A Study on Relationship Between FDI Flows and Real Exchange Rates in India

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Abstract

This paper analyzes the relationship between the net capital flow components and other fundamentals and the real exchange rate (RER) in India consequent for the liberalization of the capital account in 1990s for the period 1996-1997 to 2012-13 using the Autoregressive Distributed Lag approach to co integration. The estimation includes net capital flow components: foreign direct investment (FDI) flows, foreign portfolio flows, debt creating flows and other capital flows, government consumption expenditure, change in foreign exchange reserves, and current account balance as explanatory variables for investigating the relationship with the RER. The empirical results indicate that FDI flows are not significantly associated with the real appreciation but portfolio flows and debt creating flows are associated with real appreciation in a statistically significant manner. Government consumption expenditure is not found to be significantly associated with real appreciation. Current Account Balance has a positive and statistically significant association with RER indicating that the outflows on account of current account deficits have been associated with depreciation of RER or prevention of the appreciation on account of capital flows. The change in foreign exchange reserves has a negative and statistically significant association with RER indicating that the accumulation of reserves by the Reserve Bank of India in the face of increasing net capital flows has prevented the appreciation of RER and mitigated their adverse consequences on the competitiveness of the Indian economy.

Keywords: Real Exchange Rate, Foreign Portfolio Flows, Debt Creating Flows, Foreign Exchange Reserves, Co-integration

Introduction

India has witnessed a large trend increase in cross border flows since the introduction of the economic reforms process in the external sector in early 1990s following the Balance of Payment (BoP) crisis. Net capital flows to India increased from US$ 7.1 billion in 1990-1991 to US$ 8.85 billion in 2000-2001 and further to US$ 89.30 billion during 2012-2013. Expressed in percentage of Gross Domestic Product (GDP), the net capital flow increased from 2.2% of GDP in 1990-1991 to around 3.63 % in 2010-2011 and further to 4.84 % in 2012-2013. The increase in net capital flows has been accompanied with a significant increase in its components comprising of foreign direct Investment (FDI) flows, Portfolio flows and debt creating flows in the form of banking capital, external commercial borrowings of corporate entities and Non-resident Indian (NRI) deposits. The upswing in the capital mobility to India and other emerging markets suffered a brief setback in the global financial crisis in 2008. But after ebbing of the crisis, capital flows to India and other emerging market economies rebounded in late 2009 and 2010.

While the relatively high interest rate differentials between India and rest of the world have played an important role in pushing foreign capital after the opening of financial markets in 1990s, internal pull factors such as the significant institutional, regulatory, and policy changes following the balance of payment crisis in 1991 (such as switch to flexible exchange rate regime, full current account convertibility, dismantling of trade restrictions, consolidation of external debt, liberalization of investment policies relating to FDI, portfolio flows, etc.) have been

equally important in attracting these flows to India (Mohan, 2008). Domestic macroeconomic conditions and institutional framework factors such as strong macroeconomic fundamentals, a resilient financial sector, sophistication of the domestic equity market, the improved performance of the corporate sector, increase in investment opportunities, and attractive valuations also provided confidence to the foreign investors.

The concept of real exchange rate (RER) has been most widely used to analyze the impact of capital flows on the economies of the developing countries. The RER is an important measure of the competitiveness of an economy as it is associated with export growth.

The main objective of this research is to comprehensively analyze the relationship between the disaggregated net capital flow components: FDI, portfolio flows, debt creating flows and RER along with other determinants of RER. FDI, portfolio flows, debt creating flows and other capital flows, government consumption expenditure, current account balance, and change in foreign exchange reserves are used as explanatory variables and the real effective exchange rate (REER) index as a dependent variable. The estimations are conducted on the quarterly data on Indian economy from 1996–1997 to 2012–2013. The autoregressive distributed lag (ARDL) approach to cointegration is used to examine the relationship between capital flow and other macroeconomic fundamentals and the RER. This estimation procedure has the advantage that it allows for a mixture of explanatory variables which are integrated of different order and at the same time it provides consistent estimates for small samples.

The most significant findings of the research are that amongst the components of net capital flows, foreign direct investment flows are not found to be significantly associated with the RER appreciation but portfolio flows and debt creating flows are found to be associated with RER appreciation in a statistically significant manner. Government consumption expenditure is not found to be significantly associated with real appreciation thereby limiting the role of fiscal policy in managing capital flows.

The rest of this paper is organized as follows. Section 2 traces the trends of net capital flow components since the onset of liberalization. Section 3 attempts a review of the theoretical and empirical literature on the impact of capital flows on the domestic economy. Section 4 describes the research methodology and Section 5 presents the datasets used for analysis. Section 6 reports the results of the econometric analysis of the relation between RER and net capital flow components and other determinants and analyzes them and Section 7 draws conclusions.

The Trend and Magnitude of Capital Flow Components to India:

FDI: There has been a significant increase in the magnitude of (net) FDI inflows to India since the opening up in the early 1990s. By 2000 most sectors were opened to up 100% foreign ownership. Figure 1 that traces the FDI flows to India from 1990-91 onwards, indicates a particularly strong growth in the recent five years. As a consequence of the easing of capital controls and growing investor confidence, FDI flows to India have risen from US$ 0.107 billion in 1990-1991 to US$ 3.27 billion in 2000-2001 and US$ 19.95 billion in 2012-2013

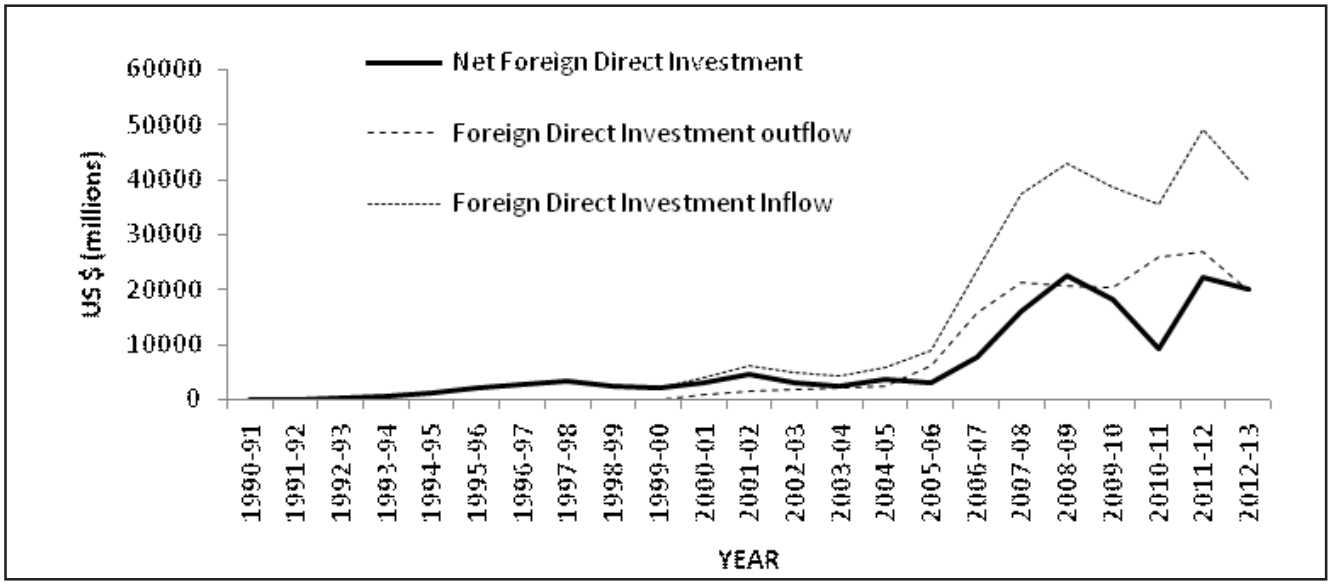

Figure 1: Foreign Direct Investment to India

(Source of Data: Reserve Bank of India Handbook of Statistics [RBI, 2014])

As a share of GDP, the FDI flows increased from 0.03 % of GDP in1990-1991 to 0.69 % of GDP in 2000-2001 and thereafter to 1.08 % of GDP in 2012-2013. Even though FDI investors are permitted to repatriate capital, so far in the Indian experience, the reverse flow of FDI capital has been miniscule. Consequently, FDI flows into India have been by and large a one way process of capital coming into the country. Most of the FDI flows into India have been attracted to the service sector. This is in contrast to dominance of manufacturing in FDI to many EMEs.

