Financial Deepening, Foreign Direct Investment and Economic Growth: Are They Cointegrated

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Abstract

The paper explores the long run equilibrium nexus between financial deepening, foreign direct investment (FDI) and economic growth in India during 1970-2007. Using Johansen's cointegration technique, the paper finds that financial deepening; foreign direct investment and economic growth are cointegrated, indicating the continuation of long run equilibrium relationship between them. The Error Correction Model (ECM) further confirms the presence of bidirectional causality between foreign direct investment and economic growth and a unidirectional causality from financial deepening to foreign direct investment. The paper at the end suggests that India needs well developed financial system in order to bring more foreign direct investment and economic growth in the Indian economy.

Keywords: Financial Deepening, FDI, Cointegration, ECM

1. Introduction

The increasing role of foreign direct investment (FDI) to economic growth has created much research interest among the development economists (Quazi, 2007). The FDI is usually recognized as a growth enhancing factor in the host country and that is considerably fact for the developing countries like India and China (Vadlamannati et al., 2009; Wang, 2009; Pradhan, 2006). FDI, in true sense, is very useful for at least three developmental goals: (1) saving investment gap by providing the much needed capital for domestic investment; (2) foreign exchange gap by providing foreign currency through initial investments and subsequent export earnings; and (3) tax-revenue gap by generating tax revenues through additional economic activities (Pradhan, 2008; Smith, 1997). We have extensive literature on the relationship between FDI and economic growth, both in the developed and developing countries in the world. However, empirical studies that increasing the relationship between FDI and economic growth on the one hand, and the role played by the circumstances FDI is confronted with whenever it enters a recipient country on the other hand, are scarce (Hermes and Lensink, 2003).

It is generally believed that the development of the financial system of the recipient country is an important pre condition for FDI to have a positive impact on economic growth. The financial system enhances the efficient allocation of resources and improves the absorptive capacity of a country with respect to FDI inflows. In particular, a more developed system may contribute to the process of technological diffusion associated with FDI (Levine, 1997; Saint-Paul, 1992; Levine, 1991; Greenwood and Jovanovic, 1990).

The purpose of this study is to empirically investigate the role of financial deepening on the nexus between FDI and economic growth. The rest of the paper is organized as follows: section 2 describes econometric setting and database; section 3 analyses the results; and section 4 provides conclusion.

2. Econometric Setting and Database

The role of financial deepening on FDI- led- growth hypothesis will be performed in the following structure.

Step 1: Normalization of time series data. For a particular variable X, the normalization and aggregation can be done on the following ways:

$$I_i(X_i) = X_i / X_i^{\max} \tag{1}$$

Where, $X_i^{\max}$ denotes maximum of variable i.

Step 2: Test the order of integration to know the stationarity of these time series variables.

Step 3: Test the cointegration to know the existence of long run equilibrium relationship between them.

Step 3: Granger causality test to assess the short run cointegration and the direction of causality between the variables.

The detail econometric approach of these three tests is described below:

2.1. Test for Order of Integration

The test for order of integration means to know the stationarity of the time series variables. The Phillips and Peron (PP) unit root test is applied to detect the order of integration. This is a non-parametric test to the conventional t-test that is robust to a wide variety of serial correlation and time dependent heteroskedasticity. The PP unit root test requires estimation of the following equation (Phillips and Perron, 1988);

$$X_t = \alpha_t + \sum_{i=1}^{T} X_{t-T} + \varepsilon_t \tag{2}$$

The bias in the error term results when the variance of the true population is as follows:

$$\sigma^2 = \underset{T\to\infty}{Lim} \; E\left(T^{-1} S_T^2\right) \tag{3}$$

Differs from the variance of the residuals in the regression equation:

$$\sigma_u^2 = \underset{T\to\infty}{Lim} \; T^{-1}\sum_{t=1}^{T} E\left(U_t^2\right) \tag{4}$$

Consistent estimators of σ2and σ_u^2 are:

$$S_u^2 = T^{-1}\sum_{t=1}^{T}\left(U_t^2\right) \tag{5}$$

$$S_{TK}^2 = T^{-1}\sum_{t=1}^{T}\left(U_t^2\right) + 2T^{-1}\sum_{t=1}^{K}\sum_{t=j+1}^{T} u_t u_{t-j} \tag{6}$$

