Capital Flows, Financial Asset Prices and Real Financial Market Exchange Rate: A Case Study for an Emerging Market, India

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Abstract: In this paper we empirically investigate the relationship between capital flows and exchange rates in India based on a new index of real effective exchange rates for the Indian Rupee. Instead of using consumer price indices we deflate exchange rates by MSCI asset price indices. The cointegration analysis indicates a long-run equilibrium relationship between real financial market exchange rate and the net outstanding equity investment in India. In the short run capital inflows are accompanied by an appreciation of real financial exchange rate of the Rupee.

Keywords: Short-term Capital Movements, Foreign Exchange, International Financial Markets, India.

INTRODUCTION

The Real Effective Exchange Rate (REER) is a crucial variable in the open economy macroeconomics. With the expansion in trade in goods and services, the REER has emerged as a prime indicator of relative prices competitiveness in international trade and finance. With its roots in the law of one price, REER's theoretical concepts, empirical applications and its impact on countries' income and wealth change have been extensively studied in the literature. With increased globalisation and financial integration, however, capital flows now account for the largest share of cross-border transactions (Hau and Rey 2004). Moreover, Lane and Shambaugh (2010) indicated that the trade weighted exchange rate indices were insufficient to understand the financial impact of currency movements. From this perspective, policy makers need new financial market indicators, which provide a timely signal of the domestic capital market attractiveness relative its global competitors. Of course, these new indicators should be closely related to global investors' decisions providing a means to explain current and forecast future capital flows.

In this study we construct and analyse a Real Financial Markets Exchange Rate (RFMER). Deflating the nominal exchange rate by asset prices rather than goods prices is likely to make the RFMER an indicator of the relative attractiveness of the reference country's financial assets as compared to its competitor countries. Preliminary inspection of the RFMER time series for the Indian Rupee generally indicates an upward trend incorporating the emerging nature of the Indian financial markets and investors optimism. The cointegration analysis indicates a long-run equilibrium relationship between real financial market exchange rate and the net outstanding equity investment in India. In the short run, capital inflows are accompanied by an appreciation of real financial exchange rate of the Rupee. Several important financial markets variables, such as the net equity. Foreign Institutional Investment (FII), net foreign currency purchases, and the Indian money market rate were found to have significant causal relation with the real financial market exchange rate, strongly indicating the policy relevance of the RFMER.

The paper is organised as follow: Section-2 briefly sketches the literature relating to the financial exchange rate asset prices. Section-3 describes the data and its sources. Section-4 describes the methodology for computing the Real Financial Markets Exchange Rates and reports related results; finally Section 5 concludes the study.

2. LITERATURE

Numerous studies such as Portes and Rey (2005), Bekaert *et al*. (2001), and Brooks *et al*. (2004) analysed the linkage between exchange rate dynamics, capital flows and the asset prices. Some of these studies found that higher returns in the home equity market relative to the foreign equity market leads to home currency depreciation. For instance, Heimonen (2009) indicated that an increase in Euro area equity returns with respect to US equity returns causes an equity capital outflow from Euro area to US, and led to an appreciation of US Dollar. Based on the now widely

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JEL: F31, F32, G15.

accepted microstructure proposition that foreign exchange order flow drives exchange rates, Hau and Rey (2004, 2006) offered a theoretically consistent explanation for this observed negative relation. However, these studies essentially concentrated on the short run dynamics of bilateral exchange rate, used (one) country specific time series rather than a large panel of countries, which assumes importance for deriving a consistent equilibrium value of the exchange rate, especially in the context of cross country capital flows and asset price movements. More important, Lane and Shambaugh (2010) indicated that the trade weighted exchange rate indices were insufficient to understand the financial impact of currency movements. This is particularly true in the face of growing importance of the valuation effect in the recent years with rapid growth in cross-border financial holdings. The authors documented the diverse behaviour of trade-weighted and financially-weighted exchange rates generally indicating that trade weighted exchange rates were not informative with regard to the financial impact of the currency movements. Tille (2003) and Milesi-Ferretti (2007) also emphasised the role of financial-variable weights and their studies indicated that the trade weights and financial currency weights are quite different for the United States.

We contribute to this literature by moving this argumentation one step forward. While considering financial market weights to calculate an effective exchange rate as suggested in the above literature, we also use financial market prices to deflate nominal bilateral exchange rates. A panel of 25 countries, which account for more than 90% of global cross-border asset holdings, is used to construct real effective financial exchange rates. This new indicator is evaluated analysing its relationship with capital flows from and into India. Against the backdrop of global investors' increased interest in emerging market economies, this analysis promises particularly interesting insights into the interaction between capital flows, financial asset prices and real financial markets exchange rate movements.

3. DATA

The main data sources for this study are the IMF's Coordinated Portfolio Investment Survey (CPIS) and the Datastream database (Reuters). The CPIS provides information on individual economy's year-end holdings of portfolio investment securities (equity securities and debt securities) valued at market prices, cross-classified by the country of issuer of the securities. The Geographic Breakdown of Total Portfolio Investment (Table **8**, CPIS) comprises data from the individual economy's residents holdings of securities issued by non-residents (reported data), and the data for non-residents' holdings of securities issued by residents (derived data). The CPIS presently reports data from 2001 to 2010; we use data from CPIS Table **8**, on the foreign investment in India and on India's investment in foreign countries over the past decade. These series are plotted in Chart **1**, which indicates three interesting observations: first, there has been a considerable increase in the foreign capital flows to and from India over the past decade; second, though there was a decline in capital flows in 2008 due to the sub-prime crisis, the foreign capital flows recovered and kept growing in the subsequent years; and third, the capital inflows in India by far exceed the capital outflows from India (which is evident from the scale differences between the left hand and right hand axis). The CPIS database has been used to evaluate India's financial ties with different financial partner countries, and calculation of the weights of different countries

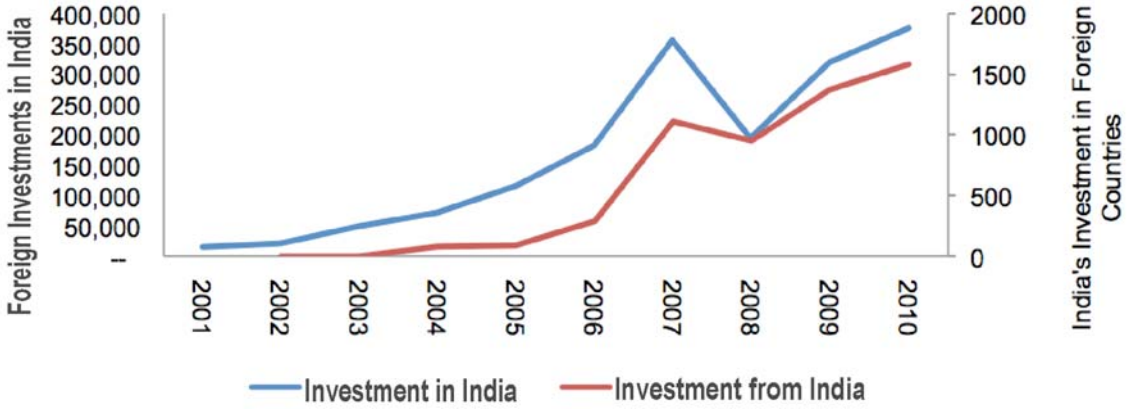

Chart 1: Foreign Investment in and from India.
Data: CPIS, IMF (USD Million).

