

***Examining the Long Run Effects of Export, Import and FDI Inflows
on the FDI Outflows from India: A Causality Analysis***

Nandita Dasgupta, Ph.D.
University of Maryland, Baltimore County, USA

The objective of this paper is to examine the effects of international trade and investment related macro economic variables, namely, exports, imports and FDI inflows on the outflows of FDI from India over 1970 through 2005. Using time series data analysis, the empirical part of the paper finds unidirectional Granger Causality from export and import to FDI outflows but no such causality exists from FDI inflows to the corresponding outflows from India. Results confirm the assumption that lagged imports and exports are a driving force of current FDI outflows and that India's capability of undertaking outbound FDI will be related to the country's performance in its trade front.

Keywords: FDI outflows; macro economic push factors; FDI inflows; export; import; Granger Causality.

JEL Classification: F21 -- International Investment; Long-Term Capital Movements.

Examining the Long Run Effects of Export, Import and FDI Inflows on the FDI Outflows from India: A Causality Analysis

1. Introduction

Conventionally, foreign direct investments (FDI)¹ have largely represented the transnational financial and physical investment activities from the capital-abundant, technologically advanced developed economies to the developing economies seeking the much-needed private (non-debt creating) external finance and the associated technological, marketing and management expertise and efficiency. In reversal to this, a trend has now emerged whereby private capital is flowing from the developing countries to the developed and other developing economies. This phenomenon of the outward/overseas/outbound FDI flows or FDI outflows (OFDI) is also observed in India in recent years².

India is demonstrating a dramatic rise in its FDI outflows since the adoption of the outward looking development strategies in the 1990s (Table 1). While the FDI outflows from India was only \$9 million in 1970-79, it increased to \$700 million in 1990-99 within a span of 20 years and thereafter it has exhibited a spectacular ascent to \$8298 million in 2000-05.

Insert Table 1 about here

Although the OFDI from India is currently low in volume and value as also in the numbers of investing firms relative to the global scale (Figure 1), yet it is growing at a fast pace at higher relative terms compared to past years as also in comparison to some other comparable countries (Pradhan 2007)³. Indian OFDI is visible in a wide range of manufacturing, information technology and knowledge based industries such as automobiles, software and pharmaceuticals, particularly through the route of mergers and acquisitions. Outward FDI flows in India is pursued not only by the private corporate sector but also by the public sector entities that have aggressively sought to

¹ FDI is an international investment where the investors have a durable or 'long-term' interest and *control* in the invested companies. *Control* is conventionally defined as owning 10% or more of the ordinary shares or voting power of an incorporated firm or its equivalent for an unincorporated firm. United Nations Conference on Trade and Development (UNCTAD), *Foreign Direct Investment*. www.unctad.org.

² FDI outflows are also recently experienced by many other liberalized developing economies including the south-east Asian economies, the east European and the Latin-American countries (UNCTAD, 2006).

³ For example, Pradhan (2007) has pointed out in his paper that between 1991 and 2003 the number of outward investing Indian companies has grown at a rate of 809 per cent from 187 to 1700. This growth rate is higher than the rate at which numbers of domestic firms investing abroad have grown in countries like China (805 per cent), Republic of Korea (611 per cent), Brazil (116 per cent) and Hong Kong (90 per cent) over approximately comparable periods.

acquire equity in the natural resources (petroleum and gas) sectors of key producer countries as a strategic initiative to manage the growing energy intensity of the economy. Ongoing liberalization of the policy framework has provided a favorable environment for FDI from India (Reserve Bank of India, 2005).

Insert Figure 1 about here

Economic literature has identified various factors that motivate outward FDI flows by the developing home countries. Aykut and Ratha (2003)⁴ have broadly categorized the determinants of FDI outflows in the Asian developing countries into demand side *pull* factors and supply side *push* factors. Pull factors are the economic, financial and institutional (micro and macro) characteristics of the host country markets that attract FDI towards them. Push factors, on the other hand are the micro and macro supply side factors originating from the economic, financial and institutional characteristics and conditions of the home/source/capital exporting country that push (induce and sometimes compel) outward FDI into the destination economies. Various *push* factors may compel a home country to make overseas FDI (e.g., diminished expected profit margin or global downturn in a sector, need for additional resources and ensuring their long-term supply, less than adequate domestic physical infrastructure, liberalized trade regime, high inflation rate, depreciated exchange rate) or induce it (increased supply of capital, loosened capital controls, regional integration, etc.) to make market-seeking, efficiency-enhancing and resource-augmenting FDI abroad (Ariff and Lopez, 2007).

The objective of this paper is to examine the long run effect of international trade and investment related⁵ macro economic *push* factors – Indian exports, imports and FDI inflows on the outflows of FDI over 1970 through 2005. The rest of the paper will be designed as follows. Following the introduction, Section 2 provides the relevance and justification for studying such effects on the outbound FDI from the Indian economy. In order to examine the long run relationship and the direction of causality among the outward FDI flows from India and the chosen trade and international investment related variables, we have employed Johansen cointegration and Granger causality analysis techniques. In Section 3 we discuss the employed methodology and analyze the results. We have used EViews 5 software for the econometric work. We try to keep the technical discussions as limited as possible and instead provide the relevant references. Section 4 presents the conclusions and suggestions for future research.

2. International Trade and Investment Related Push Factors

With a view to raise economic growth and control poverty, the Government of India, since the adoption of its structural economic reforms program in 1991, has made serious effort to reduce the barriers to international trade. In this connection, the

⁴ Also see Ariff and Lopez, 2007; UNCTAD 2006.

