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The Causality Between Foreign Portfolio Investment Inflow and Call Money Rate in India: An Application of Auto Regressive Distributed Lag Modelling and Granger Causality Approach

[*1]Roy Chowdhury Piyali

Assistant Professor, Department of Commerce and Management, Dayananda Sagar Institution, Karnataka, Bangalore (India)

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[*]Corresponding Author
Email: piyali.rc-dsjbs[at]dayanandasagar.edu

ABSTRACT

This article attempted to investigate a causality between Foreign Portfolio Investment Inflow and Short run Interest rate in India for the monthly data between the period of 2006-2017 by Auto Regressive Distributor Lag (ARDL) Model. The study proved the existence of a long run cointegration between these two variables for the given period. The long run coefficient of ARDL was significant and it explained a decrease in the short run interest rate will bring Foreign Portfolio Investors in India. The impulse response function also showed the negative relationship between the variables. The study also found out that there was 37 percent chance of the short run disequilibrium between the variables to move back to long run stable equilibrium through Error Correction Term. Surprisingly, in short run, there was no Granger Causality between the two variables. Finally, the analysis revealed that Foreign investors who were interested to invest in India for less than five years are influenced by the movement of the call money rate which was immediate and specified for less than twenty-four hours in India. It proved the hot money nature of Foreign Portfolio Investment in Indian economy.

1. Introduction

India has progressed in accordance with the flow of foreign capital inflow since 1949. The consideration of Foreign Exchange Regulation Act(FERA), established in 1949, emphasized the necessity of foreign capital keeping control on import for selective industries and protecting the national industries and entrepreneurs (M. Jaya Krishna and J. Venugopal,2003), (Nagesh Kumar,2005). The adoption of new economic policies in July 1991, reflects a major change in the pattern and amount of foreign capital flows to India. In this regime, Foreign Portfolio Investment(FPI) was restricted to the Institutional Investors and Non-Resident Indians(NRIs). Furthermore, development of FPI was encouraged in the form of American Depository Receipt (ADRs) and Global Depository Receipt (GDRs) by allowing Indian companies to attract higher amount of foreign capitals (M. Jaya Krishna and J. Venugopal,2003).

Since 1991, there is comprehensive changes in the regulation of economic structure in India. Following the New Economic Policy, India was open to internationalization. Since this period, relaxation of barriers in foreign investment was expanded. Through Liberalization, Privatization and Globalization, India was open to large foreign deposits with respect to Foreign Portfolio Investment(FPI) and Foreign Direct Investment(FDI). Introduction of FPI has changed the whole economic regulation in the country. Literatures accept that there are significant relationship between FPI and FDI with different macroeconomic variables in India. In this regard, our paper concentrates on finding a relationship between FPI and one of the important macroeconomic variables, short run interest rate for the period 2006-2017.

The study is structured as follows: Section two will consist of theoretical and empirical review of literatures. Section three will cover the analysis of the results based on econometric methodology used in this study. Section four concludes the paper.

2. Literature Review

Several studies have been analyzed on the relationship of FPI and macroeconomic variables. Eun & Resnick, 1988 studies on the inverse relationship between exchange rate and FPI. Chuhan, et al, 1998 analyzed that instability in industrial production growth would result for fluctuation in FPI. Broner and Rigobon (2004) found that FPI volatility was explained typically by economic development of a country. Durham, J. B. (2004) found out inconsistency regarding foreign investors holding national market portfolio for higher expected return. It was proved in the paper that foreign investment are not motivated towards higher expectation from host countries' equity market. Goldstein, I., & Razin, A. (2006) explained that portfolio investment is superior to that of direct investment made by foreign investors. Investors who has a higher probability of receiving liquidity invest in short term foreign equity markets. Not only economic factors, studies reveal that there are many social factors which decide the level of FPI in cross geographical areas. Hasan and Nasir (2008) observed in their study that in the long run, Money supply(M2), interest rate(IR) and exchange rate are significant factors for determining the FPI inflow. Aggarwal, R.,et al (2012) studies that cultural traits, cultural distances, geographic distance and other gravity variables in both home and host countries determine the level of FPI. Pami Dua and Reetika Garg (2013) explained that domestic stock market performance, exchange rate and domestic output growth are the crucial determinants of FPI.

Giofré, M. (2014) investigated the impact of domestic investor protection on equity cross border investment. Waqas, Y, (2015) found in their study that less volatility in international portfolio flows has a relationship with currency depreciation, inflation, interest rate and GDP growth rate of host country. Forbes, K., et al. (2016) explained that taxation plays a significant role in determining the volume of FPI. Higher volume of FPI is associated with lower tax barriers in one of the developing countries, Brazil.

