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ABSTRACT

This paper analyses the determinants of portfolio flows to India for the period October 1995 to October 2011. The determinants of disaggregated component of portfolio flows (FPI) i.e. foreign institutional investment flows (FIIs) and investment flows received through American/Global depository receipts (ADR/GDRs) are also examined. The determinants are based partially on the portfolio balance model in which capital flows in an emerging economy are determined through an arbitrage condition. These include domestic stock market performance, exchange rate, reserves to import ratio, interest rate differential, volatility in exchange rate, domestic output growth, foreign output growth and emerging market equity performance.

The results indicate that domestic stock market performance, exchange rate and domestic output growth are the most important determinants of both FII and ADR/GDR flows. Emerging market equity performance, interest rate differential and volatility in exchange rate influence FII flows but not the investment flows received through ADR/GDRs. Moreover ADR/GDR flows are influenced by foreign output growth, but this is not so for the FII flows. Since FIIs have been the most dominant component of aggregate portfolio flows, therefore as expected, the results for aggregate portfolio flows are similar to FII flows.

Keywords: FPI, FII, ADR/GDRs, Portfolio balance framework, ARDL model

1. INTRODUCTION

The international flow of capital is expected to benefit both the source as well as the host country. However, the historical and recent financial crises have also brought into focus the fact that these flows can expose the countries to new risks. Hence it is important to understand the risks associated with these flows and the factors that drive flows into India, so that policy reactions can be formulated in advance to avoid any imbalances arising out of extremely high capital inflows or sudden reversal of capital flows in future, whatever the case may be.

The recent volatility in capital flows, especially when periods of high capital inflows were followed by periods of huge reversal in these flows, has posed macroeconomic challenges to countries across the world. India has not remained untouched by the developments in the global financial markets due to greater linkages of the Indian markets with the international markets. The recent volatility in capital flows to India can mainly be attributed to volatility in foreign portfolio investment flows and especially the foreign institutional investment flows. Hence it is important to analyse the determinants of portfolio flows in this uncertain global scenario.

Foreign portfolio investment (FPI) flows have been the most volatile component of capital flows in India and play an important role in determining the overall balance of payments. During the Asian crisis as well as during the recent sub-prime crisis, it was the huge reversal of FPI flows that led to deterioration in the overall balance of payments. This is because by their very nature FPI flows do not involve a long lasting interest in the economy. The ultimate aim of FPIs is to ensure profits and risk diversification.

This study examines the determinants of portfolio flows to India in the light of increasing volatility in FPI flows which is due to uncertainty in the global scenario in recent times. This is done by using the determinants suggested by a theoretical model, initially proposed by Fernandez- Arias (1996) and Fernandez- Arias and Montiel (1995), where portfolio flows have been modeled using a zero

arbitrage condition. According to the model expected return from investing in the host country, adjusted for credit worthiness of the country should be equal to the opportunity cost i.e. returns from investing in home country. The model therefore suggests that capital flows are a function of economic factors in the host and the source country and also of the factors that influence creditworthiness of host country.

These factors include domestic stock market performance, exchange rate, foreign exchange reserves to imports ratio, volatility in exchange rate, interest rate differential and domestic and foreign output growth. In addition to the factors suggested by the theoretical model, other factors that are considered important are also included in the empirical model. This includes the effect of the stock market performance of emerging markets in general, on portfolio flows received by India is captured by emerging market MSCI index.

The disaggregated components of FPI flows i.e. determinants of Foreign Institutional Investment flows (FIIs) and American/Global Depository Receipts (ADRs/ GDRs) which have been the major components of FPI flows to India are also analyzed. It is important to do so in order to assess whether different components of portfolio flows are driven by the same or different factors.

The results indicate that a well performing domestic stock market, an appreciating exchange rate and strong domestic economic growth attracts portfolio flows. Greater volatility in the exchange rate discourages these flows. If the overall stock market performance of emerging markets in general is good then the flows received by India decline indicating that India competes with other emerging economies in terms of receiving portfolio flows. A higher interest rate differential between domestic and foreign interest rates attracts FPI flows. The results relating to FII flows are same as that of aggregate FPI flows. For ADR/GDRs, domestic stock market performance, exchange rate, domestic as well as foreign output growth, are observed to be the most significant determinants. It is observed that reserves to import ratio, which measures creditworthiness of India, does not influence any component of portfolio flows, in time series framework.

This paper makes an important contribution to the literature related to FPI flows to India. Most of the literature that analyses the determinants of portfolio flows (FPI) to India has concentrated on the FII component only. ADR/ GDR flows have not received much attention despite the fact that the Indian corporate sector has increasingly used ADR/GDR mechanism to raise foreign capital. This study thus examines the macroeconomic determinants of not only FII but also ADR/GDR flows to India in order to fill the existing gap in the literature.

Furthermore, this study examines a wider set of potential determinants of FII flows to India compared to other studies pertaining to the Indian economy such as Chakrabarti (2001), Kaur and Dhillon (2010), Rai and Bhanumurthy (2004), Srinivasan and Kalaivani (2013). While the study by Gordon and Gupta (2003) includes a wide range of determinants of portfolio flows, it uses the OLS methodology that may yield biased and inconsistent estimates if the regressors are endogenous. This study follows the ARDL approach to cointegration for estimating the long-run coefficients which overcomes such problems. The long-run coefficients are unbiased and the t-tests are also valid, even if the regressors included in the specification are endogenous (Harris and Sollis 2003)

The following section discusses the trends in the portfolio flows to India. Section 3 presents the theoretical portfolio balance model which suggests some of the factors determining financial flows. Section 4 discusses the empirical model and section 5 presents the data sources and methodology, used for estimation. Section 6 discusses the empirical results and section 7 concludes.

2. TRENDS IN DIFFERENT COMPONENTS OF PORTFOLIO FLOWS TO INDIA

To understand the volatile nature of FPI flows, it is important to know what constitutes these flows. According to UNCTAD (1999) portfolio investment involves transfer of financial assets by way of investment by resident individuals, enterprises and institutions in one country in securities of another country, either directly in the assets of the companies or indirectly through financial markets. The main aim of the investor is to benefit from capital gains or to reduce the risk of the portfolio that the investor

holds by diversifying internationally. The different components of FPI flows are Foreign Institutional Investors¹, Global/American Depository Receipts² and offshore funds.

In 1992, the Indian government allowed the foreign investors to invest in the financial markets of the country. To be able to invest in Indian financial markets, the FIIs must be registered with the Securities and Exchange Board of India (SEBI). SEBI prescribes certain norms which are to be followed by the FIIs for registration, for example they are required ensure compliance with Foreign Exchange Management Act 1999 for which they need permission from RBI; they are required to pay registration fees; etc.. Overtime, the regulatory measures of SEBI have become liberal, which has increasingly encouraged FIIs to invest in India. However, in addition, the role of robust growth performance of the Indian economy and the resilience of the country in times of global crisis in making India one of the most favoured destinations for investment cannot be overlooked. Presently, the insurance companies, banks, hedge funds, mutual funds, asset management companies and pension funds form the majority of FIIs investing in India³.