⁵ Rashmi Banga (2007) has presented a panel data analysis on the drivers of outward FDI from thirteen developing countries of Asia for the period 1980-2002 where she has categorized exports and imports of the home country as the trade-related factors. She has also identified FDI inflows as another OFDI-determining factor.

Government has simplified the tariff, eliminated quantitative restrictions on imports, and implemented various export promotion measures including the reduction in reduced export restrictions to neutralize the anti-export bias. To reduce the intensity of the operating constraints in infrastructure and administration to potential investors, the Government is also taking active effort measures in the creation and strengthening of enclaves such as export processing and special economic zones (WTO, 2002). The economic liberalization agenda has also shifted India from a restrictive OFDI policy regime during the 1970s and 1980s to a new and liberal OFDI policy regime since the 1990s, more so, with the issue of modified *Guidelines for Indian Joint Ventures and Wholly Owned Subsidiaries* in October 1992. Automatic approval for Indian OFDI projects and the removal of restrictions on cash transfers are some of the major revisions (Pradhan, 2007)⁶.

Since the late 1990s India has experienced tremendous rise not only in the OFDI flows but also in the trade volumes (both exports and imports). This section puts forward our understanding of the possible relationships between export, import, FDI inflows and FDI outflows. Economic theory tells us that the international trade and investment variables could potentially have a substitutability or complementarity relationship with OFDI.

Exports

Exporting activity of tradable goods and services helps the initial exploration of overseas markets, enhances international competitiveness of the firms and also provides valuable information on emerging opportunities in other countries. Higher exports may assure the home country firms of the existing markets in the foreign economies and therefore lower the risks and uncertainties attached to OFDI (Banga, 2007). With a trend towards more and more regional trade and investment agreements and consequent access to larger integrated markets has increased the possibility of vertically integrated outward FDI, making exports and OFDI more complementary.

On the whole, FDI literature is ambiguous about the relation between OFDI and exports. While perfect substitutability was noted by Mundell (1957), the later economists indicated the complementarity of the relationship as in Lipsey and Weiss (1981, 1984), Markusen (1983), Brenton, Di Mauro and Lücke (1999) and Kawai and Urata (1998). Literature has also shown that the nature of this relationship depends on the type of industries (Kawai and Urata, 1998; Buch, Kleinert and Toubal, 2003) and the location of the host countries (Graham, 1996; Brainard and Riker, 1997a, 1997b).

OFDI activities of home country firms (including India) can either complement or substitute its aggregate export activities, depending on the type and nature of OFDI projects undertaken by its domestic enterprises (Pradhan, 2007). In general, when trade barriers inhibit exports from the home country or when the home country tries to avoid domestic inefficiencies – such as exchange rate volatility or high capital costs due to poor country-risk ratings, OFDI can be a direct path to market expansion acting as a substitute to exports (UNCTAD, 2006).

⁶ For a detailed discussion of the prevailing OFDI policies in India, read Pradhan (2007).

Both horizontal⁷ and vertical⁸ OFDI can potentially substitute or complement exports. When the home country firms undertake horizontal OFDI projects to exploit firm specific advantages in the host economy or to avoid trade barriers, transportation costs and other transaction costs (Carr, Markusen, Maskus, 2001), this reasonably indicates the substitution of exports of final products from parent firms. However, such horizontal OFDI projects may also promote intermediate exports from the home country through the additional exports of raw materials, intermediate inputs, capital goods, spare parts, etc. On the other hand, the vertical OFDI projects by the home country firms seeking to acquire sources of raw materials and inputs from abroad may likely involve a complementary relationship between home country exports. However, contrary to this, the vertical OFDI in the form of building trade-supporting infrastructure abroad, like distribution networks, customer care centers, service centers etc., by the home country firms to give local presence to ensure timely after-sales services to global customers could help to improve and complement exports of final product from the home country (Vernon, 1966). In the case of the Indian software sector for example, on-shore presence through OFDI is critical to ensure exports of software services⁹.

According to the World Development Indicators 2007, exports, as percentage of GDP in India, exceeded the 10% mark in 1994 and in 2005 it is around 23%. Around this period OFDI as a percentage of GDP also showed a rise from virtually zero to around 0.3 percent. In this sense, exports and OFDI are complementary and an active OFDI promotion framework would work as a strategy for export promotion and an attempt at globalization.

Imports

Lowering of tariff barriers as a consequence of the opening up of the investing economies is likely to induce higher imports into the home country and this may have a 'crowding out' effect on domestic investments inducing the domestic firms to relocate outward into economies with lower manufacturing costs and higher access to larger markets (Banga, 2007). India, which was a protected economy for a long time, opened up in the 1990s to the global market through complete removal of non-tariff barriers and drastic reduction in import duties. This led to import competition that can be regarded as a push factor for the recent growth of OFDI from India. On the other hand, the vertical OFDI projects by the home country firms seeking to acquire sources of raw materials and inputs from abroad may directly result in higher imports into the home country.

FDI Inflows

⁷ Horizontal FDI takes place when firms produce the same goods and services in the home and host countries (Markusen 1984; Markusen and Venables 1998, 2000).

⁸ Companies, mainly motivated by cost considerations, undertake vertical FDI to disaggregate the production process geographically and locate specific stages of the value chain in countries offering relevant cost advantages (Helpman, 1984; Helpman and Krugman, 1985, Markusen and Zhang 1999).

⁹ Indian exports including software and information technology have risen sharply over the years (Basu and Maertens 2007).

