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Do the FDI, Economic growth and Trade affect each other for India: An ARDL Approach

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Abstract

This paper examines the dynamic causal relationships between foreign direct investment (FDI), trade and economic growth in India by applying the bounds testing (ARDL) approach to cointegration for the period from 1970 to 2012. The bounds tests suggest that the variables of interest are bound together in the long-run when GDP per capita is the dependent variable. The empirical findings confirm that there is bi-directional Granger causality between FDI and trade, unidirectional Granger causality running from FDI to economic growth and from economic growth to capital investment but there is no Granger causality from economic growth to FDI and capital investment to per capita GDP.

Key words: FDI, trade openness, economic growth, ARDL cointegration, ECM, India.

JEL classification: C22, F13, F21.

1. Introduction:

The relationship between Foreign Direct investment (FDI), exports and economic growth has gained importance and attention among policy makers and researchers. Foreign direct investment (FDI) is often seen as important catalysts for economic growth in the developing countries. FDI is also an important vehicle of technology transfer from developed countries to developing countries. It stimulates domestic investment and facilitates improvements in human capital and institutions in the host countries. International trade is also known to be an instrument of economic growth (Frankel and Romer, 1999). Trade facilitates more efficient production of goods and services by shifting production to countries that have comparative advantage in producing them. Even though past studies show that FDI and trade have a positive impact on economic growth, the size of such impact may vary across countries depending on the level of human capital, domestic investment, infrastructure, macroeconomic stability, and trade policies. The literature continues to debate the role of FDI and trade in economic growth as well as the importance of economic and institutional developments in fostering FDI and trade. This lack of consensus limits our understanding of the role of FDI and trade policies in economic growth processes and restricts our ability to develop policies to promote economic growth.

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In this paper I try to build up a long term relationship and short term dynamics between FDI Trade openness per capita GDP and Capital investment variables using an ARDL (autoregressive distributed lag) approach and ECM model.

2. Literature Review:

Yangru Wu (1999) emphasizes the role of the learning process through FDI in the growth of a country. Findlay (1978) presents the contagion effect of managerial practices and advanced technology introduced by foreign firms on the host country's technology. In contrast, Charkovic and Levine (2005) claim that FDI creates the crowding out effect on domestic capital and hence the effect of FDI on growth is either insignificant or negative. In addition, other studies reason that causality can be the other way and market seeking FDI tends to serve the growing economies. Similarly, multinational corporations are attracted towards growing and productive economies. Therefore, this bi-directional behaviour between FDI and GDP can create simultaneity bias between the two variables.

Further, there is the similar two-way causality discussion between exports and GDP. The first is the export led growth hypothesis, while the other equally appealing hypothesis is that output growth causes export growth.

Regarding the export led growth hypothesis, Makki and Somwaru (2004) argue that export growth increases factor productivity due to gains obtained from increasing returns to scale, by catering to the larger foreign market. In addition, export growth relaxes the foreign exchange constraints that result in an increase in the import of capital/technology-intensive intermediate inputs. Due to the increased exports, efficiency is enhanced because exporters are able to compete in foreign markets which results in technological advances and grooming of local entrepreneurs. Grossman and Helpman (1991) advocate that open trade regimes helps in importation of better technologies and also result in an improved investment climate.

Similarly Rodrik (1995) argues that it is difficult to identify the impact of trade on growth and there is evidence that countries with higher income for reasons other than trade, tend to trade more. Another criticism regarding the link between trade and growth comes from Rodriguez and Rodrik (1999) who argue that failing to take into account institutional factors results in an upwardly biased estimate of trade coefficients and the other variables. Furthermore, they claim that the relationship between average tariff rates and economic growth is only slightly negative and nowhere statistically significant.