Table 1: Breakdown of Outstanding Total Portfolio Investment

	Total Investment		Equity Investment		Debt Investment	
	In India	From India	In India	From India	In India	From India
2005	116,462	81	105,636	36	10,810	45
2010	376,479	1,583	317,490	1,057	58,988	527

Data Source: CPIS (IMF); USD Million.

(which are described in detail in the subsequent sections) that will be used for constructing the RFMER.

The data relating to the monthly average stock prices and bond prices of the financial partner countries were obtained from Datastream. The same datasource was used for data relating to the bilateral exchange rate of the partner countries that was used to compute the RFMER. The data relating to the Net FII Inflows were sourced from the Securities and Exchanges Board of India (SEBI) and the money market, bond market rates were sourced from Handbook of Statistics on the Indian Economy published by the Reserve Bank of India. Finally, we used the 'updated and extended version of dataset' (Lane and Milesi-Ferretti (2007)) for total portfolio equity assets, liabilities and total net foreign asset data for India.

4. METHODOLOGY AND RESULTS

4.1. Real Financial Market Exchange Rate Calculation

The RFMER is calculated as a weighted (geometric) average of nominal exchange rates, adjusted for the relative financial price differential between the domestic and the foreign countries, with both weights and price adjustments being based on the financial variables. The RFMER has four parameters, and they are pertaining to the number of countries (n), weights (W_{ji}), relative financial prices (P_i /P_j), and the nominal exchange rate (e). The RFMER, so computed, is likely to emerge as an indicator of relative attractiveness of home country's financial assets.

The coverage refers to the 25 countries that have been selected/included in the index based on their financial ties (capital inflow and outflow) with India and the availability of relevant data[1]. These 25 countries accounted for more than 90 per cent of the investment in India and investment from India in 2005 (CPIS data IMF). Their combined share has remained above 90 per cent in the end 2010, which confirms the sustained financial ties of these countries with India.

As in the case of trade weighted exchange rate, the financial assets and liability of the reference country (India here) were taken into account while calculating the real financial markets exchange rate (RFMER).

In this context, it may be worth mentioning that the portfolio investment in India has been dominated by the equity investment (both in India and from India) and debt instruments played a very small part (Table **1**). In 2005, total equity investment in India constituted 91 per cent of the total portfolio investment, in 2010 the share was 87 per cent of total portfolio investment. It may be noted that under the Foreign Exchange Management Act (FEMA) Regulations the FII investment in Government securities and Corporate debt has been subject to a ceiling decided in consultation with the Government of India[2]. Second, Table **1** also indicated that the total portfolio investment outflow from India (as compared to total portfolio inflow) continued to be small over the years under consideration.

We use CPIS data (which comprises of the countries assets and liabilities in the stocks and bonds) to calculate the country specific weights for RFMER. As in the case of the trade weighted real exchange rate, constant country weights for the base year have been used. The base period was chosen to be end of 2005, as the year witnessed stable macroeconomic and external sector performance. The calculation of the country weights (W_i) closely follow the methodology of the Deutsche-Bundesbank (April 2011). The asset

[1]The 25 countries that were selected/included are Australia, Austria, Canada, China, Denmark, France, Germany, Hong Kong SAR, Indonesia, Ireland, Japan, Korea, Luxembourg, Malaysia, Mauritius, Netherlands, Singapore, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom and United States.

[2]Before 2008, it was mandatory that the FII allocation of its total investment between equity and debt instruments (including dated Government Securities and Treasury Bills in the Indian capital market) should not exceed the ratio of 70:30. However, the Reserve Bank on Oct 16, 2008 removed a FEMA regulation, which binded FIIs to restrict their investment in the Indian capital market in the ratio of 70:30 between equity and debt to provide greater flexibility and investment options to overseas investors (http://www.rbi.org.in/scripts/NotificationUser.aspx?Id=4568&Mode=0).

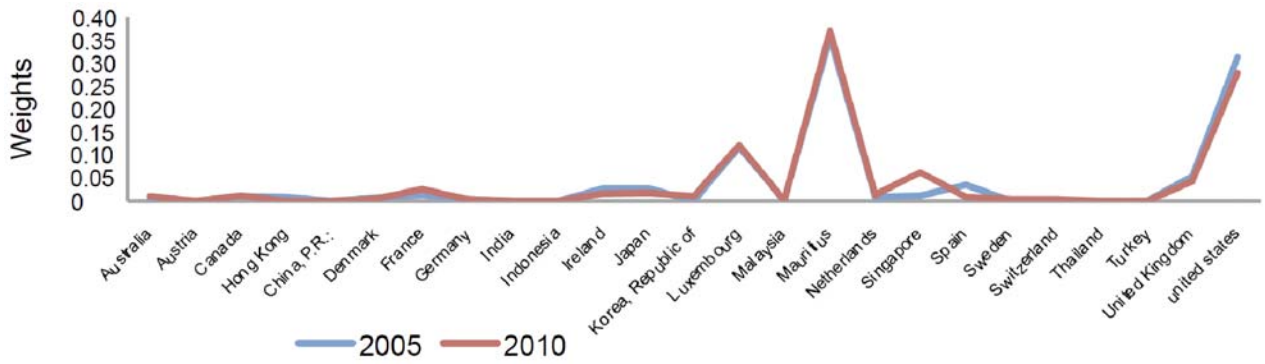

Chart 2: Country Weights in the Real Financial Markets Exchange Rate.

weight of country 'j' in the asset portfolio of country 'i' is defined as its share W^{A}_{ji} in the total investment made by residents of country 'i' in 'n' partner countries. The liability weight of country 'j' (W^{L}_{ji}) has similar connotation and represents share of country 'j' residents in the financial assets of country 'i'.

$$W^{A}_{ji} = (security)_{ji} / \sum_{k} (security)_{ki}$$

$$W_{ji} = [A/(A+L)]^{*} W^{A}_{ji} + [L/(A+L)]^{*} W^{L}_{ji}$$

Where W_{ji} is the total weight of the partner country 'j' in the effective exchange rate of country 'i'; 'A' plus 'L' gives the total value of assets and liability for the reference country.