Higher FDI inflows may also enhance the capability of the home country in undertaking outward FDI (Banga, 2007) with a lag, by enhancing the flow of non-debt private capital and technological and managerial skill, creating domestic employment through backward linkage effects and also by building up the foreign exchange reserves of the country. This is relevant for India. Thus, FDI inflows and outflows could be complementary. On the other hand, it may be a plausible theoretical proposition to argue that entry of foreign firms represented by FDI inflows increases competition in the domestic market, which in turn forces domestic firms to seek additional markets through exporting and OFDI. India has taken active steps in attracting FDI inflows by improving its investment climate in terms of infrastructure development and other fiscal incentives. It is therefore topical to get an insight into the effect of FDI inflows into corresponding outflows in the Indian context.

3. Time Series Analysis –Variables, Methodology and Results

Variables and Source

The data set comprises of annual time series data for India over the sample period 1970-2005. The sources include the World Investment Report of the UNCTAD and the World Development Indicators CD-rom released by the World Bank.

We define the outward FDI flows as nominal FDI outflows deflated by nominal Gross Domestic Product (GDP) level. Similarly export, import and FDI inflows are defined as the corresponding nominal flows deflated by the nominal levels of GDP. We have considered the inward and outward FDI as flow measures because inward and outward FDI behavior is more comprehensively measured for flows than for stocks. The data are transformed into natural logarithms to account for the expected non-linearities in the relationships and also to achieve stationarity in variance (Chang and Caudill, 2005). Each variable name is preceded by an L to indicate the inclusion of logs. Thus, LOFDI indicates natural log of FDI outflows, LX denotes natural log of exports, LM stands for natural log of imports and LIFDI symbolizes natural log of FDI inflows. The descriptive statistics for each of these variables is presented in Table 2. The graphs in Figure 2 exhibit pronounced upward stochastic¹⁰ trend (slow long run evolution of the time series) with fluctuations for exports, and imports and FDI inflows; however, the trend for outbound flows is not clear.

Insert Table 2 about here

Insert Figure 2 about here

Following Sarkar (2007), we have fitted trend equation to each of the variables using the regression analysis (Table 3). The fitted equation is showing a deterministic trend with a random walk with drift, intercept and slope dummies. The equation is $Y = a + bT + c(K) + d(SK)$ where Y is the dependent variable, T denotes time, K is the intercept

¹⁰ The trends for the variables are stochastic because the data for each of the variables in a particular year could be any value, depending on the economic and political climate prevailing in the country at that time. The value that we actually get is a particular realization of all the possibilities.

dummy (K=0 for 1970 to 1993) and SK is the slope dummy (SK=T*K). Slope and intercept dummies together effectively allow for two separate regression lines to explain two subsamples. Setting the parameters to zero, we have fitted different regression equations using the method of ordinary least squares (OLS). We have also added an AR(1) component and have recorded the magnitudes of the R-squared, adjusted R-squared, Durbin Watson test statistic for autocorrelation and the inverted AR roots. All the roots have modulus less than one that indicates the stationarity of the individual AR models depicted in Table 3.

Insert Table 3 about here

For the whole period 1970-2005, the FDI outflows increased at a 3% rate but the growth was not statistically significant. The growth was also not statistically significant over 1970 through 1993, although economically very significant. But thereafter we experience 45% growth at 3% level of significance and 47% growth at 9% significance (AR(1) model). This is quite reasonable given the fact that OFDI from India started increasing from 1994 onwards with the gradual streamlining of regulations guiding FDI outflows. Similarly we can interpret the other results. For instance, the slope dummies are statistically significant both for exports and imports.

Model Specification and Methodology

As observed in section 2, economic theory posits that we can possibly conceive of both complementarity and substitutability among OFDI and the other variables of interest. Given such ambiguity in the direction of association, we have adopted the method of vector autoregressive model (VAR) to study the long run causal relationship between outward FDI flows, export, import and the FDI inflows of India. At the initial stage neither *a priori* restrictions nor the endogenous or exogenous character of variables are established (Alguacil and Orts, 2002). We have then implemented the Granger causality approach to estimate the long run relationship between the stated variables. The relationship can be represented by the form of

$$\text{LOFDI} = f(\text{LX}, \text{LM}, \text{LIFDI}) \quad (1)$$

where LOFDI indicates natural log of FDI outflows, LX denotes natural log of exports, LM stands for natural log of imports and LIFDI symbolizes natural log of FDI inflows. We ran the trend equations for each of the variables and found that the trend variable is significant. In econometric terminology, to estimate the long run effects, we need to examine the cointegration among the variables and then the Granger causality.

Unit Root Tests

Prior to testing for cointegration and implementing the Granger causality test, econometric methodology needs to examine the stationarity for each individual time series since most macro economic data are non-stationary¹¹, i.e., they tend to exhibit a deterministic and/or stochastic trend. A series is said to be (weakly or covariance)

¹¹ Many of the macroeconomic variables are difference stationary, I (1) variables. The first differences of logarithms of initial variables represent the rate of change of these variables. Thus, the application of the first differences in econometric studies becomes useful.

stationary if the mean and variance are time-invariant and the autocovariances of the series between two time periods depend only on the interval. Any series that is not stationary is said to be *nonstationary*. A nonstationary time series will have a time dependent mean or a variance or both. It is important to make sure that the variables are stationary, because if they are not, the standard assumptions for asymptotic analysis in the Granger test will not be valid. We should now perform tests for unit root in potentially nonstationary time series. There are alternate unit root tests which are applied in time series analysis. These are the Augmented Dickey-Fuller (ADF, 1979), GLS transformed Dickey-Fuller (DFGLS, proposed by 1996), Phillips-Perron (PP, 1988), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992) and Ng and Perron (NP, 2001) and Elliot, Richardson and Stock (ERS, 1996) Point Optimal unit root tests for whether the series (at levels or at their first or second difference) is stationary. In this paper, we have applied the first five unit root tests.

