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Foreign Direct Investment (FDI) and Economic Growth in India: An Application of Granger Causality Test

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Abstract

Foreign Direct Investment (FDI) is considered as an engine of economic growth for any country including India. It helps upgrade and transfer technology; improves skills and managerial capabilities; improves efficiency; provides competitive edge to country's exports, quality of services & goods; and helps create additional jobs. The relationship between FDI and economic growth has long been a subject of great interest in the field of international development. Inadequacy of foreign direct investment retained many countries as poor country. Keeping in above backdrop, present work is a humble attempt to analyze causal relationship between Foreign Direct Investment (FDI) and economic growth in Indian economy by applying Granger Causality test. Empirical results confirm the long run and short run relationship between FDI and economic growth of India. The policy implications can be drawn from the study that to increase the pace of economic growth in India, there is an economic rationale to attract more FDI which is necessary but not sufficient.

Keywords: FDI Inflow, GDP, Causality Test and India.

Introduction

Foreign Direct Investment (FDI) plays a significant role in the developing world because it has recognized as an engine of growth and considered as a growth enhancing factor in any developing countries including India. The relationship between Foreign Direct Investment (FDI) and economic growth has long been a subject of great interest in the field of international development. FDI helps transfer and upgrade technology; provides competitive edge to country's exports; improves skills and managerial capabilities; improves efficiency and quality of services & goods and helps to create additional jobs. In Indian economy, FDI inflow in the past two decades stimulated by economic reforms in the form of liberalization, privatization and globalization (LPG) have played a complementary role in filling the gap between domestic saving and investment. It is a preferred source of external finance for the simple reason that they are not debt creating, non volatile in nature and their returns depend upon the projects financed by the investor. Emerging Market Economies (EMEs) look upon FDI as one of the easiest means to fulfill their financial, technical, employment generation and competitive efficiency requirements. Gradually, they also realized that substantial economic growth is inevitable without global integration of business process. Therefore, an important objective of promoting FDI in any developing country in general and India in particular has been to promote efficiency in production on one hand and increase exports on other.

Keeping in above backdrop, present study is a humble attempt to analyze relationship between FDI and economic growth in Indian economy by applying causality test. Section 2 describes the objective of the paper, sources of data and research methodology. Results to examine the causal relationship between FDI and economic growth of India are presented in section 3, Analysis or discussions are presented in section 4. And lastly, section 5 concludes the study with policy implications.

Objective of the Study

The prime objective of the study is to analyse the causal relationship between Foreign Direct Investment (FDI) and economic growth of India. For this, Foreign Direct Investment equity inflow is considered as proxy for Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) of India is taken as proxy for economic growth.

Research Methodology

The present study is based on secondary data, which has been collected from various sources such as secretariat of industrial approvals newsletters, publications from department of industrial policy and promotion, Ministry of Commerce and Industry, Government of India; Handbook of Statistics on Indian Economy by Reserve Bank of India. The present study considers the time span of 26 years from 1991-92 to 2016-17. To examine the relationship between FDI in economic growth, Granger Causality test has been applied. Following procedure will be followed to apply Granger Causality test. We can apply any standard test, if the time series under consideration are stationary.

Stationarity of Time Series

A time series is severely stationary if the distribution of its values remains the same as the time progresses. A covariance stationary or weakly stationary time series satisfies the following conditions:

a) E (Y_t) = μ (constant) for all t = 1, 2, 3……∞;
b) V (Y_t) = E $(Y_t - \mu)^2 = \sigma^2$ for all t
c) Cov. (Y_t, Y_{t+k}) = constant for all t and k≠0,

This above equations implies that its mean, variance and auto covariance remains constant over the specified time.

Stationarity is important for the persistent analysis of data; if the time series is non-stationary then the results of classical regression analysis will not be valid. OLS regression of non-stationary time series is meaningless and such phenomenon is known as nonsense or spurious regression. The non-stationary time series can provide a high R^2 and very high value of t–ratios, even though the series are unrelated. The standard assumptions for asymptotic analysis will not hold good after running regression. The F-statistics will not follow F-distribution and t-ratio will not follow t-distribution. So, it is essential to regress only a stationary time series over another that is stationary, in order to have meaningful regression. In spurious regression there may exist very strong first order auto correlation measured by very small value of Durbin Watson d statistics. According to Granger & Newbold, if R^2 > d or if $R^2 \approx 1$ then it indicates spurious regression.

Test for Stationarity

Stationarity of time series may be examined by using graphical method and unit root method. We will make use of both to examine the stationarity of the given variables.

A. Graphical Method

With the graphical method, stationarity of the variables under considerations can be examined at level/original data, at first difference and at second difference.