The weights calculated using the above methodology for the equity portfolio investments are reported in the Chart **2** for the base year (2005) and for the latest year (2010). Chart **2** shows that the weights remained similar over the years, which indicate the stability of the financial ties of the selected countries. As the Chart indicates, exceptional high weights were assigned to Mauritius in both 2005 and 2010; these were mainly because of the Double Taxation Avoidance Agreement between Mauritius and India from 1983. Since then Mauritius has been a conduit for routing third country investment to India.

As different sets of factors influence the stock market investment and bond market investment, a distinction was made using stock market prices and bond market prices. For the stock market, the prices that we consider are the major stock indices of the selected 'n' countries under consideration (for instance the BSE Sensex has been considered for India and for Germany the DAX has been included to represent the stock price index). Relative financial prices (P_i / P_j) (the ratio of home countries stock indices (P_i) to the foreign country stock index (P_j)) is then substituted for its goods market counterpart (i.e. the ratio of domestic CPI to foreign CPI) to calculate the financial price adjusted real effective exchange rate.

Finally, the indirect exchange rate[3] for the Rupee (denoted by 'e': exchange rate quoted as the foreign currency per unit of the domestic currency (Rupee)) was used to derive bilateral financial market exchange rates (R^{ki}_{t}) by multiplying the former (e) with the ratio of domestic to foreign stock indices (P_i / P_j). The Real Financial Markets Exchange Rates (R^{i}_{t}) is then calculated as a geometric weighted (W_{ji}) average of bilateral financial market exchange rates (R^{ki}_{t}).

$$R^{ki}_{t} = (e)^{*}(P_i / P_j)$$

$$R^{i}_{t} = \prod (R^{ki}_{t})^{Wki}$$

The Real Financial Market Exchange Rate for the Stock Market (RFMER_EQ) calculated using the above methodology is plotted in the Chart **3**. In line with the result for Germany (as presented in Deutsche-Bundesbank Monthly report) this series was found to be more volatile than its goods market counterpart.

As it is apparent from the Chart **3**, the periods under consideration (i.e. Jan 2000 to Nov 2011) could be broadly classified into four sub-periods. In the period between Jan 2000 to Dec 2003 the RFMER_EQ hovered around an average value. This was followed by an uptrend from Jan 2004 to end of 2007. The uptrend could be due to the favourable earning prospect, lasting productivity led growth, possibility of reaping the demographic dividend, which led to a relative increase in Indian financial asset prices and a trend increase in the real financial market exchange rate. The subsequent year (Dec 2007 to Dec 2008) was characterised by the outbreak of the global

[3]In an indirect quote, the foreign currency is a variable amount and the domestic currency is fixed at one unit. For instance, for India an indirect quote for U.S. dollars would be INR1=US$0.02. (Dec 2011).

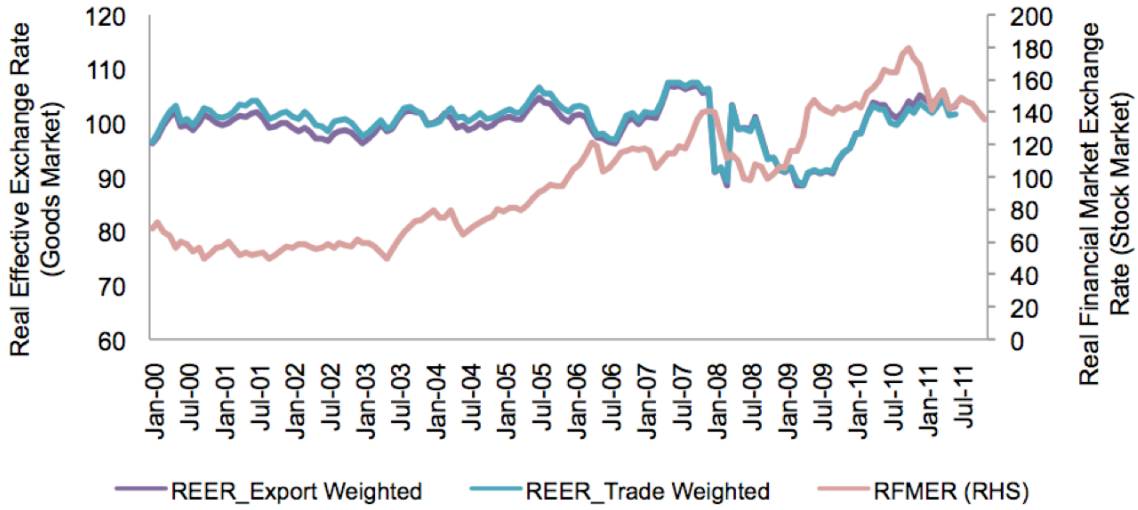

Chart 3: Real Effective Exchange Rate for Goods Market & Stock Market.

financial crisis, which led to a decline in the financial market exchange rate. This downturn almost coincided with the goods market real effective exchange rate (REER) decline. However, the financial market exchange rate started improving far before the goods market REER and the upward trend suppressed the up-trend observed during 2003-07. It may be mentioned that the sub-prime crisis largely bypassed the Indian economy and the stock indices largely and quickly recovered compared to their developed market counterpart (RCF 2010). The resilience of the emerging markets coupled with their growth potential has been reflected in the increasing stock prices and in the upturn in the real financial markets exchange rate for India[4].

4.2. Short Run Dynamics of Real Financial Market Exchange Rate (Stock Market) and other Financial Variables

The interaction of the financial variables and the Real Financial Market Exchange Rate (RFMER_EQ) is of particular interest in policy research arena. We now turn to the net monthly FII inflow data (in Equity market, debt market and total).

To evaluate the short run relation between real financial market exchange rate (stock market) and net FII equity, we use net monthly capital flows data available from the Securities and Exchange Board of India web-site. Annex Table **1A** reports the correlation coefficient between changes in the RFMER_EQ (DRFMER_EQ)[5] and the FII inflow in equity (debt and total). The correlation coefficients between net FII flows in equity (and also the total FII flow) and DRFMER_EQ were found to be positive and significant; and they indicate that an increase in capital flows went along with an appreciating RFMER_EQ in India. To analyse the direction of any causal relation between these variable, we carried out Granger causality test with lag length being determined by AIC criterion; the results (Annex Table **2A**) indicate evidences of unidirectional causality running from DRFMER_EQ to net equity FII flows (and also total FII flows) in India. These findings are in line with Chayawadee and Ho (2008), Gyntelberg et.al (2009). Hau and Rey (2006), where the authors indicated that the nominal exchange rate appreciates with increasing portfolio flows.

