Impact of FDI and Net Trade on GDP of India
Using Cointegration approach

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ABSTRACT

India is one of the fastest growing economies in the world. It is one of the leading economies in terms of growth and development among the developing countries. Foreign Direct Investment and net trade are some of the main factors to influence the GDP of an economy. India has been attracting FDI at an increasing rate since the liberalization. In the recent years, the government of India has opened FDI market to many other sectors like retail, railway and defense sectors which was not previously allowed. India is one of the major exporter and importer of many goods and services in the world which plays an important role in GDP growth. The purpose of this study is to analyse the impact of FDI and Net Trade on the GDP of Indian economy. The Cointegration methodology is used to explore the impact of FDI and Net Trade (NT) on the GDP of Indian economy. The Vector Error Correction Model is used to measure the short run and long-run equilibrium relationship between these variables. It was found that FDI and Net Trade have a positive impact on the dependent variable GDP in a long run. The FDI showed a short-run impact on GDP whereas no short-run impact was found from Net Trade using Granger Causality test. The researchers have great scope to measure the impact of other factors influencing the GDP of Indian economy with FDI and net trade.

Keywords: GDP, FDI, Net Trade, Cointegration, VECM, Granger Causality.

INTRODUCTION:

Foreign Direct Investment has been the critical investment mode for the developing countries like India. For the past few decades mainly after liberalisation policy 1991, it has increased enormously. It has helped in filling the gap of investment where the public sector is unable to invest. India has witnessed a positive influence of FDI on GDP level. Studies have shown the positive impact of FDI on economic growth of India. India has observed FDI inflow from different countries, and the investment varies across different sectors. According to the official data, the total cumulative amount of FDI inflows from April 2000 to December 2017 was US$ 532,552 million. The percentage share of total FDI inflows from top ten investing countries are 34 percent from Mauritius, 17 percent from Singapore, 7 percent from Japan and U.K. each, 6 percent from Netherland and U.S.A each, 3 percent from Germany and Cyprus each, 2 percent from France and 1 percent from UA from the time period April 2016 to Dec 2017. During this period services sector attracted 17 percent of FDI equity inflow, the highest by any sector, followed by telecommunications, computer software and hardware 8 percent. The construction development attracted 7 percent of FDI inflow followed by automobile industry 5 percent. The trading sector, drugs and pharmaceuticals, chemicals and power sector received 4 percent each followed by construction sector which receives 3 percent of Foreign Direct Investment (Quarterly Fact Sheet, GOI, 2017).

In the major studies, GDP is used as a measurement of economic growth. According to the World Bank, Gross Domestic Product (GDP) is defined as "the measure of the total output of goods and services for final use occurring within the domestic territory of a given country, regardless of the allocation to domestic and foreign claims". The real GDP growth rate of India was 5.46 percent in 2012, 6.39 percent in 2013, 7.51 percent in 2014, 8.01 percent in 2015, 7.11 percent in 2016 and 6.72 percent in 2017 (India; IMF 2018).

Net Trade is one of the essential factors to influence the GDP of a country. It includes import and export of both goods and services of a country with the rest of the trading countries. In the Indian context, though trade plays an important role, it has been in the deficit mode for the last many years. According to the World Bank, "Net Trade in goods and services is derived by offsetting imports of goods and services against exports of goods and services. Exports and imports of goods and services comprise all transactions involving a change of ownership of goods and services between residents of one country and the rest of the world".

LITERATURE REVIEW:

There have been few studies which try to find out the relationship between the economic growth and FDI with other influential factors in India and other countries. From the previous studies, it is found that the economic growth has many factors to be influenced in the long run and short-run time. Many countries have shown only long-run relationship while others have shown both long run and short run relationship. From the previous studies, few studies are reviewed below