The ADF test allows for serial correlation in the residual and still tests for unit roots. In this study, we have chosen to estimate an ADF test that includes a time trend and an intercept in the level form and only the intercept in the first difference of each variable. We employ the automatic lag length selection using a Schwarz Information Criterion (SIC) and a maximum lag length of 9. The ADF test is based on the following regression model that consists of running a regression of the first difference of the series against the series lagged once, sum of lagged difference terms, and a constant and a time trend.

$$\Delta Y_t = \beta_0 + \beta_1 t + \beta_2 Y_{t-1} + \sum_{i=1}^p \alpha_i \Delta Y_{t-i} + U_t \quad (2)$$

where U_t is the pure white noise error term that adjusts the errors of autocorrelation and is independently and identically distributed. $\Delta Y_{t-i} = Y_{t-i} - Y_{t-(i+1)}$. ΔY_{t-i} expresses the first differences with p lags. The coefficients $\beta_0, \beta_1, \beta_2$ and α_i are being estimated.

The ADF regression tests for the existence of unit root of Y_t that represents all variables (in the natural logarithmic form) at time t . The test for a unit root is conducted on the coefficient of Y_{t-1} in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that Y contains a unit root is rejected. The null and the alternative hypothesis for the existence of unit root in variable Y_t is $H_0: \beta_2 = 0$ versus $H_1: \beta_2 < 0$. Rejection of the null hypothesis denotes stationarity in the series.

As an alternative to the ADF test, we also apply the PP unit root tests. The PP test is a more comprehensive theory of unit root nonstationarity. Although similar to ADF tests, PP tests use nonparametric statistical methods (i.e., assumes no functional form for the error process of the variable) to incorporate an automatic correction to the Dickey Fuller procedure for allowing for autocorrelated residuals without requiring the addition of the lagged difference terms of the dependent variable, by using the Newey-West (1997) covariance matrix. The tests usually give the same conclusions as the ADF tests but the calculation of the test statistics is complex. We have employed the automatic selection for the bandwidth and have chosen the Newey-West bandwidth for the spectral estimation method. Our default estimator for the specific unit root test is the kernel sum-of-covariances estimator with Bartlett weights. The null hypothesis of the unit root test is that the variable has a unit root.

The ADF and PP unit root tests that have traditionally been used for this purpose do not perform well in small samples. The PP test for example, has been shown to perform well in large samples because it relies on asymptotic theory. But time series macro economic data are hardly available for large samples. That is why the PP test (or the ADF test) may not be the most appropriate test to use.

ADF-GLS test propose a simple modification of the ADF tests in which the data are detrended using generalized least squares so that explanatory variables are “taken out” of the data prior to running the test regression (See Eviews 5 Users Guide). The claim is that this test has very similar power to the standard Dickey-Fuller test in the absence of a deterministic trend and considerably improved power in the case when there is an unknown deterministic trend.

The NP test comprises four individual test statistics that are based upon the GLS detrended data. These test statistics are modified forms of Phillips and Perron Z_α and Z_t statistics, the Bhargava (1986) R_1 statistic, and the ERS Point Optimal statistic from which the modified test statistics are computed. We have employed the modified Z_α statistic in this paper.

The KPSS test differs from the other unit root tests in that the time series is assumed to be trend-stationary under the null hypothesis. The KPSS statistic is based on the residuals from the OLS regression of the time series variable on the exogenous variables. The reported critical values for the Lagrange Multiplier (LM) test statistic are based upon the asymptotic results presented in KPSS. We reverse the null (unit root) and alternative (stationary) hypotheses in the KPSS test to check if a series can reject stationarity.

A frequently adopted approach is to use alternate unit root tests and check whether the answer is the same. Keeping this in mind, we have applied the first five unit roots tests. In all the tests, we have included a time trend and an intercept in the level form and only the intercept in the first difference of each variable. The results of the unit root tests are presented in Table 4. Results show that in all the tests, all of the variables are integrated of order 1, i.e., $I(1)$.

Insert Table 4 about here

Cointegration Tests

Having found that all the four variables in examination have unit roots (that is, they are integrated of order one), our next step is to determine whether or not there exists at least one linear combination of the non-stationary variables (in level form) that is integrated of order zero ($I(0)$). In other words, do the involved variables have a stable and non-spurious, long run (cointegrating) relationship among themselves over the relevant time span?

Cointegration, an econometric property of time series variables, is a precondition for the existence of a long run or, equilibrium economic relationship between two or more variables having unit roots (i.e. integrated of order one). Two or more random variables

are said to be cointegrated if each of the series are themselves non-stationary¹², but a linear combination of them is stationary¹³ (Engle and Granger, 1987). The stationary linear combination is called the *cointegrating equation* and may be regarded as a long-run equilibrium relationship among the variables. The purpose of the cointegration test is to determine whether a group of non-stationary series is cointegrated or not. Apart from the Engle-Granger technique, there is the Johansen (1979) procedure of cointegration, which we have chosen to employ in this study. Johansen's approach that begins with an unrestricted VAR involving potentially non-stationary variables, allows us to deal with models with several endogenous variables. A key aspect of this approach is isolating and identifying the r cointegrating combinations among a set of k integrated variables and incorporating them into an empirical model. Johansen's system-based approach is robust, flexible and has the ability to test restricted versions of vectors and speeds of adjustment.

The presence of a cointegrating relation forms the basis of the vector error correction model (VECM) specification. We estimate the following system of equations formulated in a VECM.