As indicated in the beginning of this section, the two major components of the RFMER_EQ are (a) relative stock prices and (b) nominal exchange rate. The Indian Central Bank (the Reserve Bank), over the past decade, at times has intervened in the forex market to curb the excess volatility in the exchange rate market. The Chart **4** indicates the Reserve Bank's forex operation (purchase / sell) of US-dollar and the movement in the RFMER_EQ. The correlation between Net Forex Purchase and DRFMER_EQ is positive (Annex Table **2A**). The Granger causality test also indicates that the direction of causality is from the Net

[4]The above results are generally supported by a regression, where RFMER_EQ is regressed on the Trend, crisis dummy (which takes value one for the period 2007:12-2008:12, otherwise zero) and post crisis dummy (which takes value one for the period 2009:1-2011:11, otherwise zero). The trend variable has a significant positive sign, the Crisis-dummy has significant negative sign.

[5]While the monthly Net FII data was found to be stationary, the series RFMER was found to be non-stationary and was therefore first differenced to render it stationary.

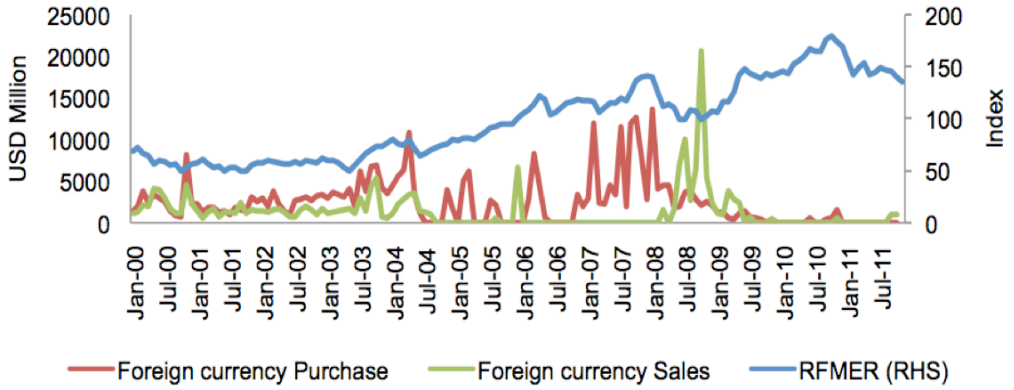

Chart 4: Forex Intervention and Real Financial Markets Exchange Rate.
RFMER-Real Financial Market Exchange Rate for Stock Market.

Forex Purchase to the changes in RFMER_EQ. However, the reverse causality is not statistically significant, indicating that high value of RFMER_EQ does not by itself induce net purchase in the forex market, which is consistent with the Reserve Bank's exchange rate policy[6].

We also investigate the co-movement between RFMER_EQ and two other important financial market variables, namely the overnight money market rate (also known as the Call rate) and the 10-year benchmark government security yield (Gsec). The Chart **5** indicates no strong observable pattern between Gsec yield and DRFMER_EQ. This has also been confirmed by the correlation analysis reported in the Annex Table **1A** and the Granger causality (Annex Table **2A**) as they fail to indicate any statistically significant results indicating the interrelationship between these variables.

The money market rate, on the other hand, seems to have a negative relation with the DRFMER_EQ, which has been supported by the correlation coefficient between these two variables; and there was some evidence of weak unidirectional causal relation between the call rate and the DRFMER_EQ. These results generally strengthen the hypothesis that the RFMER_EQ has been incorporating investor's optimism about the Indian financial market and the increase in the benchmark money market rate (consequent to the monetary policy tightening) in effect somewhat resulted in decelerating the RFMER_EQ.

Finally, in an attempt to evaluate how the above financial market variables are related to the goods market real effective exchange rate (REER)[7], we set up an unrestricted VAR and Granger causality test with REER and Equity FII, Call Rate and Gsec yield. However, the causality analysis did not indicate statistically significant causal relation in either direction. These results are in line with Lane and Shambaug (2010) which indicated that the trade weighted exchange rate indices could be at times insufficient to evaluate the impact of financial variables.

4.3. Long Run Dynamics of Real Financial Market Exchange Rate (Stock Market) and other Financial Variables

The above analysis (section 4.2) in line with Hau & Rey (2006) and Himonen (2009) concentrated on the differenced variables and therefore does not shed light on the long term equilibrium relationship between the variables under consideration. In this section we therefore consider the long term relationship between stock equity FII and the RFMER_Eq. The Bundesbank (2011) estimation results indicate that the countries with negative external position tend to have fairly high RFMER_EQ. In this context, as evident from the Table **3A** annex, India's external liability (Milesi-Ferretti (2007)) has grown by several folds along with secular increase in the RFMER_EQ over the past decade.

Given the data (Table **3A**) are of yearly frequency, and non-availability of monthly data on outstanding portfolio equity assets (and liability), statistical (cointegration) analysis for evaluating the long term

[6]"It is relevant to note in this context that the Reserve Bank's exchange rate policy is not guided by a fixed or pre-announced target or band. The policy has been to retain the flexibility to intervene in the market to manage excessive volatility and disruptions to macroeconomic stability." (Second Quarter Review of Monetary Policy 2011-12, Reserve Bank of India). We therefore included the net purchase by the Reserve Bank as an exogenous variable in the cointegration equation.

[7]The REER series was found to be stationary for the time period under consideration.