Using the autoregressive distributed lag (ARDL) model to examine the Cointegration, the study found that FDI and capital investment positively influence economic growth in the long run in India during 1970 to 2012 (A. Singh, 2013). To analyze the impact of foreign direct investment on the Gross Domestic Product of India, it is found that the foreign direct investment had a positive impact on the gross domestic product (Yameen & Ahmad, 2013). The structural cointegration model and vector error correction mechanism (VECM) was used and found that there exists a two-way long-run relationship between FDI and GDP and unit labour cost. The FDI is positively related to GDP, and there is a long-run technological relationship between real gross domestic product and unit cost of labour (ULC) (Chakraborty & Basu, 2002). There is a positive long-run relationship between FDI and GDP for both India and China. For the short run, there exists causal link unidirectional from FDI to GDP for both the nations indicating that change in FDI leads to change in GDP level (Baek & Koo, 2008). The Cointegration method was used to find the influence of FDI on GDP of Bangladesh. This method showed that there existed the long run equilibrium relationship between the FDI and GDP of the country and the Granger causality showed the presence of unidirectional causality from FDI to GDP (Rahaman & Chakraborty, 2014). The Autoregressive Distributed Lag Model (ARDL) for cointegration was used to test the long run relationship between FDI outflow, export and GDP of India during 1980-2014. Taking the FDI outflow as the dependent variable, all the three variables were found Cointegrated (S. Singh, 2017). Dynamic Causal Relationships in the developing countries was estimated among the variables economic growth, Foreign Direct Investment (FDI) and exports using the panel technique. It was found that there is a bidirectional causality between FDI Inflow and economic growth. The unidirectional causality was found in both the long run and short run moving from export to economic growth (Mehrara et al., 2012). The Cointegration methodology was used to explore the long run relationship between Foreign Direct Investment and economic growth of Ghana during 1980-2010. The long-run equilibrium and causal relationship were found between the variables FDI and GDP taking FDI as the dependent variable (Antwi & Zhao, 2013). The impact of Foreign Direct Investment on economic growth of Pakistan was analysed using Cointegration method. It was found that there exits long-run relationship between Gross Domestic Production (GDP) and Foreign Direct Investment (FDI) taking GDP as a dependent variable during the period 1980 to 2010 (Nosheen, 2013). The productivity spillover effect was analysed from Foreign Direct Investment (FDI) of India using cointegrated vector autoregression (CVAR). It was found that FDI inflow to India improved aggregate total factor productivity (TFP) growth through positive spillover effects. The trade showed a negative effect on total factor productivity (TFP) growth in India (Choi & Baek, 2017). The long-run relationship was examined between household consumption of Romania and Gross Domestic Production of the country using Cointegration method. It was found that GDP and household consumption do not possess the long run equilibrium relationship in Romania (Bălă, 2013). A Cointegration relationship was found between the Gross Domestic Production and energy consumption of Italy during 1970-2009. The short-run effects of the variables showed that the causality runs from energy to GDP and the bidirectional long-run causal relationship exists between the two given variables (Magazzino, 2014).

From the literature above, it can be observed that the Cointegration methodology was used to test the long run relationship between different time series variables. The Cointegration method is widely used to avoid the use

of differentiation variables so that the long run information in the variables could be retained. As it has been observed in the literature, the Cointegration and Vector Error Correction Model (VECM) model is used in finding both long-run equilibrium relationship and the short-run causal relationship between the variables. Confining this research to the GDP, FDI and net trade relationship, there are few studies who demonstrate the long-run and short-run relationship between these variables.

METHODOLOGY:

The present study is based on the secondary data from 1975 to 2016. The objective of this study is to analyse the impact of Foreign Direct Investment and Net Trade on the Gross Domestic Production of India. More specifically, the simplest form to capture the impact of FDI and Net Trade on GDP can be specified as

$$GDP = f(FDI, Net\ Trade)$$
$$GDP_t = \alpha + \beta_1\ FDI_t + \beta_2\ NT_t + \mu_t \underline{\hspace{2cm}} (1)$$

In examining the dynamic relationship between GDP, FDI and Net Trade, where GDP is the gross domestic product of the host country, which is a measurement of economic growth of a country. FDI is the Foreign Direct Investment by the investor into that particular host country, and NT is the Net Trade of the host country. Net Trade implies total exports minus total imports of a country during a financial year. The GDP is measured currently in US dollars ($). The Foreign direct investment, Net Trade in goods and services are measured in Balance of Payment (BoP), current US dollars.

