AN EMPIRICAL INVESTIGATION OF CAUSALITY FROM CAPITAL FLOWS TO EXCHANGE RATE IN INDIA

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ABSTRACT

This study explores the relationship between capital flows and real exchange rates, with specific reference to India for the period July, 2005 to November, 2012. The period 2005 to 2012 has been a very interesting period for capital flows in India. This period has experienced periods of both very high and dwindling capital flows on account of global uncertainty following the global financial crisis post 2008. The study has taken the three major components of capital flows into India, namely, direct investment (which includes Foreign Direct Investment [FDI]), portfolio investment (which includes investment by Foreign Institutional Investors [FIIs]) and External Commercial Borrowings (ECBs which are primarily foreign currency denominated loans taken by Indian companies from overseas lenders). Some of the noteworthy findings of the study are FDI flows have no significant impact on the change in real exchange rates in India. However, portfolio flows and debt flows (ECBs) have a significant impact on the change in real exchange rates in India, during the period of study.

Key Words: Exchange Rate, Capital Control, Capital Flow

Introduction

Traditional exchange rate theories (during the 1940s and 1950s) were primarily based on trade flows (Isard, 1995). Such theories tended to explain exchange rate in the long run since a change in exchange rates translates into an adjustment in trade flows only over a period of time (it takes time for adjusting imports and exports as it involves changing the patterns of consumption and production). Some of the early models treated the exchange rate that cleared the market with well defined demand and supply curves ('elasticities approach'). These models were followed by models which attempted to integrate the 'elasticities approach' with the Keynesian concepts of national income ('absorption approach'). The later models started

integrating the concepts of Keynesian macroeconomics along with the integration of elasticities approach with the absorption approach.

During the course of time, cross border capital flows started becoming as significant as trade flows. Thus, exchange rates were no longer determined by trade flows alone but by both cross border trade and capital flows. This led to the emergence of the Mundell-Fleming framework which combined the Keynesian model of national income for an open economy with the effect of capital flows (which depended on domestic interest rates) on exchange rates. The Mundell Fleming model was followed by the emergence of the monetary approach and portfolio balance approach. The monetary approach provided a framework of linking elements of the balance of payments to the change in money supply. The portfolio balance approach differed from the monetary approach primarily in the assumption that home country securities are perfect substitutes for foreign country substitutes. While the monetary approach presumes that the two securities (home country and foreign country) are perfect substitutes the portfolio approach does not consider them as perfect substitutes.

India had embarked upon a process of liberalization of the external sector policies in order to attract foreign capital from 1991 onwards. Consequently, there was an increase in capital flows (more particularly private capital flows) to India, which has witnessed steady rise in the last two decades. A prominent feature of the capital inflows to India has been the large volume of portfolio flows. Increased size of the capital flows has impacted the exchange rate in India. India is not fully convertible on the capital account whereas it has achieved full current account convertibility since 1993-94. The exchange control policy in India has been broadly guided by the two Tarapore Committee reports on fuller capital account convertibility (1999 and 2006). Accordingly, capital account convertibility has never been considered an event and a calibrated and studied approach has been adopted to achieve fuller capital account convertibility over a period of time. On hindsight, such an approach has worked reasonably well, especially in the aftermath of the global financial crisis. Further exchange rate policies have consciously given preference to FDI inflows over portfolio capital inflows and equity capital flows over debt creating ones. Nevertheless the unique Indian feature of a reasonably well regulated domestic capital market (vis-a-vis other emerging markets) has resulted in both large as well as volatile portfolio capital inflows and at times portfolio capital inflows have exceeded FDI. Similarly while the policy preference has been largely towards encouraging equity capital inflows, debt flows such as External Commercial Borrowings (ECBs) by Indian companies have also increased substantially, albeit within the quantitative limits set for them.