American/Global Depository Receipts provide a mechanism of indirect listing of Indian companies in foreign stock exchange. The Indian company that wants to get listed indirectly in the foreign stock exchange, deposits its shares in a bank in that country. The bank then issues receipts against these shares, which are sold to the residents of that country. These receipts are also listed in the stock exchange of that country and are bought and sold like other instruments. The prices of these are also

¹ FIIs are those institutions, enterprises or organizations that invest in the financial markets of the other country.

² American/Global Depository Receipts are instruments that are used by NRIs and foreign nationals for investing in Indian companies.

³ Currently there are 1506 FIIs registered with SEBI out of which 56% belong to Mauritius (The Times of India May 12 2012). This may be because the funds from other countries are also mobilized to India via Mauritius to ensure tax benefits which accrue due to the Double Tax Avoidance Agreement (DTAA) between India and Mauritius.

determined by the market forces. If the receipts are traded in American markets then they are called American Depository Receipts and if these are traded in markets of countries other than America, then they are called Global Depository Receipts.

An alternative way of investment in Indian companies by NRIs and foreign nationals would be if the companies directly get listed in the stock exchange of the foreign country to which these people belong or they come and invest in Indian markets directly. Both these methods involve a lot of restrictions and have great costs. Investment through ADR/GDRs helps to overcome these limitations and hence is preferred over the aforesaid methods.

Investment in Offshore financial funds i.e. those funds that are supposed to provide tax benefit to the investor are also included under the category of portfolio investment flows. In India a few companies that have offshore mutual funds are Reliance, Kotak and TATA.

FII's have been the most dominant component in the history of aggregate portfolio flows to India. The cumulative FII investment has increased consistently from 1.6 billion dollars in 1993-94 to approximately 127.8 billion dollars till December 2011, with the only exception of a decline to 59 billion dollars in 2008-09 from 68.9 billion dollars in 2007-08 (SEBI HoS 2011).

In Figure 1, if we focus on the annual trends in net investment inflows through FII's, it can be seen that after 1992-93 when FII's were allowed to enter the capital markets of India, FII flows started rising. Till 1996-97 these flows kept rising, however, in 1997-98 and 1998-99 there was a reversal in FII investment due to the impact of the Asian crisis. Although Indian economy was not directly involved in the crisis, and the intervention by RBI in the currency market as well as imposition of capital controls was used to insulate the Indian economy from the crisis (Dua and Sinha 2007), still the foreign investment flows to the Indian economy declined, specially the FII's. This was mainly due to the contagion effect i.e. deterioration of investor confidence in the East and South-east Asian region. However as compared to other East Asian countries, the magnitude of adverse impact on India was small and short lived.

In 1999-2000 FII flows to the Indian economy revived but again dipped to 2.77 billion dollars in 2002-03. This was mainly due to the sluggish performance of the Indian stock markets, as well as the credit rating downgrade of the Indian economy by the international credit rating agencies. In the following year in 2003-04, FII flows shot up to 10.9 billion dollars which was mainly the result of an increase in the limit of investment by FIIs in the securities of the Indian companies and increase in the number of sectors in which the investment could be made as well as allowing FIIs to invest in the derivatives market.

The overall trend in FPI flows imitates the trend in FII investment, with the peaks and troughs of both the flows coinciding with each other in every single instance. In 2008-09, it was the huge reversal in FII flows that created havoc in the Indian financial markets and led to a sharp decline in the total portfolio investment flows to India. The magnitude of decline was so immense that its effect on the overall balance of payments was also felt. Although the decline in investment received through ADR/GDRs was also seen but the magnitude was not large. A similar role of FIIs during the Asian crisis was also seen with the sharp reversal in FIIs leading to a decline in total portfolio flows despite a rise in investment received through ADR/GDRs during the Asian crisis.

In 1992 Indian companies were allowed to raise capital by issuing depository receipts in the world financial markets. In 2001-02 Indian government announced several liberal measures relating to portfolio flows like increase in investment limit by FIIs from 40-49 percent and allowing two way fungibility of ADRs and GDRs. On the other hand international financial markets were also taking measures to attract firms in the emerging markets to list on their stock exchanges. Both these developments resulted in investment flowing into India through the ADR/GDR route.

Initially in the 1990s Indian firms refrained from listing in the US stock exchanges because of the stringent accounting standard requirements of US GAAP and SEC. The most attractive destination of the Indian firms was London Stock Exchange and Luxemburg Stock Exchange.

However, as observed by Pagano et. al. (2002), poor liquidity in the European stock exchanges made Indian companies change their preferences and they started listing on US stock exchanges. This was also because, overtime, Indian companies improved their accounting standards, reflecting greater transparency, which allowed these firms to list in the US stock markets as well. Initially most of the Indian companies listing in the US, listed on the NASDAQ and then later on NYSE as well because of the stricter norms of NYSE.

The share of FIIs in total FPI flows has always been higher than the share of investment flows received through ADR/GDRs since 1996-97, except in 2002-03 and in 2006-07. The share of ADR/GDR flows has declined overtime but this does not mean that ADR/GDR flows are insignificant component of FPI flows. In 1996-97 the share of ADR/GDR flows was 41 % and that of FII flows was 58%. In 2007-08 the share of ADR/GDR flows was 24% and that of FII flows was 75%. In 2009-10 FII flows accounted for 89% of the total flows while ADR/GDR flows were 10% of the total flows. Offshore funds have always been a minor portion of the total portfolio flows, however in the recent years since 2008-09, India has not been receiving any investment on account of offshore funds.

In absolute terms, as can be observed from Figure 1, there has been a surge in investment flows received through ADR/GDRs from 2004-05 onwards, while the magnitude of FII flows increased considerably after 2002-03.

3. THEORETICAL MODEL

(a) Portfolio balance framework

The empirical model in this paper draws from the factors suggested by the theoretical model which is based on the fact that foreign investors exploit all the possibilities of arbitrage across the home and the host country. In addition to the factors suggested by the theoretical model, the empirical model will include additional variables that may influence financial flows.