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \dots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-1} + \mu + \varepsilon_t; \quad t=1, \dots, T \quad (3)$$

where, Δ is the first difference operator, Z denotes vector of variables in natural logarithmic form, ε_t is a normal, independent and identically distributed random variable with mean zero and standard deviation Σ ($\varepsilon_t \sim \text{niid}(0, \Sigma)$), μ is a drift parameter, and Π is a $(p \times p)$ matrix of the form $\Pi = \alpha \beta'$, where α and β are both $(p \times r)$ matrices of full rank, with β containing the r cointegrating relationships and α carrying the corresponding adjustment coefficients in each of the r vectors.

Johansen's procedure of multivariate cointegration requires the existence of a sufficient number of time lags. For this purpose, we look into the standard criteria of lag length selection (Table 5). The Schwartz criterion suggest the lag length as 1, both the sequential modified Likelihood Ratio (LR) test statistic and the Hannan Quinn (HQ) information criterion indicate the optimal lag length to be 2 and the Akaike information criterion (AIC) recommend that it should be 3. Since the sample size is relatively small, we select 2 for the lag order of the VAR model (Pesaran and Pesaran, 1997).

Insert Table 5 about here

¹² Economic time series are dominated by smooth, long term trends, that is, the variables behave individually as non-stationary random walks. A non-stationary time series has no long-run into which the series returns. The variance depends on time and approaches infinity as time goes to infinity.

¹³ In contrast to non-stationary variables, a stationary variable has a mean reverting around a constant long-run average, a constant variance which is time-invariant and a covariance that is independent of time.

Cointegration test based on the Maximum Likelihood method of Johansen (1979) suggests two tests (the trace test and the maximum eigenvalues test) statistics to determine the cointegration rank. Taking linear deterministic trend, a lag interval in first differences up to 2 and the MacKinnon-Haug-Michelis (1999) p-values, we see that the null hypothesis of no cointegrating relationship can be rejected at the five percent level (trace statistic = 55.61 > critical value = 47.86 (p-value: 0.0079); and maximal Eigenvalue statistic= 33.17 > critical value = 27.18 (p-value: 0.0086)), thereby suggesting that there is one (unique) linear combination of these non-stationary variables (in level form) that is stationary (Table 6). The existence of the cointegrating equations prompts us to confirm the long run equilibrium relation among our macro economic time series. The co-integrating regression (normalized on LOFDI) is given in Table 7. The corresponding equation is shown below. The figures in parentheses show the t statistics.

Insert Tables 6 and 7 about here

$$\text{LOFDI} = -1.67\text{LIFDI} + 34.58\text{LX} - 31.64\text{LM} \quad (4)$$

(-2.51) (4.04) (-3.87)

The signs are reversed because of the normalization process and they clearly show that, in the long run, LM has a positive and highly significant (both statistical and economical) effect on the outflow of FDI (LOFDI), while LX has a negative but once again, an overall significant effect¹⁴. FDI inflows however, have a negative and a relatively much more weak effect on the corresponding outflows. The estimates of the coefficients in the equilibrium relationship are essentially the long-run estimated elasticities of the explanatory variables with respect to the FDI outflows. All the explanatory variables are elastic to outward FDI in the long run, although the elasticities are relatively stronger for the trade variables.

Granger Causality

Once we have established the long run relationship between FDI outflows, inflows, export and import for India, the next logical step for our purpose is to examine the Granger-causal relationship among the variables. X is said to “Granger-cause” Y if and only if the forecast of Y is improved by using the past values of X together with the past values of Y, than by not doing so (Granger 1969). Granger causality distinguishes between unidirectional and bi-directional causality. Unidirectional causality is said to exist from X to Y if X causes Y but Y does not cause X. If neither of them causes the other, then the two time series are statistically independent. If each of the variables causes the other, then a mutual feedback is said to exist between the variables. In order to test for Granger causality, we will estimate a four variable VAR model as follows, where all variables are initially considered symmetrically and endogenously. This is shown by Equation system 3 below.

¹⁴ The relatively low log likelihood statistic in Table 5 however suggests that the included variables taken together are not highly significant in explaining the variation in the outflow of FDI in the long run.

$$\begin{bmatrix} LOFDIt \\ LIFDIt \\ LXt \\ LMt \end{bmatrix} = A_0 + A_1 \begin{bmatrix} LOFDIt-1 \\ LIFDIt-1 \\ LXt-1 \\ LMt-1 \end{bmatrix} + A_2 \begin{bmatrix} LOFDIt-2 \\ LIFDIt-2 \\ LXt-2 \\ LMt-2 \end{bmatrix} + \dots + A_p \begin{bmatrix} LOFDIt-p \\ LIFDIt-p \\ LXt-p \\ LMt-p \end{bmatrix} + \begin{bmatrix} u1t \\ u2t \\ u3t \\ u4t \end{bmatrix}$$

(3)

where t is the time subscript, p is the number of lags for the VAR, A₀ is the vector of constants and A₁, A₂,, A_p are all parameter matrices and the variables have their usual meanings.