Specification of Time-Series Models:
To estimate the long-run relationship among Gross Domestic Production (GDP), Foreign Direct Investment (FDI) and Net Trade, this study uses the maximum likelihood estimation method given by Johansen (1988) and Johansen and Juselius (1992) (Baek & Koo, 2008). The cointegration concept was first introduced by Granger (1981) and was extended further and modified by Engle and Granger (1987) (Chakraborty & Basu, 2002). According to this concept, if the economic time series possess the non-stationary behaviour, a proper linear combination between trending variables could eliminate the common trend component, and thus the linear combination of the variables will be stationary which indicates that the variables are cointegrated.

The Engle-Granger residual-based test is used most commonly for cointegration tests. For cointegrated variables models, this test includes the two steps. The first step is the estimation of a cointegrating regression by applying OLS on the levels of the variables included and the second step is testing for stationarity of the residuals by using augmented Dickey-Fuller tests (Chakraborty & Basu, 2002). There are two tests for the Johansen and Juselius (JJ) methods to determine the number of cointegrating vectors namely trace test and maximum-eigenvalue test. The null hypothesis of the trace test states that the number of cointegrating vectors is less than or equal to r, where r=0, 1, 2, etc.

After finding out that Cointegration exists between the variables which could be one or more than one equations, then the Vector Error Correction Model is used to explore the long run relationship. The process of estimating the Vector Error Correction Model (VECM) consists roughly of the three following steps:

1. Estimation and Specification of a Vector Autoregressive (VAR) model for the integrated multivariate time series for selecting lag criteria
2. Calculate likelihood ratio tests (trace and Maximum Eigenvalue test) to determine the number of Cointegration relations.
3. After the number of Cointegration is determined, estimate the Vector Error Correction Model.

The Vector Error Correction Model (VECM) follows as:

$$\Delta Y_t = \beta_0 + \beta_i \Delta Y_{t-i} + \delta_i \Delta X_{t-i} + \varphi\ z_{t-1} + \mu_t \underline{\hspace{2cm}} (2)$$

For the long run Cointegration equation, the model follows as

$$Z_{t-1} = ECT_{t-1} = Y_{t-1} - \beta_0 - \beta_i X_{t-1} \underline{\hspace{2cm}} (3)$$

RESULTS AND DISCUSSIONS:

The first step to run the Cointegration is to check the stationarity of the data series. The data series' Gross Domestic Production, Foreign Direct Investment, and Net Trade are non-stationary at the level. All the three variables are stationary at first difference (table 1) and hence the first step to run the Cointegration is fulfilled. After concluding that all the three variables are stationary at first difference, the next step is followed by selecting the lag order. For that VAR lag order selection process is used. According to this process, three to four lags can be used for Cointegration test. The results of lag selection criteria are presented in (table 2). The next step is to run the Cointegration test to check whether there exists the long run relationship between the

Gross Domestic Production, Foreign Direct Investment and Net Trade of India. Trace test and the Max-eigenvalue test is used to check the number of cointegration equations existing between the given variables. The results of trace test from table 3 showed that there exist at least three Cointegrating equations at the 0.05 probability. Similarly, the trace test shows that there exists three Cointegrating equation (table 4).

From the test results presented in table 3 and table 4, it is interpreted that Cointegration equations are existing. After identifying that, the Vector Error Correction model (VECM) is estimated (table 5). A Vector Error Correction model (VECM) enables to use non-stationary data, which is cointegrated, for interpretation. This helps to retain the relevant information in the data which would otherwise get missed on differencing of the same. The Vector Error Correction Model (VECM) adjusts to both short-run changes in the variables and deviations from equilibrium if a set of variables have one or more cointegrating vectors. The most important benefit of VECM is that it has an interpretation for both short run and long run equations.

The long run and short run Cointegration equations of Gross Domestic Production (GDP), Foreign Direct Investment (FDI) and Net Trade derived from the table 4 are as follows

