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Relationship between Foreign Institutional Investment, Exchange Rate and Foreign Exchange Reserves: The Case of India using ARDL Bounds Testing Approach

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Abstract

Foreign institutional investment (FII) is believed to affect real economy of a country through its impact on factors such as exchange rates and foreign exchange reserves. Similarly, exchange rate movements are also believed to affect the FII coming to the country and foreign exchange reserves of the country. In the light of recent volatility in the movements of these variables, we examine the long-run and short-run relationship between these three variables. Using monthly data for the period September 1993 to July 2013, this paper employs the more recent and robust autoregressive distributed lag (ARDL) bounds testing approach to study the relationship among these three variables. The results indicate strong evidence of a long-run relationship between FII as dependent variable and exchange rate and foreign exchange reserves as independent variables. We also find exchange rate to be a significant determinant of FII movements.

Keywords: Foreign Institutional Investment, Exchange Rate, Foreign Exchange Reserves, ARDL Bounds Testing

Introduction

Foreign investment plays an important role in the long term economic development of a country by bridging the gap between savings and investment, augmenting availability of capital, and raising productivity. Encouraged by this, many developing countries opened their economies to foreign capital flows in the late 1980s and early 1990s. Portfolio investment, an important form of international capital flows, is a phenomenon which began at a reasonable scale in the early 1990s in developing and emerging markets. The Indian economy liberalised in 1991 following the Balance of Payment (BOP) crisis. The Foreign Institutional Investors (FIIs) were allowed to invest in India from September 1992. The FIIs since then have become important players in the domestic financial markets and the Foreign Institutional investment (FII) has become an important source of portfolio investment in the country. The cumulative FII investment (purchases) in India since November 1992 till end of November 2013 stood at around Rs. 7406539 crores while the net investment for the same period stood at around Rs. 769383.88 crores (www.sebi.gov.in). Such huge inflows of foreign institutional investment affect the real economy of a country through its impact on macroeconomic factors such as exchange rates and foreign exchange reserves.

In this paper, we attempt to understand the dynamics of the relationship between FII flows, exchange rate, and foreign exchange reserves. FII flows can affect and get affected by exchange rate movements. For instance, an increase in the FII inflows can result in the appreciation of the Indian rupee. (Since March 1993, India has a flexible exchange rate regime whereby exchange rate of the rupee is determined by the market forces). The FIIs demand rupees to invest in the Indian stock markets. The high demand for rupees can therefore result in the appreciation of rupee vis-a-vis U.S. dollar. At the same

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time, the expectations about the value of the rupee can also have an impact on FII inflows to India. A high rupee return on equities can be neutralised, at least in part, by a depreciation of the rupee. For example, a 15 percent rupee return on equities with a 7 percent depreciation of the rupee results in an effective dollar rate of return of about 8 per cent only. A relatively unattractive low rupee rate of return on equities can become attractive in dollar terms only if the rupee appreciates vis-à-vis the dollar. Therefore, other things remaining the same, FII inflows are expected to go up when there are expectations of domestic currency appreciation and go down when there are expectations of domestic currency depreciation.

The inflow of foreign capital has also enabled India to build up huge foreign exchange reserves. From a situation where the foreign exchange reserves in India in the early 1990s were not enough to pay even three weeks import bill of the economy, India now has foreign reserves to the extent of as much as Rs. 18007 billion as on 22nd November 2013 (www.rbi.org.in). Similarly, exchange rate movements are also believed to affect the level of foreign exchange reserves of the country. This can be explained as follows. The appreciation of the rupee will lead to the increase in imports and without any simultaneous increase in exports, an increase in imports will lead to the erosion of foreign exchange reserves so as to be paid in the form of import bill. On the other hand depreciation of the Indian rupee will make the Indian exports competitive and therefore can add to the foreign exchange earnings of the country.

Rationale and Objective of the Study

The capital flows[1] can thus contribute to both, the fluctuations in the exchange rate and reserve accumulation in the country and also gets affected by it. With a shift of exchange rate, changes can take place in foreign exchange reserves valuation and result in to the FIIs inward / outward movement in stock market. Similarly, FIIs inflows in the stock market enhance the foreign exchange reserve resulting in the exchange rate movement and vice versa. In wake of the possible interaction between foreign institutional investment, foreign exchange reserves and exchange rates, the objective of this paper is to examine the interrelationship between these three variables in case of India using the more recent and robust autoregressive distributed lag (ARDL) bounds testing approach. The present paper tries to fill the gap in the existing literature by examining the interrelationship between these three variables simultaneously.

[1] In developing countries the exchange rate development is generally assessed in the context of developments in the current account of balance of payments. But with the huge foreign capital inflows to these countries, the dominance of current account developments in determining exchange rate has been taken over by capital flows.