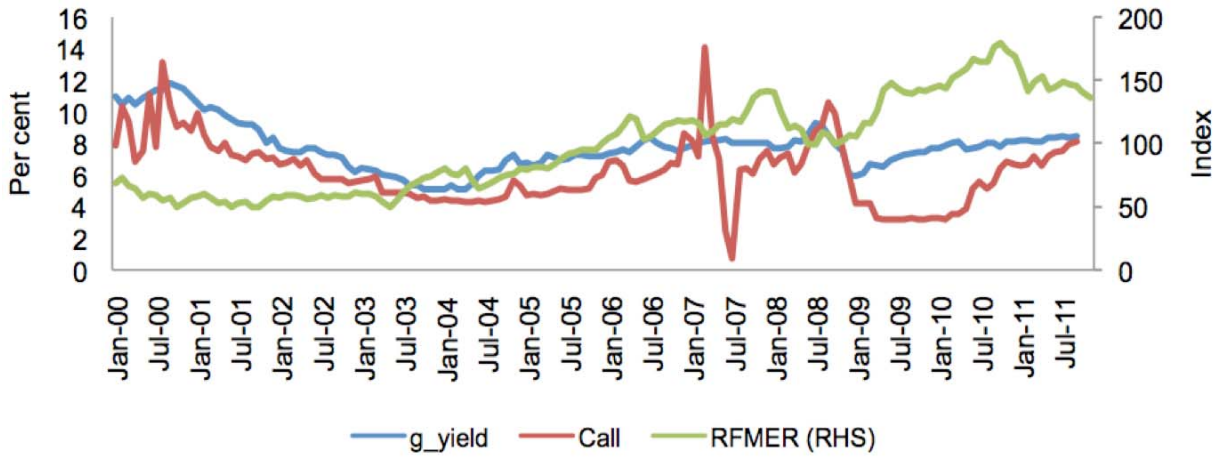

Chart 5: Real Financial Market Exchange Rate, Call and Gsec Yield Movement.

G_yield-Yield on 10-year benchmark Government Security; Call-Overnight Money Market Rate; RFMER-Real Financial Market Exchange Rate for Stock Market.

relationship using yearly data was not feasible for the (10-year) period under consideration. To overcome this problem, we combined the outstanding Portfolio Equity liability data for the year-end 1999 (December 1999) from Milesi-Ferretti (2007) with the net FII inflow data (converted to USD Million using monthly average Dollar-Rupee exchange rate), reported in Securities and Exchange Board of India (SEBI) web-site, to derive the monthly outstanding equity FII investment series for India[8].

To analyse the long term relation between the RFMER_EQ and outstanding net equity position (PEFII), in line with standard practice in time-series econometrics, we calculated Augmented Dickey-Fuller (ADF) test statistics. The test statistics reported in the Annex Table **4A** indicate that both variables were *non-stationary* in their levels (and in logarithms) and were differenced *stationary*. Having established that both the variables were *I(1)* in their levels, we found that the trace test and maximum eigenvalue test under different assumptions indicate existence of at least one Cointegration relation (Johansen test Annex Table **4B**). Furthermore, we got the optimal lag structure for the Cointegraiton analysis using unrestricted vector autoregressive model (VAR), and by comparing different test criteria (i.e. LR, AIC, SBC and HQ); both AIC and SBC criteria indicated that data support a one-lag structure (Annex Table **4C**). We then estimate a Vector Error Correction Model (VECM) with one-lag after controlling for the movement in other exogenous variables.

Charts **3** and **4** indicated some jump in RFMER and in the Reserve Banks forex intervention (purchase and sell). We calculated month-to-month growth rates in RFMER and identify those observations that are two standard deviation larger (in absolute value) than average. These are mostly found to be data during the financial crisis of 2007-2008, or during large scale capital flows in India during 2004-06. In line with the exchange rate policy of the Reserve Bank during these periods there have been substantial increases in intervention to curb the excess volatility in the forex market. To control for these periods and also to explain the significance of the Reserve Bank's forex intervention during the period of such crisis, we have incorporated the net purchase by the Central Bank (the RBI) in the forex market (NETPURCHASE) and its lag to in the error correction equation. The other three exogenous variables include (a) Call rate (overnight money market interest rate representing the monetary policy stance) (b) Gsec rate indicating the fiscal situation and the inflationary expectations underlying the Indian economy and (c) an exogenous *Crisis* dummy. The results of the VECM estimate are reported in Table **2**. It indicates that (a) the coefficients of the log variables (RFMER_EQ and PEFII) have the right sign and they are significant in the Cointegration equation, indicating that the real financial market exchange rate appreciates with the increase in the capital flows; (b) the negative sign of *CointEq1* and its significance indicate that D(lnPEFII) adjust by around 3 per cent

[8]The difference between Year-end (December) 1999 portfolio equity liability and portfolio equity asset (Milessi-Ferreti database) was taken as the starting value. The net FII inflow data reported in the SEBI web-site after appropriately converting to USD million was added (subtracted) each month to arrive at month-end stock of Net FII investment in India. To cross-check, the same Net equity inflow data from another data source (RBI Table No. 186) was used to construct monthly outstanding portfolio FII flows, and data from both sources generally tallied well.

every month to restore the system equilibrium in case of any short term departure from its long run equilibrium value.

Among the exogenous variables considered, the Crisis dummy has an expected significant negative sign, indicating the decline in financial market activities during the crisis. The coefficient of 'netpurchase' has a positive sign, which was significant at conventional level. The coefficient of one period and two period lagged 'netpurchase' is negative and significant (and the sum of these lagged 'netpurchase' coefficients added approximately to the positive contemporary coefficient) indicating that the intervention policy was not guided by a fixed or pre-announced target or band. The Call rate coefficient has a negative sign, indicating the decelerating impact of tight monetary policy on the RFMER, but it was at best weakly significant at the conventional level. The G-sec yield coefficient was not statistically significant.

As a robustness check, we did the same cointegration analysis with the two key variables RFMER and PEFII in levels (rather than in their logarithms) and with changed lag-structure as indicated by the AIC and SBC criterion. The exogenous rate variables (i.e. the Call and the Gsec yields) and 'Netpurchase' were included in their level in the error correction equation. The sign and significance of the coefficients of the cointegration equation and the error correction equation were found to be in line with those reported in Table **2**, which underlines the robustness of the results.

Finally, since some of the countries (namely Luxumbourg, Mauritius and Singapore) that have high weight in the RFMER index calculation (Chart **2**) could represent offshore capital flows from other countries and regulatory arbitrage; we replace these countries stock indices by MSCI-world index (after making appropriate adjustment to the exchange rate) to calculate the revised-RFMER. The revised index indicated the same trend as in RFMER and the cointegration analysis supported the finding of Table **2**, emphasizing the robustness of the index calculation and the long term cointegration results.