In the Indian context a large and persistent current account deficit (CAD) has ensured that exchange rate policies and capital controls have tended to work towards trying to create an investment climate that is conducive for large and sustained capital inflows (since these feed into the CAD). In the last one year, several policy initiatives have ceaselessly worked towards this objective. Some of them are as follows: The creation of a new category of foreign portfolio investors, namely qualified foreign investors (QFIs), has paved the way for substantially broad basing the universe of foreign portfolio investors in India. Allowing long term non resident investors such as foreign central banks, multilateral agencies, sovereign

wealth funds, endowment funds, pension funds and insurance funds as a new category of foreign investors in government securities, listed corporate debt including units and bonds issued by infrastructure debt funds (IDFs) has also created an opportunity for further deepening of the domestic debt markets. Opening up of domestic scheduled airlines, power exchanges, single and multi brand retail sectors for FDI has also contributed towards creating a positive investment climate for sustained capital inflows into India. Several procedural changes and simplifications have also been implemented for FDI inflows such as ability to leverage FDI investments by pledge of shares and doing away with the prior approvals in case of transfer of shares in the financial sector.

This paper attempts to explore the link between capital flows and exchange rates in India, especially foreign investment and real exchange rates. Previously, the relationship between exchange rate and capital flows in the Indian case had been empirically examined by several authors including Chakraborti (2003), Dua and Sen (2006) and Ahmad and Masood (2009). However, this study focuses only on the impact of capital flows (foreign direct investment, portfolio investment and ECBs) on the exchange rate and, thus, in that sense, it is different from other studies. This paper is organized as follows: Section II discusses some of the available literature on the subject. Section III explains the methodology and data. The empirical results are discussed in Section IV, while Section V discusses the issues that emerge from the study and Section VI contains some concluding observations.

Literature Review

Harvey (2006) explains how neoclassical theories of exchange rates have focussed mostly on real side of the economy (trade flows) whereas Post-Keynesians have focussed on capital flows (portfolio flows) to explain exchange rates. Harvey compares the two approaches in the case of exchange rates of the US between 1975 and 1998. He finds that over the long-run also Post Keynesian approach (which emphasises the role of financial markets and portfolio capital flows) proves to be more relevant to modern currency markets than the neo classical approaches (such as, purchasing power parity or the monetary model).

Kohli (2000) has done a study of the exchange rate behaviour during the period 1993-1998. She finds that exchange rate volatility in India has not significantly increased from the pre-1993 period to the post-1993 period, despite the fact that most industrialized countries faced an increase in exchange rate volatility after moving from fixed to floating exchange rate regimes. She feels that one of reasons could be that the official exchange rate policy allowed Central Bank intervention to contain any volatility in exchange rates. She also finds that the relative price levels between US and India (PPP theory) do not reflect in the exchange rate behaviour for both periods (pre-1993 (1978-1993) and post-1993 (1993-1998)).

Dornbusch (1986) in his study on special exchange rates has explained the rationale for governments in some countries implementing dual exchange rate systems, which entails having different exchange rate for different kinds of transactions. The primary objective of such exchange control regimes is to insulate the domestic economy from the inter-linkages of national and international financial markets. In most such regimes, capital account

transactions are conducted at a free rate while commercial trade is maintained at an overvalued exchange rate. Over the long run, there are distortionary effects of such dual rate systems, which have to be offset by central bank intervention in the currency markets. The efficiency of such systems, however, depends on the administrative effectiveness of such measures. Leakages between capital and current account transactions can reduce the effectiveness of these systems. The study reveals that dual exchange rates may be effective if the administered rate is maintained in a range close to the free rate.

Corbo and Hernández (1996) in their analysis of macroeconomic adjustments to capital flows have explained how capital flows cause real exchange rate appreciation and even predictable capital flows can cause cyclic exchange rate fluctuations. Increased capital flows lead to increase in domestic expenditure. While an increase in expenditure in tradables results in an increase in imports and, thus, widening trade deficit and depreciating effect on the real exchange rate, an increase in expenditure and, hence, an increase in demand for non tradabales results in increase in their relative prices and, hence, an appreciating effect on the real exchange rates. Consequently the combined effect would be a real exchange rate appreciation on account of increased capital flows.