Layout of the Paper

The present study is divided into five sections. The first section as already discussed introduces the topic and lays out the objectives. The second section presents an overview of the existing literature in this area of research. The third section describes the data and explains the methodology used in the study. The next section presents and discusses the empirical results, and the final section concludes the study.

Review of Literature

The existing literature on FII flows has a number of studies focusing on the determinants of foreign institutional investment in India (Bhasin and Khandelwal, 2013; Saraogi, 2008; Sehgal and Tripathi, 2007; Gordon and Gupta, 2003; Bose and Coondoo, 2002; Agarwal, 1997).

Bhasin and Khandelwal (2013) identify the determinants of FII inflows in India, with special reference to the impact of crisis, using monthly data from April 1994 to December 2011. They find that the factors affecting FII inflows to India are the returns on MSCI Emerging Market Index, past values of FII inflows and the growth rate of the Indian economy. They also find the global financial crisis of the year 2008 had a significant impact on net FII inflows.

Dua and Sen (2006) examine the relationship between the real exchange rate, level of capital flows, volatility of the flows, fiscal and monetary policy indicators and the current account surplus for the Indian economy for the period 1993Q2 to 2004Q1. They find that the real effective exchange rate is cointegrated with the level of capital flows, volatility of the flows, high-powered money, current account surplus and government expenditure. This relationship is statistically significant and each of the above determinants Granger causes the real effective exchange rate.

Ahmad and Masood (2009), using quarterly data for the period 1994Q1-2007Q4, find that cointegration test confirms the long run equilibrium relation between total capital inflows (TCI) and real effective exchange rate-both trade based and export based and between TCI and nominal effective exchange rate-export based. Granger causality test confirms the bidirectional causality between real effective exchange rate-export based and TCI and between foreign exchange reserve and TCI and unidirectional causality from TCI to real effective exchange rate-trade based.

Ghosh and Herwadkar (2009) find that there exists a long term relation between capital flows and exchange rate appreciation. In the short run, the VAR and impulses response functions also indicated that a positive shock to net FII flow generally result in exchange rate appreciation. Kaur and Dhillon (2010) using the same methodology find that exchange rate of Indian rupee has negative but insignificant impact on FIIs investment in India both in long run and short run.

Raju *et al.* (2010), using Granger Causality Test and Vector Auto Regression (VAR), investigate the direction and dynamic interaction between four major exchange rates viz. Dollar, Euro, Pound and Yen and net FII flows in India using daily data of exchange rates and net FII flows. Their causality tests results show that dollar exhibit bi-directional relationship with net foreign institutional investments. The regression results also validate that the net FII flows are positively correlated to rupee appreciation in dollar.

Sethi (2012) using the Vector Auto Regression (VAR) method, examine the effects of private foreign capital inflows on macroeconomic variables such as exchange rate, inflation, money supply, foreign exchange reserve, etc. in India with the help of monthly data from 1995:04 to 2011:07. The results show that there is dynamic short and long equilibrium relationship between few macroeconomic variables like exchange rate, foreign exchange reserve, money supply among others with private foreign capital inflows.

Bhatia and Kishor (2013) investigate the nature of the causal relationship by using Granger Causality Test between Net FII flows, the Stock Price Movements, and Foreign Exchange Reserves (FERs) using monthly data for the 20 years period. The results show that there is bi-directional Granger Causality between FERs and FII Flows.

Srinivasan and Kalaivani (2013) explore the determinants of foreign institutional investments in India through ARDL bounds testing approach using quarterly time series data for the period from January 2004 to December 2011. The study showed that exchange rate has significant negative impact on FII inflows both in the short-run and long-run, implying that depreciation of currency adversely affects the FII flows into India.

Data and Methodology

Sample Period and Data Sources

Sample Period

The study uses monthly time series data for the period September 1993 to July 2013.

Data Sources

The data on net FII inflows (debt and equity, in rupees crores) has been obtained from SEBI's website, www.sebi.gov.in. The data on exchange rate (rupee-dollar exchange rate, monthly closing) and foreign exchange reserves (in US dollar million) have been taken from the database on Indian economy maintained by Reserve Bank of India (www.rbi.org.in).