We have adopted the VAR Granger Causality/Block Exogeneity Wald Tests to examine the causal relationship among the variables. Under this system, an endogenous variable can be treated as exogenous. We used the chi-square (Wald) statistics to test the joint significance of each of the other lagged endogenous variables in each equation of the model & also for joint significance of *all* other lagged endogenous variables in each equation of the model. Results are reported in Table 8. A chi-square test statistics of 13.17 for LM with reference to LOFDI, represents the hypothesis that lagged coefficients of LM in the regression equation of LOFDI are equal to zero. Similarly, the lagged coefficients of LX as well as block of all coefficients in the regression equation of LOFDI are equal to zero. Thus, LM and LX are Granger Causal for LOFDI at 0.0025 and 0.0014 levels of significance respectively. Also, all the variables are Granger Causal for LOFDI at the 0.0077 significance level. The test results for LOFDI equation however indicate that null hypothesis cannot be rejected for individual lagged coefficient LIFDI. This suggests that LOFDI is not influenced by LIFDI. The null hypothesis of block exogeneity is rejected for all equations in the model, except for LX. This indicates LX is not jointly influenced by the other variables. The only evidence of bi-directional causality is observed between LX and LM which implies that both imports and exports are influenced by each other. Uni-directional causality is observed from trade variables (LX and LM) to LOFDI and from LX to LIFDI.

Insert Table 8 about here

4. Conclusion

The objective of this paper was to empirically examine the long run causal effect of Indian exports, imports and FDI inflows on the outflows of FDI over 1970 through 2005 using the methodology of Granger causality and vector autoregression (VAR). To search for the nature of the relationship between these variables, we have implemented the Granger Causality/Block Exogeneity Wald Tests. Our results show strong evidence of the unidirectional causality from the trade variables (export and import) to the FDI outflows. This result confirms the assumption that lagged imports and exports are a driving force of current FDI outflows and that India's capability of undertaking outbound FDI will be related to the country's performance in its trade front. The empirical analysis also reveals that the lagged values of FDI inflows however do not Granger cause FDI outflows from India. This indicates that the effect of FDI inflows on the determination of outbound FDI is still limited in India. These findings are further validated by the interpretation of the cointegrated regression equation (4) shown above.

With the reversal of signs of the coefficients on account of the normalization process, exports demonstrate a clear negative relationship with FDI outflows. Economic literature has evidence that trade barriers to exports and domestic inefficiencies – such as exchange rate volatility or high capital costs due to poor country-risk ratings, can lead to OFDI as a direct path to market expansion acting as a substitute to exports (UNCTAD, 2006). This would mean that the Indian firms seem to undertake horizontal OFDI projects to exploit firm specific advantages in the host economy, leading to the substitution of exports of final products by the parent firms¹⁵. The study also shows that the imports to India have a positive relation with the FDI outflows. This could be explained in terms of the vertical OFDI projects by the Indian firms seeking to acquire sources of raw materials and inputs from abroad directly resulting in higher imports into the home country.

Due to the inherent data constraints of the macro economic time series data, the above results are admittedly tentative. Yet it is true that they reveal certain new facets of the FDI outflows from India that have not been examined earlier. Moreover, India's success in outward FDI is very recent, dating back to the economic reforms of the 1990s. With such a short history, it is yet to be seen whether the time series data can sustainably display the relations that the empirical evidence of this study suggests or whether the interaction of the home country and host country economic forces change the prevailing relationship pattern. A natural extension of this paper would be to take a closer look at a broader set of the macro economic push factors that would generate FDI outflows from India. Also, another topical proposal would be to examine the effects of international trade and variables on the FDI outflows of the competing Asian countries like China and South Korea and compare the outcomes with those of India.

¹⁵ Also, the vertical OFDI projects by Indian firms seeking to acquire sources of raw materials and inputs from abroad may cause a fall in exports of such products to India. However, theoretically, the extent of intermediate exports in terms of raw materials, intermediate inputs, capital goods, spare parts, etc. for these horizontal OFDI projects could also generate additional exports from India. We do not get such indications from our empirical result.

Table 1
FDI Outflows in India, 1970-2005

Time Period	India (US \$ mn)	Percentage Increase
1970-79	9	
1980-89	44	388.89
1990-99	700	1490.91
2000-05	8298	1085.43

Source: UNCTAD, World Investment Report, 2006.

Figure 1
Outbound FDI Flows (US \$ Million) of the BRIMC Economies, 1970-79 to 2000-05

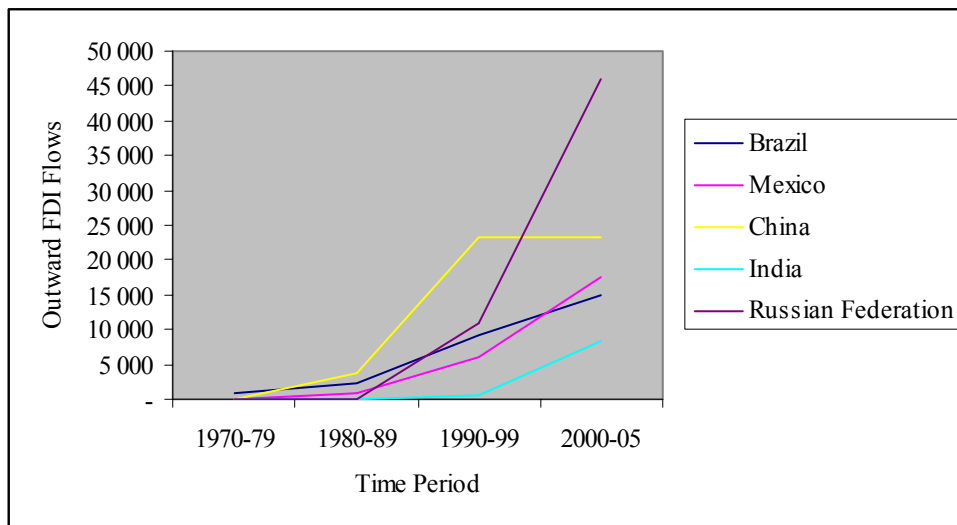


Table 2
Descriptive Statistics

	LIFDI	LM	LOFDI	LX
Mean	-2.225000	2.208333	-2.836667	2.042222
Median	-2.795000	2.150000	-2.680000	1.895000
Maximum	0.130000	3.130000	0.000000	3.010000
Minimum	-5.810000	1.470000	-6.910000	1.280000
Std. Dev.	1.652576	0.402950	2.507162	0.440520
Skewness	-0.008919	0.195657	-0.226078	0.262829
Kurtosis	1.945748	2.739738	1.552140	2.256088
Jarque-Bera	1.667648	0.331294	3.451115	1.244582
Probability	0.434385	0.847345	0.178074	0.536714
Sum	-80.10000	79.50000	-102.1200	73.52000
Sum Sq. Dev.	95.58530	5.682900	220.0052	6.792022
Observations	36	36	36	36