This is indicative of the service lead growth of the Indian economy and its comparative advantage in the international trade in services (Mohan, 2008). Within the service sector, financing, insurance, real estate and business sector witnessed a large increase in their share in FDI flows to India between 2000-2001 and 2012-2013. Computer hardware and software services also attracted significant FDI. The rise in FDI inflows to India in the recent years has been accompanied by a significant leap in outflows on account of overseas investment by Indian corporate.

Foreign Portfolio Investment Flows: The portfolio flows to India have also registered a sharp growth since the opening up through the Foreign Institutional Investment framework from the early 1990s. Figure 2 indicates the trend of (net) portfolio flows to India since 1990-1991.

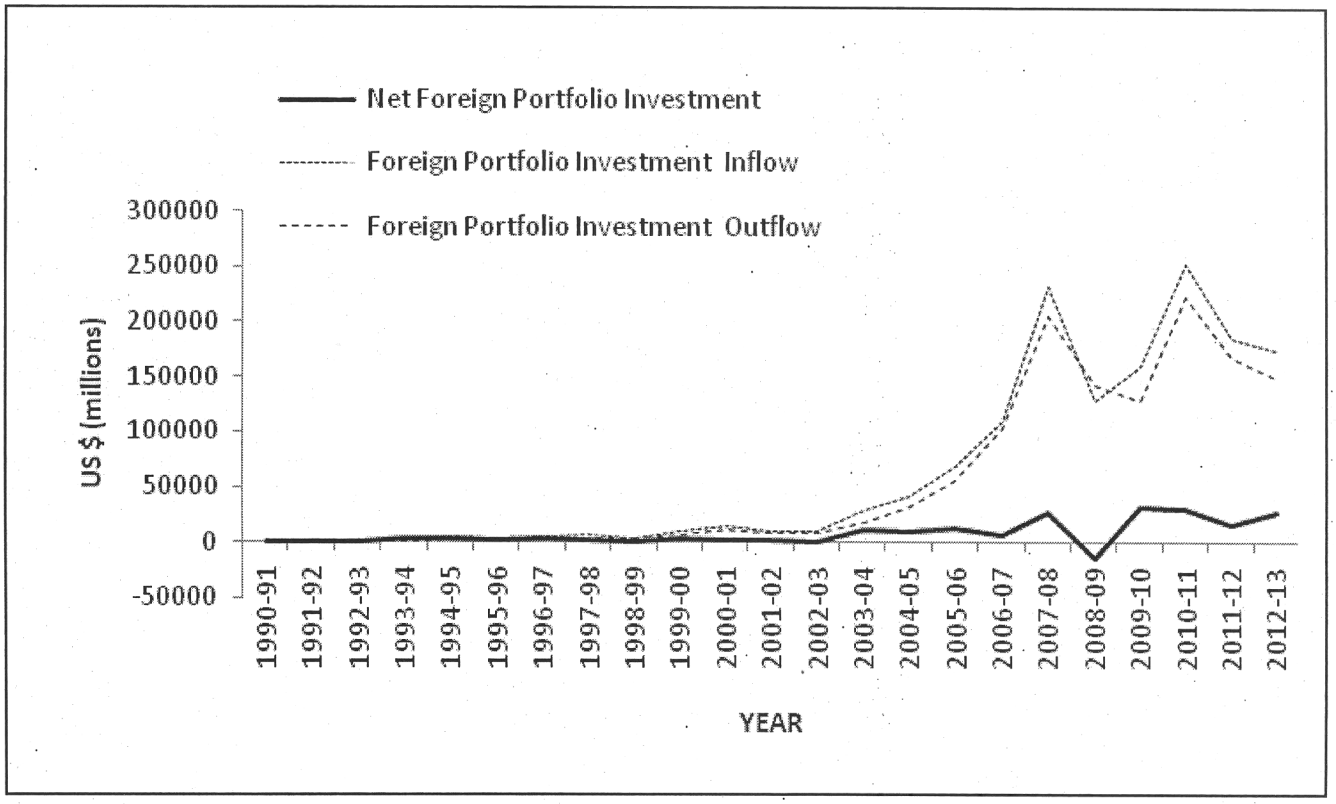

Figure 2: Foreign Portfolio Flows to India.

(Source of Data: Reserve Bank of India Handbook of Statistics [RBI, 2014])

The portfolio flows have registered a growth from US $ 0.006 billion in 1990-1991 to US $ 2.6 billion in 2000-2001 and further to US $ 26.9 billion in 2012-2013. As a share of GDP, the net portfolio flows have grown from 0.54 % of GDP in 2000-2001 to 1.46 % of GDP in 2012-2013. India's share in portfolio flows to emerging markets and developing countries has expanded significantly during this period. The portfolio flows in India have dominated FDI flows during the various periods of time. This is in contrast with what has been observed in most developing and emerging market economies where foreign capital was dominated by FDI flows after opening up of the capital account. In a way, this observation is indicative of the substantial changes in the global financial markets by the 1990s with portfolio capital flows registering a sharp rise (Kohli, 2001). Another reason for tilting the composition in favour of portfolio flows is that foreign portfolio investments in India through financial market route was much faster and simpler as compared to FDI where procedures remained complicated and discretionary. Portfolio investments exhibit substantial inbound and outbound flows due to the de facto convertibility granted to these flows. However, unlike FDI flows that have exhibited steady upwards trend, a remarkable feature of the portfolio flows has been that over the years they have been more volatile depending on the domestic and international market sentiments.

Debt Creating Flows: These mainly comprise of the Loans, Banking Capital and Rupee Debt Service. Loans mainly comprise of External Assistance, Commercial Borrowings (Medium Term and Long term), and Short Term Credits to India.

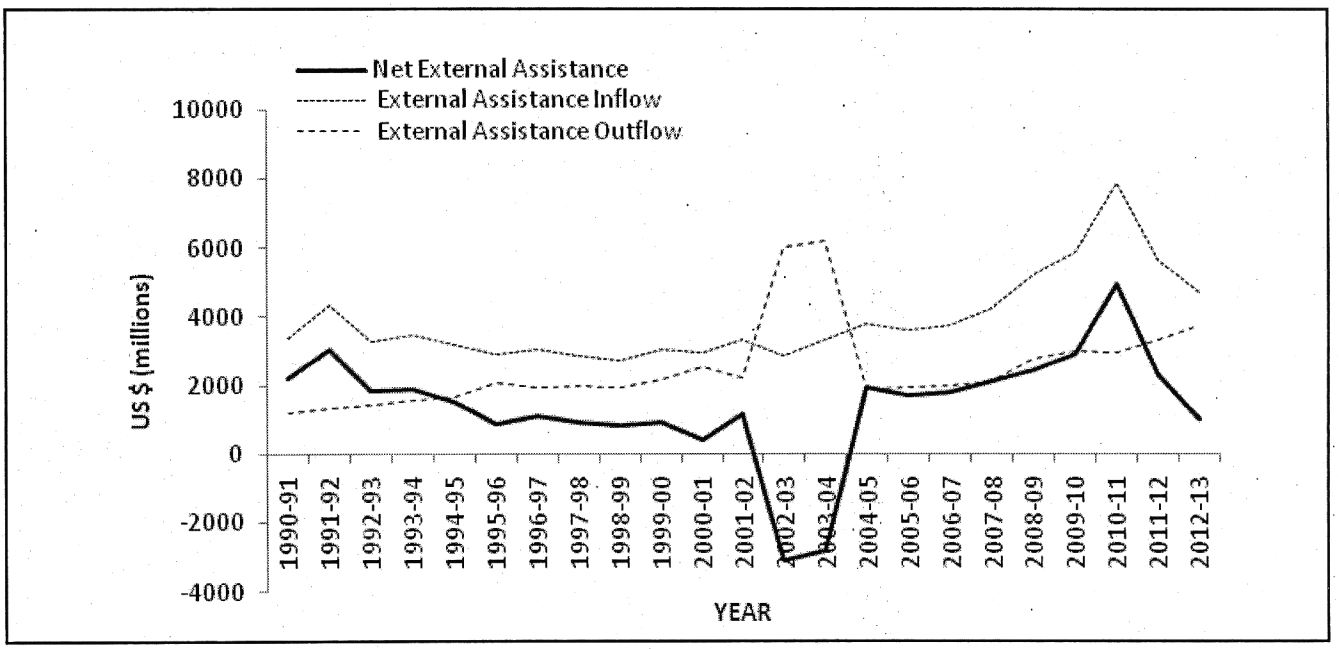

Figure 3: External Assistance

(Source of Data: Reserve Bank of India Handbook of Statistics [RBI, 2014])