The literature on the theoretical model of capital flows in portfolio balance framework mainly includes the model developed by Fernandez- Arias and Montiel (1995) and extended by Taylor and Sarno (1997) and Mody, Taylor and Kim (2001). This model analyses the effect of domestic (pull) and global (push) factors on capital flows. Pull factors represent country specific investment risk and returns which attract foreign investment and push factors represent global liquidity and other factors that push investment towards emerging economies. The model bifurcates the domestic factors into those that operate at country level and those that operate at asset / project level. Assume that capital flows are represented by transactions in different types of assets $s = 1, \dots, n$. The expected return by investing in an asset of type i in an emerging economy comprises of two elements. First is the expected return from the project (G_s) and the second is an adjustment factor for G_s depending on credit worthiness of the country (C_s).

The expected return from the project is of function of vector of net capital flows (F) going into each project and the domestic economy environment (g). The adjusting credit worthiness factor is a function of stock of capital ($S = S_{-1} + F$) and other factors reflecting credit worthiness of the emerging economy (c).

The stock of capital S is the vector of each of period stocks of liabilities which is the sum of initial stocks of liabilities and current net capital inflows.

Now the foreign investor will consider the opportunity cost of assets of type $s(V_s)$. This is the return the foreign investor gets by investing in his own economy. V_s is a function of the stock of capital ($S = S_{-1} + F$) and the financial and economic opportunities in the source country (v).

Note that g and c represent pull factors and v represents push factors.

The arbitrage condition is thus given by

$$G_s(g, F) C_s(c, S_{-1} + F) = V_s(v, S_{-1} + F)$$

Assume that G_s , C_s & V_s are increasing functions of g , c & v respectively. The above equation can be solved for equilibrium vector of net capital flows F^* which can be expressed as:

$$F^* = F^*(g, c, v, S_{-1})$$

This gives the effect of change in economic factors in host country (g) and source country (v) and also the effect of factors that influence creditworthiness of host country (c), on changes in capital flows.

To capture the effect of economic factors in the host country (g) domestic stock market performance, exchange rate, domestic interest rate, domestic output growth and volatility in exchange rate are included. For the source country factors (v), foreign interest rate and foreign output growth are included. As a measure of creditworthiness (c) reserves to import ratio is included in the empirical model.

(b) Other Factors

While diversifying globally, foreign investors can either invest in emerging markets or they can invest in financial markets of the industrialized countries. According to Buckberg (1996) investors follow a two step process in deciding capital allocation. Firstly, the total capital to be invested in emerging markets is determined and then a part of that capital is allocated to each of the emerging market depending on returns. This implies that if total capital allocated to emerging markets is high, then each emerging economy has a higher probability of receiving greater amount of capital.

Alternately, it is also important to view different emerging economies as competitors to each other, where each economy is trying its best to receive a greater share of foreign investment. In this case, once the foreign investor decides the total amount to be invested in all the emerging economies taken together, then a higher share will be received by a particular emerging economy only at the cost of another.

Thus emerging market stock returns are also included in the empirical estimation in addition to the variables suggested above.

4. EMPIRICAL MODEL

The portfolio balance framework categorizes the determinants of portfolio flows into factors that affect returns from investment in the host country, factors that affect creditworthiness of the host country and factors that affect returns from investment in the home country. Variables that capture these factors alongwith an indicator of emerging market stock performance are used to estimate the empirical model.

$$FPI/FII/ADR = f(S, e, R/M, MSCI, i-i^*, y, y^*, Vol(e))$$

where the dependant variables are foreign portfolio investment inflows (FPI), foreign institutional investment inflows (FII) and American/ Global Depository Receipts (ADR), all three denominated in billions of US dollars.

The independent variables include

- Domestic stock market performance - BSE Sensex (S)
- Exchange Rate - Nominal effective exchange rate 36 country export based (e).
- Creditworthiness indicators – reserves to import ratio (R/M)
- Regional factor – Morgan Stanley Capital International Emerging Markets Net Index ($MSCI$)
- Excess of Domestic Interest Rate over Foreign Interest Rate - 3 month Treasury bill rate for India - 3 month LIBOR ($i-i^*$)
- domestic output growth - m-o-m IIP growth of India (y)
- foreign output growth - m-o-m IIP growth of OECD countries (y^*)
- Exchange Rate Volatility- square root of estimated variance in nominal effective exchange rate from GARCH model ($Vol(e)$)

The domestic stock market returns can influence portfolio flows in a positive way when foreign investors are said to be chasing the returns. In the Indian context a positive relation is observed by Aggarwal (1997), Chakrabarti (2001), Rai and Bhanumurthy (2004). However if the influence is negative, it would be a case of foreign investors buying (selling) when domestic stock returns are low (high), with the expectation that returns will rise (fall) in future (Gordon and Gupta 2003).

In a world of flexible exchange rate, capital can earn a return not only through yields on assets, but also through a change in exchange rate overtime. Appreciation of currency of the host country, intertemporally, is an additional avenue of gaining returns for foreign investors. In the Indian context, exchange rate is found to be significant in explaining portfolio flows especially FII flows (Chakrabarti 2001, Gordon and Gupta 2003, Bhattacharya, Bhanumurthy, Chakravarty and Rai 2003).

Reserves to import ratio is included as a measure of availability of sufficient liquidity in India, so that in the event of withdrawal of funds by the investors, India doesn't default on the payments. Higher value of this ratio is an indicator of availability of sufficient stock of reserves to meet short run obligations and hence is a measure of credit worthiness of the country or sovereign risk. It is expected that countries with sufficient amount of reserves (able to cover for imports) are perceived to be credit worthy and the probability of their defaulting is less. Thus it is hypothesized that the periods when India has sufficient reserves will coincide with greater flows.

Emerging market stock returns captured by MSCI Index⁴ is used to capture regional effects and it determines the allotment of capital by foreign investor to emerging market economies. If the index is higher then the allotment of capital by foreign investor to emerging market economies is higher and hence the proportion allotted to the emerging economy like India will also be higher. This would mean that the income effect is higher and flows to India are complementary to flows received by other emerging markets. Alternately, if India is competing with other emerging economies in receiving the financial

⁴ The Morgan Stanley Capital International (MSCI) Emerging Markets Net Index is a free float-adjusted market capitalization weighted index which measures equity market performance of emerging markets. The MSCI Emerging Markets Index consists of 21 emerging market country indices. These include 5 American countries (Brazil, Chile, Columbia, Mexico and Peru); 8 European, Middle East and African countries (Czech Republic, Egypt, Hungary, Morocco, Poland, Russia, South Africa and Turkey); and 8 Asian countries (China, India, Indonesia, Korea, Malaysia, Philippines, Taiwan and Thailand)

flows, then a higher value of the index would mean lesser magnitude of flows received by India and vice-versa. This would mean that the substitution effect dominates.