Johnson, McKibben and Trevor (1982) in their sensitivity analysis of capital flows and exchange rates have drawn up different scenarios with different exchange rate policies/regimes. When capital flows are slow to adjust to a managed exchange rate, it leads to greater stability of macroeconomic variables. When capital flows adjust quickly then a flexible exchange rate policy helps to reduce adverse effects on macroeconomic variables, such as, prices and domestic output and the overall responses are quite complex and depend on a large number of variables, which, inter alia, include monetary and fiscal policies.

Ahmad and Masood (2009) in a study of the macroeconomic effects of capital flows in India have analysed the effect of capital flows to India on the exchange rates. They have observed that there is a positive correlation between real exchange rate and total capital flows to India. They have also found a two way causality between capital inflows and the real exchange rate in India for the period 1994 to 2007.

Chakraborty (2006) has examined the volatility of different components of capital flows and she finds that portfolio flows into India are volatile in nature. The study also shows that an error correction mechanism was operating between the net capital flows and real exchange rate in India from 1993 onwards. Post 1993 there also exists a cointegrating relationship between net capital inflows, real exchange rates and interest rate differential. Charkaborty also argues that this co-integrating relationship exists due to the foreign exchange market intervention by the Reserve Bank of India.

Alba, Park and Wang (2009) have analyzed the impact of exchange rates on FDI. Their analysis shows that although there is a theoretical possibility of exchange rates having both positive and negative effects on FDI insofar as US is concerned, a strong dollar promotes and has a positive impact on FDI inflows into US.

Research Methodology

Monthly data has been taken for foreign direct investment, foreign portfolio investment, ECBs and real effective exchange rate (36 currency trade based REER) for the period from June, 2005 to November, 2012. Since capital flows, especially foreign investment (FDI, portfolio and ECBs) remained very critical during 2005 to 2012, the same period has been chosen for the analysis. During this period, there were record FDI and FIIs flows into India. Further, in 2008-09 after the breakout of the global financial crisis, there were reversals in FIIs flows as well a slowdown in ECBs. The exchange rate also saw large fluctuations during this period. The data has been sourced from the Handbook of Statistics on Indian Economy (RBI) and the Reserve Bank of India Bulletins of various months. The Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests have been used to test the unit root properties of the time series. Further, linear regression equation (OLS) has been estimated with the 36 currency trade based REER as dependent variable and Direct Investment(DI), Portfolio Investment (PI) and ECBs as explanatory variables. Since capital flows is only one of the many explanatory variables for exchange rate, the other explanatory variables have been accounted for by taking a lag of the trade based REER as an independent variable. Further, Granger Causality test has been applied to find out causality from DI, PI and ECBs to REER and vice versa, if any, in order to further corroborate the results of the linear regression.

Research Results

The results of the unit root tests, furnished in Table 1, show that both DI, PI and ECB are all stationary at level, while REER is stationary at first difference. It can be seen from the results that DI and PI are stationary at 1 per cent level of significance, ECB is stationary at per cent level of significance while REER is not stationary. We have taken first difference of REER [D(REER)] to overcome the problem of unit root and the same has been found stationary at 1 per cent level of significance. In our estimation, we use D(REER) as dependent variable in place of REER.