B. Unit Root Test

The unit root test is meant to know the stationarity of the variables. The procedure of this test is to regress equation:

$Y_t = \rho Y_{t-1} + U_t$ and $-1 \le \rho \le 1$ ………….. (2.1)

If ρ = 1, then there is unit root problem that is Y is non-stationary. If $|\rho| < 1$, then there is no unit root problem that is Y is stationary. For theoretical reasons subtract Y_{t-1} from both sides of the above equation and we obtain:

$\Delta Y_t = \delta Y_{t-1} + U_t$……………… (2.2)

In practice, instead of estimating equation (2.1), the equation (2.2) is used to test the null hypothesis that H_0: δ=0 against an alternative hypothesis H_A: $\delta \neq 0$. If $\delta = 0$ then ρ=1 then ρ=1 that is there is unit root in the model which means time series under consideration is non-stationary. But if δ < 0, then time series is stationary.

In order to find out whether the estimated coefficient of Y_{t-1} in (2.2) is zero or not, the Augmented Dickey-Fuller (ADF) test has been used. The ADF test is estimated in three different forms, that is, under three different null hypotheses.

Y_t is random walk without drift: $\Delta Y_t = \delta Y_{t-1} + U_t$………… (2.3)

Y_t is random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + U_t$………… (2.4)

Y_t is random walk with drift around a stochastic trend: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + U_t$……… (2.5)

In above three cases, the null hypothesis is that H_0: δ=0 (unit root problem) and the alternative hypothesis is that H_A: $\delta \neq 0$ (no unit root problem). Ordinary Least Square (OLS) has been applied to estimate equation (2.3), (2.4) and (2.5) and τ statistic is computed. If the computed absolute value of τ statistic exceed the Dickey-Fuller critical value, then reject null hypothesis and conclude that time series under consideration is stationary, which is pre requisite condition for the application of any standard test of econometrics. And if the computed absolute value of τ statistic does not exceed the Dickey-Fuller critical value then null hypothesis is accepted. Which implies the time series under consideration is non-stationary. In this case, we cannot apply any standard test.

In order to find out whether the estimated coefficient of Y_{t-1} in (2.5) is zero or not, two tests are used in the present study:

a. Dickey-Fuller (DF) Test
b. Philips Perron (PP) Test

Dickey-Fuller (DF) Test

Dickey and Fuller have shown that under the null hypothesis H_0: δ= 0, the estimated t value of the coefficient of Y_{t-1} in (2.5) follows the τ statistic (Tau-Statistic). The DF test is estimated in three different forms, that is, three different null hypotheses.

Y_t is random walk without drift: $\Delta Y_t = \delta Y_{t-1} + U_t$ … (2.6)

Y_t is random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + U_t$… (2.7)

Y_t is random walk with drift around a stochastic trend:

$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + U_t$ ………… (2.8)

In above three cases, the null hypothesis is that H_0: δ=0 (existence of unit root problem is non-stationary) and

H_A: δ≠0 (existence of no unit root problem is stationary).

Ordinary Least Square (OLS) has been applied to estimate (2.6), (2.7) and (2.8) and τ statistic is computed by using the following formula.

$$\tau^* = \frac{\hat{\delta}}{S.E._{\hat{\delta}}}$$

If the computed absolute value of τ statistic exceed the Dickey-Fuller critical value, then reject null hypothesis and conclude that time series under consideration is stationary, which is pre requisite condition for the application of Granger test.

And if the computed absolute value of τ statistic does not exceed the Dickey-Fuller critical value then null hypothesis is accepted. Which implies the time series under consideration is non-stationary. In this case Granger test cannot be applied. And above same procedure is adopted to apply Philips Perron test to examine the unit root problem.

Philips-Perron (PP) Test

To overcome the limitations of Dickey-Fuller test, which assumes that error terms are serially uncorrelated and homogeneous, Phillips & Perron (1988) test is conducted. It adjusts the DF test to take care of possible serial correlation in error terms by adding the lag difference term of the dependent variable. The PP test, like ADF, can also be performed with a constant, a constant with linear trend or neither.

Cointegration

The existence of long run equilibrium relationship between X and Y is referred to, in the literature as cointegration. According to Granger (1988), standard tests for causality are valid only if X_t and Y_t are cointegrated. Therefore, a necessary precondition to causality testing is to check the co-integrating properties of the variable under consideration.

For this Y_t is regressed on X_t as: $Y_t = \alpha_0 + \alpha_1 X_t + U_t$ ……..……. (2.9)

The above regression is known as the cointegrating regression and slope parameter (α_1) is known as cointegrated parameter. The cointegration test was first introduced by Engel and Granger (1987) and then developed and modified by Stock and Watson (1988), Johanson (1988), and Johanson and Juselius (1990). The test is very useful to examine the long run equilibrium relationships between the variables.