To analyze the debate on the FDI's role as a complement or substitute to international trade, Wei, Wang and Liu (2001) expound that according to Hechscher-Ohlin- Samuelson models, trade can substitute for international movement of factors of production including FDI. For example, by exporting capital intensive commodities in exchange for labour intensive commodities, the perfectly immobile factors move through exports and imports. Helpman (1984) and Krugman (1985) argue that if countries are asymmetric, the capital abundant country provides the headquarter services in a labor intensive country through FDI in exchange for finished varieties of differentiated goods. So FDI generates complementary trade flows from labour intensive countries. However, if the countries are symmetric, there is a substitution effect and capital intensive goods are exchanged for labor intensive goods.

Fosu and Magnus (2006) examine the long-run impact of foreign direct investment and trade on economic growth in Ghana between 1970 and 2002. Using an augmented aggregate production function growth model and by applying the bounds testing approach to cointegration, they found cointegration relations between growth and its determinants in the aggregate production function model. Their results indicated the impact of FDI on growth to be negative. Trade however was found to have significant positive impact on growth.

Theoretical growth studies suggest at best a very complex and ambiguous relationship between trade restrictions and growth. The endogenous growth literature has been diverse enough to provide a different array of models in which trade restrictions can decrease or increase the worldwide rate of growth. Note that if trading partners are asymmetric countries in the sense that they have considerably different technologies and endowments, even if economic integration raises the worldwide growth rate, it may adversely affect individual countries (see Grossman and Helpman, 1991a,b; Lucas, 1988; Rivera-Batiz and Xie, 1993; Young 1991).

It is worthwhile to note that the theoretical growth literature has given more attention to the relationship between trade policies and growth rather than the relationship between trade openess and growth. Therefore, the conclusion about the relationship between trade barriers and growth cannot be directly applied to the effects of changes in trade volumes on growth.

3. Data sources and description of variables

I have used the annual time series data in this study on economic growth, FDI, trade and capital stock, which cover the 1970-2012 periods. The data has been obtained from different sources, including Tunisia Central Bank annual reports, World Bank indicators etc.

The economic growth variable, which is measured by real GDP per capita, is noted by Y. F is the value of real gross foreign direct investment inflows to GDP ratio; Trade openness is the total sum of exports and imports divided by GDP and is noted by T; capital stock (K) is measured by the real value of gross fixed capital formation (GFCF).

4. Methodology and empirical results

4.1 Unit roots Tests

In time series analysis, variables must be tested for stationarity before running the causality test. For this test, in this current study we use the conventional ADF tests, the Phillips-Perron test following Phillips and Perron (1988) and the Kwiatkowski-Phillips-Schmidt-Shin test proposed by Kwiatkowski-Phillips-Schmidt-Shin (1992).

The ARDL / Bounds Testing methodology of Pesaran and Shin (1999) and Pesaran et al. (2001) is based on the assumption that all variables are mixed of I(0) or I(1). So, before applying this test, we determine the order of integration of the variables using the unit root tests. The objective is to ensure that the variables are not I(2) so as to avoid spurious results. In the presence of variables integrated of order two, we cannot interpret the values of F statistics.

The results of the stationarity tests show that all variables are non-stationary at level. These results are given in Table 1. The ADF, the Phillips-Perron and KPSS tests applied to the first difference of the data series reject the null hypothesis of non-stationarity for all the variables used in this study (Table 2). It is, therefore, worth concluding that all the variables are integrated of order one.

Table 1. Unit root test results on the log values of the variables at I(0)

	ADF			Phillip-Perron			KPSS		
Variables	Test statistic	Critical value at 5%	SIC lag Max =9	Test statistic	Critical value at 5%	Bandwidth	Test statistic	Critical value at 5%	Bandwidth
Ln(F)	-2.79*	-3.52	0	-2.56*	-3.52	8	0.13*	0.15	3
Ln(K)	-1.57*	-3.52	0	-1.31*	-3.52	2	0.20*	0.21(.10)	5
Ln(Y)	-1.55*	-3.52	0	-1.55*	-3.52	3	0.215*	0.216(.10)	5
Ln(T)	-1.44*	-3.52	0	-1.65*	-3.52	2	0.14*	0.15	5

*with trend and Intercept

Table 2. Unit root test results on the log values of the variables at I(1)