In econometrics, the long run Cointegration equation is described as:
$$Z_{t-1} = ECT_{t-1} = Y_{t-1} - \beta_0 - \beta_i X_{t-1}$$
In this study the Cointegration equation (long run model) is as follows
$$Ect_{t-1} = 1.00\ GDP_{t-1} - 704.6274\ FDI_{t-1} - 235.0892\ N.T_{t-1} - 8.18E+10 \underline{\hspace{2cm}} (4)$$
$$GDP_{t-1} = 704.6274\ FDI_{t-1} + 235.0892\ N.T_{t-1} + 8.18E+10 \underline{\hspace{2cm}} (5)$$
The equation of Vector Error Correction Model (VECM) in described as:
$$\Delta Y_t = \beta_0 + \beta_i \Delta Y_{t-i} + \delta_i \Delta X_{t-i} + \varphi\ z_{t-1} + \mu_t$$
In this study, the Estimated VECM with GDP as target variable is as follows
$$\Delta GDP_t = -0.016983\ Ect_{t-1} + 0.000211\Delta\ GDP_{t-1} - 0.170662\ \Delta GDP_{t-2} + 0.853611\ \Delta GDP_{t-3} - 6.654953\ \Delta FDI_{t-1} - 8.795185\ \Delta FDI_{t-2} + 2.949472\ \Delta FDI_{t-3} - 0.648537\ \Delta N.T_{t-1} + 0.376406\ \Delta N.T_{t-2} - 0.374235\ \Delta N.T_{t-3} + 3.74E+10 \underline{\hspace{2cm}} (6)$$

The equation 5 derived from the table 5 shows the Equilibrium long-run relationship between Gross Domestic Production, Foreign Direct Investment and Net Trade of India. The GDP is dependent variable with FDI and Net Trade as independent variables. The coefficients of the equation show that there is a positive impact of Foreign Direct Investment and Net Trade on the GDP in the long run. The vector error correction model with GDP as the dependent variable, FDI and Net Trade as independent variables derived from the table 5 is depicted in equation 6. This equation shows the short-run effect on GDP from its lags, the effect of FDI and Net Trade on Gross Domestic Product of India.

After it is found that there is a long-run relationship between the variables, the next step is to check the significance of the Cointegration equation coefficients. The coefficient value is -0.016983 and the probability value is 0.0404 (table 5). To establish the long-run relationship, the coefficient value needs to be negative and significant. In the given equation, both the conditions are satisfied to establish the long run relationship. The R-square is 0.63 implying the independent variables influence the dependent variable by 63%. So from these indicators, we can interpret that there exists a long-run relationship between the GDP, FDI and Net Trade. It is worth mentioning that the GDP of India may not be the FDI driven economy, but FDI shows a long run positive impact on the GDP of India. The Breusch-Godfrey LM Test is used to identify the Serial Correlation and is found that there is no serial correlation present in the model consisting the variables GDP, FDI and Net Trade (table 6). The Cusum test used to check the stability of the model. In this study, the test is showing that the model is stable with dependent variable Gross Domestic Production, independent variables Foreign Direct Investment and Net Trade (figure 1).

The Granger causality Wald test was used to identify the short run influence or feedback of independent variables on the dependent variable. From the table 7, part I where GDP of India is the dependent variable, it is observed that there is short-run feedback of FDI on the GDP with chi-square value 10.76 and probability value 0.013, whereas Net Trade does not show short-run feedback on GDP with Chi-square value 0.316 and probability value 0.95. The overall feedback is significant for this model putting both the variables together. In the second part of the table, it is observed that the FDI has significant short-run feedback from both GDP and Net Trade. From the part III of table 7, it can be observed that Net Trade also gets short-run feedback from the GDP and FDI of India.

CONCLUSION:

GDP of India has been growing at an increasing rate over the last few decades. The increase in GDP has

multiple factors. For example, political stability, economic policies, foreign policies, foreign debt, exchange rate and trade policies. In this study, the effect of FDI and Net Trade on GDP of India has been analysed. Johnsen's Cointegration method with Vector Error Correction Model has been used to measure the long run effect of FDI and Net Trade on GDP of India. Also, Granger causality test has been used to explore the short-run effect of FDI and Net Trade on GDP of India. The empirical results show that FDI and Net Trade has a significant effect on the growth of GDP of India in the long run. However, Net Trade does not show the short-run effect on GDP, though there is the short-run effect of FDI on GDP. Further, the FDI has short-run effect form both GDP and Net Trade of India. Also, Net Trade shows the significant effect of both GDP and FDI inflow of India.