Figure 2
Time Trends of LOFDI, LIFDI, LX and LM

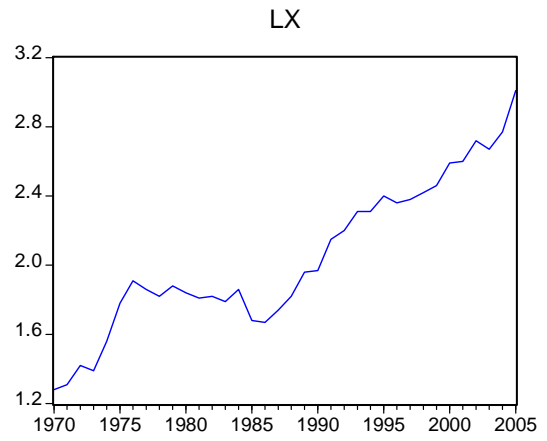
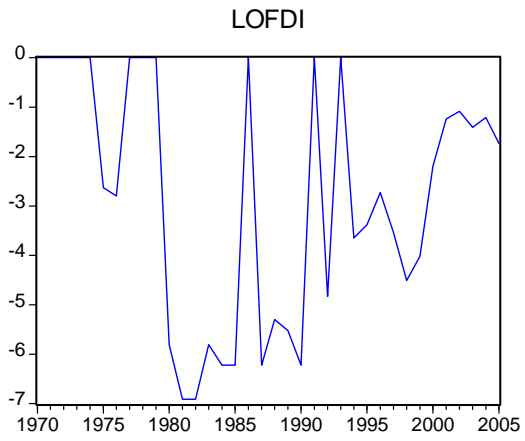
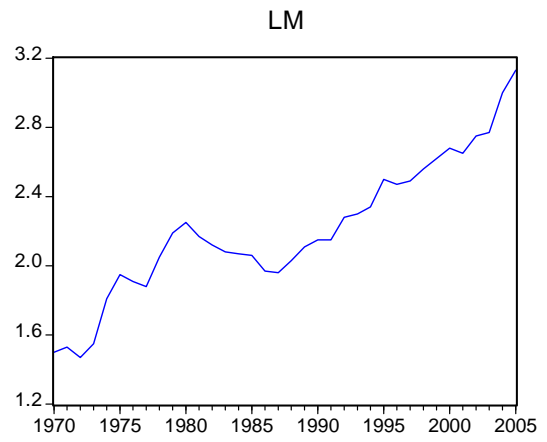
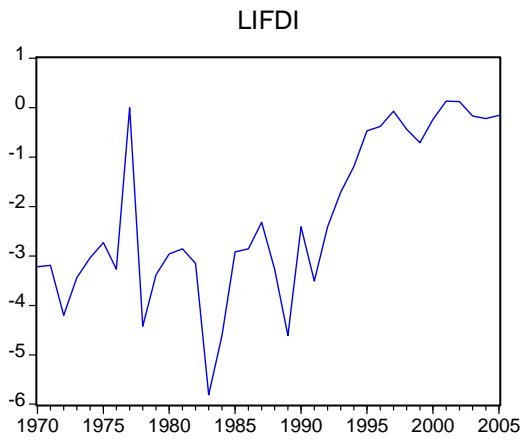


Table 3
Trends in LOFDI, LIFDI, LM and LX over 1970 through 2005

Dependent Variables/ Period and Process	Intercept	Time (p value)	Intercept Dummy (p value)	Slope Dummy (p value)	AR(1) (p value)	R-Squared	Adjusted R- Squared	DW Statistic	Inverte AR Ro
LOFDI									
OLS	-2.26 (0.01)	-0.03 (0.44)				0.02	-0.01	1.09	
AR(1)	-2.88 (0.07)	-0.004 (0.95)			0.044 (0.008)	0.21	0.16	2.27	0.44
OLS	-0.60 (0.54)	-0.19 (0.008)	-9.82 (0.11)	0.45 (0.03)		0.24	0.17	1.47	
AR(1)	-1.12 (0.48)	-0.15 (0.18)	-11.63 (0.15)	0.47 (0.09)	0.30 (0.12)	0.27	0.18	2.12	0.30
LIFDI									
OLS	-4.31 (0.00)	0.11 (0.00)				0.51	0.50	1.23	
AR(1)	-4.51 (0.00)	0.12 (0.00)			0.37 (0.03)	0.59	0.56	2.17	0.37
OLS	-3.35 (0.00)	0.01 (0.63)	1.09 (0.66)	0.05 (0.56)		0.69	0.67	2.06	
AR(1)	-3.37 (0.00)	0.01 (0.64)	1.18 (0.64)	0.05 (0.59)	-0.03 (0.85)	0.69	0.65	2.00	-0.03
LM									
OLS	0.036 (0.00)	1.55 (0.00)				0.87	0.86	0.33	
AR(1)	1.43 (0.00)	0.04 (0.00)			0.89 (0.00)	0.955	0.952	1.41	0.89
OLS	1.64 (0.00)	0.03 (0.00)	-0.78 (0.03)	0.03 (0.01)		0.90	0.89	0.41	
AR(1)	1.83 (0.00)	0.02 (0.19)	-1.30 (0.04)	0.05 (0.04)	0.78 (0.00)	0.960	0.955	1.44	0.78
LX									
OLS	1.31 (0.00)	0.04 (0.00)				0.89	0.88	0.35	
AR(1)	1.22 (0.00)	0.05 (0.00)			0.87 (0.00)	0.96	0.957	1.63	0.87
OLS	1.42 (0.00)	0.03 (0.00)	-0.52 (0.15)	0.02 (0.05)		0.913	0.905	0.48	
AR(1)	1.51 (0.00)	0.03 (0.03)	-1.08 (0.08)	0.04 (0.08)	0.77 (0.00)	0.962	0.958	1.59	0.77