	ADF			Phillip-Perron		
Variables	Test statistic	Critical value at 5%	SIC lag Max =9	Test statistic	Critical value at 5%	Bandwidth
Ln(F)	-6.30*	-1.95	0	-7.29*	-1.95	40
Ln(K)	-8.94***	-3.52	0	-5.45*	-1.95	4
Ln(Y)	-7.33***	-3.52	0	-9.30***	-3.52	8
Ln(T)	-5.71***	-3.52	0	-5.71***	-3.52	0

***with trend and Intercept and * without trend and Intercept

4.2 Bounds tests for cointegration

In order to empirically analyze the long-run relationships and short run dynamic interactions among the variables of interest (trade, FDI, capital investment and economic growth), we apply the autoregressive distributed lag (ARDL) cointegration technique as a general vector autoregressive (VAR) model of order p in the vector of these variables $Z_t = (Y_t, K_t, T_t, F_t)$. The ARDL / Bounds Testing methodology of Pesaran and Shin (1999) and Pesaran et al. (2001) has a number of features that many researchers feel give it some advantages over conventional cointegration testing. For instance: It can be used with a mixture of I(0) and I(1) data; It involves just a single-equation set-up, making it simple to implement and interpret; Different variables can be assigned different lag-lengths as they enter the model.

The ARDL models used in this study are expressed as follows:

$$D(\ln(Y_t)) = a_{01} + b_{11}\ln(Y_{t-1}) + b_{21}\ln(K_{t-1}) + b_{31}\ln(T_{t-1}) + b_{51}\ln(F_{t-1}) + \sum_{i=1}^{p} a_{1i} D(ln(Y_{t-i})) + \sum_{i=1}^{q_1} a_{2i} D(ln(K_{t-i})) + \sum_{i=1}^{q_2} a_{3i} D(ln(T_{t-i})) + \sum_{i=1}^{q_3} a_{4i} D(ln(F_{t-i})) + \varepsilon_{1t} \quad \textbf{(1)}$$

$$D(\ln(K_t)) = a_{01} + b_{12}\ln(Y_{t-1}) + b_{22}\ln(K_{t-1}) + b_{32}\ln(T_{t-1}) + b_{42}\ln(F_{t-1}) + \sum_{i=1}^{p} a_{1i} D(\ln(Y_{t-i})) + \sum_{i=1}^{q_1} a_{2i} D(\ln(K_{t-i})) + \sum_{i=1}^{q_2} a_{3i} D(\ln(T_{t-i})) + \sum_{i=1}^{q_3} a_{4i} D(\ln(F_{t-i})) + \varepsilon_{2t} \quad \textbf{(2)}$$

$$D(\ln(T_t)) = a_{01} + b_{13}\ln(Y_{t-1}) + b_{23}\ln(K_{t-1}) + b_{33}\ln(T_{t-1}) + b_{43}\ln(F_{t-1}) + \sum_{i=1}^{p} a_{1i} D(ln(Y_{t-i})) + \sum_{i=1}^{q_1} a_{2i} D(ln(K_{t-i})) + \sum_{i=1}^{q_2} a_{3i} D(ln(T_{t-i})) + \sum_{i=1}^{q_3} a_{4i} D(ln(F_{t-i})) + \varepsilon_{3t} \quad \textbf{(3)}$$

$$D(\ln(F_t)) = a_{01} + b_{14}\ln(Y_{t-1}) + b_{24}\ln(K_{t-1}) + b_{34}\ln(T_{t-1}) + b_{44}\ln(F_{t-1}) + \sum_{i=1}^{p} a_{1i} D(\ln(Y_{t-i})) + \sum_{i=1}^{q_1} a_{2i} D(\ln(K_{t-i})) + \sum_{i=1}^{q_2} a_{3i} D(\ln(T_{t-i})) + \sum_{i=1}^{q_3} a_{4i} D(\ln(F_{t-i})) + \varepsilon_{4t} \quad \textbf{(4)}$$

Where all variables are as previously defined, ln(.) is the logarithm operator, D is the first difference, and ε_t are the error terms.