Table 1: Unit Root Test Results

Variable	t-statistics	Critical value		
		1%	5%	10%
		DF test		
DI	-3.8899***	-2.5921	-1.9446	-1.6142
PI	-10.2544***	-2.5921	-1.9446	-1.6142
ECB	-2.5524	-2.5927	-1.9447	-1.6142
REER	-1.4382	-2.5924	-1.9446	-1.6142
D(REER)	-5.7454***	-2.5924	-1.9446	-1.6142
		ADF test		
DI	-5.4707***	-3.5083	-2.8955	-2.5849
PI	-10.1951***	-3.5083	-2.8955	-2.5849
ECB	-7.1466	-3.5083	-2.8955	-2.5849
REER	-1.8350	-3.5092	-2.8959	-2.5851
D(REER)	-5.7454***	-2.5924	-1.9446	-1.6142

***, **, * indicates statistical significance at 1% level, 5% level, 10 % level, respectively.

In order to explore the preliminary relationship between the different components of capital flows and real exchange rates, we estimate the correlation coefficients between DI, ECDB, PI and D(REER). It is observed from the results in Table 2 that there is no significant correlation between DI and REER. However, there is a significant positive correlation between PI and D(REER) and a small correlation between ECB and D(REER). Thus, there is an indication of a likely casual relationship between PI and D(REER) and ECB and D(REER). Thus the correlation results show that there is a possibility of some causal relationship between capital inflows in the form of portfolio and ECB flows and the change in real exchange rate (Since D(REER) has been taken as the variable instead of REER).

Table 2: Correlation coefficient

	D(REER)	DI	PI	ECB
D(REER)	1.000000	-0.093642	0.349757	0.138686
DI	-0.093642	1.000000	-0.041393	0.084463
PI	0.349757	-0.041393	1.000000	0.051168
ECB	0.138686	0.084463	0.051168	1.000000

The linear regression D(REER) as the dependant variable and DI, PI and ECB as explanatory variables has been estimated in the following form:

$$D(REER)=C(1)+C(2)*DI+C(3)*PI+C(4)*ECB+C(5)*D(REER(-1))+e \quad (1)$$

The lag of dependent variable has been taken to explain variation in D(REER) by other controlling variables. The results, furnished in table 3 below, show that coefficient of PI and D(REER) is statistically significant at 1 per cent level of significance, while the coefficient of DI and ECB have been found statistically insignificance.

Table 3: Linear regression results

Explanatory Variable	Coefficient	Std. Error	T-Stat	Prob
Constant	-0.525243	0.499646	-1.051231	0.2963
DI	-0.000117	0.000172	-0.681571	0.4975
PI	0.000125	3.95E-05	3.154027	0.0023
ECB	0.000192	0.000174	1.103070	0.2733
D(REER(-1))	0.169753	0.104454	1.625146	0.1081
R-squared = 0.1756				
Adjusted R-squared=0.1344				
F-Stat= 4.2607				
DW-Stat= 1.853				

The sign of the coefficient is positive, which is consistent with a priori theory and suggest that increase in PI leads to appreciation in D(REER) or the change in REER. The sign of the

coefficient of DI is negative, *albeit*, statistically insignificant. The sign of the coefficient of ECB is positive, *albeit*, statistically insignificant.

This is well documented in the literature that an increase in capital inflows leads to appreciation of the domestic currency vis-a-vis foreign currency. Overall we can reasonably conclude that an increase in portfolio investment flows to India during the period 2005-2012 did have a direct appreciating effect on the domestic currency and vice versa.

The Granger Causality test using direct investment, portfolio investment, external commercial borrowings and REER (first difference to make it stationary) and shows that there does not seem to be any significant level of causality between the three variables namely DI, PI and D(REER). Hence, there does not seem to be any causality shown with the Granger Causality test between the three variables namely 36 currency trade based REER, direct investment and portfolio investment in India. However there is significant level of causality between ECBs and REER (first difference to make it stationary) and there too the results indicate a causality to flow from ECB to REER. There is also significant level of causality between ECB and PI where again the result indicate a causality to flow from ECB to PI.