To sum up, this section evaluates the long run relation between the Real Financial (Stock) market exchange rate and outstanding portfolio FII using cointegration analysis. These results, in line with Deutsche-Bundesbank (2011) study, indicate the existence of a long run relation between the above two variables. The cointegraton equation's coefficients indicate that the rise in outstanding foreign portfolio investment in equity is accompanied by (a) an appreciation of domestic currency and /or (b) a rise in the asset prices compared to other countries. For India, given that the goods market REER was much more

Table 2: Cointegration Analysis

Cointegrating Eq:	**CointEq1**	
LNPEFII(-1)	1	
LNRFMER(-1)	-1.61	
	[-24.45]	
C	-3.36	
Error Correction:	D(LNPEFII)	D(LNRFMER)
CointEq1	-0.03	0.12
	[-2.06]	[4.13]
D(LNPEFII(-1))	0.04	0.24
	[0.47]	[1.28]
D(LNRFMER(-1))	-0.04	0.15
	[-0.96]	[1.78]
C	0.04	0.03
	[3.66]	[1.24]
CALL	-0.0020	-0.0025
	[-1.59]	[-0.91]
G_YIELD	-0.0016	-0.0011
	[-0.88]	[-0.27]
NETPURCHASE	0.0000027	0.0000050
	[4.45]	[3.86]
NETPURCHASE(-1)	-0.0000012	-0.0000042
	[-1.79]	[-2.82]
NETPURCHASE(-2)	-0.0000010	-0.0000019
	[-1.58]	[-1.40]
CRISIS	-0.020	-0.034
	[-2.84]	[-2.20]
R-squared	0.34	0.32
Adj. R-squared	0.29	0.27

Note: t-statistics reported in the ().Variables LnRFMER_EQ-log of real financial markets exchange rate for equity market; LnPEFII-log of outstanding portfolio FII equity flows. *crisis dummy,* takes value one for the period 2007:12-2008:12, otherwise zero; CALL is the overnight money market rate; G_yield is the 10-year benchmark Government security yield. Netpurchase: Net USD purchase by the Reserve Bank.

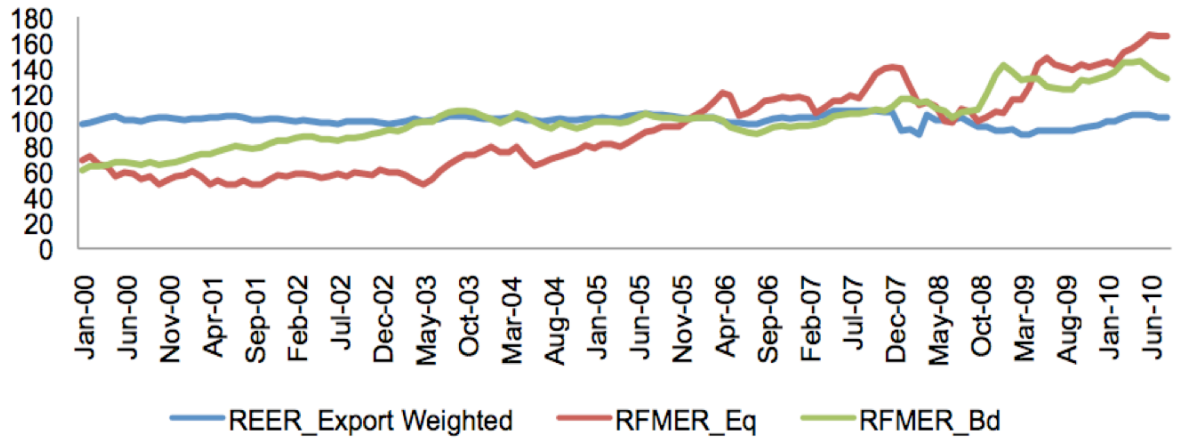

Chart 6: Real Financial Markets Exchange Rate, Bond Market.
RFMER_Eq-Real Financial Market Exchange Rate for Stock Market; RFMER_BD-Real Financial Market Exchange Rate for Bond (debt) Market; REER-Real Effective Exchange Rate (Goods Market).

stable as compared to its financial markets counterpart, it appears that the relative stock price appreciation was the major factor causing the equity capital inflows. The error correction term was negative and significant indicating that the Net FII inflow adjust in case of short term disequilibrium. However, the error correction term indicated a slow adjustment process, which underlines the simultaneous role of good market real effective exchange rate in the correction process. The causality test and the sign and significance of the exogenous variables in the short term error correction equation broadly support the observations in section 4.2 based on the published net FII inflow data and underlines the robustness of these empirical results.

4.4. Real Financial Market Exchange Rate (Debt Market) and other Financial Variables

At this stage, is it perhaps a bit too premature to calculate and analyse the Real Financial Markets Exchange Rate for Bonds (RFMER_BD) market. It is evident from Table **1** that the main source of capital flows in India was through the equity route. On the data front, bond performance indices are difficult to construct as compared to the stock indices, and therefore more conspicuous. For instance, out of the 25 shortlisted countries that were considered for the stock markets RFMER, we could get active bond performance index for 20 countries[9]. The investment from India to rest of the world was in general small and it was even more so for the bond market. For instance, in 2005, among the 20 shortlisted countries USA was the sole country to report positive total portfolio bond investment from India. However, for the completeness of the analysis we calculate the RFMER_BD using the methodology described in Section 4.1 and the computed series is plotted in the Chart **6**. It indicates that the RFMER_BD was less volatile as compared with its equity counterpart. Except the early phases (2000:01-2003:03) and the post crisis period the RFMER_BD was almost aligned to the goods market REER. These observations for Indian bond market were in line with the Germany, as reported in Deutsche Bundesbank (April 2011). The correlation analysis Annex Table **1B** indicates that the differenced real financial market exchange rate for the debt market (DRFER_BD) was only significantly positively correlated with the Debt market FII flows. The Granger causality analysis Annex Table **2B** indicated unidirectional causal relation from DRFMER_BD to Debt FII flows. It also indicated that benchmark Gsec-yield Granger cause DRFMER_BD. Finally, the causality analysis indicated that the 'Net-purchase' variable Granger cause DRFMER_BD.

To sum up, these results indicated a dominant role of equity-segment portfolio flows among the other financial market segments in India. Though there were different phases in real effective financial exchange rate for stock market (RFMER _EQ) movements, the index generally indicated an upward trend incorporating the emerging nature of the Indian financial markets and investors' optimism. The cointegration relation between RFMER _EQ and the net outstanding equity FII indicated existence of a long run equilibrium relation;

[9]The 20 countries that were selected/included are Australia, Austria, Canada, China, Denmark, France, Germany, Hong Kong SAR, Ireland, Japan, Korea, Luxembourg, Netherlands, Singapore, Spain, Sweden, Switzerland, United Kingdom and United States. These countries were selected on the basis of bilateral capital flow and on the basis of availability of data.

and the short term adjustment process is represented by the negative and significant error correction term. Several important financial markets variables (e.g. equity-FII, net forex purchase, money market rate) were found to be correlated and found to have significant causal relation with the real financial market exchange rate.