Interest rate differential between the host and the source country also determine portfolio flows. The traditional open economy macroeconomic models proposed by Mundell and Fleming suggest that in a world where capital is mobile and exchange rates are fixed, capital flows occur so as to restore interest parity, i.e. capital moves in or out of the country till the domestic and foreign interest rates equalize. Investors invest their capital wherever the interest rates adjusted for risk are higher. Verma and Prakash (2011) find that FDI and FII flows to India for the period 2000-01 to 2009-10 are not sensitive to interest rate differentials⁵.

Domestic output growth is used to indicate the soundness of macroeconomic and institutional fundamentals of the host country, which are very important in attracting capital flows. A higher economic growth in India indicates rapidly expanding economic activity (Dua and Rashid 1998) which in turn would mean greater profitability from investing in the Indian corporate sector. Index of Industrial Production is an appropriate reflection of these.

Foreign output growth which is measured by the growth of OECD industrial production represents the profitability of investment in the corporate sector in OECD countries. With regard to foreign output growth, it is argued in the literature that a slowdown in the growth of industrialized countries (most importantly US), increases liquidity in international markets, leading to greater capital flows to emerging market economies. Verma and Prakash (2011) for the period 2000-01 to 2009-10 find that OECD output growth is positively related with capital flows to India

Volatility in exchange rate is expected to have negative impact on capital flows to India especially FPI flows. A higher volatility represents a higher degree of uncertainty in the returns received

⁵ Interest rate differential measured as the difference between interest rate on NRI deposits and six month LIBOR.

by foreign investor. This is because exchange rate plays an important role in deciding the returns in terms of home currency of the investor. Persson and Svensson (1989) observe that increased exchange rate variability has negative impact on international trade and capital flows.

The impact of recent subprime crisis that originated in US, but affected the real and financial flows across the globe, is capture through a dummy. When global liquidity is affected due to any given exogenous reason, the flow of financial investment to emerging economies gets hit. Thus it is necessary to control for such effects.

5. DATA AND METHODOLOGY

The main sources of the data used in the analysis are Handbook of Statistics and Current Statistics of RBI, International Financial Statistics of IMF and Federal Reserve Bank. Net portfolio inflows, FII flows and ADR/GDR flows denominated in US \$ billion are taken as the dependent variable.

Domestic stock market performance is measured by the monthly average of the BSE sensitivity index. Exchange rate is defined as the nominal effective exchange rate 36 country (export based)⁶. Interest rate differential is defined as the difference between 3 month Treasury bill rate for India and 3 month LIBOR⁷. Domestic output growth is defined as the annual growth rate of index of industrial production for India. Similarly foreign output growth is measured by annual growth rate of index of industrial production for OECD countries. Both the series are calculated as the difference between logarithm of index of a particular month and the twelfth lagged month. This also helps to remove the seasonality in the IIP series if there exists any.

Reserves to imports ratio is calculated as the total reserves divided by the imports, both denominated in US million dollars. Emerging market MSCI index is obtained from the

⁶ The results are robust to the use of 36 country trade based nominal effective exchange rate.

⁷ Alternately it can also be defined as the difference between 3 month Treasury bill rate for India and 3 month Treasury bill rate for US. The results are robust to this definition.

www.msibarra.com. Volatility in exchange rates is calculated using the GARCH method⁸. The goal of GARCH method is to provide a volatility measure similar to a standard deviation.

According to the ARCH model, variance of a variable at time t is a weighted average of the squared residuals of the previous time period ($t-1, t-2, \dots$). The weights are estimated in such a way so that the observations in the more recent past get higher weights compared to observations far away in the past. GARCH model is a generalization of the ARCH model where variance of a variable at time t is a weighted average of not only the squared residuals but also the variance of residuals in the previous time period ($t-1, t-2, \dots$). The residuals are calculated by fitting an appropriate univariate ARMA model on the variable. GARCH(p, q) model can be represented as:

$$y_t = E(y_t | \Omega_{t-1}) + e_t \quad \text{and}$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^p \beta_i e_{t-i}^2 + \sum_{j=1}^q \gamma_j \sigma_{t-j}^2$$

(a) Dickey-Fuller Test with GLS Detrending (DFGLS)

To test if a series y_t contains a unit root or whether it is non-stationary, Dickey Fuller Generalised Least Squares Test is employed. If we chose to include a constant, or a constant and a linear time trend, in the ADF test regression, then for these two cases, Elliot, Rothenberg, and Stock (1996) propose a simple modification of the ADF tests in which the data are detrended so that the effect of constant and trend need not be captured by the ADF test equation, explicitly.

For this Elliot, Rothenberg, and Stock (1996) define a quasi-difference of y_t , which is regressed on the quasi-differenced x_t , where x_t includes the constant or a constant and trend. The residual series of this regression is the GLS detrended data y_t^d .

⁸ To check for robustness, the 3 month moving average standard deviation in nominal effective exchange rate was alternatively used to measure volatility in nominal effective exchange rate, and the results are qualitatively similar.

The DFGLS test involves estimating the standard ADF test equation, after substituting the GLS detrended y_t^d for the original y_t :

$$\Delta y_t^d = \alpha y_{t-1}^d + \sum_{i=1}^{p-1} \beta_i \Delta y_{t-i}^d + \varepsilon_t$$

Note that since y_t^d are detrended, we do not include the constant or trend in the DFGLS test equation. As with the ADF test, we consider the t – ratio for α from this test equation. While the DFGLS t-ratio follows a Dickey-Fuller distribution in the constant only case, the asymptotic distribution differs when both a constant and trend are included. Elliot, Rothenberg, and Stock (1996) simulate the critical values of the test statistic in this latter setting. The null hypothesis is rejected for values that fall above the critical value band.

(B) Autoregressive Distributed Lag (ARDL) Model

The cointegration methods proposed by Engle and Granger (1987) based on residuals and Johansen (1991, 1995) and Johansen-Juselius (1990) based on maximum likelihood estimation are applicable only if all the series are integrated of the same order. However, while carrying out any macroeconomic study and identifying the relation between any two or more time series variables it may be the case that they are not integrated of the same order. In that case, one possibility is that the series that are integrated of higher orders should be differenced so that all the variables in the analysis are integrated of the same order, and then the conventional cointegration methods are applied. But, in such a case, the interpretation of coefficients sometimes loses its meaning. To overcome this limitation, the autoregressive distributed lag (ARDL) approach to co-integration was proposed by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001). This method is applicable irrespective of the fact that the variables included in the analysis are I(0) or I(1) or fractionally integrated.

The ARDL method cannot be applied if either of the variables is I(2) so it is still important to check for unit root to make sure that none of the variables are integrated of order higher than one.

The estimates based on ARDL are highly consistent and inferences regarding the long run parameters based on standard normal asymptotic theory are valid.