Table 4: Granger Causality Tests

Pairwise Granger Causality Tests
Date: 07/18/13   Time: 13:03
Sample: 1 87

				Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.	Result
DI does not Granger Cause D(REER)	84	0.22898	0.7959	Accept
D(REER) does not Granger Cause DI		0.33538	0.7161	Accept
PI does not Granger Cause D(REER)	84	0.72240	0.4888	Accept
D(REER) does not Granger Cause PI		1.44778	0.2413	Accept
ECB does not Granger Cause D(REER)	84	3.08060	0.0515	Reject
D(REER) does not Granger Cause ECB		1.22449	0.2994	Accept
PI does not Granger Cause DI	85	0.30895	0.7351	Accept
DI does not Granger Cause PI		0.30506	0.7379	Accept
ECB does not Granger Cause DI	85	0.42018	0.6584	Accept
DI does not Granger Cause ECB		1.30172	0.2778	Accept
ECB does not Granger Cause PI	85	2.58423	0.0817	Reject
PI does not Granger Cause ECB		1.23576	0.2961	Accept

As far as FDI is concerned it does not cause or affect REER and visa versa. Essentially FDI is more likely dependant on other push and pull factors such as economic growth, interest rate differentials, business environment and political and other socio-economic factors. Further the quantum or nature of FDI flows does not affect real exchange rates. Since FDI represents long term nature of capital flows which is usually preceded by due diligence for setting up subsidiaries or joint ventures or cross border mergers and acquisitions, the amount of capital inflows on account of FDI is not really dependant on exchange rates and per se FDI does not

influence exchange rates. A look at the FDI figures during the period 2005-2012 also demonstrates that FDI flows have been fairly stable and unaffected by not only exchange rate movements but also they have remained largely insulated from the global financial downturn which erupted in 2008-09.

However while portfolio flows and ECBs seem to have a significant effect on the change in REER, as the linear regression and Granger Causality results show, capital flows in the form of portfolio flows and ECBS are not the only factors affecting the change in REER. The REER is also influenced by a large number of other macroeconomic indicators such as the current account balance, inflation differentials etc..

Discussion

The stationarity tests find that all the variables for the period June, 2005 to November, 2012, barring the real exchange rate (REER), are level stationary. REER is stationary at first difference. In order to overcome the problem of stationarity of REER we have therefore taken the first difference of the REER (or change in REER) as the dependant variable for further statistical analysis. The correlation tests reveal no correlation between foreign direct investment (FDI, which is the major component of direct investment). However there is a significant 34.9 % correlation between portfolio investment and the change in REER as well as a 13.8 % correlation between ECB flows and the change in REER. Both these correlations are positive and indicate that an increase in portfolio or ECB capital inflows do tend to change increase REER or contribute to a positive change in REER.

A linear regression is also conducted taking D(REER) or change in REER as the dependant variable. The regression shows a significant but small effect of portfolio capital flows on the change in REER. Exchange rates depend on a number of macroeconomic and other variables and effects. What the regression tells us is that there is a small, yet significant positive impact of portfolio capital flows on the change in REER during the period under study (June, 2005 to November, 2012).

The Granger Causality test reveals no causality between either direct investment and D(REER) or between portfolio investment and D(REER). It only shows a both ways causality between ECB and D(REER). Thus ECB capital flows which are primarily debt capital flows do seem to effected by the change in REER and visa versa.

Conclusions and Recommendations

This paper has started by reviewing the literature in the area as well and specifically explored the preliminary effect of capital flows on exchange rates in India. This paper has also analysed some of the implications of capital flows for REER which has been taken as a representative of the real exchange rate in the Indian context. It is observed that while portfolio capital flows and ECBs do have an impact on the change in real exchange rates direct capital inflows do not seem to affect the change in real exchange rates in the Indian context for the period 2005-2012.

The empirical analysis shows that increased portfolio capital flows lead to an appreciation in the INR and this is borne out by the experience during 2005-2008 when huge capital inflows were accompanied by appreciation of the INR vis-à-vis other currencies specially the USD. The analysis also shows that there is a causality flowing from ECBs flows to the change in REER.