5. CONCLUSION

There have so far been a large number of studies that analysed the inter-relation between macro/financial variables and nominal or real effective exchange rates. While the underlying assumption of REER was that the trade flows would dominate the cross boarder international activities, over time financial capital flows far superseded the trade flows in general and in particular in the Emerging Market Economies. The changed environment raised questions on the use of REER and suggested the use of financial prices adjusted and financial-variable weighted Real Financial Markets Exchange Rate. Our study is an attempt in this direction, which calculates the Real Financial Market Exchange rate for an emerging economy, India, and analyses its interrelations with other financial variables.

The results indicate that the capital flows in the Indian financial markets were mainly directed towards the equity segment (as compared with the debt segment) and therefore the equity price weighted real exchange rate (RFMER_EQ) primarily represented the Real Financial Markets Exchange Rate. Though there were different phases, the index generally indicated an upward trend incorporating the emerging nature of the Indian market, high growth potential, financial markets' resilience, demographic dividends and consequent investors' optimism. The cointegration relation between RFMER _EQ and the net outstanding equity FII indicate a long run equilibrium relation; and a statistically significant negative error correction coefficient indicate that short term deviation reverts back to the long term equilibrium path. These findings indicate that an increase in outstanding foreign capital inflow is accompanied by an appreciation of domestic currency and /or a rise in domestic asset prices as compared to the asset prices in selected set of countries. The empirical results indicate that the changes in the RFMER_EQ are positively and significantly correlated to the net equity FII inflows and the former caused the latter during the period under consideration. The overnight money market (Call) rate, on the other hand, had a negative and significant correlation coefficient, and the Call rate caused the change in RFMER. These findings indicate that a tight monetary policy has a depreciating impact on the real financial markets exchange rate, which could be because of the fact that inflation (which generally triggers the monetary tightening) and possibility of decelerated output growth reduces the financial asset prices in India as compared to its foreign counterparts. Finally, our study also found evidences of unidirectional causal relationship from net dollar purchase to changes in RFMER_EQ; however, the reverse causality was not found to be statistically significant at the conventional levels.

Our analyses generally indicate that the capital flows in the bond market remained minimal so far, resulting in the Real Financial Market Exchange Rate for bond market having limited explanatory power. On the policy front, this calls for accelerated development of debt market infrastructure. The Reserve Bank has already made long strides in this direction and is actively pursuing policy measures to further develop bond market and strengthen activities in the domestic corporate bond market. It is therefore likely that the debt market will also play an active role attracting substantial capital flows and enriching the information content of real bond market effective exchange rate.

In this study, we have attempted to highlight the importance of the real financial market exchange rate as a policy variable for an emerging market in face of large and volatile capital flows. With increasing global financial market integration, we expect the real financial market exchange rate to share the centre stage with the trade weighted exchange rate. The former is likely to provide useful information about investors' optimism, relative valuation of the asset prices and an indication of speculative and/or destabilizing forces operating through asset prices. In all, the real financial market exchange rate is likely to complement its goods market counterpart in making crucial policy decisions relating to monetary policy, capital flows, financial asset prices and exchange rate.

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ANNEX

Table 1A: Correlation Analysis (Stock Market)

	DRFMER	EQUITY_FII	DEBT_FII	TOTAL_FII	NETPURCHASE	USD_PUR	USD_SALE	G_YIELD	CALL
DRFMER _EQ	1								

EQUITY_FII	0.44	1							
	(5.76)	-----							
DEBT_FII	-0.02	0.15	1						
	(-0.22)	(1.79)	-----						
TOTAL_FII	0.40	0.96	0.43	1					
	(5.08)	(39.02)	(5.61)	-----					
NETPURCHASE	0.18	0.28	0.04	0.27	1				
	(2.20)	(3.47)	(0.49)	(3.31)	-----				
USD_PUR	0.12	0.09	-0.07	0.06	0.74	1			
	(1.44)	(1.05)	(-0.86)	(0.71)	(13.09)	-----			
USD_SALE	-0.13	-0.31	-0.15	-0.33	-0.59	0.10	1		
	(-1.51)	(-3.88)	(-1.77)	(-4.11)	(-8.61)	(1.21)	-----		
G_YIELD	-0.14	-0.12	0.04	-0.10	-0.14	-0.12	0.06	1	
	(-1.70)	(-1.44)	(0.42)	(-1.18)	(-1.62)	(-1.46)	(0.65)	-----	
CALL	-0.24	-0.34	-0.07	-0.33	-0.17	0.01	0.26	0.67	1
	(-2.92)	(-4.30)	(-0.78)	(-4.15)	(-2.00)	(0.10)	(3.16)	(10.73)	-----

T-Statistics reported in the parentheses. Variables: *RFMER_EQ*-real financial markets exchange rate for equity market; *Equity_FII*- net portfolio FII equity flows, Similarly Debt_FII and Total_FII. *crisis dummy,* takes value one for the period 2007:12-2008:12, otherwise zero; *CALL* is the overnight money market rate; *G_yield* is the 10-year benchmark Government security yield. *Netpurchase*: Net USD purchase by the Reserve Bank; USD_PUR-purchase of forex by RBI, USE_SALE: sell of forex by RBI.

Table 1B: Correlation Analysis (Bond Market)

	DRFMER_BD	EQUITY_FII	DEBT_FII	TOTAL_FII	NETPURCHASE	USD_PUR	USD_SALE	G_YIELD	CALL
DRFMER_BD	1								

EQUITY_FII	0.03	1							
	(0.38)	-----							
DEBT_FII	0.26	0.24	1						
	(2.98)	(2.78)	-----						
TOTAL_FII	0.10	0.96	0.50	1					
	(1.16)	(38.83)	(6.49)	-----					
NETPURCHASE	0.11	0.34	0.07	0.32	1				
	(1.26)	(4.05)	(0.76)	(3.81)	-----				
USD_PUR	0.15	0.13	-0.03	0.11	0.75	1			
	(1.71)	(1.51)	(-0.36)	(1.24)	(12.57)	-----			
USD_SALE	0.01	-0.35	-0.14	-0.35	-0.62	0.07	1		
	(0.12)	(-4.20)	(-1.57)	(-4.23)	(-8.78)	(0.73)	-----		
G_YIELD	-0.01	-0.14	0.02	-0.12	-0.13	-0.10	0.07	1	
	(-0.07)	(-1.58)	(0.21)	(-1.35)	(-1.45)	(-1.17)	(0.79)	-----	
CALL	0.06	-0.39	-0.09	-0.37	-0.16	0.04	0.28	0.67	1
	(0.71)	(-4.79)	(-0.96)	(-4.53)	(-1.77)	(0.48)	(3.33)	(10.16)	-----

T-Statistics in the parentheses. Variables: *RFMER_EQ*-real financial markets exchange rate for equity market; *Equity_FII*- net portfolio FII equity flows, Similarly Debt_FII and Total_FII. *crisis dummy,* takes value one for the period 2007:12-2008:12, otherwise zero; *CALL* is the overnight money market rate; *G_yield* is the 10-year benchmark Government security yield. *Netpurchase:* Net USD purchase by the Reserve Bank; USD_PUR-purchase of forex by RBI, USE_SALE: sell of forex by RBI.