Granger Causality Test

Granger Causality (1969) has significant importance as it allows analyzing which variable leads or precedes the other. Following Granger (1969), the Granger-casualty test has been developed to ascertain whether or not the inclusion of past values of a variable X (FDI) do or do not help in the prediction of present values of another variable Y (GDP).

1. If variable Y is better predicted by including past values of X than by not including them, then, X is said to Granger-cause Y.
2. Similarly, if past values of Y can be used to predict X more accurately than simply using the past values of X, then Y is said to Granger cause X.
3. If the analysis reveals that X Granger causes Y and Y also Granger causes X, there is bi-directional causality.

In order to avoid spurious causality, both of the variables under consideration need to be stationary. However, the prime requirement of this technique is to test the order of integration and unit root test has been used to ascertain the order of integration. Therefore, we first spotlight the concept of unit root test and then cointegration.

2.3.1 Granger Causality Test Equations

The test involves estimating the following pair of regressions:

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{j=1}^{m} \beta_j Y_{t-j} + U_t \quad \text{…… (2.10)}$$

$$X_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{j=1}^{m} \beta_j Y_{t-j} + U_t \quad \text{…… (2.11)}$$

The number of lags 'm' in the above regressions is arbitrary and boils down to a question of judgment. Generally, it is best to run the test for a few different values of 'm'.*

Equation (2.10) postulates that current Y is related to past values of itself as well as that of X and (2.11) postulates a similar behavior for X.

Steps involved in implementing the Granger causality test are as follows:

Step-I, regress current Y on all past values of Y but do not include the lagged X terms. This is the restricted regression. From this regression, obtain the restricted residual sum of squares, RSS_R.

Step-II, now run the regression including lagged X terms. This is the unrestricted regression. From this regression, obtain the unrestricted residual sum of squares, RSS_{UR}.

Step-III, the null hypothesis is $H_0{:}\sum \alpha_i = 0$. In other words, the lagged X terms do not belong in the regression.

Step-IV, to test this hypothesis, F- test is applied as shown below:

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/(n-2m-1)} \text{ and } F \sim (m, n-2m-1)$$

Where m is the number of lags; n is the number of observation involved in the model.

If the calculated F-value exceeds the critical F-value at the chosen level of significance, the null hypothesis is rejected, in which case the lagged X variable belongs in the regression. This is another way of saying X causes Y. The same steps are used to test that whether Y causes X.

*See Pindyek, R.S. and Rubinfield, D.L. (1976). Econometric Models and Econometric Forecasts, McGraw Hill Kogakusha Tokyo pp. 242-45

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Results and Discussions

Results

Figure 3.1: Gross Domestic Product (GDP) at Level Data

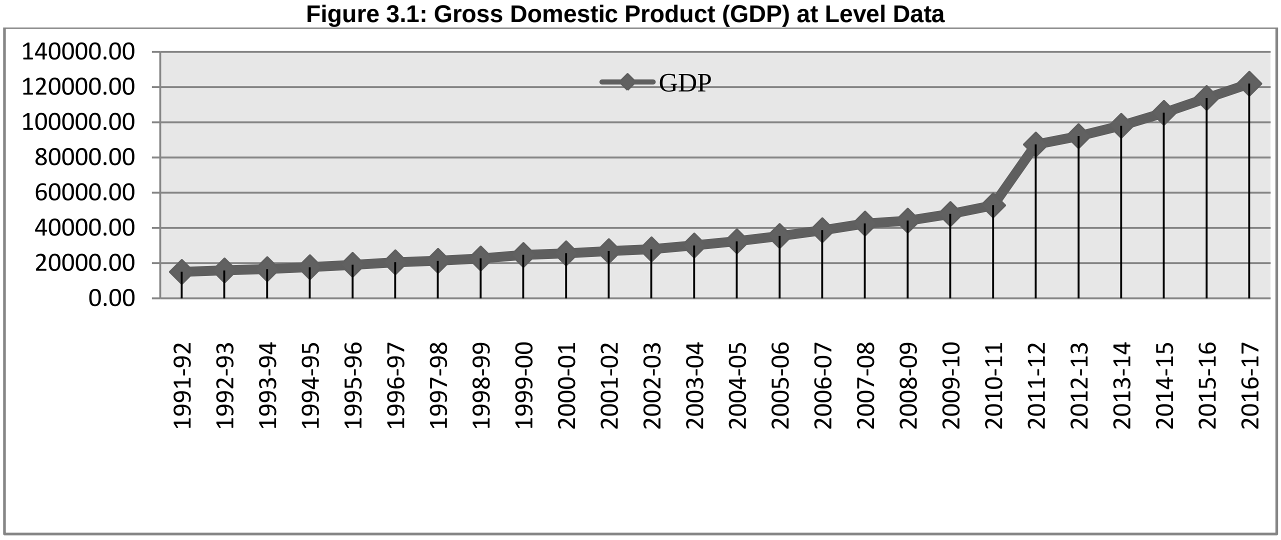

Figure 3.2 Gross Domestic Product (GDP) at First Difference (DGDP)