(c) Bounds Testing Approach

To test whether there exists a long run relation between the variables, when all the variables are integrated of different order i.e. I(0) or I(1), bounds testing approach is used. This involves testing the null hypothesis of $\pi = \pi_1 = \pi_2 = \dots = \pi_k = 0$ against the alternative hypothesis of $\pi_1 \neq \pi_2 \neq \dots \neq \pi_k \neq 0$ in the following equation

$$\begin{aligned} \Delta y_t = & c_0 + \pi y_{t-1} + \pi_1 x_{1,t-1} + \pi_2 x_{2,t-1} + \dots + \pi_k x_{k,t-1} + \sum_{i=1}^m \psi_{1i} \Delta y_{t-i} + \sum_{i=1}^m \psi_{1i} \Delta x_{1,t-i} \\ & + \sum_{i=1}^m \psi_{2i} \Delta x_{2,t-i} + \dots + \sum_{i=1}^m \psi_{ki} \Delta x_{k,t-i} + \mu_t \end{aligned}$$

The calculated F-statistic has a non standard asymptotic distribution of under the null hypothesis of no long run relationship between the variables, irrespective of whether the variables are I(0) or I(1) or fractionally integrated. Pesaran and Pesaran (1997) have two sets of asymptotic critical values for the F-statistic. One is the lower bound critical value which assumes that all variables are integrate of order zero i.e. I(0). The other is the upper bound critical value which assumes that all variables are I(1). If the calculated F-statistic is greater than the upper bound critical value then the null hypothesis of no long run relationship is rejected. If the computed F-statistic falls below the lower bound critical value, then the null hypothesis of no long run relationship is not rejected. If the calculated F-statistic falls within the lower and upper bound critical values, then the result is inconclusive.

(d) Estimation of Long-Run Relationship

The Augmented ARDL (p, q_1, q_2, \dots, q_k) is given by the following equation (Pesaran and Pesaran, 1997; Pesaran, Shin and Smith, 2001)

$$\varphi(L, p)y_t = \sum_{i=1}^k \beta_i(L, q_i)x_{it} + \lambda' w_t + \varepsilon_t \quad \forall t = 1, \dots, n$$

where

$$\begin{aligned}\varphi(L, p) &= 1 - \varphi_1 L - \varphi_2 L^2 - \dots - \varphi_p L^p \\ \beta_i(L, q_i) &= \beta_{i0} + \beta_{i1} L + \beta_{i2} L^2 + \dots + \beta_{iq_i} L^{q_i} \quad \forall i = 1, 2, \dots, k\end{aligned}$$

y_t is an independent variable, L is the lag operator such that $L^p y_t = y_{t-p}$, w_t is the $s \times 1$ vector of the deterministic variables such as the intercept term, time trends, dummies or exogenous variables with fixed lags. x_{it} represents i th independent variable where $i = 1, 2, \dots, k$ where lag order of i th variable is q_i .

This equation is first estimated through OLS for $p=0,1,2, \dots, m$ and $q_i=0,1,2, \dots, m$ where m is the maximum lag chosen. All the possible ARDL models with all the possible permutations of the lag structure are estimated and the total number of ARDL models estimated are $(m+1)^k$. The appropriate lag structure is chosen based on different criterion such as AIC, SBC and HQC in such a way so that there is no remaining serial correlation in the chosen model. Once the appropriate lag structure of the model is chosen, the long-run slope coefficients of the endogenous variables are estimated as follows:

$$\Phi_i = \frac{\hat{\beta}_i(1, \hat{q}_i)}{\hat{\varphi}(1, \hat{p})} \quad \forall i = 1, 2, \dots, k$$

where \hat{p} and $\hat{q}_i, i = 1, 2, \dots, k$ are the selected (estimated) values of \hat{p} and $\hat{q}_i, i = 1, 2, \dots, k$

Φ_i gives the long run impact of x_{it} on y_t .

The long-run coefficients of the deterministic variables included in the model are estimated by:

$$\Phi'_i = \frac{\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \dots, \hat{q}_k)}{1 - \hat{\varphi}_1 - \hat{\varphi}_2 - \dots - \hat{\varphi}_p}$$

Symbols with hat (^) denote the OLS estimates for the selected ARDL model.

When the selected ARDL ($\hat{p}, \hat{q}_1, \hat{q}_2, \dots, \hat{q}_k$) model is written in terms of lagged levels and the first difference of $y_t, x_{1t}, x_{2t}, \dots, x_{kt}$ and w_t , we get the error correction model (ECM) which is as follows:

$$\Delta y_t = -\varphi(1, \hat{p})(y_t - \alpha - \sum \hat{\beta}_i x_{it} - \lambda' w_t)_{t-1} + \sum_{i=1}^k \beta_{i0} \Delta x_{it} + \lambda' \Delta w_t - \sum_{j=1}^{\hat{p}-1} \varphi_j^* \Delta y_{t-1} - \sum_{i=1}^k \sum_{j=1}^{\hat{q}_i-1} \beta_{ij}^* \Delta x_{i,t-j} + \varepsilon_t$$

$y_t - \alpha - \sum \hat{\beta}_i x_{it} - \lambda' w_t$ is defined as the error correction term and is interpreted as the speed of adjustment to the equilibrium when the model is given a shock. φ_i^* and β_{ij}^* are defined as :

$$\varphi_i^* = \sum_{j=i+1}^{\hat{p}} \varphi_j \quad \forall i = 1, 2, \dots, \hat{p} - 1$$

$$\beta_{ij}^* = \sum_{l=j+1}^{\hat{q}_i} \beta_{i,l} \quad \forall j = 1, 2, \dots, \hat{q}_i - 1$$

According to Pesaran and Pesaran (1997) and Pesaran, Shin and Smith (2001) the first step in the estimation of long run relation through the ARDL approach is to test whether there exists a long-run relationship amongst the variables in the model to be estimated. For this the bound testing approach described above is used. If there exists a long run relationship, then the second step involves estimating the long-run and short-run coefficients of the given equation.

The error correction model derived from the ARDL framework can also be used to test for Granger causality. This can be done by testing the statistical significance of the error correction term using a t-test, or by testing the joint significance of the sum of lags of each explanatory variables using F-test. Alternatively a joint test of all the aforesaid terms can be conducted using F-test.

6. EMPIRICAL RESULTS

(a) Results of the Unit Root Test and the Bounds Test

The DFGLS unit root tests⁹ suggest that Indian output growth, foreign output growth and volatility in exchange rate are stationary. All the other variables i.e. net FPI inflows, net FII inflows, net

⁹ Augmented Dickey-Fuller Test (Dickey and Fuller 1979,1981), Phillips-Perron Test (Phillips and Perron 1988), and the Kwiatkowski, Phillips, Schmidt, and Shin Test (Kwiatkowski, Phillips, Schmidt, and Shin 1992) were also conducted and all of them give the same result as the DFGLS Test

ADR/GDR flows, domestic stock market index, exchange rate, emerging market stock returns index, reserves to imports ratio and interest rate differential are integrated of order one. Since the variables under consideration are a mix of $I(0)$ and $I(1)$, hence the ARDL method was found suitable for estimation.