Since India has witnessed Foreign Direct Investment in many other sectors in the recent years. It provides an insight for the Government to make the policies liberal to increase the FDI inflow in the country which would lead to the subsequent growth of the country's GDP. Counting the benefits of FDI in the host country, like an increase in the employment, serving the gap of investment in the country. The final products reach at lower prices to the customer; the natural resources are well utilized including the human resources. The import and inclusion of new technology also help in producing the product at a lower rate. However, it is worth mentioning that with the benefits of FDI inflow there are negative impacts as well. In the market where it sells its product, the domestic firms get tough competition to face. In the developing country like India, the manufacturing sector is not strong enough to compete with the Multi-National Companies (MNCs) of foreign countries. The retail sector and small businesses in the market have to lower their margin of profit to survive and sustain. In few cases where there is high input cost, the business ends up in losses. Most importantly, the amount of money which a foreign company earns in the host country goes out of circulation from the money market, thus leads to less availability of cash flow for the domestic country. Before allowing the FDI in any sector, the government shall analyse all costs and benefits of that foreign investment and take the decision accordingly.

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Why use vector error correction model? VECM: Retrieved (5th April 2018). from https://stats.stackexchange.com/questions/77791/why-use-vector-error-correction-model.

Figure 1: showing the stability of the model for variables GDP, FDI and Net Trade.
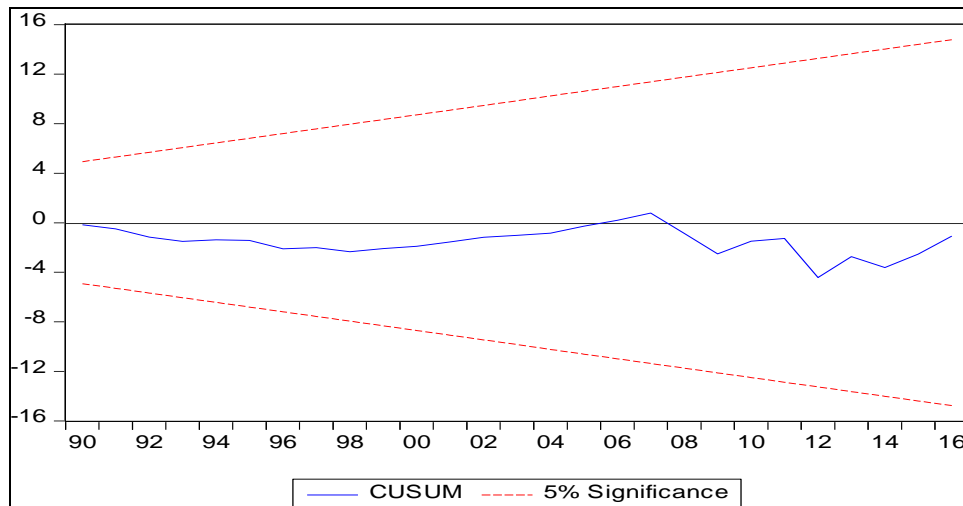
TABLES:

Table 1: showing stationary test results of GDP FDI Net Trade for India

	Variables at level		Variables at 1st difference	
	Critical value 5%	Prob.	Critical value 5%	Prob.
GDP	-2.935001	1.00	-2.936942	0.0027
FDI	-2.957110	1.00	-2.936942	0.0000
Net Trade	-2.957110	0.9898	-2.957110	0.0007

Table 2: showing the VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-2834.071	NA	1.94e+61	149.6353	150.0232	149.7733
2	-2795.789	64.47510	4.19e+60	148.0941	148.8698	148.3701
3	-2759.020	56.12153	9.91e+59	146.6326	147.7962	147.0466
4	-2729.893	39.85757*	3.58e+59*	145.5733*	147.1247*	146.1253*

Table 3: showing Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.869398	117.5183	29.79707	0.0000
At most 1 *	0.514486	40.16536	15.49471	0.0000
At most 2 *	0.284259	12.70858	3.841466	0.0004

Trace test indicates 3 cointegrating eqn (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4: showing Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.869398	77.35292	21.13162	0.0000
At most 1 *	0.514486	27.45678	14.26460	0.0003
At most 2 *	0.284259	12.70858	3.841466	0.0004

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5: showing Vector Error Correction Estimates