The bounds test is based on the joint F-statistic which its asymptotic distribution is non-standard under the null hypothesis of no cointegration. The first step in the ARDL bounds approach is to estimate the five equations (1, 2, 3 and 4) by ordinary least squares (OLS). The estimation of the five equations tests for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. Two sets of critical values for a given significance level can be determined (Pesaran et al., 2001). The first level is calculated on the assumption that all variables included in the ARDL model are integrated of order zero, while the second one is calculated on the assumption that the variables are integrated of order one. The null hypothesis of no cointegration is rejected when the value of the test statistic exceeds the upper critical bounds value, while it is accepted if the F-statistic is lower than the lower bounds value. Other ways, the cointegration test is inconclusive. The use of this approach is guided by the short data span. We choose a maximum lag order of 2 for the conditional ARDL vector error correction model by using the Akaike information criteria

(AIC). The calculated F-statistics are reported in Table 3 when each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions.

Table 3: Results from bound tests

Dependent Variable	Independent Variables	F-Statistic	Result
F	K, Y, T	2.894	No Cointegration
K	F, Y, T	2.842	No Cointegration
Y	F, K, T	7.084	**Cointegration**
T	F, K, Y	2.92	No Cointegration
Lower-bound critical value for "without intercept and trend" at 1% = 3.42			
Upper-bound critical value for "without intercept and trend" at 1% = 4.84			

Lower and Upper-bound critical values are taken from Pesaran et al. (2001), Table CI(ii) Case I.

From these results, it is clear that there is a long run relationship amongst the variables when per Capita GDP is the dependent variable because its F-statistic (7.084) is higher than the upper-bound critical value (4.84) at the 1% level. This implies that the null hypothesis of no cointegration among the variables in equation (1) is rejected. However, for the other equations (2) - (4), the null hypothesis of no cointegration is accepted.

4.3 Granger short run and long run causality tests

Once cointegration is established, the conditional ARDL (p, q_1, q_2, q_3) long-run model for $\ln(Y_t)$ can be estimated as:

$$\ln(Y_t) = a_0 + \sum_{i=1}^{p} a_{1i}\ ln(Y_{t-i}) + \sum_{i=0}^{q_1} a_{2i}\ ln(K_{t-i}) + \sum_{i=0}^{q_2} a_{3i}\ ln(T_{t-i}) + \sum_{i=0}^{q_3} a_{4i}\ ln(F_{t-i}) + \varepsilon_t \quad \textbf{(5)}$$

The orders of the ARDL model (p, q_1, q_2, q_3) in the five variables are selected by using AIC. Equation (5) is estimated using the following ARDL (1, 0, 0, 0) specification. The results obtained by normalizing on FDI, in the long run are reported in Table 4.

Table 4. Estimated long run coefficients using the ARDL approach

Variable	Coefficient	t-Statistic	Probability
C	-3.05	-4.59	0.00
Ln(K)	0.54	5.38	0.00
Ln(F)	0.01	2.85	0.007
Ln(T)	-0.03	-1.01	0.3227

The estimated coefficients of the long-run relationship are significant for capital investment and FDI but not significant for trade. Capital investment and FDI have a positive significant impact on per Capita GDP. Trade variable is negatively signed but not significant at the 5% level.

Following the research papers of Narayan and Smyth (2008), we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. The long-run relationship between the variables indicates that there is Granger-causality in at least one direction which is determined by the F-statistic and the lagged error-correction term. The short-run causal effect and is represented by the F-statistic on the explanatory variables while the t-statistic on the coefficient of the lagged error-correction term represents the long-run causal relationship (Odhiambo 2009; Narayan and Smyth, 2006). The equation where the null hypothesis of no cointegration is rejected is estimated with an error-correction term .