The first step is to check for cointegration between the variables using the ARDL bounds test suggested by Pesaran, Shin and Smith (2001). The null hypothesis of no long run relation of domestic stock market performance, exchange rate, emerging market equity performance, reserves to import ratio, interest rate differential, domestic output growth, foreign output growth and volatility in exchange rate (calculated through GARCH method¹⁰) with FPI, FII and ADR/GDR flows was tested. Note that in the first specification of FPI, FII and ADR/GDR flows all the variables were included, but in the subsequent specifications, depending on the results, a few variables were excluded. However, for each specification bounds test was conducted to ensure that long run relationship between the variables included in the respective specification existed. A maximum lag value of four was used for implementing the test.

The dummy variable for crisis was also included in the FPI and FII specifications, since it was observed that these flows were affected the most during the recent subprime crisis. For ADR/GDR a dummy variable to control for three outlier observations was included. For all the specifications, the null hypothesis is rejected, as the calculated F-statistic lies above the upper bound critical F value at 95% (Table 1, 2 & 3).

Once the bounds test ensures the presence of long run cointegration between the variables, the next step is to estimate the ARDL model and obtain the long run coefficients and then perform granger causality tests based on the short run error correction model. The optimal lag length for the variables is chosen such that there is no residual serial correlation in the underlying model.

¹⁰ The results are qualitatively similar even if we use the 3 month moving average standard deviation in NEERE as the definition of volatility in nominal effective exchange rate.

(b) Aggregate Foreign Portfolio Investment Inflows and Foreign Institutional Investment Inflows

As noted earlier, the decomposition of aggregate FPI flows shows that FII flows are a dominant component of FPI flow and the peaks and the troughs in total FPI flows closely matches with that in FII flows (Figure 1), hence as expected, the estimation results of aggregate FPI flows is quite similar to that of FII flows (Table 4 &5).

For all the specifications of FPI and FII (Table 4 &5), the coefficient on domestic stock market performance is found to be positive and statistically significant (at 1% level of significance) indicating that well performing domestic stock markets attract portfolio flows and FII flows to India. Similarly the coefficient on exchange rate is positive and significant in all the specifications indicating that an appreciating exchange rate attracts greater flows (FPI as well as FII) to India. This is because an appreciating exchange rate provides an additional source of returns to foreign investors. The impact of exchange rate on aggregate portfolio flows was stronger relative to FII flows, both in terms of magnitude and statistical significance.

The impact of improvement in performance of emerging market stocks has a negative impact on FII as well as aggregate FPI flows to India. This implies that when the overall returns from investing in emerging market stocks in general increases, foreign investment received by India decreases. Thus substitution effect dominates the income effect with regard to FPI and FII flows. In other words, when emerging markets as a whole perform better, then income effect would mean greater allocation of funds to emerging markets by foreign investor, because of which the probability that greater funds are allotted to each emerging economy increases. However, there is also a possibility of substitution of investment flows between these emerging economies, because all of them compete with each other for receiving these flows. In case of India, the former effect gets dominated by the latter.

The differential between domestic and foreign interest rates has a positive association with portfolio and FII flows to India. However, the relationship is statistically significant only in the second FII specification. This response of FII flows to interest rates can be attributed to the fact that the debt

component of FII flows would be sensitive to the interest rate differential. More recently a trend of increasing investment by FIIs in the less risky debt instruments is observed in India.

Increase in domestic output growth, attracts FPI and FII flows as it indicates an increasingly expanding economic activity in the country which further indicates increasing corporate profits. A higher growth rate is an indicator of better investment opportunities in the country and indicates strong economic fundamentals of India. Thus to a foreign investor better growth performance of the host country is a guard against sovereign risk as well as a signal that demand for investment in the host country will remain high as it is a rapidly expanding economy, and hence the probability that returns from investment will fall in future will be low.

The long run coefficient on volatility in exchange rate is negative and significant in all the specifications. This implies that volatility in exchange rate significantly discourages portfolio and FII flows to India. This is because increased volatility in exchange rate increases the uncertainties in the returns that will be received by the foreign investor in terms of his/her own currency. Thus in a way, exchange rate is an additional source of return to foreign investor apart from asset returns. Also, a volatile exchange rate indicates that the overall health of the economy is not good and that there are destabilizing forces that are present in the economy.

The measure of creditworthiness of India i.e. reserves to import ratio and foreign output growth which were included in the first specification of both FPI and FII were found to be insignificant.

The granger causality tests based on the error correction model of the final ARDL specification shows that all the variables significantly granger cause FPI and FII flows to India. This means that they help to improve the predictive performance of these flows (Table 6& 7).

(c) American/Global Depository Receipts (ADR/GDRs)

It has been noted earlier that ADR/GDRs help the foreign investor to invest in the shares of a company in an emerging economy like India, without involving the complication of conversion of foreign currency into domestic currency (rupees). In case, the investment by foreign investor is done directly in

the domestic (Indian) companies through the financial markets, then the foreign investor has to monitor not only the changes in the price of assets in which he decides to invest, but also the changes in exchange rate as the process involves conversion of foreign currency into domestic (Indian) currency.

But this does not imply that investment through ADR/GDRs is independent of exchange rate changes. It is only the case that the burden of currency risk is not borne by the foreign investor, who purchases the receipts. For instance, when ADR/ GDRs are issued, then each receipt is backed by a certain number of shares of the domestic (Indian) company. Once this ratio between ADR/GDR shares and domestic shares is decided, the price of each receipt (ADR/GDR) is decided. The pricing decision is based on the price of the shares of the company in the domestic (Indian) market, and the corresponding exchange rate between the two economies.

Now if the price of the shares of the company in the domestic (Indian) market increases, then the price of ADR/GDR will also increase so that the zero arbitrage condition holds. In case the domestic currency (rupee) is getting devalued, the price of ADR/GDR being issued will be higher.

The implication of changes in the exchange rate will be similar in the case when dividends are issued by the domestic (Indian) company. The domestic company will issue dividends in terms of domestic currency (rupees) but this dividend will be received by the foreign investor only after conversion into foreign currency. In this case again, a devaluation in the domestic currency vis-à-vis the foreign currency would mean a decline in the amount of dividend received by the foreign investor in terms of foreign currency.

The empirical results for the investment flows received by India on account of ADR/GDRs support both the above arguments. The estimation of the long run coefficients (Table 8) show that the coefficient on domestic stock market returns and exchange rate is positive and significant in all the specifications. This indicates that well performing domestic stock markets and an appreciation in the domestic currency encourages ADR/GDR flows received by India.