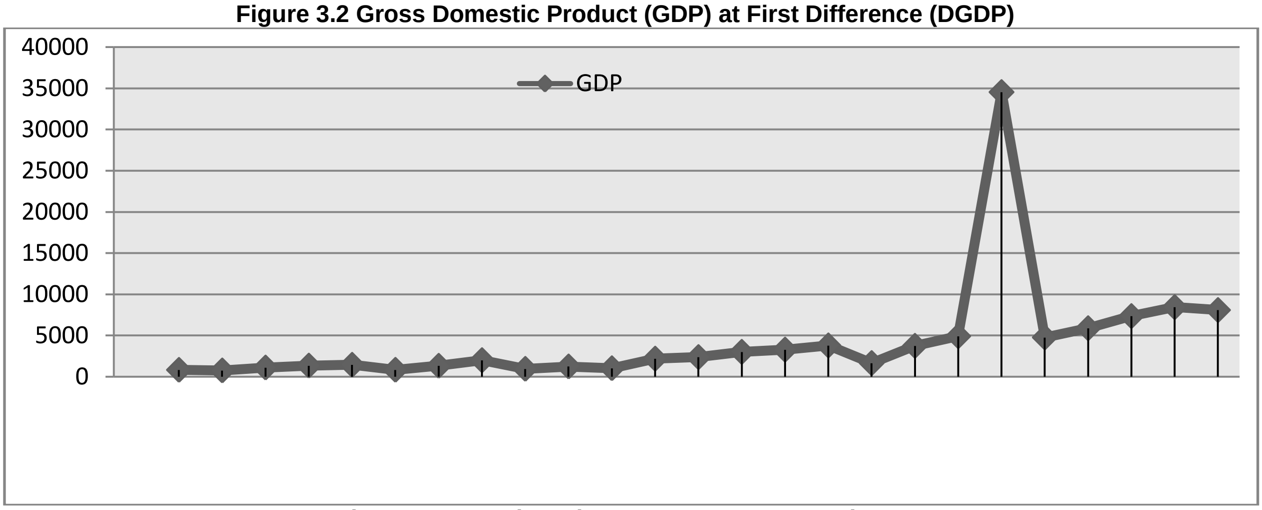

Figure 3.3: Foreign Direct Investment at Level Data

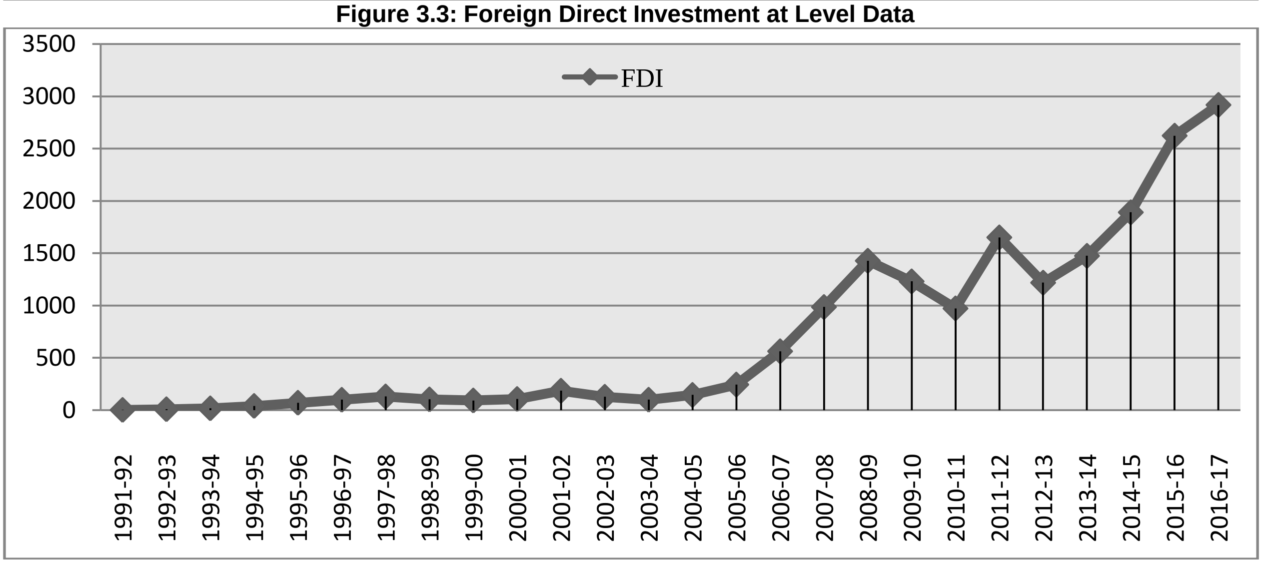

Figure 3.4: Foreign Direct Investment at First Difference (DFDI)