The vector error correction model is specified as follows:

$$D(\ln(Y_t)) = a_0 + \sum_{i=1}^{p} a_{1i}\, D\big(ln(Y_{t-i})\big) + \sum_{i=0}^{q_1} a_{2i}\, D\big(ln(K_{t-i})\big) + \sum_{i=0}^{q_2} a_{3i}\, D\big(ln(T_{t-i})\big) + \sum_{i=0}^{q_3} a_{4i}\, D\big(ln(F_{t-i})\big) + \alpha\, ECT_{t-1} + \varepsilon_{1t} \quad \textbf{(6)}$$

$$D(\ln(K_t)) = a_0 + \sum_{i=1}^{p} a_{1i}\, D\big(ln(K_{t-i})\big) + \sum_{i=0}^{q_1} a_{2i}\, D\big(ln(Y_{t-i})\big) + \sum_{i=0}^{q_2} a_{3i}\, D\big(ln(T_{t-i})\big) + \sum_{i=0}^{q_3} a_{4i}\, D\big(ln(F_{t-i})\big) + \alpha\, ECT_{t-1} + \varepsilon_{1t} \quad \textbf{(7)}$$

$$D(\ln(T_t)) = a_0 + \sum_{i=1}^{p} a_{1i}\, D\big(ln(T_{t-i})\big) + \sum_{i=0}^{q_1} a_{2i}\, D\big(ln(K_{t-i})\big) + \sum_{i=0}^{q_2} a_{3i}\, D\big(ln(Y_{t-i})\big) + \sum_{i=0}^{q_3} a_{4i}\, D\big(ln(F_{t-i})\big) + \alpha\, ECT_{t-1} + \varepsilon_{1t} \quad \textbf{(8)}$$

$$D(\ln(F_t)) = a_0 + \sum_{i=1}^{p} a_{1i}\, D\big(ln(F_{t-i})\big) + \sum_{i=0}^{q_1} a_{2i}\, D\big(ln(K_{t-i})\big) + \sum_{i=0}^{q_2} a_{3i}\, D\big(ln(T_{t-i})\big) + \sum_{i=0}^{q_3} a_{4i}\, D\big(ln(Y_{t-i})\big) + \alpha\, ECT_{t-1} + \varepsilon_{1t} \quad \textbf{(9)}$$

Where a_{1i}, a_{2i}, a_{3i} and a_{4i} are the short-run dynamic coefficients of the model's convergence to equilibrium and is the speed of adjustment.

The equations (6) – (9) are estimated by OLS regression separately. The results of the short-run dynamic coefficients associated with the long-run relationships obtained from the equation (6) are given in Table 5. Beginning with the results for the long-run, the coefficient on the lagged error-correction term is significant at 1% level with the expected sign, which confirms the result of the bounds test for cointegration. Its value is estimated to -0.46 which implies that the speed of adjustment to equilibrium after a shock is high. Approximately 46% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year. In the long run FDI, capital and trade Granger cause GDP per capita. This result implies that causality runs interactively through the error-correction term from FDI, capital and trade to real GDP per capita. In the short run, capital investment, FDI is significant and has an important impact on per capita GDP. Trade have a negative impact but not significant.

The regression for the underlying ARDL equation (7) fits very well and the model is globally significant. It also passes all the diagnostic tests against serial correlation (Durbin Watson test and Breusch-Godfrey test), heteroscedasticity (White Heteroskedasticity Test). The Ramsey RESET test also suggests that the model is well specified. All the results of these tests are shown in Table 6.

The stability of the long-run coefficient is tested by the short-run dynamics. Once the ECM model given by equation (7) has been estimated, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess the parameter stability (Pesaran and Pesaran (1997)). Graphs 1 and 2 plot the results for CUSUM and CUSUMSQ tests. The results indicate the absence of any instability of the coefficients because the plot of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