Considering the available literatures, our study explains the relationship between FPI and short run interest rate for India. The study concentrates the period between 2006-2017. The objectives of the study are:

Objectives:

- To find out the long run relationship between the two variables.
- To find out the short run causality among them.
- To find out Granger Causality between them.
- To suggest probable policy measures.

3. Research Method

In the first stage, to analyze an empirical long run relationship and short run nexus among the variables FPI and SINT taken into consideration for this analysis, we execute Auto Regressive Distributed Lag (ARDL) model. In the second stage, Granger causality is applied to determine both directional short-term causality effect. We have used Eviews 9.5 software to conduct the experiment.

4. Results and Analysis

4.1 Unit Root Tests

ARDL model is established on the concept that all the underlying variables should be either integrated to order zero [I(0)] or order one[(I(1)], but none will be of I(2) because of its spurious outputs in the analysis. Thus, variables need to be checked with stationarity problems at I(0) or I(1) level. For this purpose, we have performed Augmented Dicky Fuller(ADF) Test, Phillips Perron and Dicky Fuller Generalised Least Square(DF-GLS) for checking stationarity and detrending of each variable prescribed by Elliot et al. (1996).

Below Table 1 and Table 2 explains the unit root results. It shows L(FPI) is integrated to order zero and L(SINT) is of order 1. This ensures the possibility of applying ARDL in the present context.

Table-1
ADF, PP and DF-GLS unit root tests on log levels of variables

	ADF		PP		DFGLS	
Variables	**t-Stat**	**Critical value at 5%**	**t-Stat**	**Critical value at 5%**	**t-Stat**	**Critical value at 5%**
L(FPI)	-4.085778*	-2.883579	-6.893822*	-2.883408	-1.896413	-1.943304
L(SINT)	1.943096	-2.884109	0.118589	-2.883408	2.461942*	-1.943344

Source: Author's own specification using Eviews version 9.5
**indicates significant at 5% level*

Table-2
ADF, PP and DF-GLS unit root tests on first difference of log levels of variables

	ADF		PP		DFGLS	
Variables	**t-Stat**	**Critical value at 5%**	**t-Stat**	**Critical value at 5%**	**t-Stat**	**Critical value at 5%**
L(SINT)	-8.492261*	-2.884109	-16.61214*	-2.883579	-7.977426*	-1.943344

Source: Author's own specification using Eviews version 9.5
**indicates significant at 5% level*

4.2 ARDL Bound Test for Cointegration Results

The basis of applying ARDL model, here, is that ARDL holds three advantages over the other traditional cointegration techniques. First, the underlying variables need not to be integrated of the same order. Variables can be of order zero, one or fractionally integrated. The second is ARDL is more effective for small sample data size. The third advantage is through ARDL, we can get an unbiased long run relation among the variables taken into consideration. (Harris, R., & Sollis, R, 2003)

The co-integration equation applied in this study is as follows:

$$\Delta \ln Y_t = \alpha + \sum_{i=1}^{n} \beta_i \, \Delta \ln Y_{t-i} + \sum_{j=0}^{n} \gamma_j \, \Delta \ln X_{t-j} + \gamma_1 \ln(Y_{t-1}) + \gamma_2 \ln(X_{t-1}) + + e_t$$

------- Equation 1

Where all the variables employed here are ln(.) or Logarithmic operator. Δ is first difference and et is error term. The specifications of the variables are:

Yt = FPI equity inflow (FPI)
Xt = Short Run Interest Rate (SINT)

The first step in ARDL model is to measure the above Equation (1) by Ordinary Least Square(OLS). Through this procedure, we can find out the long run relationship between FDI, and SINT over the period. The estimation of the above Equation (1) tests for the joint significance of coefficients of the lagged variables by conducting F test. The Null (H0) hypothesis for long run estimation of the variables states that $\gamma 1 = \gamma 2 = 0$, i.e. no cointegration or long run relationship among the variables against the Alternative hypothesis (H1) as $\gamma 1 \neq \gamma 2 \neq 0$,i.e. proving existence of cointegration. Two sets of critical values at given significance levels can be learned from Pesaran

Table (Pesaran et al.,2001). The first set of values, i.e., upper bound values, at any given significance level is evaluated on the assumption that all the variables under consideration are of order one and the second set of values, i.e., lower bound, are of the order zero. If the value of calculated F-statistics exceeds the upper bound values, it ascertains the rejection of Null Hypothesis of no cointegration and explains a long run cointegrating relationship among the variables. If the F-statistics is lower than lower bound it indicates acceptance of Null hypothesis. If calculated F-statistics falls in between the upper and lower bound values, the result is inconclusive.

The calculated F statistic values are noted in Table (3). The F value 4.548042 is more than both upper bound level of 5% and 10 % that proves the existence of cointegration in long run between the two variables.