Where k is lag truncation parameter, which is used to ensure that the autocorrelation of the residual is fully captured. The equation (7) represents that when there is no autocorrelation the last term in the formula

defining S_{TK}^2 is zero and σ_u^2 = σ2. The PP test-statistic [Z(tμ)] under the null-hypothesis of I (0) is

$$Z(t_\mu) = \langle S_u \,|\, S_{tk} \rangle t_\mu - \frac{1}{2}\left(S_{tk}^2 - S_u^2\right)\left[S_{tk}\left\{T^2\sum_{t=2}^{T}\left(Y_t - Y_{t-k}\right)^2\right\}^{\frac{1}{2}}\right]^{-1} \tag{7}$$

Let us assume "d" is the number of times that a variable needs to be differenced in order to attain stationarity. Such variable is said to be integrated of order "d" and denoted by I (d). If the variable is stationary at the level data, it is integrated of order zero [I (0)]. Similarly if the variable is stationary at the first difference, it is integrated of order one [I (I)] and if the variable is stationary at the second difference, it is integrated of order two [I (2)] and so on.

2.2. Testing for Cointegration

The Cointegration test is meant to know the existence of long run equilibrium relationship between financial development, foreign direct investment and economic growth. The long run equilibrium relationship, as a statistical point of view, means the variables move together over time so that short term disturbances from the long term trend will be corrected. A lack of cointegration suggests that such variable have no long run equilibrium relationship and in principle, they can wander arbitrarily far away from each other (Dickey et al., 1991). Note that regression among integrated series is meaningful, if they involve cointegrated variables.

The Johansen (1988) maximum likelihood (ML) test is applied to examine the cointegration between financial deepening, foreign direct investment and economic growth. The econometric procedure of this technique is as follows:

Let Xt be a (n X 1) vector of variables with a sample of t. Assuming Xt follows I (1) process, identifying the number of cointegrating vector involves estimation of the vector error correction representation:

$$\Delta X_t = A_0 + \prod X_{t-p} + \sum_{i=1}^{p-1} A_i \Delta X_{t-i} + \varepsilon_t \tag{8}$$

Where, vector ΔXt and ΔXt-1 are I (1) representation. The long run equilibrium relationship among Xt is determined by the rank of Π (say r) is zero, then equation (3) can be transferred to a VAR model of pth order and the variables in level do not have any cointegrating relationship. If 0 < r < n, then there are n X r matrices of α and β such that

$$\Pi = \alpha\beta' \tag{9}$$

Where, both α and β are (n x r) matrices. The cointegrating vectors β have the property that $\beta' X_t$ is stationary [I (0)] even though Xt is non-stationary [I (1)]. Johansen likelihood ratio test looks for two statistics: trace statistics and maximum eigen value.

The likelihood ratio test statistic for the null hypothesis that there are at most r cointegrating vectors is the trace test and is computed as:

$$Trace = -T \sum_{i=r+1}^{n} Log\left(1 - \hat{\lambda}_i\right) \tag{10}$$

Where $\hat{\lambda}_{r+1} \dots \hat{\lambda}_n$ are (n-r) smallest estimated eigen values.

The likelihood ratio test statistic for the null hypothesis of r cointegrating vectors against the alternative of r + 1 cointegrating vectors is the maximum eigen value test and is given by

$$\lambda_{\max} = -TLog\left(1 - \hat{\lambda}_{r+1}\right) \tag{11}$$

Here, the null hypothesis of r cointegrating vectors is tested against the alternative hypothesis of r +1 cointegrating vectors. Hence the null hypothesis r = 0 is tested against the alternative r = 1, r =1 against the alternative r = 2, and so forth. It is well known that the cointegartion tests are very sensitive to the choice of lag length. The AIC statistics has been applied for the same.