External Assistance consists of debt-creating external aid flows from bilateral and multilateral sources. Up to 1970s external assistance used to be the major source of external financing, but they declined significantly thereafter. The net external assistance flow which stood at US $ 2.20 billion in 1990-1991 declined to US$ 0.410 billion in 2000-2001 and US $ 0.982 billion in 2012-2013. Their share in India's total net capital flows dwindled from 31.2% in 1990-1991 to 5% in 2000-2001 and further to 1 % in 2012-2013 and they have been replaced by private capital flows. In the recent years there has been a significant outflow of external assistance that India has started extending to other developing countries in the form of grants and soft loans for technical cooperation, training and infrastructure development. In 2012-2013 net flows of external assistance by India stood at US$ 286 million. Figure 3 indicates the trend of net flows on account of External Assistance.

Commercial Borrowings relate to the borrowing abroad by Indian corporates in the form of foreign currency denominated loans or bond issues abroad. With the decline in aid flows in the late 1970s and increase in external financing requirements to meet the BoP obligations, commercial borrowings from international capital markets were allowed. Commercial Borrowings exhibited a decline in early 1990s in the wake of BoP crisis. Even though commercial flows resumed subsequently, their demand in late 1990s and early 2000 remained low on account of global economic slowdown. Figure 4 indicates the trend of net flows on account of Commercial Borrowings. Driven by high domestic interest rates, robust growth expectations, combined with greater risk appetite of global investors for emerging markets bonds and loans, the net flows from Commercial Borrowings, increased significantly from US $ 4.3 billion in 2000-2001 to US $ 8.48 billion in 2012-2013.

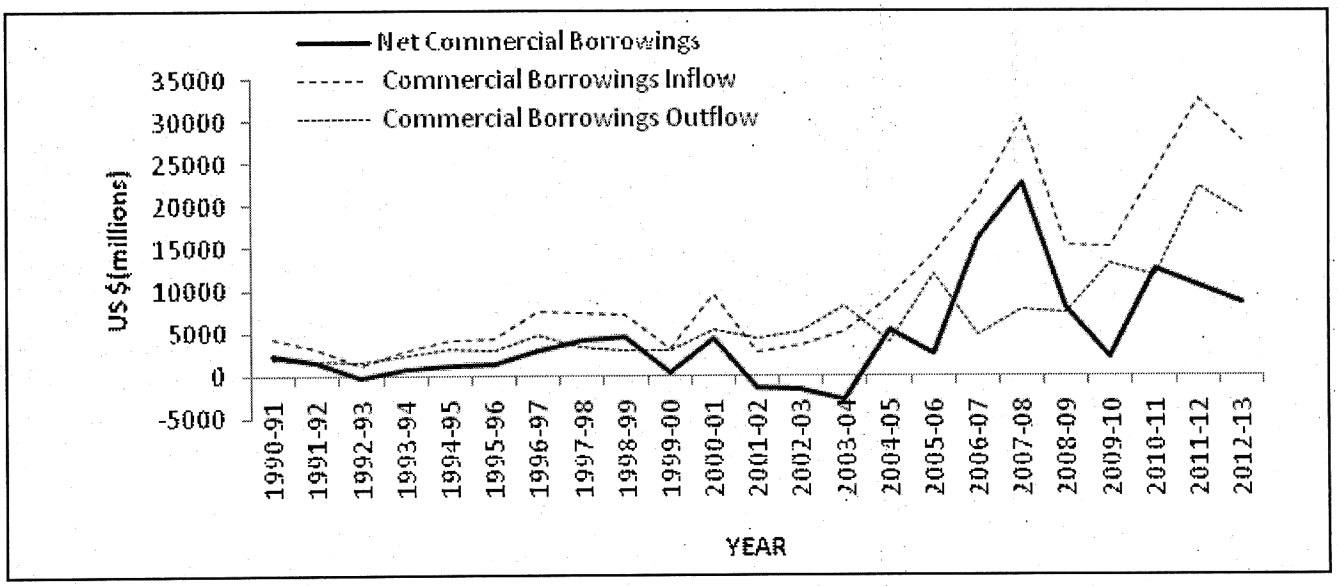

Figure 4: Commercial Borrowings

(Source of Data: Reserve Bank of India Handbook of Statistics [RBI, 2014])

An important component of the Banking Capital flows is the NRI deposits. These constitute borrowings by Indian banks abroad in the form of bank deposits, both rupees denominated and foreign currency denominated, from NRIs/Overseas corporate bodies. The interest rates on these deposits are set by Reserve Bank of India (RBI). While NRI deposits were a generally stable source of support to India's foreign exchange requirements in the wake of decline of external assistance flows in the 1980s, but the external payment crisis in 1990-91 demonstrated the vulnerability associated with these deposits due to drastic change in expectations in times of difficulty (Mohan, 2008). Since the 1990s the interest rates on these deposits have been aligned to international rates. However, their interest rates and maturity requirements are changed by the RBI from time to time, in order to modulate these flows in accordance with the overall macroeconomic management requirements. Fig 6 traces the Net flows on account of NRI deposits from 1990-91 onwards.