Research Methodology

We first test for the stationarity of the time series applying Augmented Dicky Fuller and Phillips-Perron Unit root tests. To test the long-run relationship between FII, exchange rate and foreign exchange reserves, we use the bounds testing approach to cointegration developed by Pesaran *et al*. (2001) which is based on the autoregressive distributed lag framework (ARDL). This is because this approach can be used even when we have a combination of I(1) and I(0) series. In our study, while the exchange rate and foreign exchange reserves are I(1) variables, the net FII variable is I(0). Further, the bound testing approach to cointegration has better small sample properties. It has been shown by Pesaran and Shin (1999) that the OLS estimators of ARDL parameters are $\sqrt{n}$ consistent, where n is sample size and the estimators of the long-run coefficients are super-consistent in small sample sizes. In

the multivariate framework that we have employed in our paper, the bound testing approach will examine if a long-run relationship exists between the variables with the following Unrestricted Error Correction Models:

$$\Delta FII_t = \alpha_o + \sum^{n}_{i=1} \alpha_{oi} \Delta FII_{t-i} + \sum^{n}_{i=0} \alpha_{gi} \Delta ER_{t-i} + \sum^{n}_{i=0} \alpha_{fi} \Delta Forex_{t-i} + \alpha_1 FII_{t-1} + \alpha_2 ER_{t-1} + \alpha_3 Forex_{t-1} + \square\alpha_t \quad (1)$$

$$\Delta ER_t = \beta_o + \sum^{n}_{i=1} \beta_{gi} \Delta ER_{t-i} + \sum^{n}_{i=0} \beta_{oi} \Delta FII_{t-i} + \sum^{n}_{i=0} \beta_{fi} \Delta Forex_{t-i} + \beta_1 ER_{t-1} + \beta_2 FII_{t-1} + \beta_3 Forex_{t-1} + \square\beta_t \quad (2)$$

$$\Delta Forex_t = \gamma_o + \sum^{n}_{i=1} \gamma_{fi} \Delta Forex_{t-i} + \sum^{n}_{i=0} \gamma_{oi} \Delta FII_{t-i} + \sum^{n}_{i=0} \gamma_{gi} \Delta ER_{t-i} + \gamma_1 Forex_{t-1} + \gamma_2 FII_{t-1} + \gamma_3 ER_{t-1} + \square\gamma_t \quad (3)$$

where FII represents the net FII inflows, ER represents the rupee-dollar exchange rate and Forex represents the foreign exchange reserves.

The null and alternate hypotheses in equation (1) are:

H_{1o}: 0

H_{1a}: 0, 0

The null and alternate hypotheses in equation (2) are:

H_{2o}: 0

H_{2a}: 0, 0

The null and alternate hypotheses in equation (3) are:

H_{3o}: 0

H_{3a}: 0, 0

The null hypothesis in the above cases will be tested with the F-test, which follows a non-standard distribution. The

Table 1: Unit Root Test results

Variable	*ADF test*		*Phillips Perron test*	
	Level	First difference	Level	First difference
Net_FII	-3.994446*** (0.0017)	-----	-6.709998*** (0.0000)	--------
Forex reserves	-0.738120 (0.8337)	-4.805487*** (0.0001)	-0.316480 (0.9191)	-11.11468*** (0.0000)
Exchange rate	-0.563841 (0.8747)	-12.51006*** (0.0000)	-0.356002 (0.9130)	-12.44581*** (0.0000)

Table 2: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria						
Sample: 1993M09 2013M07						
Included observations: 230						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4964.051	NA	1.24e+15	43.27001	43.44939	43.34237
1	-4935.084	56.17058	1.05e+15	43.09638	43.41029*	43.22301
2	-4920.218	28.44027	9.93e+14	43.04537	43.49382	43.22626
3	-4897.891	42.12841	8.85e+14	42.92949	43.51247	43.16465
4	-4880.196	32.92936	8.20e+14	42.85388	43.57139	43.14331
5	-4864.104	29.52402	7.72e+14	42.79221	43.64426	43.13591*
6	-4854.652	17.09576*	7.69e+14*	42.78828*	43.77486	43.18625
7	-4848.116	11.65153	7.87e+14	42.80971	43.93082	43.26194
8	-4841.146	12.24341	8.01e+14	42.82736	44.08300	43.33386
* 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						

F-test statistic of joint significance will lead to acceptance or rejection of the existence of long-run relationship (cointegration) among the variables. If the computed F-statistic falls below the lower bound we would conclude that the variables are I(0), so no cointegration is possible, by definition. If the F-statistic exceeds the upper bound, we conclude that we have cointegration. Finally, if the F-statistic falls between the bounds, the test is inconclusive.

Results

Unit Root Test

To test for the stationarity of the time series, we first apply the ADF test where the null hypothesis is that the series has a unit root and is hence non-stationary. We use the Schwarz Information Criterion (SIC) to determine the number of lagged first differences for the ADF test. We also apply the Phillips Perron test for testing stationarity. The results of both the ADF test and Phillips Perron test (Table 1) show that for net FII inflows, the series is I(0), i.e., stationary at level. The series of both foreign exchange reserves as well as exchange rate is I(1), i.e., integrated of the order one.

