Indian Journal of Economics and Business
Vol. 21 No. 1 (January-July, 2022)

http://www.ashwinanokha.com/IJEB.php

Do International Reserves Holdings induce the Corporates to Borrow in Foreign Currency?

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Received: 11th October 2021
Revised: 27th December 2021
Accepted: 01st March 2022

Abstract: In this study, we examine whether foreign currency borrowings by the corporate sector acts as a determinant of international reserves holdings by the central bank of India and discuss on the adequacy of forex reserves. Departing from the previous studies, we employ the ARDL model, we show that forex reserves accumulation by the RBI is because of mercantilist motives and there is no evidence that such accumulation of forex reserves provides implicit guarantee for the firms to borrow in foreign currency. The central bank will accumulate forex reserves keeping in view the money circulation in the economy, current account and capital account volatility. These results endorse the existing policy framework of the central bank on the reserves accumulation and external commercial borrowings by the corporate sector.

Keywords: Foreign Exchange Reserves; Central Bank; Foreign Currency Borrowings; India.

1. Introduction

Since the global financial crisis, most of the emerging developing economies including India have become more alert and started accumulating sizeable amount of cross-border financial assets chiefly in the form of foreign exchange reserves (henceforth forex reserves). The central bank has been maintaining these forex

reserves to meet unexpected exigencies. Abundant international reserves have been showcased by the Reserve Bank of India (RBI) as a cushion against the loss bearing bonds or other foreign exchange assets during an increase in interest rates or rupee appreciation, and other risks associated with the exchange rate depreciation. These funds would also be helpful to carry out bail out programs during banking and corporate sector defaults that may threaten financial stability.

The forex reserves held with most of the emerging developing economies have witnessed a staggering rise in recent times. Following the global trends, the international reserves held with the RBI is around US $ 393.133 billion on November 2, 2018 which slipped from US $ 426.082 billion held on April 13, 2018. Since the balance of payment crisis of 1990s and adoption of financial liberalization, the stockpile of forex reserves in India is the highest currently. According to a study by Morgan Stanley (2013), India has surpassed Brazil among nations that have high current account deficit (CAD) and consequent higher dependence on capital flows and therefore is considered as one among the "Fragile Five" nations. However, Bhattacharya (2017) shows that the country has been able to retain its top position in the holding of forex reserves among nations with high CAD. Therefore, it is important to understand the motives of RBI to hoard such exceptional bulk of forex reserves despite the fact that India has been implementing the managed flexible exchange rate regime since March 1993.

The need for forex reserves by most of the emerging market economies is to meet the precautionary motives. Nevertheless, excess accumulation of international reserves after certain threshold invites an opportunity cost. According to Sharma and Bhanumurthy (2011), the existing financial resources for financing the developmental projects in India are scanty and the country has to attract the foreign capital onshore if it has to meet the requirements of its projects by keeping the domestic interest rate relatively high. Therefore, the international reserves held with the central bank can be channelized to the needy projects as hoarding these precious funds is not beneficial and coherent. The rationale of keeping these reserves idle for an extended period is misgiving. The RBI's reports in the past have also reflected that India has a surplus of international reserves than essential with a motive to hedge risk against any unforeseen financial instability. Rodrik (2006), argued that the opportunity cost of holding these reserves is high for a country like India which invests in low-yielding foreign currency assets namely short-term US Treasury or similar safer securities.

Academic scientists suggest that there is a need of an optimum level of reserves the central bank must keep in order to meet uncertainty and minimize the opportunity cost. Similar to these opinions Reddy (1997), recommends optimal forex reserves holding by the RBI must be equivalent to a summation of monthly import payments and debt service. However, Reddy (1997) recommend to include other primary indicators to the proposed method. Later Greenspan (1999), proposed a rule (popularly known as Greenspan-Guidotti rule) and suggest that the optimum forex reserves of the country must be based on all repayments and interests on foreign borrowings taken together. Greenspan also opined that a nation can be considered healthy if its forex reserves equals to one-year short-term borrowings. However, despite such globally acclaimed rules prevailing at international level, most of the countries do not follow them and hence there is no end to the staggering rise in the international reserves, and the notion of keeping huge stocks of forex reserves is not rationale.