Table 4
The Unit Root Test Results

Variables	ADF (SIC)	PP (Bartlett Kernel)	Ng-Perron MZ_{α}^{GLS}	DF-GLS	KPSS
LOFDI Level (Trend & Intercept)	-3.538 (0)	-3.513(2)	-13.583(0)	-3.546(0)*	0.171(4)*
First Difference (Intercept) Decision	-9.511(0) I(1)	-12.046(11) I(1)	-13.517(0) I(1)	-9.658(0) I(1)	0.227(11) I(1)
LIFDI Level (Trend & Intercept)	-3.867(0)*	-3.852(2)*	-14.852(0)	-3.875(0)	0.156(4)
First Difference (Intercept) Decision	-9.164(0) I(1)	-15.005(18) I(1)	-16.577(0) I(1)	-9.301(0) I(0)	0.247(17) I(1)
LX Level (Trend & Intercept)	-1.234(0)	-1.492(2)	-4.684(0)	-1.459(0)	0.118(0)
First Difference (Intercept) Decision	-4.857(0) I(1)	-4.857(0) I(1)	-19.106(0) I(1)	-4.931(0) I(0)	0.156(1) I(0)
LM Level (Trend & Intercept)	-1.089(0)	-1.391(2)	-4.246(0)	-1.347(0)	0.112(4)
First Difference (Intercept) Decision	-4.326(0) I(1)	-4.2023(8) I(1)	-17.152(0) I(1)	-4.397(0) I(1)	0.168(4) I(0)

*1% level of significance; otherwise, the usual is the 5% level of significance.;

When the computed ADF test statistic is smaller than the critical value, we reject the null hypothesis of a unit root and conclude that the time series is a stationary process. The critical ADF values are based on the finite sample values computed by McKinnon (1991). On the other hand, if the computed test statistic exceeds the critical values, we do not reject the null at conventional test sizes. That means the series is a non-stationary series. The parentheses under the ADF (SIC) indicate lag lengths which are selected automatically by EViews

For the PP test and the KPSS test, the values in parentheses show the Bandwidth: Newey West using kernel sum-of-covariances with Bartlett weights. The software EViews 5 was used for these tests. EViews reports the critical values at the 1%, 5% and 10% levels of significance.

Table 5
Lag Length Criteria Results

VAR Lag Order Selection Criteria

Endogenous variables: LIFDI LM LOFDI LX

Exogenous variables: C

Sample: 1970 2005

Included observations: 33

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-106.2796	NA	0.009393	6.683612	6.865007	6.744646
1	-30.93704	127.8540	0.000260	3.087093	3.994067*	3.392262
2	-10.28489	30.03949*	0.000206	2.805145	4.437698	3.354449*
3	8.608415	22.90097	0.000195*	2.629793*	4.987926	3.423233

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 6
The Unrestricted Cointegration Rank Test Results

Null	Alternate	Statistic	0.05 Critical Value (p value)
Unrestricted Cointegration Rank Test (Maximal Eigenvalue)			
r=0	r=1	33.17	27.18 (0.0086)
Unrestricted Cointegration Rank Test (Trace)			
r=0	r=1	55.61	47.86 (0.0079)

Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level. Trace test indicates 1 cointegrating equation at the 0.05 level.

r indicates the number of cointegrating relations (the cointegrating rank).

Table 7
Cointegrating Regression

1 Cointegrating Equation(s): Log likelihood -2.611443

Normalized cointegrating coefficients (standard error in parentheses)

LOFDI LM LIFDI LX

1.000000	-31.64344	-1.668920	34.57989
	(8.17504)	(0.66442)	(8.55674)
	[-3.87]	[-2.51]	[4.04]

Note: standard errors are in parenthesis and t-ratios are in brackets.

Table 8
VAR Granger Causality/Block Exogeneity Wald Test Results

Dependent Variable	Excluded	Chi-Square Statistics	Degrees of Freedom	P value
LOFDI	LIFDI	0.85	2	0.6544
	LM	13.17	2	0.0014
	LX	12.00	2	0.0025
	ALL VALUES TAKEN TOGETHER	17.48	6	0.0077
LIFDI	LOFDI	2.78	2	0.2494
	LM	1.07	2	0.5847
	LX	5.19	2	0.0745
	ALL VALUES TAKEN TOGETHER	15.00	6	0.0203
LX	LOFDI	0.18	2	0.9153
	LIFDI	2.20	2	0.3326
	LM	5.30	2	0.0706
	ALL VALUES TAKEN TOGETHER	8.90	6	0.1792
LM	LOFDI	2.51	2	0.2845
	LIFDI	0.77	2	0.6808
	LX	6.48	2	0.0391
	ALL VALUES TAKEN TOGETHER	17.60	6	0.0073

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