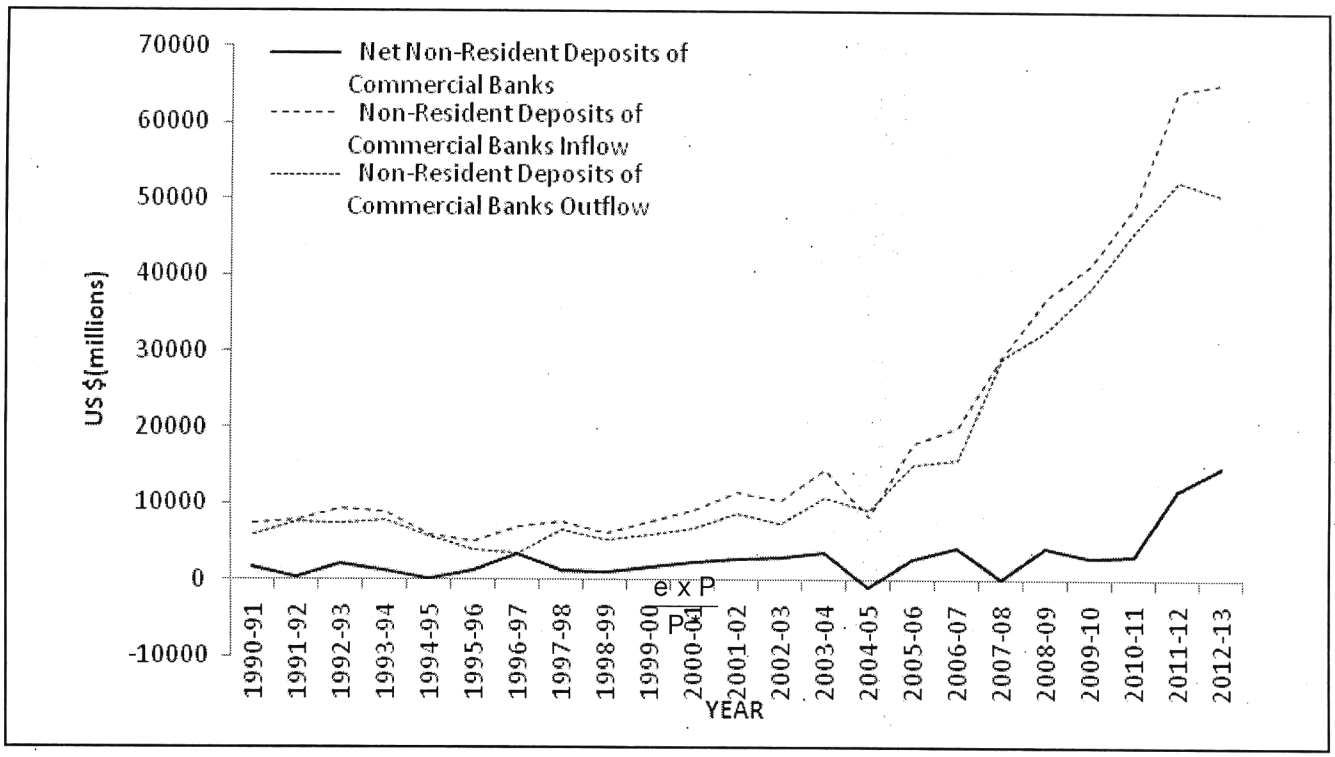

Figure 5: NRI Deposits

(Source of Data: Reserve Bank of India Handbook of Statistics [RBI, 2014])

Literature Review

The concept of RER has been most widely used to analyze the impact of capital flows on the economies of the developing countries. The impact of the capital inflows on the domestic economy which is mainly captured through the appreciation of RER is referred to as the "the transfer problem". The RER is an important measure of the competitiveness of an economy as it is associated with export growth. RER is the relative price of the domestic goods in terms of foreign goods (eg US pizza per Indian Pizza)

$$RER = \frac{e \times P}{P^*}$$

where e = nominal exchange rate, the relative price of domestic currency in terms of foreign currency (e.g. dollar per rupee)

P = Overall price level in domestic country.

P^* = Overall price level in foreign country.

The seminal works of Salter (1959), Swan (1960) Corden (1960), and Dornbusch (1974) provide the theoretical framework to draw inferences on the incidence of capital flows on the RER in emerging market economies. In theory a surge in capital inflows in excess of domestic absorption capacity is associated with an increase in expenditure and an appreciation of the RER. The effects of capital inflows on appreciation of RER can be derived from standard open economy models, such as the intertemporal model of consumption and investment in an open economy with capital mobility in the tradition of Irving Fischer (Calvo, Leiderman, & Reinhart, 1996). The theoretical models assume an economy with two goods—traded and nontraded—and a representative consumer who maximizes utility by choosing the consumption of the two goods over time (Mejia, 1999). In these models, a decline in world interest rate induces income and substitution effects in the capital recipient country generating increase in consumption and investment and a decline in savings (which is the converse of higher consumption). Capital inflows generate higher domestic demand of both tradeables and nontradeables in the economy. The rise in demand for tradeables leads to rise in imports and a widening of the trade deficit. The tradeable goods are exogenously priced. The increase in demand of nontradeables, however, leads to an

increase in the relative price of nontradeables, which are more limited in supply than the traded goods, so that the domestic resources get diverted to their production. A higher relative price of the nontradeables corresponds to RER appreciation. The extent of real appreciation in the economy will depend largely on the intertemporal elasticity of aggregate demand and the income elasticity of demand and supply elasticity for nontradeable goods. The intertemporal elasticity will determine the extent of consumption smoothing and the distribution of expenditure increase through time. The elasticities for nontradeables will determine the extent to which the surge in capital flows will exercise pressure on the nontradeable prices. The appreciation of the RER is indicative of the "Dutch disease effects" (Corden & Neary, 1982) that illustrates the impact of natural resources booms or increase in capital flows on the competiveness of the export-oriented sectors and the import-competing sectors.

The effect of net capital flows on the RER can be different depending upon the composition of capital flows (Combes, Kinda, & Plane, 2011). In the financial account of BoP four distinctive types of capital flows usually appear, namely FDI, Portfolio investments, Debt Creating Flows and Other Capital. The impact on RER depends on the types of expenditure which each flow is tied to. In economies with supply constraints, capital flows associated with the higher consumption put more pressure on the relative prices of non-tradables, leading to an increase in their relative prices and consequently to RER appreciation. On the other hand, capital flows associated with higher investments, which have significant imported goods content are less likely to lead to RER appreciation. FDI flows could be related to investment in imported machinery and equipment, which do not suffer from constraints in domestic supply capacity and thus would have no effect on prices of domestic goods and consequently almost no appreciation effect on RER. In addition, the spillover effects of FDI may also improve local productive capacity through transfer of technology and managerial know how thereby reducing pressure on the RER (Javorick, 2004). FDI is also more stable as compared to portfolio investment and other investment flows such as bank lending. The effect of portfolio investment flows on the RER might be different. If portfolio investment flows are oriented towards the modernization of firms in recipient countries, which requires new machinery and new product lines, the impact might be similar to that of FDI. But if they are volatile investments for speculation that do not necessarily increase the production capacity in the economy then they would lead to a higher appreciation of RER as compared to FDI (Lartey, 2007). The same applies to other investment flows that can be either liabilities of the private or public sector of the economy. Their impact would be different if they are used to finance purchase of nontradeables, or tradeables or are used to finance exports production.

The behavior of RER in response to capital inflows and its components has been examined in several empirical studies. Among the literary works in the early 1990s that examine the relationship between capital flows and RERs, Calvo, Leiderman, and Reinhart (1993) found evidence that with the exception of Brazil, all countries in Latin America experienced real appreciation since January 1991 in the aftermath of the resurgence of capital inflows to Latin America in the early 1990s. Similar inferences were reported by Elbadawi and Soto (1994), who studied the impact of the four disaggregated components—short-term capital flows, long-term capital flows, portfolio investment, and FDI for the case of Chile and found that long-term capital flows and FDI have a significant appreciating effect on the equilibrium and RER, though the short-term capital flows and portfolio investments did not have any affect. Similar findings were reported by Edwards (1998) who found that increases in capital inflows had been associated with the RER appreciation, while decline in inflows were associated with RER depreciation for Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela for the period 1980 to 1997.

3.5 A number of studies in the literature examine the comparative experience of Asian and Latin American countries on the impact of capital flows on RERs. A prominent study on this issue was by Corboand Hernandez (1994), who reviewed and compared the experiences of Latin American Countries (Argentina, Chile, Colombia, and Mexico) and five East Asian Countries (Indonesia, Malaysia, the Philippines, the Republic of Korea, and Thailand) with capital flows and found that generally they would result in appreciation of the RER, a larger nontradeable sector, a smaller tradeable sector and a larger trade deficit. However, a similar study on macroeconomic effects of capital flows by Khan and Reinhart (1995) for the period 1984–1993 indicates that appreciation in real exchange has been less common in Asian countries as compared to Latin American countries. A similar mixed response of the RER behavior to the resurgence of capital inflows in Asian and Latin American countries is reported in the study by Calvo and colleagues (1996). Similar outcomes have also been reported in another comparative analysis of the experiences of the emerging market economies in Asia and Latin America on the nexus of RERs and capital inflows by Athukorala and Rajapatirana (2003). Their study reports that during the period 1985–2000, the degree of appreciation in RER associated with capital inflow is uniformly much higher in Latin American countries as compared to Asian economies, in spite of the fact that the latter experienced far greater foreign capital inflows relative to the size of the economy. A significant aspect of their study is that they found evidence that both the composition of capital flows and differences in the degree of response of RER to capital inflows matter in explaining these contrasting experiences. The evidence suggested that for all countries on an average one percent increase in other capital flows brings about a 0.56 % appreciation in RER, but by contrast FDI inflows are associated with depreciation rather than appreciation of the RER. The authors attribute the depreciation effect of FDI on RER on the hypothesis that FDI generally tends to have a more tradable bias compared to other types of capital

flows. Further, their analysis indicated that a given level of non-FDI capital flows led to a far greater degree of appreciation of RER in Latin America where the importance of these flows in total capital inflows is also far greater.