The optimum level of international reserves is considered as the level where the marginal productivity of reserves comprising stability of exchange rates, business and investor's confidence, mitigation of financial and economic risks, insurance against capital flight, and interest earned on reserves, equals the marginal productivity of real resources. Most of the central bank do not calculate these costs and benefits since the evaluation of these costs and benefits are challenging. Pragmatically, the central bank of most of the countries employ several indicators of foreign exchange adequacy, none of which by itself is sufficient (William, 2006).

Moreover, the increase in the international reserves by the central bank can also been perceived as an implicit guarantee for the financial firms and non-financial firms borrowing lavishly in foreign currency. The hike in forex reserves can aggravate moral hazard problems as it inspires the entities to progressively borrow in foreign currency (which is considered to be a cheaper loan for their business) with the expectation that the central bank will bail them out in the event of considerable exchange rate depreciation. Hence, the reserves accumulated by the central bank reflect reserves as insurance provisions to the Indian entities which have generated high stocks of debt denominated in foreign currency and at times when exchange rate is depreciating (Pradhan, 2018; Pradhan and Hiremath, 2020a). However, these claims need further investigation and empirical support. The present study deciphers the motives of the central bank for maintaining such a staggering rise in the international reserves and fill the literature gap.

Given the pressing concern of the growing reserves holdings by the Central bank, we contribute to the literature on central banking in multiple ways. First, to the best of our knowledge, the present work is able to explain the relationship between the motives of corporate firms borrowing behavior and central banks reserves holding behavior. There are seldom any empirical studies which deciphers such moral hazard behaviors of the entities. The growing corporate borrowings and forex reserves with the RBI makes India an appropriate applicant for an empirical examination. Despite the growing concerns about the corporate borrowings[1] and rich theoretical base postulating central bank forex reserves as an implicit guarantee, the issue has not received due attention. The extant literature pertaining to forex reserve mostly focused on the determinants of international reserves (Gosselin and Parent 2005; *Popovska-Kamnar et al. 2016*), adequacy of reserves (Heller 1968; Willet 1969; Barnichon 2008; Officer 1976), and compositions of forex reserves (Heller and Knight 1978; Dooley et al. 1989; Eichengreen and Matheison 2000; McCaulay et al. 2015). Second, departing from the earlier studies we use ARDL approach to examine the long-run and short-run relationships between forex reserves and potential explanatory variables as dictated by the previous literature. Third, this study is perhaps the first on emerging developing economies on these lines against the backdrop of several episodes of crises in past two decades. Finally, this study will be a value addition for the central bankers who are to take a decision on their position of the level of forex reserves holdings maintained by the central bank. This study also provides inputs to country's policy on corporate borrowings framework and offers insights into debt strategies of the firms.

[1]Recently, many studies explored on the consequences of external commercial borrowings (ECBs). Prior studies probed on the reasons for ECBs by the corporate sector (Pradhan and Hiremath, 2020b); effect of ECBs on Indian firm's balance sheet (Pradhan and Hiremath, 2021); and impact of ECBs on Indian exports (Pradhan and Hiremath, 2020c).

The remainder of this study is organized into following sections. In the Section 2, we provide a discussion on the literature and the theoretical framework. Section 3, details about the methodology and data sources. Section 4, provides a discussion on the results and Section 5 concludes the study.

2. Review of Literature

2.1 Previous Studies

During the early 1990s, most of the countries choose to shift from fixed exchange rate regime to managed floating which is considered to be an intermediate approach and lie between the fixed rates and a clean float extreme. Since the managed floating system of exchange rate regime intervention by the central bank necessitates accumulation of forex reserves, it is clear that empirical studies on international reserves is relevant in the present times as it has been in the past.

The extant literature emphasized on two important motives of international reserves holding: (i) mercantilism motive, (ii) precautionary motive. Among the mercantilist studies, Dooley et al. (2005) view that abundant forex reserve in East Asia is due to the promotion of their export and poor functioning of their financial markets. The authors further argue that international reserves holdings boost export thereby avoiding appreciation of domestic currency. However, Aizenman and Marion (2003) attempt to study the factors influencing the decision to hold international reserves in developing countries. The study uses the yearly data on forex reserves for 125 developing countries for the period from 1980 to 1996. Using a panel data regression analysis, the study finds that the forex reserves is positively related to the population, the GDP per capita, the export volatility, and the imports, and negatively related to the volatility in nominal effective exchange rate. Their study observes that countries that perceive high sovereign risk and costly domestic tax collection prefer to accumulate high reserves because of precautionary motives. Furthermore, in another study Aizenman and Lee (2007) also find similar precautionary motives for holding reserves by employing the fixed effect regressions for a period from 1980 to 2000.Their study find trade openness and exposure to financial crises variables to be significantly influencing the reserves. Contrastingly, variables implying mercantilist views seldom provide any economic explanation.

