-FULLER		ORDER OF INTEGRATION
	Level	2nd Difference	
LFDI	0.4313	0.0000	I(2)
LGDP	0.9997	0.0120	I(2)
LCO2	0.9621	0.0095	I(2)

Table 2: Result of the co-integration Test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *(r=0)	0.850443	45.09497	29.79707	0.0004
At most 1 (r ≤ 1)	0.465504	14.69372	15.49471	0.0658
At most 2 * (r ≤ 2)	0.253177	4.670827	3.841466	0.0307

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3: Result of Granger Causality Test

Dependent variable	ΔLFDI	ΔLGDP	ΔLCO2
ΔLFDI	------	0.73223(0.5011)	0.27342(0.7654)
ΔLGDP	1.50853(0.2604)	------	6.83194(0.0105)**
ΔLCO2	0.47591(0.6326)	0.52413(0.6050)	------

Note: *, ** and *** indicate the rejection of the null hypothesis at 1%, 5% and 10% level of significance, respectively.