2.3. Granger Causality Test

The Granger causality test (Granger, 1988) is applied to examine the causality between financial development, foreign direct investment and economic growth in India. The model is used for the same is as follows

$$GDP_t = \phi_1 + \sum_{i=1}^{p} \alpha_1 GDP_{t-i} + \sum_{j=1}^{q} \beta_1 FDI_{t-j} + \sum_{k=1}^{r} \delta_1 FD_{t-k} + \lambda_1 EC_{t-1} + \xi_t \tag{12}$$

$$FDI_t = \phi_2 + \sum_{i=1}^{p} \alpha_2 FDI_{t-i} + \sum_{j=1}^{q} \beta_2 GDP_{t-j} + \sum_{k=1}^{r} \delta_2 FD_{t-k} + \lambda_2 EC_{t-1} + \xi_t \tag{13}$$

$$FD_t = \phi_3 + \sum_{i=1}^{p} \alpha_3 FD_{t-i} + \sum_{j=1}^{q} \beta_3 FDI_{t-j} + \sum_{k=1}^{r} \delta_3 GDP_{t-k} + \lambda_3 EC_{t-1} + \xi_t \tag{14}$$

Where, GDP represents real per capita economic growth, FDI represents inflows of foreign direct investment and FD represents financial deepening, which is measured as the ratio of broad money supply to GDP. The Generalized Impulse Response Functions (GIRFs) is used further to summarize the relationships between variables in a cointegrated system. The GIRF approach is invariant to the alternative orderings of the variables in the VAR system. It is unique and explicitly reflects the historical patterns of the observed correlation among the different shocks (Pesaran and Shin, 1998). The empirical analysis has been carried out in India over the period 1970-2007. The data are obtained from Handbooks of Statistics on Indian economy, Reserve Bank of India and International Financial Statistics, International Monetary Fund, Washington.

3. Results and Discussion

In the light of econometric setting presented in the previous section, the empirical results are discussed in this section. The Table 1 presents the estimated results of PP test. The results indicate that the time series variables are non-stationary in their levels but found stationary in the first differences. That means they are integrated of order one [I (1)] and confirms the possibility of long run equilibrium relationship between them. Using Johansen cointegration test, we found the presence of one cointegrating vector between financial development, foreign direct investment and economic growth (see Table 2). That means they are cointegrated and indicates that there is long run equilibrium relationship between them. The existence of cointegrating relationship implies that an Error Correction Model (ECM) is appropriate. The estimated results of ECM are reported in Table 3. The each column of Table 3 shows an equation of each of the three variables in the system. For each variable, at least one channel of causality is active: (1) the short run Granger causality through the joint significance tests of the lagged differenced coefficients (F-statistics) or (2) long run causality through a statistically significant lagged error correction term (t-statistics). A significant of error correction coefficient implies that past equilibrium errors affect current outcomes.

The result showed that there is bidirectional causality between foreign direct investment and economic growth and is supported at the 1% level of significance. A unidirectional causality is also found from financial development to foreign direct investment ($p < 0.00$), but the reverse causality does not hold true. The significance of error correction term implies the evidence in support of long run causal relationship from financial development and foreign direct investment to economic growth. This is also verified by GIRFs, which indicates the causal properties of the system. The significance of GIRF is to treat all the variables jointly determined and to avoid the possibility of specification bias. The estimated GIRFs are reported in Figure 2. It provides a support to the Granger causality results. To complement this study, it is important to investigate whether the above long run relationship that we found are stable over the period of study. We conduct the diagnostic tests for serial correlation (LM test), autoregressive conditional heteroskedasticity (ARCH test), heteroskedasticity (White test) and stability test (Ramsey test). The estimated results are reported in Table 4. The results confirm the stability of the model on the nexus between foreign direct investment, financial deepening and economic growth in India during 1970-2007.

4. Conclusion

The present work explores the role of financial development on the nexus between foreign direct investment and economic growth in India during 1970-2007. Using cointegration and ECM, the paper finds the following:

-Financial development, foreign direct investment and economic growth are integrated of order one.

-The Johansen's multivariate cointegration test confirmed that financial development, foreign direct investment and economic growth are cointegrated. This suggests the presence of a long run equilibrium relationship between these variables.

-The Granger causality test confirmed that there is presence of bidirectional causality between foreign direct investment and economic growth.

-And a unidirectional causality from financial development to foreign direct investment.

The above findings clearly indicate that financial deepening plays a role in contributing foreign direct investment and economic growth, both directly and indirectly. This suggests that there is need of reforming Indian financial system in order to bring more foreign direct investment and economic growth in the Indian economy.