Thus, policy makers need to be careful about the effect of portfolio capital flows and ECB flows on exchange rates. If portfolio capital flows and ECB flows are beyond the absorptive capacity of the domestic economy, their effect on exchange rates needs to monitored and handled carefully with appropriate public policy responses / measures. In the Indian context we must also keep in mind the ever increasing current account deficit and the adverse impact an appreciation in domestic currency (on account of increased capital flows) can have on Indian exports by making them uncompetitive.

In case of India since there are still adequate levels of capital controls in place, these controls can be tweaked to modulate flows in quantity, quality as well as channelizing the flows to the most economically and socially desirable sectors of the domestic economy. In terms of quantity, measures are possible to encourage long-term equity flows such as FDI as against debt flows or short-term volatile portfolio flows. Similarly the external commercial borrowing guidelines are used to modulate the quantity as well as channelize the sectors for debt capital flows into the country. Thus, capital controls can be used in an Indian context to modulate the quality and quantity of capital flows. It is also pertinent to mention that increased volatility in exchange rates on account of volatile capital flows such as portfolio flows and ECB flows are a disruptive factor from the point of view of India's external sector vulnerabilities. While excessive depreciation in the short run can further increase the current account deficit on account of the huge burden of oil imports, a sharp appreciation of the rupee will adversely affect India's exports. Therefore in the current context at least perhaps the utility of such capital controls in an Indian context far outweighs the arguments put forth by the detractors of such a policy.

References

Books

Isard, Peter (1995) *Exchange Rate Economics*. Cambridge Survey of Economic Literature, Cambridge University Press, 1995.

Journals

Harvey, John T (2006) *Post Keynesian versus Neoclassical Explanations of Exchange Rate Movements : A Short look at the long run.* Journal of Post Keynesian Economics, Vol.28, No.2, (Winter, 2005-06), pp.161-179.

Jonson, P D, W J McKibbin, R G Trevor (1982) *Exchange Rates and Capital Flows: A Sensitivity Analysis.* The Canadian Journal of Economics / Revue canadienned'Economique, Vol. 15, No. 4(Nov., 1982), pp. 669-692 Blackwell Publishing.

Single Author

Dornbusch, Rudiger (1986) *Special Exchange Rates for Capital Account Transactions.* The World Bank Economic Review, Vol.1, No.1 (Sep., 1986) pp.3-33, Oxford University Press.

Indrani Chakraborty (2003) *Liberalization of Capital Flows and the Real Exchange Rate in India : A VAR Analysis.* Working Paper No.351, Centre for Development Studies, Thiruvananthapuram.

Kohli, Renu (2000) *Aspects of Exchange Rate Behaviour and Management in India 1993-98.* Money, Banking and Finance (Jan. 29 – Feb 4, 2000). Pp 365-367+369-372.

2-3 Authors

Alba, J., Park D. And Wang P. (2009) *The impact of exchange rate on FDI and the Interdependence of FDI over time.* ADB Economics Working Paper Series No. 164.

Ahmad, Mohd. Izhar and Tariq Masood (2009) *Macroeconomic Implications of Capital Inflows in India.* International Review of Business Research Papers, Vol.5 No.6, November 2009 pp.133-147.

Carbo, Vittorio and Leonardo Hernandez (1996) *Macroeconomic Adjustment to Capital Inflows: Lessons from Recent Latin American and East Asian Experience.* The World Bank Research Observer, Vol. 11, No. 1 (Feb., 1996), pp. 61-85, Oxford University.

Chakraborty, C and Peter Nunnenkamp (2006) *Economic Reforms Foreign Direct Investment and its Economic Effects in India.* Kiel Working Paper No.1272, Kiel Institute for the World Economy, Kiel, Germany, 2006.

Pami Dua and Partha Sen (2006) *Capital Flow Volatility and Exchange Rates : The Case of India.* Working Paper No.144, Centre for Development Studies, Department of Economics, Delhi School of Economics, Delhi.