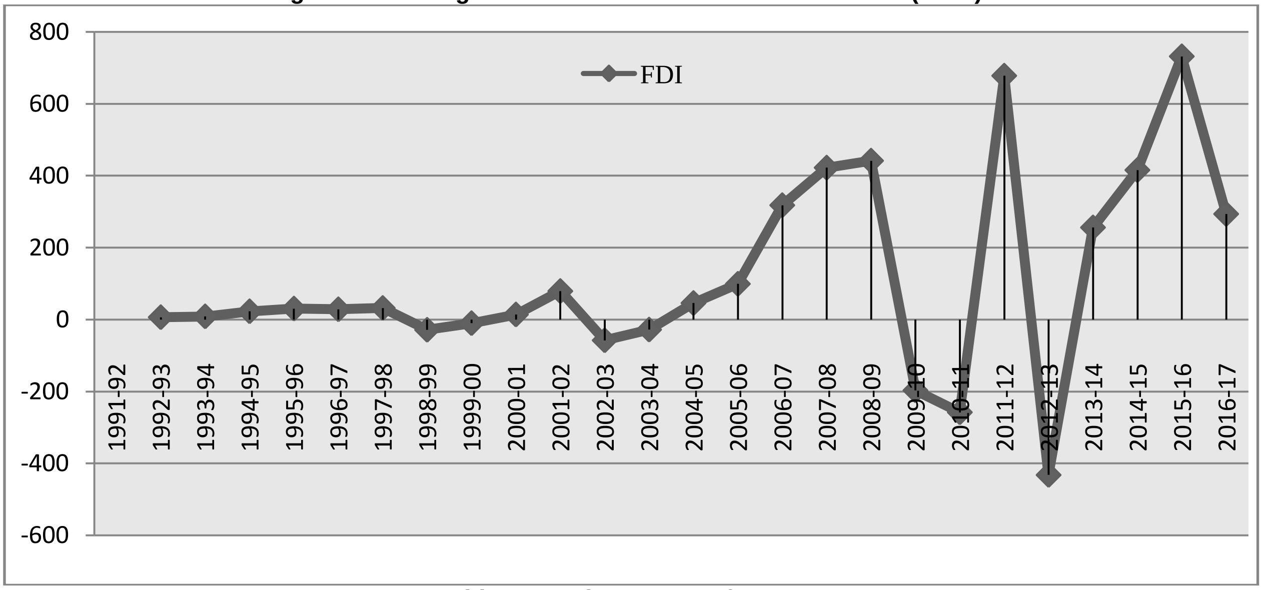

Table 3.1: Unit Root Test for GDP

Augmented Dickey-Fuller test for GDP						
	At Level					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**
1% level 5% level 10%level	-3.724070 -2.986225 -2.632604	2.049081 (0.9998)	-4.498307 -3.658446 -3.268973	4.357651 (1.0000)	-2.660720 -1.955020 -1.609070	4.024251 (0.9999)
	R^2 = 0.15, Adj.R^2 = 0.12 D.W.=2.11		R^2 = 0.72, Adj. R^2 = 0.56 D.W.=2.41		R^2 = 0.15, Adj. R^2 = 0.15 D.W.=2.13	
Decision	Non-Stationary		Non-Stationary		Non-Stationary	
	At First Difference					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**
1% level 5% level 10% level	-3.737853 -2.991878 -2.635542	-3.947023 (0.0062)	-4.394309 -3.612199 -3.243079	-4.998912 (0.0027)	-2.664853 -1.955681 -1.608793	-2.992878 (0.0045)
	R^2 = 0.41, Adj.R^2 = 0.39 D.W.=2.05		R^2 = 0.54, Adj. R^2 = 0.50 D.W.=2.02		R^2 = 0.28, Adj. R^2 = 0.28 D.W.=2.21	
Decision	Stationary		Stationary		Stationary	

Source: Authors Computation (2018) using E-Views 10
Figure in parenthesis indicate probability

Table 3.2: Unit Root Test for GDP

Phillips-Perron Test for GDP						
	At Level					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**PP-T-Stat.**	**Critical Values**	**PP-T-Stat.**	**Critical Values**	**PP-T-Stat.**
1% level 5% level 10%level	-3.724070 -2.986225 -2.632604	2.268435 (0.9999)	-4.374307 -3.603202 -3.238054	-0.41847 (0.9809)	-2.660720 -1.955020 -1.609070	4.401987 (1.0000)