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Table 1: Unit Root Test Results

		Level Data		First Differences		Conclusion
		C	C +T	C	C +T	
Variables	FD	1.940	0.047	-4.32*	-4.77*	[1 (1)]
	FDI	1.165	1.269	-3.03*	-3.25*	[1 (1)]
	GDP	0.023	-1.64	-3.79*	-3.72*	[1 (1)]
Critical Values (at 10 %)	FD	2.61	-3.20	2.61	-3.20	
	FDI	2.61	-3.20	2.61	-3.20	
	GDP	2.61	-3.20	2.61	-3.20	

1. FD: Financial Development; FDI: Foreign Direct Investment; GDP: Economic growth; C: Constant; C+T: Constant and trend.
2. PP test is use with trend and no trend.
3. The lag length has been choosen based on minimum of AIC.
4. The critical values follow MacKinnon and James, 1996.
5. * implies significant at 1% level.

Table 2: Results of Cointegration Test

Null Hypothesis	Trace Statistics	Probability Level	Max Eigen Value	Probability Level
H_0: r = 0	35.374	0.05	16.33	0.10
H_0: r ≤ 1	19.04	0.10	12.12	0.18
H_0: r ≤ 2	6.93	0.13	6.92	0.13

1. r denotes the number of cointegrating vectors.

2. The Estimation process follows linear deterministic trend.

3. The critical values follow MacKinnon-Haug-Michelis, 1999.

Table 3: Granger Causality Test based on ECM

	Dependent Variables		
	FD	GDP	FDI
FD	--------	3.258*	3.695*
GDP	0.559	--------	5.452*
FDI	2.338	45.94*	--------
ECT	-2.12	-11.92*	-4.055*
F	6.847*	49.57*	7.77*

*: Indicates significance level; and other notations are defined earlier.

Table 4: Short Run Diagnostic Tests

Dependent Variables	LM	ARCH	Ramsey	White
FDI	89.55* [0.00]	57.17* [0.00]	389.04* [0.00]	50.71 [0.00]
FD	302.63* [0.00]	78.26* [0.00]	74.71* [0.00]	5.94* [0.00]
GDP	152.5* [0.00]	15.70* [0.01]	27.82* [0.38]	7.44 [0.00]

LM: Serial Correlation LM Test; ARCH: ARCH Test; Ramsey: Ramsey Test; White: White Heteroskedasticity Test; *: Indicates that the statistics is significant; and other notations are defined earlier.

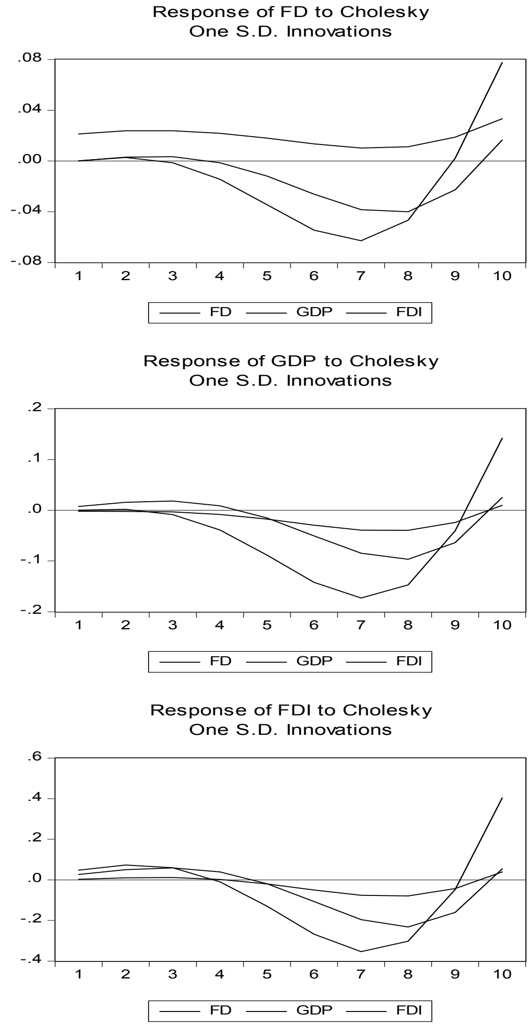

Figure 1: The Generalized Impulse Responses to one SE Shock in ECM