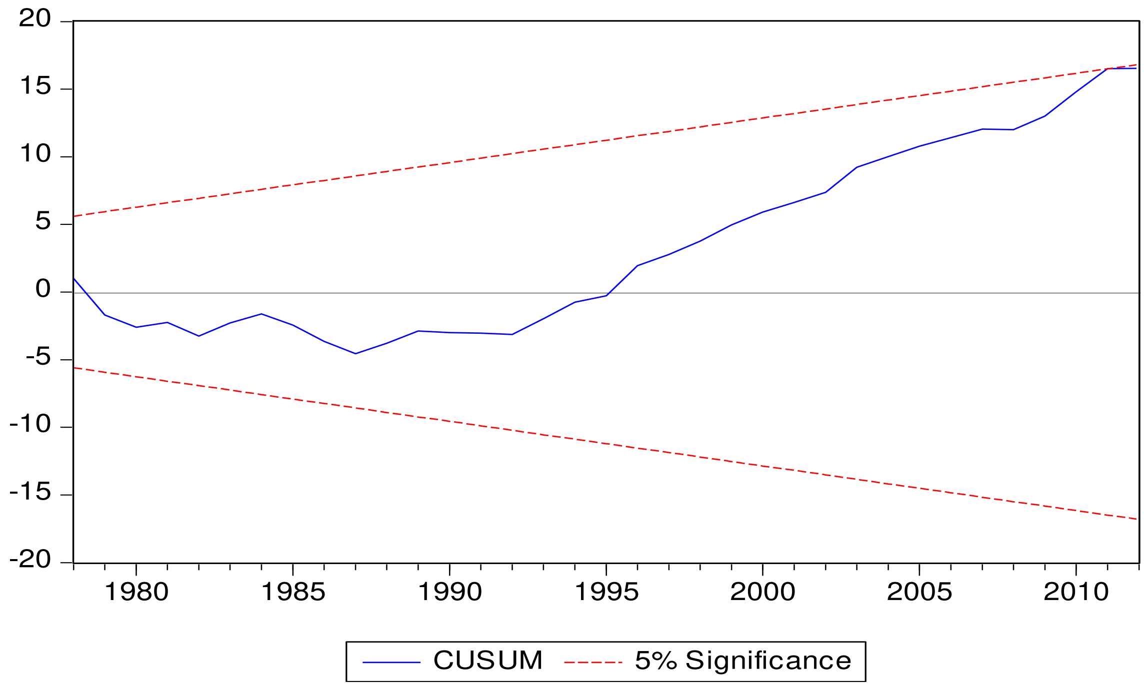
Table 5. Results of equation (6), ARDL (1, 0, 0, 0) selected based on AIC

Variable	Coefficient	t-Statistic	Probability
C	-7.500352	-8.117119	0.00
D(ln(F))	0.01	2.37	0.02
D(ln(K))	0.23	4.49	0.00
D(ln(T))	-0.05	-0.90	0.38
ECM(-1)	-0.46	-3.59	0.00
R-squared	0.45		
F-statistic	5.69		0.00
Durbin-Watson stat	1.99		