In another recent work, Bakardzhieva, Naceur and Kamar (2010), reported that an increase in net capital flow would lead to appreciation of RER and to the possible loss of competitiveness. Their analysis of the impact of different type of capital flows indicated that except FDI, other forms of capital flows i.e., debt, portfolio investments, aid have a significant positive impact on the RER. Their study reveals that FDI has no significant impact on the RER. Based on these findings they suggest that while FDI flows might lead to RER appreciation in the short run when the economy receives the flows, its impact is diluted over time as part of the flows start to leave the country in the form of imports of machinery and other capital goods. Besides, the increase in production induced by FDI can lead to downward pressure on prices and result in RER depreciation.

In another important recent study Combes, Kinda and Plane (2011) analyzed the impact of capital inflows and their composition on the RER. Their results show that aggregated capital inflows as well as public and private flows are associated with RER appreciation. Among private flows, portfolio investment has the highest appreciation effect – almost seven times that of FDI or bank loans. The authors suggest that the portfolio investment flows as compared to other private flows are more volatile and speculative—something generally associated with macroeconomic instability and no improvement of productivity. They further argued that FDI is the most stable flow than portfolio investment and increases productive capacity through transfers of technology and know-how. It is primarily for investment purposes and can lead to import of new machinery and equipment, which has limited impact on the RER. The appreciation of the RER on account of loans from commercial bank is limited as in the case of FDI. The authors suggest that bank loans can be directed to some extent to investment financing like FDI thereby improving productive capacity with a similar inflation potential as that of FDI.

In a more recent study Jongwanich and Kohpaiboon (2013) examined the impact of capital flows on RERs in emerging Asian Countries for the period 2000-2009 by using a dynamic panel-data model and found evidence that composition of capital flows matters in determining the impact of these flows on RERs. They found that portfolio investments bring in a faster speed of RER appreciation than FDI, though the magnitude of appreciation by different types of capital flows is close to each other. The evidence further indicates that capital outflows bring about a greater degree of exchange rate adjustment than capital inflows.

Among the literatures on the impact of capital flows on RERs in the Indian economy is the work by Kohli (2001), who shows that the RER appreciates in response to capital flows and that during the capital surge in 1992–1995 and 1996–1997, the RER appreciated by 10.7% and 14%, respectively, over its March 1993 level. Another empirical study by Dua and Sen (2006) that examined the relationship between the RER, the level of capital flows, volatility of capital flows, fiscal and monetary policy indicators, and current account surplus of the Indian economy using quarterly data for the period 1993Q2–2004Q1 indicates that the RER is positively related to NCFs and their volatility.

Another recent study for India by Sohrabji (2011) estimated the relationship with RER as dependent variable and terms of trade, openness, investment, capital flows, government spending, and technological progress as explanatory variables using the Johansen cointegration test and error correction model with annual data from 1975 to 2006. The results indicate that increased capital flows are associated with an appreciating RER. In addition, capital flows are found to be an important contributor to RER misalignment, which explains the overvaluation of the rupee associated with increased foreign investment in recent years.

Another study by Biswas and Dasgupta (2012) that examined the impact of capital inflows in India on the RERs using quarterly data for the period 1994–1995Q1 to 2009–2010Q4 using the Johansen multivariate cointegration test arrived at the findings that FDI and workers' remittances affect RER positively. The impulse response analysis results indicated that shocks to FDI has a long-term positive impact on the RERs though it is slightly negative in some of the ending periods. However, a very recent study by Gaiha, Padhi, and Ramanathan (2014) that explored the relationship between capital flows and RERs in India for the period 2005–2012 using ordinary least squares estimation, has reported findings that FDI flows have no significant impact on change in RER. However, portfolio flows and debt flows have a significant appreciation impact on the change in RERs.

The cross country studies on the effects of net capital flows on macroeconomic aggregates present mixed results largely due to difference in foreign exchange regimes, internal factors and policy responses of these countries. Further, different types of capital flows have different effects on the real exchange rate because they act through different channels. In a recent study Goel, and Saradhi (2014) have analyzed the relationship between the net capital flows and other fundamentals and the in India for the period 1996–1997 to 2012–2013 using the ARDL approach to cointegration and reported findings that net capital flows in India are positively associated with RER appreciation, and the association is statistically significant. But no systematic study is available on the relationship between the RER and different types of flows (FDI or portfolio or debt flows etc) in India, especially for the more recent period. This calls for further research on the subject.

Research Method

Conceptual Model and Selection of Model Variables

In this study following variables are used in order to investigate the relationship between the disaggregated

components of net capital flows and the RER in the Indian economy.

REER

In order to measure the RER, the REER index is included in the baseline model. REER index is the weighted geometric average of the bilateral nominal exchange rates of the home currency (Indian rupee, in this case) in terms of foreign currencies adjusted by the ratio of domestic prices to the foreign prices (RBI, 2005).

$$REER = \prod_{i=1}^{n}[(e/e_i)(P/P_i)]^{w_i} \quad (2)$$

where e = exchange rate of Indian rupee against a numeraire (i.e., the International Monetary Fund's special drawing rights [SDRs]) in indexed form,

e_i = exchange rate of foreign currency i against the numeraire (SDRs; i.e., SDRs per currency i) in indexed form,

w_i = weights attached to foreign currency/country i in the index, $\prod_{i=1}^{n} w_i = 1$,

P = India's wholesale price index,

P_i = consumer price index of country i (CPI_i), and

n = number of countries/currencies in the index other than India.

FDI, PORT, DEBTCF & OTHCAP

These are the main explanatory variable in the study and hence included in the model. In order to measure the volume of net capital flow components relative to the size of the economy, the ratio of the disaggregated components of capital flows into the Indian economy in the quarter and the quarterly GDP at market prices (at current prices) is used. FDI is the ratio of the net FDI flows in the quarter and the quarterly GDP at market prices (at current prices), PORT is the ratio of the net portfolio flows in the quarter and quarterly GDP at market prices (at current prices), DEBTCF is the ratio of the aggregate of net loans, banking capital, rupee debt service in the quarter and the quarterly GDP at market prices (at current prices) and OTHCAP is the ratio of net other capital in the quarter and quarterly GDP at market prices (at current prices).

GFCE

Government spending is an important fundamental determinant of RER, as it adds to the aggregate demand and impacts the price levels in the economy; it is, therefore, included in the model. In order to measure the size of public spending relative to the size of the economy, government final consumption expenditure (GFCE) in the quarter as proportion of the quarterly GDP at market prices (at current prices) is used in the analysis. As a sizeable portion of the government expenditure in India is devoted to imports of essential commodities, the association of GFCE with REER is expected to be ambiguous.

CAB

Current Account Balance has been included in the analysis as a sizeable portion of capital flows in India is used to finance the current account deficit. Capital flows to the extent of utilization for meeting the financing needs of the country are not expected to cause adverse macroeconomic consequences. It is the surplus capital flows over and above the financing requirements that have an adverse impact on the economy. CAB is in the current account balance in the quarter as a proportion of the quarterly GDP at market prices (at current prices). A more negative CAB is expected to be associated with deprecation of the RER.

CFER

Reserve Bank of India (RBI) maintains foreign exchange reserves in the form of SDRs, gold, foreign currency assets, and reserve tranche position. CFER which is ratio of change in foreign exchange reserves in the quarter as a proportion of the quarterly GDP at market prices (at current prices) is used as a proxy for capturing the effect on RER of the change in rupee value of the components of foreign exchange reserves, that is, SDRs, gold, foreign currency assets, and reserve tranche position held by the RBI, which is different from the increase/decrease in foreign reserves due to overall balance of payments. An increase in foreign exchange reserves, to the extent it is accompanied with prevention of increase in money supply (due to sterilization, etc.), is expected to lead to depreciation of the RER for the Indian economy. On the other hand, an increase in foreign exchange reserves accompanied with an increase in money supply is expected to lead to appreciation of the RER in the economy.