	R^2 = 0.15, Adj.R^2 = 0.12 D.W.=2.11		R^2 = 0.25, Adj. R^2 = 0.18 D.W.=2.09		R^2 = 0.15, Adj. R^2 = 0.15 D.W.=2.13	
Decision	Non-Stationary		Non-Stationary		Non-Stationary	
	At First Difference					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**PP T-Stat.**	**Critical Values**	**PP T-Stat.**	**Critical Values**	**PP T-Stat.**
1% level 5% level 10% level	-3.737853 -2.991878 -2.635542	-3.933200 (0.0064)	-4.394309 -3.612199 -3.243079	-5.012436 (0.0026)	-2.664853 -1.955681 -1.608793	-2.904921 (0.0055)
	R^2 = 0.41, Adj.R^2 = -0.39 D.W.=2.05		R^2 = 0.54, Adj. R^2 = 0.50 D.W.=2.02		R^2 = 0.28, Adj. R^2 = 0.0.28 D.W.=2.21	
Decision	Stationary		Stationary		Stationary	

Source: Authors Computation (2018) using E-Views 10
Figure in parenthesis indicate probability

Table 3.3: Unit Root Test for FDI

Augmented Dickey-Fuller Test for FDI						
	At Level					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**
1% level 5% level 10%level	-3.724070 -2.986225 -2.632604	1.433512 (0.9985)	-4.374307 -3.603202 -3.238054	-0.725403 (0.9597)	-2.660720 -1.955020 -1.609070	2.536805 (0.9960)
	R^2 = 0.08, Adj.R^2 = 0.04 D.W.=2.32		R^2 = 0.18, Adj. R^2 = 0.11 D.W.=2.12		R^2 = 0.06, Adj. R^2 = 0.06 D.W.=2.34	
Decision	Non-Stationary		Non-Stationary		Non-Stationary	
	At First Difference					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**	**Critical Values**	**ADF T-Stat.**
1% level 5% level 10% level	-3.737853 -2.991878 -2.635542	-4.532995 (0.0016)	-4.394309 -3.612199 -3.243079	-5.344298 (0.0013)	-2.664853 -1.955681 -1.608793	-3.909468 (0.0004)
	R^2 = 0.48, Adj.R^2 = 0.45 D.W.=1.99		R^2 = 0.58, Adj. R^2 = 0.54 D.W.=2.03		R^2 = 0.40, Adj. R^2 = 0.40 D.W.=2.21	
Decision	Stationary		Stationary		Stationary	

Source: Authors Computation (2018) using E-Views 10
Figure in parenthesis indicate probability

Table 3.4: Unit Root Test for FDI

Phillips-Perron Test for FDI						
	At Level					
	Constant		**Constant, Linear Trend**		**None**	
	Critical Values	**PP-T-Stat.**	**Critical Values**	**PP-T-Stat.**	**Critical Values**	**T-Stat.**
1% level 5% level 10%level	-3.724070 -2.986225 -2.632604	2.317673 (0.9999)	-4.374307 -3.603202 -3.238054	-0.540504 (0.9740)	-2.660720 -1.955020 -1.609070	3.706323 (0.9998)
	R^2 = 0.08, Adj.R^2 = 0.04 D.W.=2.32		R^2 = 0.18, Adj. R^2 = 0.11 D.W.=2.12		R^2 = 0.06, Adj. R^2 = 0.06 D.W.=2.34	
Decision	Non-Stationary		Non-Stationary		Non-Stationary	
	At First Difference					
	Constant		**Constant, Linear Trend**		**None**	

	Critical Values	PP T-Stat.	Critical Values	PP T-Stat.	Critical Values	PP T-Stat.
1% level 5% level 10% level	-3.737853 -2.991878 -2.635542	-4.532995 (0.0016)	-4.394309 -3.612199 -3.243079	-5.385370 (0.0011)	-2.664853 -1.955681 -1.608793	-3.898610 (0.0004)
	R^2 = 0.48, Adj.R^2 = -0.45 D.W.=1.99		R^2 = 0.58, Adj. R^2 = 0.54 D.W.=2.04		R^2 = 0.40, Adj. R^2 = 0.0.40 D.W.=2.03	
Decision	Stationary		Stationary		Stationary	

Source: Authors Computation (2018) using E-Views 10
Figure in parenthesis indicate probability

Table 3.5: Johansen Cointegration Test for FDI

Hypothesized No. of CE (s)	Eigen Value	Trace Statistic	Critical Value	Prob.**
None *	0.575774	29.11171	15.49471	0.0003
At most 1 *	0.299177	8.531996	3.841466	0.0035