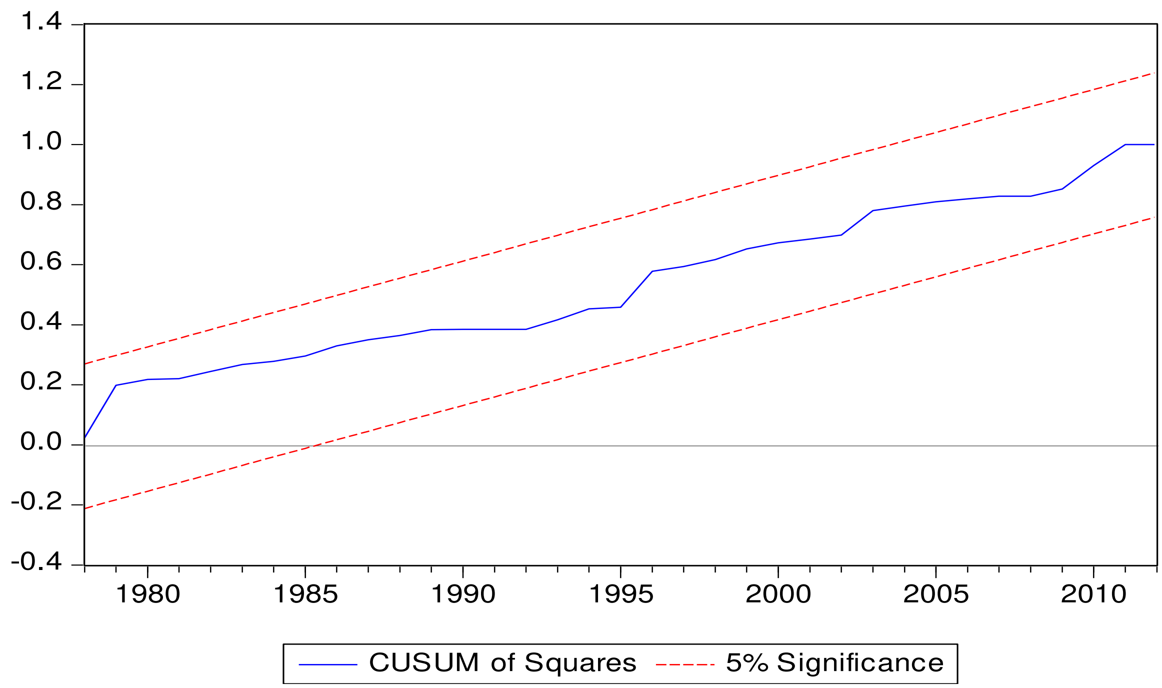
Table 6. Results of diagnostic tests

	Test staistic	Probability
Ramsey RESET Test (log likelihood ratio)	2.198332	0.1474
White Heteroskedasticity test	1.043919	0.4622
Breusch-Godfrey Serial Correlation test	1.575165	0.2221

Graph 1. Plot of CUSUM Test for equation (6)



Graph 2. Plot of CUSUMSQ Test for equation (6)



Results of short run Granger causality tests are shown in Table 8. In the short-run, the F-statistics on the explanatory variables suggest that at the 10% level or better there is bi-directional Granger causality between FDI and trade, unidirectional Granger causality running from FDI to economic growth and from economic growth to capital investment. There is no Granger causality from economic growth to FDI and capital investment to per capita GDP. The Granger causality test results for the relationship between FDI and capital investment are interesting. These results indicate that there is no significant Granger causality from FDI to capital investment or from capital investment to FDI. Turning to the Granger causality test results for trade openness and capital investment, there is also no significant Granger causality from trade to capital investment or from capital investment to trade. The results support the idea that FDI will only be growth enhancing.

We can conclude that FDI which promotes trade and economic growth in the short-run for India. FDI is the main catalyser of economic growth in India.

Table 8. Results of short run Granger causality

	F-statistic				Direction of causality
Variables	D(ln(Y))	D(ln(F))	D(ln(K))	D(ln(T))	
D(ln(Y))	-	4.12*	0.17	2.27	F -> Y
D(ln(F))	0.47	-	0.69	5.93*	T -> F
D(ln(K))	5.63*	0.73	-	0.07	Y -> K
D(ln(T))	0.80	3.65**	2.66	-	F -> T

(*) and (**) denote statistical significance at the 5% and 10% levels respectively.

5. Conclusion

The paper examines the dynamic causal relationship among the series of economic growth, foreign direct investment, trade and capital investment for India for the period of 1970-2012. It implements ARDL model to cointegration to investigate the existence of a long run relation among the above noted series; and the Granger causality within VECM to test the direction of causality between the variables. The topic merits special importance due to the possible interrelations among the series with implications for economic growth. The results show that there is cointegration among the variables specified in the model when per capita GDP is the dependent variable. Capital investment and FDI promote economic growth in India in the long run. These results indicate that there is no significant Granger causality from FDI to capital investment or from capital investment to FDI. Turning to the Granger causality test results for trade openness and capital investment, there is also no significant Granger causality from trade to capital investment or from capital investment to trade.

Foreign direct investment is the catalyser of economic growth in India. This finding generates important implications and recommendations for policy makers in India. The results suggest that for FDI to bring in the anticipated positive impacts on trade, Indian government will undertake serious reforms with clear objectives and strong commitments.

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