Cointegrating Eq:	Coint Eq1		
INDIA_GDP(-1)	1.000000		
INDIA_FDI(-1)	-704.6274		
	(53.8662)		
	[-13.0811]		
INDIA_NET_TRADE(-1)	-235.0892		
	(25.0888)		
	[-9.37029]		
C	-8.18E+10		
Error Correction:	**D(INDIA_GDP)**	**D(INDIA_FDI)**	**D(INDIA_NET_TRADE)**
CointEq1	-0.016983**	0.002834	0.002675
	(0.00789)	(0.00032)	(0.00052)
	[-2.15303]	[8.79732]	[5.17889]
D(INDIA_GDP(-1))	0.000211	0.071970	-0.102834
	(0.20211)	(0.00825)	(0.01324)
	[0.00104]	[8.71866]	[-7.76969]
D(INDIA_GDP(-2))	-0.170662	-0.009216	0.026630
	(0.34594)	(0.01413)	(0.02265)
	[-0.49333]	[-0.65224]	[1.17548]
D(INDIA_GDP(-3))	0.853611**	-0.024193	0.160132
	(0.36161)	(0.01477)	(0.02368)
	[2.36058]	[-1.63806]	[6.76228]
D(INDIA_FDI(-1))	-6.654953	1.657356	0.980151
	(4.99464)	(0.20399)	(0.32708)
	[-1.33242]	[8.12450]	[2.99670]
D(INDIA_FDI(-2))	-8.795185	1.652892	0.453013
	(5.96979)	(0.24382)	(0.39093)
	[-1.47328]	[6.77908]	[1.15880]
D(INDIA_FDI(-3))	2.949472	0.957750	1.648479
	(3.33575)	(0.13624)	(0.21844)
	[0.88420]	[7.02982]	[7.54650]
D(INDIA_NET_TRADE(-1))	-0.648537	0.337876	0.412547
	(1.82430)	(0.07451)	(0.11947)
	[-0.35550]	[4.53467]	[3.45328]
D(INDIA_NET_TRADE(-2))	0.376406	0.218581	1.140273
	(1.35314)	(0.05527)	(0.08861)
	[0.27817]	[3.95509]	[12.8683]
D(INDIA_NET_TRADE(-3))	-0.374235	0.134762	0.201218
	(1.29260)	(0.05279)	(0.08465)
	[-0.28952]	[2.55264]	[2.37717]
C	3.74E+10**	-3.82E+09	-4.04E+09
	(1.7E+10)	(6.8E+08)	(1.1E+09)
	[2.24171]	[-5.60521]	[-3.69916]
R-squared	0.643910	0.857373	0.942034
Adj. R-squared	0.512025	0.804548	0.920565
Sum sq. resids	8.56E+22	1.43E+20	3.67E+20
S.E. equation	5.63E+10	2.30E+09	3.69E+09
F-statistic	4.882348	16.23048	43.87891
Log likelihood	-988.0755	-866.5504	-884.4902
Akaike AIC	52.58292	46.18687	47.13106

Cointegrating Eq:	Coint Eq1		
Schwarz SC	53.05696	46.66090	47.60510
Mean dependent	5.60E+10	1.17E+09	-1.07E+09
S.D. dependent	8.06E+10	5.20E+09	1.31E+10
Determinant resid covariance (dof adj.)		1.57E+59	
Determinant resid covariance		5.62E+58	
Log likelihood		-2732.018	
Akaike information criterion		145.6852	
Schwarz criterion		147.2366	
Number of coefficients		36	
** sig at 5 %			

Table 6: showing Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.444102	Prob. F(2,25)	0.6464
Obs*R-squared	1.303752	Prob. Chi-Square(2)	0.5211

Table 7 showing VEC Granger Causality/Block Exogeneity Wald Tests

I) Dependent variable: D(INDIA_GDP)			
Excluded	Chi-sq	df	Prob.
D(INDIA_FDI)	10.76238	3	0.0131
D(INDIA_NET_TRADE)	0.316714	3	0.9569
All	13.28332	6	0.0388
II) Dependent variable: D(INDIA_FDI)			
Excluded	Chi-sq	df	Prob.
D(INDIA_GDP)	82.39936	3	0.0000
D(INDIA_NET_TRADE)	51.47017	3	0.0000
All	158.1251	6	0.0000
III) Dependent variable: D(INDIA_NET_TRADE)			
Excluded	Chi-sq	df	Prob.
D(INDIA_GDP)	155.4452	3	0.0000
D(INDIA_FDI)	82.17017	3	0.0000
All	334.6891	6	0.0000