This is because improvements in the performance of shares of the company in the domestic stock market (which back the ADR/GDRs) lead to improved performance of ADR/GDRs, through arbitrage. Similarly for the reasons stated above an appreciating rupee would lead to better returns from investing in ADR/GDR and a higher value of dividends issued on ADR/GDR.

The estimated long run coefficients also show that an improvement in the foreign growth rates reduces the amount of ADR/GDR investment flows received by India. This supports the fact that improvement in economic activity of the foreign countries would imply improvement in corporate profits and hence better investment opportunities in the developed countries. Thus although increase in foreign growth rate should mean that overall more funds are available with foreign investors for investment, and thus a higher probability of greater investment in Indian securities, however this phenomenon gets dominated by a diversion of these flows to investment in the securities of other countries. Here there could be a possibility of home bias in the pattern of foreign investors. This means that even if more funds are available, the allocation would be towards the developed or home countries that present better investment opportunities.

The coefficient on domestic output growth is positive which means that an increase in the Indian growth increases the investment flows through ADR/GDR mechanism. This is because on one hand the foreign investor perceives an improvement in growth performance of India (i.e. the country to which the firm floating ADR/GDR belongs) as an indicator that the returns on the instrument will be promising in future because of the expansion in the economic activity of the country. On the other hand, more importantly, a higher growth rate also means an increase in the requirement of capital by Indian firms, which is met by greater issuance of ADR/GDRs by Indian firms.

The emerging market equity performance, reserves to import ratio, interest rate differential, foreign output growth and volatility in exchange rate were included initially in the ADR/GDR specification but are found to be insignificant in determining investment flows through ADR/GDR to India.

The granger causality tests based on the error correction model shows that domestic stock market performance, exchange rate, domestic and foreign output growth significantly granger cause ADR/GDR flows to India. This means that they help to improve the predictive performance of these flows (Table 9).

7. CONCLUSION

In the recent past when the global macroeconomic scenario displayed greater uncertainties, investment flows across the world experienced large scale movements. India being an economy that has experienced greater integration with the world economy overtime did not remain insulated from this phenomenon. Investment flows to India and particularly portfolio flows experienced huge volatility. One of the growing concerns among the policymakers was to control the adverse impact of huge reversal of portfolio flows and more importantly manage the increasing volatility in portfolio flows.

This study analyses the determinants of aggregate portfolio flows to India as well its disaggregated component i.e. FII and ADR/GDR flows. The results from the econometric analysis indicate that the common factors that drive both FII and ADR/GDR flows are domestic stock market performance, exchange rate and domestic output growth. In addition to these, emerging market equity performance, interest rate differential and volatility in exchange rate are found to be important in driving FII flows while foreign output growth drives ADR/GDR flows. Since FIIs have been the most dominant component of aggregate portfolio flows, therefore as expected, the results of aggregate portfolio flows are similar to FII flows.

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Figure

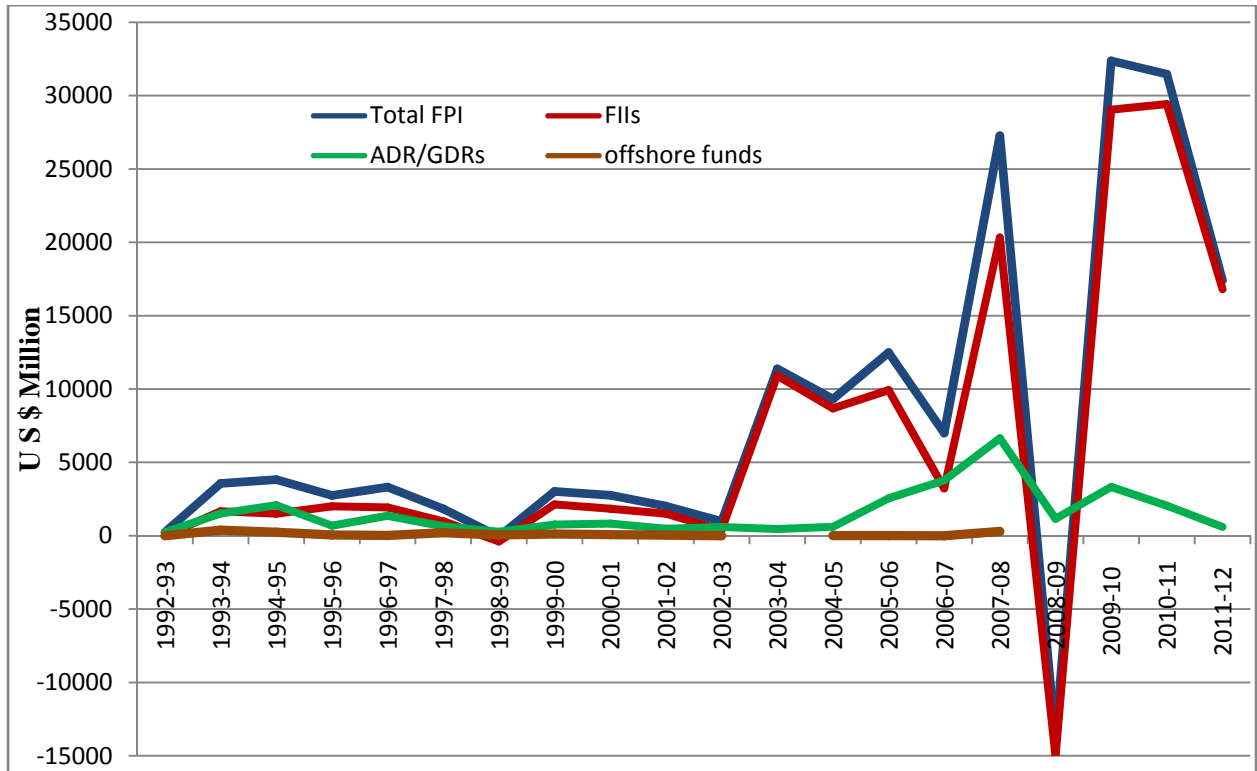


Figure 1: Trends in Components of FPI flows

Tables

Table 1. ARDL Bounds Testing Approach for Cointegration
 Dependant Variable: Net Foreign Portfolio Investment flows (US\$ Billion)
 1995M10 – 2011M10

H ₀ :No long run relationship					
H ₁ :There exists long run relationship					
Model I					
<i>FPI = f(S, e, R/M, MSCI, i-i*, y, y*, Vol(e), Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(9,146)=3.8837[.000]	2.272	3.447	1.956	3.085	Reject H ₀
Model II					
<i>FPI = f(S, e, MSCI, i-i*, y, Vol(e), Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(7,156)=5.2065[.000]	2.476	3.646	2.141	3.250	Reject H ₀