With this choice of variables, the functional relationship between RER and the explanatory variables is represented as follows:

$$REER_t = f\{FDI_t, PORT_t, DEBTCF_t, OTHCAP_t, GFCE_t, CAB_t, CFER_t\} \quad (3)$$

where t refers to time.

To estimate the relationship between the dependent variable (i.e., REER) and the components of the net capital flows, i.e., FDI, PORT, DEBTCF and OTCAP and other explanatory variables, the following log-linear specifications are used:

$$LNREER_t = C + \beta_1 FDI_t + {}_2 PORT_t + {}_3 DEBTCF_t + {}_4 OTHCAP_t + {}_5 GFCE_t + {}_6 CAB_t + {}_7 CFER_t + {}_t \quad (4)$$

Where ${}_t$ is a stochastic white noise at time t,

LNREER = natural log (REER),

Empirical Method

Time Series Analysis of Variables

Before estimating the model, the dependent and independent variables are separately subjected to unit

roots tests using the Augmented Dickey–Fuller (ADF) test (Dickey &Fuller, 1979) and Philips–Perron (PP) test (Philips & Perron, 1988) for testing the stationarity and order of integration. Usually, all variables are tested with an intercept, with and without a linear trend. The ADF framework does not provide a fully adequate test for the existence of unit roots in cases of uncertainty regarding the dynamic structure of the time series of the variable under study and where the error term may be nonwhite noise. In particular, the power of the ADF test is likely to be low where moving average terms are present or where the disturbances are heterogeneously distributed. In such circumstances, Philips and Perron have proposed further set of statistics using nonparametric adjustments that are modifications of the *t* statistics employed for the Dickey–Fuller test. The Philips and Perron tests can provide superior results, and the nonparametric adjustments of the PP test are likely to raise the power of the test.

Co-integration Analysis

In the econometric literature, different methodological approaches have been used to empirically analyze the long-run relationships and dynamic interactions between two or more time-series variables. The most widely used methods for estimating the cointegrating vector between a set of time series variables include the Engle and Granger (1987) two-step procedure and the maximum-likelihood approach (Johansen & Juselius, 1990). Both these methods require that all the variables under study are integrated of order one, I(1). This, in turn, requires that the variables are subjected to pretesting for ascertaining their orders of integration before including them in particular cointegrating regressions. This introduces a certain degree of uncertainty into the analysis. Apart from this, some of these test procedures have very low power and do not have good small sample properties. One of the relatively recent developments on univariate cointegration analysis is the ARDL approach to cointegration introduced by Pesaran and Shin (1999) and further extended by Pesaran, Shin, and Smith (2001). The main advantage of the ARDL method over the Johansen and Juselius (1990) approach is that it allows for a mix of I(1) and I(0) variables in the same cointegration equation. Another advantage is that the ARDL test is more efficient, and the estimates derived from it are relatively more robust in small sample sizes as compared to traditional Johansen–Juselius cointegration approach, which typically requires a large sample size for the results to be valid. In addition, the choice of ARDL bounds-testing procedure allows for both dependent and the independent variables to be introduced in the model with lags. This is a highly plausible feature because, conceptually, a change in the economic variables may not necessarily lead to an immediate change in another variable. In some cases, they may respond to the economic developments with a lag, and there is usually no reason to assume that all regressors should have the same lags. Because the ARDL approach draws on the unrestricted error correction model, it is likely to have better statistical properties than the traditional cointegration techniques. The ARDL approach is particularly applicable in the presence of the disequilibrium nature of the time series data stemming from the presence of possible structural breaks as happens with most economic variables. The ARDL analysis also provides estimates of the corresponding error correction model (ECM), which shows how the endogenous variable adjusts to the deviation from the long-run equilibrium.

In view of these considerations, the ARDL approach to cointegration, as suggested by Pesaran and colleagues (2001), is employed in this research in order to analyze the long-run relationship between REER and FDI, PORT, DEBTCF & OTHCAP, as well as other explanatory variables. An ARDL (p, q_1, q_2, . . . q_k) model has the following form (Pesaran & Pesaran, 2009):

$$\phi(L, p)y_t = \sum_{i=1}^{k} \beta_i (L, q_i)x_{it} + \gamma' z_t + \varepsilon_t$$

$$\phi(L, p) = 1 - \phi_1 L - \phi_2 L^2 - \ldots\ldots\ldots - \phi_p L^p$$

$$\beta_i (L, q_i) = \beta_{i0} + \beta_{i1} L + \ldots\ldots + \beta_{iqi} L^{qi},\ i = 1, 2 \ldots\ldots k \qquad (5)$$

where

y_t is the dependent variable,

x_{it}, i = 1, . . . , k are explanatory variables,

L is a lag operator such that $Ly_t = y_{t-1}$, and

z_t is an s x 1 vector of deterministic variables such as the intercept term, time trends, or seasonal dummies, or exogenous variables with fixed lags.

The ARDL procedure involves two stages. In the first stage the existence of the long-run relationship between the variables under investigation is tested by computing the F statistics for testing significance of the lagged levels of the variables in the error correction form of the ARDL model. Once the existence of long-run relationship is established, then in the second stage the long-run coefficients and the error correction model are estimated. Equation 5 is estimated by the ordinary least squares method for all possible values of p = 0, 1, 2, . . ., m (m is the maximum lag order), q_i = 0, 1, 2, . . ., m, i = 1, 2, . . ., k; namely a total of $(m+1)^{k+1}$ different ARDL models. All the models are estimated for the same sample period, namely $t = m+1, m+2, \ldots, n$. Thereafter, one of the $(m+1)^{k+1}$ estimated models is selected using one of the following four model selection criteria: the R^2 criterion, Akaike Information criterion (AIC), Schwarz Bayesian criterion (SBC), and the Hannan and Quinn criterion. Thereafter, the long-run coefficients and their asymptotic standard errors for the selected ARDL model are computed. The estimates of the ECM that corresponds to the selected ARDL model are also computed.

Data Sources

The dataset comprises the quarterly data for the Indian economy for the period 1996–1997Q1 to 2012–2013Q4. The REER index used in the study is the monthly trade-weighted 36 currency REER indices obtained from the

Handbook of Statistics published by the RBI (2014). The quarterly REER indices are obtained by averaging the monthly indices for the quarter.

In this study, FDI, PORT, DEBTCF (which in turn comprises of Loans, Net Banking Capital, and Net Rupee Debt Service), OTHCAP, GFCE, and CAB, are measured as ratios of their quarterly values to quarterly estimates of GDP at market prices (at current prices; base year 2004–2005). The CFER is measured as a ratio of the Change in foreign exchange reserves (in rupees) from the end of the previous quarter to the end of the present quarter to the quarterly estimates of GDP at market prices (at current prices; base year 2004–2005). The data for net capital flow components, current account balance and foreign exchange reserves is obtained from the *Handbook of Statistics* (RBI, 2014). The data for quarterly GDP at market prices (at current prices), and GFCE base year 2004–2005 are obtained from the National Account Statics of the Central Statistical Office, Ministry of Statistics, and Programme Implementation.