Source: Authors Computation (2018) using E-Views 10
Trace test indicates 2 cointegrating equation (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigen value)

Hypothesized No. of CE (s)	Eigen Value	Max-Eigen Statistic	Critical Value	Prob.**
None *	0.575774	20.57972	14.26460	0.0044
At most 1 *	0.299177	8.531996	3.841466	0.0035

Source: Authors Computation (20178 using E-Views 10
Max-eigen value test indicates 2 cointegrating equation (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3.6: Results of Granger Causality Test

Lag Length	Null Hypothesis	Observations	F-Statistics	Prob.	Decision
1.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	25	0.28461 3.30346	**0.5990** 0.0828	Did not Reject Null Did not Reject Null
2.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	24	3.27811 6.46117	**0.0598** **0.0072***	Did not Reject Null Reject Null at 1%
3.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	23	7.68406 4.18454	**0.0021*** **0.0230***	Reject Null at 1% Reject Null at 1%
4.	FDI does not Granger Cause HEE GDP does not Granger Cause FDI	22	26.8769 4.91119	**4.E-06*** **0.0124***	Reject Null at 1% Reject Null at 1%
5.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	21	27.0508 5.86985	**2E-05*** **0.0087***	Reject Null at 1% Reject Null at 1%
6.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	20	16.0671 3.08670	**0.0009*** 0.0831	Reject Null at 1% Did not Reject Null
7.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	19	43.5891 8.12166	**0.0013*** **0.0304***	Reject Null at 1% Reject Null at 1%
8.	FDI does not Granger Cause GDP GDP does not Granger Cause FDI	18	10.9261 7.84557	**0.2300** **0.2697**	Did not Reject Null Did not Reject Null

Source: Authors Computation (2018) using E-Views 10
* Indicates significant at 1% level

Discussions

In order to examine the causal relationship between FDI and economic growth denoted as 'GDP', Granger Causality Test is used which is more authentic than lag regression model. However, before examining the causal relationship or causality between the variables (FDI and GDP), the first step is to determine whether time series under consideration is stationary or not. In present study, both graphic method and unit root method have been used.

From the graphic method, the stationarity of the given time series i.e. GDP and FDI are examined. The graphs 3.1 & 3.2 show the different trends of GDP time series at level data and at first difference respectively. And similarly, graph 3.3 & 3.4 shows the different trends of FDI time series at level data and at first difference respectively.

The graph 3.1 clearly exhibits that the GDP series at level data is non-stationary because rising trend of GDP of India can be observed over the period

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of time. Therefore, given time series is not stationary hence we cannot apply Granger test directly. Therefore, by taking first difference of GDP time series, the stationarity is examined through the graph 3.2. The Graph explains that when the first difference of GDP time series is taken then GDP becomes stationary. It can be observed from the graph that less variation is observed in GDP time series at first difference over the period of time. Hence, we can say that GDP series becomes stationary at first difference hence we can apply Granger Causality test at first difference. Now, the stationarity of FDI series will be examined through graphs. It is clear from the graph that the FDI is non-stationary because rising trend of FDI can be observed over the period of time in India. Therefore, by taking first difference of FDI series, the stationarity is examined in graph 3.4. It is clear from the graph that when the first difference of FDI time series is considered then FDI becomes stationary hence we can apply causality test at first difference data.

Thus from the graphic method it can be concluded that both time series GDP as well as FDI becomes stationary after taking the first difference means that we can apply granger causality test at first difference data, not at level data and it will not produce spurious results.

Another popular method for examining the stationarity of time series is the Unit Root test.

In the present study, we have used Augmented Dickey-Fuller test and Phillips-Perron test to check the stationarity of the time series. Unit root test has been applied to both the series GDP and FDI separately. It is clear from the above table 3.1 and 3.2 that GDP are non-stationary at level data because at all levels ((a) Constant (b) Constant and Linear trend and (c) None) probabilities are more than 0.05 per cent level. Both Augmented Dickey-Fuller (ADF) and Philips Perron (PP) test confirms that time series GDP is non-stationary at level data and but it becomes stationary after taking first difference. It means that we can apply causality test at first difference of GDP will not produce spurious results.

Similarly, it is clear from the table 3.3 and 3.4 that FDI are non-stationary at level data because at all levels ((a) Constant (b) Constant and Linear trend and (c) None) probabilities are more than 0.05 per cent level. For the purpose of getting stationary variables, we make first order difference of each variable. And results of both Augmented Dickey-Fuller (ADF) and Philips Perron (PP) test confirms that time series FDI is non-stationary at level data and at first difference but the series become stationary after taking first difference. It means that we can apply causality test at first difference of FDI will not produce spurious results.