Table-3

ADF, PP and DF-GLS unit root tests on first difference of log levels of variables

Dependent Variable	Independent Variables	Calculated F Statistic	Critical Values at 5 % level	Critical Values at 10% level	Decision
FPI	SINT	4.548042**	3.62-I (0) 4.16-I (1	3.02-I (0) 3.51-I (1)	Cointegration

Source: Author's own specification using Eviews version 9.5

***indicates significant at 5% and 10 % level*

Note:

a. Lower and Upper-bound critical values are taken from Pesaran et al. (2001).

b. Table CI(ii) Case II: Restricted intercept and no trend

Once the cointegration is established, the long run equation and model of FPI and SINT is expressed as below:

$$lnY_t = \Omega + \sum_{i=1}^{n} \beta_{1i}\ lnY_{t-i} + \sum_{j=0}^{n} \gamma_{1j}\ lnX_{t-j}\ + \mu t$$ ------ Equation 2

The estimated Long run coefficients of the above equation are given below in Table (4).

Table-4

Estimated Long run coefficients of ARDL Bound Test

Variables	Coefficient	t-statistic	Probability
C	4.955426	65.90295	0.0000
Ln(SINT)	-0.213235*	-2.151203	0.0334

Source: Author's own specification using Eviews version 9.5

**indicates significant at 5% level*

The long run coefficient of short run interest rate clearly explains that there is a long run impact of the variable on FPI in India. The lesser is the short run interest rate, the higher is FPI. Hence, FPI is attracted towards Indian economy when call money rate in India comes down.

According to Odhiambo (2009) and Narayan and Smyth (2008), the short run parameters are calculated by estimating Error Correction Model associated with the long run estimates, which is determined by F statistic and the lagged Error Correction Term(ECT). The short run and long run relationship (represented through ECT), together, are expressed in equation (3). The short run coefficients of the equation and ECT are reported in Table (5). The coefficient of Error Correction Term(ECT) displays long run causal relationship. The error correction term is an equation where null hypothesis of no cointegration is rejected.

The Error Correction Term along with short run causality equation is noted below as:

$$\Delta lnY_t = \Pi + \sum_{i=1}^{n} \beta_i\ \Delta lnY_{t-i} + \sum_{j=0}^{n} \gamma_j\ \Delta lnX_{t-j}\ \O\, ECT_{t-1} + \Psi t$$

-------- Equation 3

The coefficients in the above equation βi, ɣj, explain the short run relationship among the variables and the coefficient of ECTt-1, Ø, explains the long run causality among the variables for the period mentioned in the study. It is also noted as speed of adjustment from short run disequilibrium to long run stable equilibrium with due course of time. The details of the short run and ECTt-1 coefficients are reported below in Table (5).

Table-5

Results of Eq. (3), ARDL (3, 0) selected based on AIC

Variables	Coefficients	t- Statistic	Probability
Δ (ln (FPI (-1)))	-0.344555***	-3.302840	0.0012
Δ (ln (FPI (-2)))	-0.127919	-1.456334	0.1478
ECT (-1)	-0.371077***	-3.723229	0.0003
Schwarz criterion	-0.827371	Akaike info criterion	-0.893545
Hannan-Quinn criteria.	-0.866657	DW-statistic	2.011917

Source: Author's own specification using Eviews version 9.5

****indicates significant at 1% level*

The short run impact of FPI is also same as long run impact. It also clearly explains the negative relationship between FPI and SINT. ECT in Table(5) explains there remains 37 percent change to move the variables from short run disequilibrium to long run stable equilibrium.

Table (6) explains that the data taken for the study is consistent as errors of the variables are not serially correlated and data is not heteroskedastic in nature. Also, in figure (1), CUSUM and CUSUMQ explain stability of the whole model. The impulse response function, shown in figure (2) explains the negative relationship between FPI and SINT.

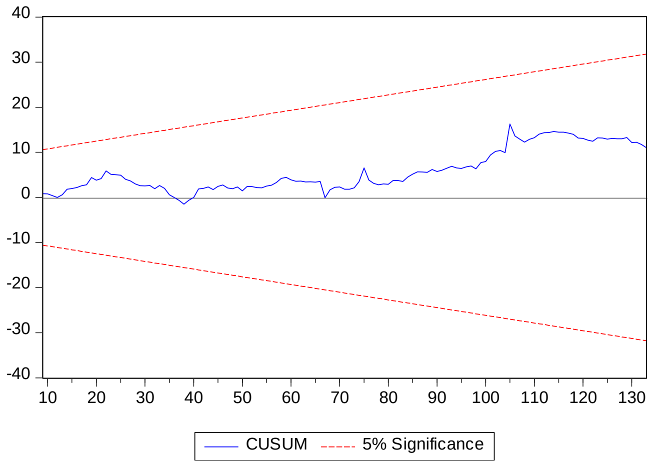
Table-6
Results of Diagnostic Tests

		Probability
FPI Breusch-Godfrey Serial Correlation LM Test	F – Statistic: 0.176383	0.8385
Heteroskedasticity Test: Breusch-Pagan-Godfrey	F – Statistic: 0.194853	0.9407