Results Estimation

Stationary Properties of Variables

For the quarterly data on variables for the period 1996–1997Q1 to 2012–2013Q4, the results of the ADF test and PP test are presented in the Table 1

Table 1: Results of Unit Root Tests

Series	Order	Exogenous	ADF test		PP test	
			t statistic	(*p* value)	*t* statistic	(*p* value)
LNREER	Level	Constant	–4.761667	(.0002)	–3.103267	(.0310)
		Constant and linear trend	–4.745895	(.0015)	–3.046587	(.1277)
FDI	Level	Constant	-5.014212	(.0001)	-4.961302	(.0001)
		Constant and linear trend	-5.387830	(.0002)	-5.300916	(.0002)
PORT	Level	Constant Constant and linear trend	-5.405416 -5.731200	(.0000) (.0001)	-5.439670 -5.676181	(.0000) (.0001)
DEBTCF	Level	Constant Constant and linear trend	-6.770273 -7.231928	(.0000) (.0000)	-6.868259 -7.256328	(.0000) (.0000)
OTHCAP	Level	Constant Constant and linear trend	-7.988167 -8.668519	(.0000) (.0000)	-7.986862 -8.896950	(.0000) (.0000)
GFCE	Level	Constant	–1.680792	(.4360)	–10.62818	(.0000)
		Constant and linear trend	–1.880807	(.6529)	–10.65427	(.0000)
	First difference	Constant	–21.29816	(.0001)	–37.03903	(.0001)
		Constant and linear trend	–21.10828	(.0001)	–36.90740	(.0001)
CAB	Level	Constant	–0.593625	(.8642)	–3.620344	(.0078)
		Constant and linear trend	–1.618830	(.7746)	–4.751141	(.0014)
	First difference	Constant	–9.726036	(.0000)	–17.17713	(.0000)
		Constant and linear trend	–9.823498	(.0000)	–19.38159	(.0001)
CFER	Level	Constant	–6.988502	(.0000)	–7.109852	(.0000)
		Constant and linear trend	–6.927756	(.0000)	–7.054127	(.0000)

Note. ADF = Augmented Dickey–Fuller; PP = Philips–Perron; LNREER = natural log of real effective exchange rate; GFCE = government final consumption expenditure; CAB = current account balance; CFER = change in foreign exchange reserves; FDI = net Foreign Direct Investment; PORT = net portfolio flows; DEBTCF = net debt creating flows; OTHCAP = net other capital flows.
Source: Author's calculations by EViews 5

The results of the unit root tests show that the null hypothesis of unit root is rejected for the variables LNREER, FDI, PORT, DEBTCF, OTHCAP, and CFER as per the test statistics for both the ADF and PP tests. Hence, these variables are stationary *I*(0) in the level. For the variables GFCE and CAB the ADF test statistic fail to reject the null hypothesis for unit root, but the PP test statistic indicates that the null hypothesis of unit root is rejected at even 1% level of significance. Both the ADF and PP tests for the first differences of these series indicate that null hypothesis of unit root is rejected for the first differences and that they are stationary.

Results of Co-integration Analysis

In the first stage, the existence of long-run co integration relationship for the variables is investigated by computing the *F* test statistic. Given the few observations available for estimation, the maximum lag order for the various variables in the model is set at two (m =2), and the estimation is carried out for the period 1996Q1–2012Q4. The computed *F* statistic for testing the joint null hypothesis that there exists no long-run relationship between the variables is $F = 3.7906[.002]$. The relevant critical value bounds for this test as computed by Pesaran, Shin, and Smith (1996) at the 95% level of is given by [2.272 – 3.447]. Because the *F* statistic exceeds the upper bound of the critical value band, the null hypothesis of no long-run relationship between the variables is rejected. This test result suggests that there exists a long-run relationship between LNREER, GFCE, FDI, PORT, OTHCAP, DEBTCF, CAB, and CFER.

Next, the ARDL model is estimated using the univariate ARDL cointegration test option of Microfit 4.0, with the maximum lag $m = 2$. Microfit estimates $(2+1)^{7+1} = 6{,}561$ models and presents the choice of the selection of the model with optimum number of lags of variables between different selection criteria. The ARDL model specifications selected based on Schwarz Bayesian Criteria (SBC) and Akaike Information Criterion (AIC) are ARDL(2,0,0,0,0,0,0,0) and ARDL(1,1,1,1,2,1,2,1) respectively. The ARDL estimates for these models are presented in the Tables 2 & 3 respectively.

Table 2: Autoregressive Distributed Lag Estimates of the ARDL (2,0,0,0,0,0,0,0) Selected Based on Schwarz Bayesian Criterion

Regressor	Coefficient	*SE*	*t* ratio	(Probability)
LNREER(-1)	1.0268	0.10453	9.8234	(.000)
LNREER(-2)	-0.20096	0.10126	-1.9847	(.052)
GFCE	-0.0017211	0.0011604	-1.4832	(.144)
FDI	0.12352	0.59407	0.20793	(.836)
PORT	0.62480	0.021407	2.9186	(.005)
DEBTCF	1.0300	0.20857	4.9385	(.000)
OTHCAP	0.030561	0.35908	0.085109	(.932)
CAB	0.72391	0.17515	4.1330	(.000)
CFER	-0.55469	0.13809	-4.0170	(.000)
C	0.82112	0.32550	2.5226	(.015)
R^2	0.81545	$\bar{R}^2$	0.78580	
SE of regression	0.019106	*F* statistic *f*(13,52)	27.4943	(.000)
M of dependent variable	4.5956	*SD* of dependent variable	0.041281	
Residual sum of squares	0.020442	Equation log-likelihood	172.9844	
AIC	162.9844	SBC	152.0361	
DW statistic	2.3234	Durbin's *h* statistic		

Note. Dependent variable is LNREER. *SE* = standard error; LNREER = natural log of real effective exchange rate; GFCE = government final consumption expenditure; FDI = net foreign direct investment flows; PORT = net portfolio flows; DEBTCF = net debt creating flows; OTHCAP = net other capital flows; CAB = current account balance; CFER = change in foreign exchange reserves; C = constant term; *M* = mean; AIC = Akaike Information criterion; *DW* = Durbin Watson; *SD* = standard deviation; SBC = Schwarz Bayesian criterion. Source: Author's calculations by Microfit (4.0).

Table 3: Autoregressive Distributed Lag Estimates of the ARDL(1,1,1,1,2,1,2,1) Selected Based on Akaike Information Criterion

Regressor	Coefficient	*SE*	*t* ratio	(Probability)
LNREER (-1)	0.84579	0.074321	11.3803	(.000)
GFCE	-0.1831E-4	0.0012373	-0.014801	(.988)
GFCE (-1)	0.0018557	0.0012959	1.4320	(.159)
FDI	0.14448	0.61803	0.23378	(.816)
FDI (-1)	1.0843	0.63250	1.7143	(.093)
PORT	061917	0.21640	2.8613	(.006)
PORT (-1)	0.60549	0.24908	2.4309	(.019)
DEBTCF	0.96219	0.22530	4.2706	(.000)
DEBTCF (-1)	0.53794	0.21326	2.5225	(.015)
DEBTCF (-2)	0.30632	0.15267	2.0064	(.050)
OTHCAP	-0.11882	0.36092	-0.32920	(.743)
OTHCAP (-1)	0.67974	0.40542	1.6766	(.100)
CAB	0.56588	0.21766	2.5999	(.012)
CAB (-1)	0.61554	0.23183	2.6551	(.011)
CAB (-2)	0.21045	0.15366	1.3696	(.177)
CFER	-0.64118	0.14015	-4.5751	(.000)
CFER (-1)	-0.42895	0.13394	-3.2026	(.002)
C	0.68285	0.34653	1.9706	(.055)
R^2	0.86154	$\bar{R}^2$	0.81251	
SE of regression	0.017875	*F* statistic *f*(13,52)	17.5694	(.000)
M of dependent variable	4.5956	*SD* of dependent variable	0.041281	
Residual sum of squares	0.015337	Equation log-likelihood	182.4666	
AIC	164.4666	SBC	144.7597	
DW statistic	2.0009	Durbin's *h* statistic	-0.0047451	(.996)

Note. Dependent variable is LNREER. *SE* = standard error; LNREER = natural log of real effective exchange rate; GFCE = government final consumption expenditure; FDI = net foreign direct investment flows; PORT = net portfolio flows; DEBTCF = net debt creating flows; OTHCAP = net other capital flows; CAB = current account balance; CFER = change in foreign exchange reserves; C = constant term; *M* = mean; AIC = Akaike Information criterion; *DW* = Durbin Watson; *SD* = standard deviation; SBC = Schwarz Bayesian criterion. Source: Author's calculations by Microfit (4.0).

In the second stage, the estimates of the long-run coefficients of the model are computed. Table 4 & 5 present the estimated long-run coefficients for the ARDL(2,0,0,0,0,0,0,0) and ARDL(1,1,1,1,2,1,2,1) specifications selected using the SBC and AIC criterion respectively.