Barnichon (2008) devise an analytical framework in order to quantify the optimum level of forex reserves that will be sufficient to meet outsized external shocks, namely natural disasters and trade shocks. In similar lines, the author estimates the optimal level of forex reserves for two set of countries namely hurricanes in the Caribbean and droughts in the Sahel. The study finds the variables namely the type of shocks hitting a country, country's export sector, and degree of risk aversion can largely affect reserves holdings. In another empirical study, Elhiraika and Ndikumana (2007) explore on the determinants of forex reserves of 21 African countries for the period from 1979 through 2005. Especially, the study investigates the accumulation of international reserves is not rationalized by portfolio choice motives or stabilization objectives. The empirical results show that reserves buffers is accompanied by appreciation of domestic currencies and there is no significant impact on current inflation in the short run, but a statistically significant and positive effect on inflation in the long run. Departing from the previous literature, Lizondo

and Mathieson (1987) show that the difficulties of external payments and diminishing access to international financial markets accompanies the variations in the estimated demands of forex reserves.

Flood and Marion (2002) investigates the reasons of reserve accumulation and studied that the need of forex reserves holdings against the backdrop of increase in financial volatility and diminished faithfulness to fixed exchange rates. The key findings suggest that the efficacy of exchange rate stability, nation's financial openness, and opportunity cost explains around 40 per cent of the discrepancy in the countries' forex reserves holdings. In another study, Prabhesh et al., (2007) analyzed the determinants of international reserves for India from 1983 to 2005. Applying cointegration and vector error correction approach, the authors found that RBI's motive of holding forex reserves in the long-run are a function of ratio of broad money to GDP, ratio of imports to GDP, opportunity cost of accumulating international reserves and, flexibility of exchange rate. The authors also opined that the behavior of holding international reserves is primarily influenced by the vulnerability of capital account and less sensitive to the opportunity cost. Nevertheless, Jalil and Bokhari (2008) use the monthly data on forex reserves holdings by the central bank of Pakistan from 1995 to 2005 and finds that opportunity cost of holding reserves is more influential than reserve volatility in explaining the demands for forex buffers of the country.

Edison (2003) use a panel data for 122 countries from the period 1980-1996 to study the factors affecting the level of international reserves. The author finds significant contribution of population, GDP Per-capita ratio of imports to GDP and exchange rate volatility in explaining the levels of forex reserves. In the similar vein, Romero (2005) analyzed the determinants of forex reserves holding for China and India. The results show current account to be a significant variable in examining the need for holding reserves for both India and China. Variables namely average propensity to import and exchange rate also prove to be significant in explaining the level of forex reserves in India.

Focusing on the optimal forex holdings Sehgal and Sharma (2008) finds that during the year 2005-06, excess of international reserves with RBI has reached US $ 33 billion in value. Using cointegration and VECM approach the authors find that central bank of India would prefer to hold forex reserves because of both mercantilist and precautionary motive. Especially, exchange rate volatility and risky capital positively affect international reserves demand.

The literature on international reserves mostly concentrated on the broader issues namely the demand for reserves, the supply of reserves, the composition and distribution of reserves, etc. The present study fills the important gap in the literature. Departing from previous studies, in this study we focus on the factors affecting the levels of international reserves and examine that whether corporate external commercial borrowings and other precautionary events influence central bank forex reserves holdings.

2.2 Theoretical Model

The literature on central banking and international reserves explains many factors which affects the levels of forex reserves of the central bank. Notably, the current account balance (CAB) is one of the crucial factor which determines the levels of forex reserves. It includes exports and imports of goods and services; payments made to the foreign investors and payments received by the domestic investors from foreign

investments; and unilateral transfers payments in the form of foreign aid and remittances. On one hand, surplus in the current account reflects country's better economic health since net inflow of foreign exchange in the economy increases as compared to the rest of the world. On the other hand, deficit in the current account indicates that the country is a net borrower. A deficit in the current account would reduce the value of the foreign currency assets and eventually increase the demand for international reserves.