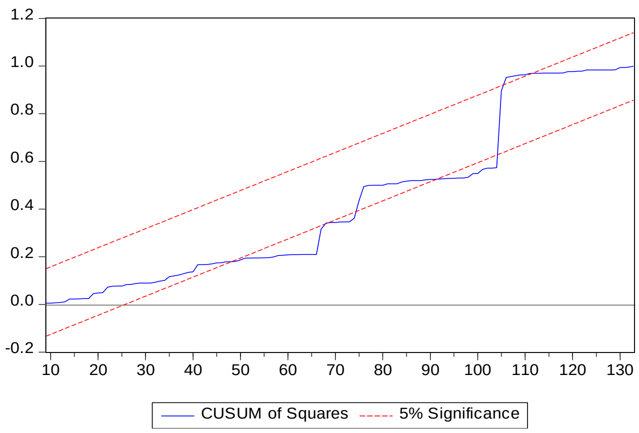
Source: Author's own specification using Eviews version 9.5

Figure 1 explains the the stability of the model through Cumulative Sum and Cumulative Sum of Square Test.

Figure 1
Results of CUSUM and CUSUMQ



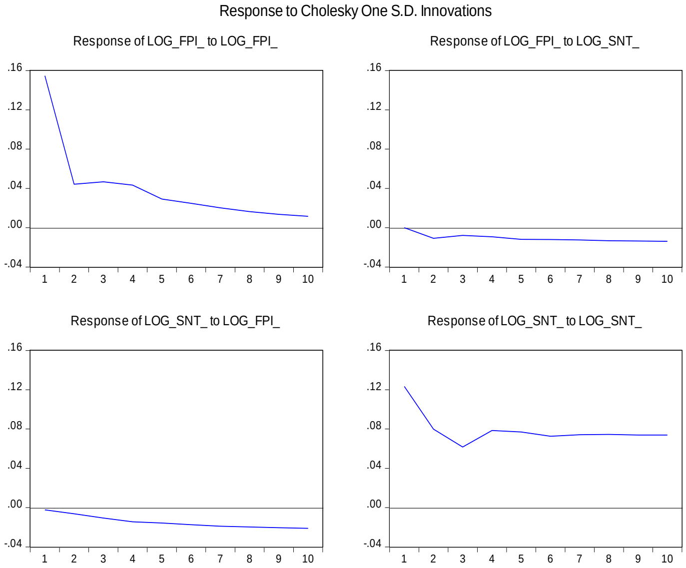
Result of CUSUM Test



Result of CUSUM Square Test

Source: Author's own specification using Eviews version 9.5

Figure 2



Source: Author's own specification using Eviews version 9.5

4.3 Granger Causality Test:

In this section, the study tries to prove the short run causality by Granger Causality Test. If we find Granger causality in only one direction, we can prove that the case for "real" causality is stronger if there is no instantaneous causality. (Sørensen, B. E, 2005).

The result of short run Granger Causality is given below in Table (7).

Table-7
Result of Short Run Granger Causality

Pairwise Granger Causality Tests Sample: 1 133 Lags: 2			
Null Hypothesis:	**Observation**	**F Statistic**	**Probability**
L(SINT) does not granger cause L(FPI)	131	2.52871	0.0838
L(FPI) does not granger cause L(SINT)	131	0.58668	0.5577

Source: Author's own specification using Eviews version 9.5

The Granger Causality Test explains short run interest rate (SINT) granger causes FPI in short run. It explains the real causality running from SINT to FPI for the period analyzed in this paper.

5. Conclusion

This paper concentrates on a relationship between FPI and Indian Call money rate for a period between 2006-2017. Study reveals that in India, short run interest rate impacts significantly on Foreign Portfolio Investment in India. The paper explains that Call money rate is the crucial economic factor to determine the level of FPI in India. As FPI is characterized as 'Hot Money' in India, the nature of FPI is closely related to the short run macroeconomic variables in India. Rise in liquidity in Indian capital market is associated with fall in call money rate. And thus, liquidity in capital market augments FPI inflow in India. The probable policy measures can be stated in the way that if Government of India allows foreign investments for the sake of boosting capital market, minimizing the trade gap and managing different external difficulties in India economy, it is better and suggested to control the level of call money rate for the sake of development of Indian economy.

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