Table 4: Estimated Long-Run Coefficients Using the ARDL(2,0,0,0,0,0,0,0) Model Selected Based on Schwarz Bayesian Criterion

Regressor	Coefficient	*SE*	*t* ratio	(Probability)
GFCE	-0.0098815	0.0072372	-1.3654	(.178)
FDI	0.070920	3.3836	0.20960	(.835)
PORT	3.5873	1.9734	1.8178	(.074)
DEBTCF	5.9138	2.7542	2.1472	(.036)
OTHCAP	0.17547	2.0551	0.085381	(.932)
CAB	4.1563	2.0220	2.0556	(.044)
CFER	-3.1848	1.6935	-1.8806	(.065)
C	4.7145	0.098941	47.6498	(.000)

Note. Dependent variable is LNREER. *SE* = standard error; LNREER = natural log of real effective exchange rate; GFCE = government final consumption expenditure; FDI = net foreign direct investment flows; PORT = net portfolio flows; DEBTCF = net debt creating flows; OTHCAP = net other capital flows; CAB = current account balance; CFER = change in foreign exchange reserves; C = constant term. Source: Author's calculations by Microfit (4.0).

Table 5: Estimated Long-Run Coefficients Using the ARDL(1,1,1,1,2,1,2,1) Model Selected Based on Akaike Information Criterion

Regressor	Coefficient	*SE*	*t* ratio	(Probability)
GFCE	0.011915	0.015874	0.75059	(.457)
FDI	7.9683	6.5021	1.2255	(.226)
PORT	7.9417	4.1960	1.8927	(.064)
DEBTCF	11.7145	5.8803	1.9922	(.052)
OTHCAP	3.6375	3.7174	0.97849	(.333)
CAB	9.0260	4.6986	1.9210	(.061)
CFER	-6.9396	3.9693	-1.7483	(.087)
C	4.4281	0.20217	21.9036	(.000)

Note. Dependent variable is LNREER. *SE* = standard error; LNREER = natural log of real effective exchange rate; GFCE = government final consumption expenditure; FDI = net foreign direct investment flows; PORT = net portfolio flows; DEBTCF = net debt creating flows; OTHCAP = net other capital flows; CAB = current account balance; CFER = change in foreign exchange reserves; C = constant term. Source: Author's calculations by Microfit (4.0).

The point estimates for the two ARDL models are very similar, but the estimated standard errors obtained for the model selected by SBC are considerably smaller as compared to the model selected by AIC. The long run model corresponding to ARDL (2, 0, 0, 0, 0, 0, 0, 0) for the relationship between the natural log of REER and the components of net capital flows and other explanatory variables can be written as follows:

$$LNREER_t = 4.7145 - 0.0098815*GFCE_t + 0.70920*FDI_t + 3.5873*PORT_t + 5.9138*DEBTCF_t + 0.17547*OTHCAP_t + 4.1563*CAB_t - 3.1848*CFER_t \quad (6)$$

In the next stage, the ECM for the selected ARDL model is estimated. Table 6 presents the results of the estimated ECM using Microfit 4.0. The estimated ECM has two parts: the first part contains the estimated coefficients of short-run dynamics, and the second part consists of the estimates of the error correction term that measures the speed of adjustment whereby short-run dynamics converge to the long-run equilibrium path in the model.

Table 6: Error Correction Representation for the Selected ARDL(2,0,0,0,0,0,0,0) Model

Regressor	Coefficient	*SE*	*t* ratio	(Probability)
dLNREER1	0.20096	0.10126	1.9847	(.052)
dGFCE	-0.0017211	0.0011604	-1.4832	(.144)
dFDI	0.12352	0.59047	0.20793	(.836)
dPORT	0.62480	0.21407	2.9186	(.005)
dDEBTCF	1.0300	0.20857	4.9385	(.000)
dOTHCAP	0.030561	0.35908	0.085109	(.932)
dCAB	0.72391	0.17515	4.1330	(.000)
dCFER	-0.55469	0.13809	-4.0170	(.000)
dC	0.82112	0.32550	2.5226	(.015)
ecm(-1)	-0.17417	0.070611	-2.4666	(.017)
R^2	0.54542	$\bar{R}^2$	0.47236	
SE of regression	0.019106	*F* statistic *f*(8,57)	7.4655	(.000)
M of dependent variable	-0.2288E-3	*SD* of dependent variable	0.026302	
Residual sum of squares	0.020442	Equation log-likelihood	172.9844	
AIC	162.9844	SBC	152.0361	
DW statistic	2.3234			

Note. Dependent variable is dLNREER, *SE* = standard error; dLNREER = change in natural log of real effective exchange rate; dLNREER1 = LNREER(-1)-LNREER(-2); dGFCE = change in government final consumption expenditure; dFDI = change in net foreign direct investment flows; dPORT = change in net portfolio flows; dDEBTCF = change in net debt creating flows; dOTHCAP = change in net other capital flows; dCAB = change in current account balance; dCFER = change in change in foreign exchange reserves; dC = change in constant term; *M* = mean; AIC = Akaike Information criterion; *DW* = Durbin Watson; *SD* = standard deviation; SBC = Schwarz Bayesian criterion. Source: Author's calculations by Microfit (4.0).

Interpretation of Results

The ARDL estimates for the long run coefficients indicate that the relationship between LNREER and FDI is not statistically significant. Thus for the estimation period 1996-97 to 2012-13 there is no significant evidence to indicate that net FDI flows to India have been associated with real exchange rate appreciation. However the long run coefficients on PORT & DEBTCF are positive and significant at 10% level. This indicates that the portfolio flows and debt creating flows to India have been associated with RER appreciation indicating loss of competitiveness and overheating of the economy. Similarly, the CAB has a positive and statistically significant association with LNREER indicating that the outflows on account of current account deficits have been associated with depreciation of RER or limiting the appreciation on account of capital flows. The coefficient on CFER in the results is statistically significant at 10% level of significance and negative. This indicates that to some extent the accumulation of reserves by RBI in the face of increasing net capital flows has prevented the appreciation of RER and, thus, mitigated their adverse consequences on the competitiveness of the Indian economy. The results of the ECM indicate that short run coefficients for dPORT, dDEBTCF, and dCAB are statistically significant at the 5% level and positive, the coefficients for dCFER is statistically significant and negative and the coefficient of error correction term ecm(-1) is negative and highly significant indicating that in the short run net portfolio flows, net debt creating flows and the current account balance are associated with RER appreciation while increase in foreign exchange reserves is associated with depreciation of RER. The estimated value of the coefficient indicates that about 17.4 % of the disequilibrium in RER is offset by the short run adjustment in the same quarter.

Concluding Remarks

The main contribution of this research lies in comprehensively analyzing the relationship between the net capital flows components and the RER in India consequent to the liberalization of the capital account in the early 1990s. The most significant findings are that net FDI flows are not significantly associated with the RER appreciation but portfolio flows and debt creating flows are found to be significantly associated with RER appreciation. This evidence indicates that the increasing volume of cross border flows of portfolio investments and debt in India have adverse consequences, such as loss of competiveness of the export sectors, inflationary pressures leading to lowering of profitability of producers, widening of trade deficit and shock to the real economy. But FDI flows do not seem to be associated with these unfavorable costs.

Government consumption expenditure is not found to be significantly associated with real appreciation, thereby limiting the role of fiscal policy in managing capital flows. The empirical evidence on the positive association between some of the net capital flow components and the RER and negative association between change in foreign exchange reserves and RER shows that accumulation of reserves by RBI in the face of increasing capital flows has prevented the appreciation of RER and mitigated their adverse consequences on the Indian economy to some extent.

The evidence that FDI flows are not associated with real appreciation and overheating of the Indian economy suggests that that there is a strong case for further liberalization of these flows by removing procedural bottlenecks and improving facilitation for investment. FDI flows are accompanied with transfer of technology and management practices, and cause an increase in domestic capital formation leading to boost in production. On the other hand the evidence that portfolio flows and debt creating flows are associated with real appreciation and overheating of the Indian economy suggests that there is a strong case for greater caution in liberalization of these flows.

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