Table 2A: Granger Causality Test (Stock Market)

Null Hypothesis:	F-Statistic	Prob.
EQUITY_FII does not Granger Cause DRFMER	1.11	0.35
DRFMER does not Granger Cause EQUITY_FII	2.27	0.08
DEBT_FII does not Granger Cause DRFMER	0.70	0.55
DRFMER does not Granger Cause DEBT_FII	0.47	0.70
TOTAL_FII does not Granger Cause DRFMER	0.81	0.49
DRFMER does not Granger Cause TOTAL_FII	2.39	0.07
NETPURCHASE does not Granger Cause DRFMER	2.44	0.07
DRFMER does not Granger Cause NETPURCHASE	1.63	0.19
USD_PUR does not Granger Cause DRFMER	1.68	0.17
DRFMER does not Granger Cause USD_PUR	0.75	0.52
USD_SALE does not Granger Cause DRFMER	0.55	0.65
DRFMER does not Granger Cause USD_SALE	1.47	0.22
G_YIELD does not Granger Cause DRFMER	0.74	0.53
DRFMER does not Granger Cause G_YIELD	0.77	0.51
CALL does not Granger Cause DRFMER	2.09	0.10
DRFMER does not Granger Cause CALL	0.84	0.46
DEBT_FII does not Granger Cause EQUITY_FII	0.99	0.40
EQUITY_FII does not Granger Cause DEBT_FII	2.48	0.06
TOTAL_FII does not Granger Cause EQUITY_FII	0.99	0.40
EQUITY_FII does not Granger Cause TOTAL_FII	2.10	0.10
NETPURCHASE does not Granger Cause EQUITY_FII	1.28	0.28
EQUITY_FII does not Granger Cause NETPURCHASE	1.48	0.22

Variables: *RFMER_EQ*-real financial markets exchange rate for equity market; *Equity_FII*- net portfolio FII equity flows, Similarly Debt_FII and Total_FII. *crisis dummy,* takes value one for the period 2007:12-2008:12, otherwise zero; *CALL* is the overnight money market rate; *G_yield* is the 10-year benchmark Government security yield. *Netpurchase*: Net USD purchase by the Reserve Bank; USD_PUR-purchase of forex by RBI, USE_SALE: sell of forex by RBI.

Table 2B: Granger Causality Test (Bond Market)

Null Hypothesis:	F-Statistic	Prob.
EQUITY_FII does not Granger Cause DRFMER_BD	1.81408	0.1483
DRFMER_BD does not Granger Cause EQUITY_FII	0.78723	0.5033
DEBT_FII does not Granger Cause DRFMER_BD	0.33571	0.7995
DRFMER_BD does not Granger Cause DEBT_FII	4.47572	0.0052
TOTAL_FII does not Granger Cause DRFMER_BD	1.11663	0.3453
DRFMER_BD does not Granger Cause TOTAL_FII	1.50231	0.2176
NETPURCHASE does not Granger Cause DRFMER_BD	5.99546	0.0008
DRFMER_BD does not Granger Cause NETPURCHASE	1.34598	0.2629
USD_PUR does not Granger Cause DRFMER_BD	0.86699	0.4604
DRFMER_BD does not Granger Cause USD_PUR	0.72999	0.5361
USD_SALE does not Granger Cause DRFMER_BD	6.94158	0.0002
DRFMER_BD does not Granger Cause USD_SALE	1.78628	0.1535
G_YIELD does not Granger Cause DRFMER_BD	2.29188	0.0817
DRFMER_BD does not Granger Cause G_YIELD	4.6804	0.004
CALL does not Granger Cause DRFMER_BD	1.64139	0.1835
DRFMER_BD does not Granger Cause CALL	1.41819	0.2409

Table 3A: Net Foreign Asset and Real Financial Market Exchange Rate

	RFMER_EQ	Portfolio equity assets	Portfolio equity liabilities	Net Foreign Assets (NFA)
2000	59.2	783	17,373	-80,355
2001	53.8	740	18,853	-79,163
2002	57.4	625	21,064	-68,390
2003	62.3	849	48,826	-70,671
2004	73.0	962	67,685	-82,326
2005	87.7	1,047	105,652	-116,670
2006	112.1	1,243	161,694	-166,734
2007	121.0	1,207	302,204	-279,271

Data Source: Updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007).

Table 4A: Augmented Dickey-Fuller Test Statistics

	t-Statistic	Prob.*	
lnPEFII	-0.26	0.92	
D(lnPEFII)	-9.82	0.00	
lnRFMER_EQ	-0.77	0.82	
D(lnRFMER_EQ)	-5.86	0.00	
*MacKinnon (1996) one-sided p-values.			
Critical values:	1% level		-3.45
	5% level		-2.88
	10% level		-2.56

Variables LnRFMER_EQ-log of real financial markets exchange rate for equity market; LnPEFII-log of outstanding portfolio FII equity flows.

Table 4B: Number of Cointegration Relation as Indicated by Different Models

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	1	1	1	2
Max-Eig	1	1	1	1	2

*Critical values based on MacKinnon-Haug-Michelis 0.05 level, Variables LnRFMER_EQ-log of real financial markets exchange rate for equity market; LnPEFII-log of outstanding portfolio FII equity flows.

Table 4C: VAR Lag Order Selection Criteria

Lag	LogL	LR	AIC	SC	HQ
0	41.76	NA	-0.45	-0.19	-0.34
1	562.41	978.67	-8.26*	-7.87*	-8.08
2	569.59	13.27*	-8.22	-7.83	-8.08*
3	570.96	2.51	-8.23	-7.70	-8.01
4	575.19	7.57	-8.23	-7.62	-7.98
5	578.52	5.85	-8.22	-7.52	-7.94
6	582.70	7.22	-8.22	-7.44	-7.90
7	584.23	2.61	-8.18	-7.31	-7.83
8	584.80	0.94	-8.13	-7.18	-7.74

*indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level); AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion. Variables LnRFMER_EQ-log of real financial markets exchange rate for equity market; LnPEFII-log of outstanding portfolio FII equity flows.

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