And we can observe that ADF and PP values of both GDP and FDI variables are greater than critical level and probability is also less than 0.05 per cent which is desirable/ideal situation at first difference. Hence GDP and FDI become stationary at first difference, means that we can apply granger causality test at first difference data not at level data. Having established that the given variables are stationary at first order difference, the next step is to test for cointegration between GDP and FDI. We can directly apply granger causality test on level data if the given series found cointegrated.

Johansen test of Cointegration presents the Trace and Maximum Eigen value performed to determine the order of integration; which both indicates that we reject the null hypothesis that none of the variables is cointegrated and at most one variable is cointegrated since p-value 0.0000 < 0.05, but revealed that both variables under consideration are cointegrated since p-values is greater than 0.05 for both Trace and Maximum Eigen value that is variables GDP, HEE have long run relationship meaning that whenever GDP goes up FDI goes. Now, since the variables (GDP and FDI) are cointegrated or there is a long term or equilibrium relationship between GDP and FDI implying there by the application of Granger-causality test to GDP and FDI in their original form will not produce spurious results.

Table 3.6 contains the results of Granger Causality test and direction of Granger Causality. In case of GDP ⇒FDI, it is clear from the table that at time lag 1 and 8, the F-value is not significant and therefore null hypothesis is accepted for lag 1 and 8. Whereas, in case of time lag 3 to 5 and 7, the computed F value is more than the critical value of F at 1 per cent level of significance. Therefore at time lag 3 to 5 and 7, the null hypothesis is rejected which implies that GDP granger causes FDI. Another case, FDI ⇒ GDP also shows that F-value is significant at every time lag from 3 to 7 but not for 1, 2 and 8. Therefore from time lag 3 to 7, the null hypothesis is rejected which implies that FDI granger causes GDP. Whereas, in case of time lag 1, 2 and 8 the computed F- value is less than the critical value of F, means we reject the null hypothesis which implies FDI does not granger causes GDP. In brief, the results of Granger causality test finally confirmed that there is the presence of bi-directional causality between FDI and GDP that is FDI leads to GDP (FDI ⇒ GDP) as well as GDP leads to FDI (GDP⇒FDI).

More precisely, the past values of FDI significantly contribute to the prediction of present value of GDP even in the presence of past values of GDP. Similarly, the past values of GDP significantly contribute to the prediction of present value of FDI even in the presence of past values of FDI.

Conclusion with Policy Implications

In brief, the present paper is an attempt to investigate the causal relationship between foreign direct investment and economic growth in India, by using the data for the period 1991-92 to 2016-17. For this, Foreign Direct Investment equity inflows and Gross Domestic Product (GDP) are used as proxies for Foreign Direct Investment and economic growth in India respectively. To check the stationarity of data, the study used graphic method and unit root tests (Augmented Dickey-Fuller test and Phillips-Perron Test). It is found from the analysis that GDP and FDI both are non-stationary at level/original data but become stationary at first difference. To test the long run relationship between the variables, Johansen cointegrating technique is used and it is clear from the results that there is long run association ship exist between the variables (GDP and FDI) meaning that whenever FDI goes up GDP also goes which implies that to attract more FDI in India, Government should continue its efforts to improve the ranking of India in ease of doing business index. As variables are cointegrated, we can apply Granger Causality test at level data. And the results confirms that there is presence of bi-directional causality between FDI and GDP that is FDI leads to GDP (FDI $\Rightarrow$ GDP) as well as GDP leads to FDI (GDP$\Rightarrow$FDI) in India, it strongly demonstrating that foreign capital penetration Granger-causes economic growth of Indian economy.

The implications for policy makers can be drawn from the study that to enhance the pace of economic growth or development in Indian economy, there is rationale and logic to reduce the size of shocks and increase the size of stimulants so that we can attract more and more foreign direct investment in Indian economy. No doubt, Indian Government has already taken many steps in form of liberalization, globalization and privatization and also adopted uniform tax system that is Goods and Services Tax (GST) to make India a preferred destination hub for foreign investors. The greater the inflows of foreign capital into Indian economy, greater will be the productivity gains, introduction of new processes, managerial skills, technology transfer and know-how gain to the Indian economy, it can contributes to economic growth of Indian economy through spillover effect, competition effect and linkage effect. As FDI is non-debt creating and non-volatile source of finance, it can supplement to domestic investment for boosting manufacturing sector, leading to more job creation in the economy and in this way it can prove panacea for many economic problems of Indian economy. No doubt, necessary efforts have been taken by Government due to which India is at the tenth position in top twenty host economies for FDI inflows in the world, while China is at the second position (according to World Investment Report 2018). To uplift ranking of India and to make India a preferred investment destination at the global scene, we have to build business environment very conducive for domestic as well as foreign investor with good governance at all the level of Indian economy.

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