Table 2. ARDL Bounds Testing Approach for Cointegration
 Dependant Variable: Net Foreign Institutional Investment flows (US\$ Billion)
 1995M10 – 2011M10

H ₀ :No long run relationship					
H ₁ :There exists long run relationship					
Model I					
<i>FII = f(S, e, R/M, MSCI, i-i*, y, y*, Vol(e), Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(9,146)=4.0143[.000]	2.272	3.447	1.956	3.085	Reject H ₀
Model II					
<i>FII = f(S, e, MSCI, i-i*, y, Vol(e), Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(7,156)=5.4218[.000]	2.476	3.646	2.141	3.250	Reject H ₀

Table 3. ARDL Bounds Testing Approach for Cointegration
 Dependant Variable: Net American/Global Depository Receipt Inflows (US\$ Billion)
 1995M10 – 2011M10

H ₀ :No long run relationship					
H ₁ :There exists long run relationship					
Model I					
<i>ADR = f(S, e, R/M, MSCI, i-i*, y, y*, Vol(e), Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(9,146)=5.2614[.000]	2.272	3.447	1.956	3.085	Reject H ₀
Model II					
<i>ADR = f(S, e, MSCI, i-i*, y, y*, Vol(e), Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(8,151)=6.1459[.000]	2.365	3.553	2.035	3.153	Reject H ₀
Model III					
<i>ADR = f(S, e, i-i*, y, y*, Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(6,161)=9.9744[.000]	2.649	3.805	2.262	3.367	Reject H ₀
Model IV					
<i>ADR = f(S, e, y, y*, Dummy)</i>					
F-Statistic	Critical F Value (95%)		Critical F Value (90%)		Result
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	
F(5,166)=12.8455[.000]	2.850	4.049	2.425	3.574	Reject H ₀

Table 4. Long Run Coefficients

Dependant Variable: Net Foreign Portfolio Inflows (US \$ Billion)
1995M10 to 2011M10

Variable	Coefficient	
	[p-value]	
	Model I ARDL(4,1,2,1,1,1,2,1,1)	Model II ARDL(4,1,2,1,1,2,1)
BSE	.000376[.003]	.000368[.002]
NEERE	.175010[.014]	.183200[.004]
MSCI	-.005268[.030]	-.005096[.021]
RMRATIO	-.014402[.824]	
i-i*	.126600[.165]	.136060[.110]
y	.123040[.024]	.119040[.010]
y*	.003277[.944]	
Volneere (GARCH)	-.376200[.046]	-.378680[.036]
Crisis dummy	Yes	Yes
Intercept	Yes	Yes

*, **, *** indicates significance at 10, 5 and 1 % respectively

Table 5. Long Run Coefficients

Dependant Variable: Net Foreign Institutional Investment Inflows (US \$ Billion)
1995M10 to 2011M10

Variable	Coefficient [p-value]	
	Model I ARDL(4,1,2,1,1,1,2,1,1)	Model II ARDL(4,1,2,1,1,2,2)
BSE	.000359[.003]	.000339[.003]
NEERE	.114800[.091]	.135110[.026]
MSCI	-.005373[.021]	-.004899[.022]
RMRATIO	-.011275[.854]	
i-i*	.124220[.150]	.142400[.080]
y	.095046[.060]	.101090[.018]
y*	-.016918[.689]	
Volneere (GARCH)	-.312100[.088]	-.382370[.026]
Crisis dummy	Yes	Yes
Intercept	Yes	Yes

*, **, *** indicates significance at 10, 5 and 1 % respectively

Table 6. Granger Causality Test from ECM

Net Foreign Portfolio Inflows

Null Hypothesis	Lag	Chi-Square Statistic [p-value]	Conclusion
BSE Sensex does not Granger cause FPI	1	106.5756[.000]	Reject H ₀
Exchange Rate does not Granger cause FPI	2	68.7153[.000]	Reject H ₀
MSCI does not Granger cause FPI	1	56.7942[.000]	Reject H ₀
Interest differential does not Granger cause FPI	1	56.7825[.000]	Reject H ₀
Domestic Output Growth does not Granger cause FPI	2	55.7905[.000]	Reject H ₀
Volatility in Exchange Rate does not Granger cause FPI	1	77.4479[.000]	Reject H ₀

Table 7. Granger Causality Test from ECM
Net Foreign Institutional Investment Inflows

Null Hypothesis	Lag	Chi-Square Statistic [p-value]	Conclusion
BSE Sensex does not Granger cause FII	1	106.1532[.000]	Reject H ₀
Exchange Rate does not Granger cause FII	2	61.1412[.000]	Reject H ₀
MSCI does not Granger cause FII	1	49.9603[.000]	Reject H ₀
Interest differential does not Granger cause FII	1	48.6887[.000]	Reject H ₀
Domestic Output Growth does not Granger cause FII	2	48.9052[.000]	Reject H ₀
Volatility in Exchange Rate does not Granger cause FII	2	75.9569[.000]	Reject H ₀

Table 8. Long Run Coefficients
Dependant Variable: Net American/Global Depository Receipt Inflows (US \$ Billion)
1995M10 to 2011M10

Variable	Coefficient [p-value]			
	Model I ARDL(2,2,4,0,4,4,2,1,0)	Model II ARDL(2,2,4,0,4,2,2,0)	Model III ARDL(2,2,4,4,2,2)	Model IV ARDL(2,2,4,2,2)
BSE	.000038[.098]	.000034[.100]	.000020[.000]	.000018[.000]
NEERE	.045080[.001]	.041924[.001]	.036956[.001]	.035407[.000]
MSCI	-.000325[.434]	-.000257[.502]		
RMRATIO	.002307[.839]			
i-i*	.006417[.714]	.003399[.832]	.000432[.977]	
y	.009807[.291]	.011318[.205]	.011000[.207]	.010896[.198]
y*	-.017264[.018]	-.016460[.016]	-.016526[.012]	-.016884[.007]
Volneere (GARCH)	-.008736[.707]	-.006350[.772]		
Dummy	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes

*, **, *** indicates significance at 10, 5 and 1 % respectively

Table 9. Granger Causality Test from ECM
 Net American/Global Depository Receipt Inflows

Null Hypothesis	Lag	Chi-Square Statistic [p-value]	Conclusion
BSE Sensex does not Granger cause ADR	2	87.1700[.000]	Reject H ₀
Exchange Rate does not Granger cause ADR	4	108.0586[.000]	Reject H ₀
Domestic Output Growth does not Granger cause ADR	2	88.8691[.000]	Reject H ₀
Foreign Output Growth does not Granger cause ADR	2	89.3956[.000]	Reject H ₀