As we have a combination of I(0) and I(1) series, we use the bounds testing approach to cointegration developed by Pesaran *et al*. (2001) which is based on the autoregressive distributed lag framework (ARDL). As mentioned above, this approach to test cointegration is the best when we have a combination of I(0) and I(1) series.

Determining Optimal Lag Length in the UECM

We now determine the optimal order of the lag for the first differenced variables. As our data is monthly, so we allow for maximum lag length of 8. The results are shown in Table 2.

As can be seen from Table 2, the lag order selected by most of the criteria is 6 while for Schwarz information criteria, it is 1. We go with the majority criteria and take the optimal lag length as 6.

Bounds Test Results

We now estimate equations (1) to (3) using OLS and a lag order of 6 for the first differenced variables and then perform the Wald (F) test for the three sets of hypotheses corresponding to equations (1) to (3). The results are given in Table 3.

Table 3: F-statistic for Bounds test (lag order 6)

Null Hypotheses	*Calculated F*
0	5.892226*** (0.0007)
0	1.467108 (0.2244)
0	0.550140 (0.6486)

From Table CI (iii) of Pesaran *et al.* (2001), at k=2 (2 regressors), the lower and upper bounds for the F-test statistic at the 10%, 5%, and 1% significance levels are [3.17, 4.14], [3.79, 4.85], and [4.41, 5.52] respectively.

If we consider net FII as the dependent variable (equation (1)), the calculated F value exceeds the upper bound at all significance levels. Thus, there is a strong evidence of long-run relationship if net FII is treated as the dependent variable. In the case of exchange rate as the dependent variable (equation (2)), the calculated F value falls below the lower bounds of the critical values indicating no long-run relationship if exchange rate is treated as the dependent variable. Again, with foreign exchange reserves as the dependent variable (equation (3)), the calculated F value falls below the lower bounds and hence there is lack of cointegrating relationship.

Estimation of the ARDL Model

To obtain the long-run coefficients, we now estimate the ARDL model given in equation (1). The lag specification used based on criteria mentioned before is (6,1,1). To get the error correction term, we first estimate the levels model by OLS and construct the residuals series. We then fit a regular ECM. The results of the estimation are given in Table 4.

As can be seen from Table 4, the coefficient of the error correction term is negative and highly significant. Thus, there is a long-run causality from exchange rate and foreign exchange reserves to net FII. The speed of adjustment towards long-run equilibrium is 38%. In other words, nearly 38% of any disequilibrium between the three variables is corrected within one time period (i.e.,

Table 4: Dependent Variable: Net FII

Variable		*Coefficient*	*p-value*
D(NET_FII(-1))		-0.046879	0.5545
D(NET_FII(-2))		0.083650	0.3160
D(NET_FII(-3))		0.233541	0.0027
D(NET_FII(-4))		-0.114502	0.1413
D(NET_FII(-5))		0.252078	0.0010
D(NET_FII(-6))		-0.168359	0.0232
D(FOREX)		0.166315	0.2437
D(FOREX(-1))		-0.288742	0.0401
D(ER)		-2747.422	0.0001
D(ER(-1))		119.6609	0.8649
ECT(-1)		-0.383340	0.0000
R-squared	0.394108	Mean dependent var	-80.53491
Adjusted R-squared	0.366692	S.D. dependent var	10356.90
S.E. of regression	8242.093	Akaike info criterion	20.91815
Sum squared resid	1.50E+10	Schwarz criterion	21.08157
Log likelihood	-2415.505	Hannan-Quinn criter.	20.98406
Durbin-Watson stat	2.036614		

one month). Foreign exchange reserves are not found to be a very significant determinant of FII flows. The results indicate that exchange rate has negative and significant influence on FIIs inflows to India in the long-run, implying that depreciation of the rupee tends to lowers the value of foreign institutional investments in India thereby leading to a fall in FII inflows to India and vice versa. This confirms our expectations about the relationship between the two. With the rise in the value of rupee, the FIIs can get more dollars with the same amount of rupees, that is, the value of their investments increase. Hence, there would be an increase in FII inflows.

Conclusions

This paper examines the relationship between foreign institutional investment, exchange rate and foreign exchange reserves using the more robust ARDL bounds testing approach. We find strong evidence of cointegration with net FII as the dependent variable and foreign exchange reserves and exchange rate as the independent variables. This indicates that foreign exchange reserves and exchange rate cause FII inflows in the long-run. Exchange rate is found to be a significant negative determinant of FII. From a policy perspective, it implies that frequent changes in exchange rate can make the FII flows more volatile and can have implications for macroeconomic stability. With a flexible exchange rate regime that exists in the case of India, exchange rate movements are bound to happen thereby contributing further to the volatility of FII movements. In such cases, then, it would be preferable if we focus more on attracting foreign direct investment which is more long-term in nature and relatively less affected by short-term movements in exchange rates.

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