ECBs[2]are commercial loans offered to Indian borrowers by the non-resident lenders in the form of loan raised form bank, suppliers' credit, buyers' credit, securitized instruments such as floating rate notes and fixed rate bonds, non-convertible, partially convertible, or optionally convertible preference shares, foreign currency convertible bonds, foreign currency exchangeable bonds and financial lease for a minimum average maturity period of three years. The expected sign of the ECB and forex reserves is uncertain. The relationship between ECBs and levels of international reserves will be positive when a rise in corporate borrowings raises the susceptibility of the capital account. On the other hand, central bank would like to reduce its levels of forex reserves if moral hazard hypothesis is hold true. ECBs is detrimental in the event of exchange rate shocks and a rise in the levels of forex reserves with the central bank might imply implicit insurance guarantee among the corporate firms to borrow in foreign currency.

We expect a positive relationship between foreign investment (FINV) and forex reserves because of the volatile nature of capital flows. Foreign investment includes foreign direct investment (FDI) and foreign portfolio investment. FDI is perpetual and stable relative to the volatile nature of foreign portfolio investment (FPI). Similar to ECB, increase in foreign investment would make the capital account vulnerable and certainly would increase the demand for international reserves. The finance literature explains two channels through which the foreign investment depends on the levels of forex reserves. First, the central bank is expected to stabilize the abrupt movements in the exchange rate which is associated with the foreign investments. Second, central bank offers bailout programs during uncertainties based on the level of central bank's forex reserves holdings (Qian and Steiner, 2014). Therefore, forex reserves act as a cushion against volatile capital flows and positively affect investors' confidence.

Opportunity cost turns out to be a crucial factor of reserve demand, if measured properly. We expect a negative sign of the variable call money rate (CALL)—a proxy of opportunity cost, as increase in call money rates compared to the prevailing interest rates elsewhere would reduce the need for reserves (Vasudevan, 2016). This is because investing these precious reserves in profitable securities would generate more return as opportunity cost which is involved in holding these reserves idle. Most of the past empirical studies were unable to find a significant opportunity cost effect on the reserves holdings. This is because of the issue of the measurement of opportunity cost in accordance with its theoretical definition. For instance, most of the past studies use commonly found proxies such as domestic discount rate or government bond yields. Courchene and Youssef (1967) and Frenkel and Jovanovic (1981) find a negative association between international reserves and the discount rate. However, the discount rate is considered an unsatisfactory proxy because nominal rates of return do not reflect the adjustment of rate of inflation and the discount rate is influenced by the prevailing monetary policy at any given point of time. Other studies use yield differential to measure opportunity cost. Similarly, Iyoha (1976) considers the discount rate of every country and find a positive association between the discount

[2]External commercial borrowings refer to the debt issued in foreign currencies by the Indian firms from overseas market on long-term basis. The finance literature interchangeably uses the term ECBs, as foreign currency borrowings (FCBs), corporate debt, and dollar debt.

rates and the international reserves. However, Hipple (1979) and Shinkai (1979), pointed out that this interpretation might be problematic because reserves are invested abroad, chiefly in US $, so the appropriate interest rate should either have been LIBOR (as in Edwards, 1985) or else it should have been reflected in the respective country's currency composition of reserves.

We use broad money (BRMON) to measure the money circulation in the economy. Broad money (M3) includes currency deposits with a maturity of up to two years, repayable deposits up to three months and repurchase agreements, money market securities up to two years. Reddy (2002) mentions about four measures to define the adequacy of forex reserves. While focusing on the money based indicators, the author explains that reserve to broad money is a potential tool of capital flight from currency. Therefore, weak banking system and unstable money demand in the economy might aggravate capital flights. Previous studies find a positive relationship between demand for international reserves and broad money supply (Panda and Trivedi, 2014).

3. Data and Methodology

The current study is subject to secondary data. The data for the present analysis is collected from RBI's Handbook of Statistics on Indian Economy, Ministry of Finance, Government of India and Federal Reserve Bank of Saint Louis. The period of the study is from 1991 through 2018. The choice of variables is dictated by the theoretical literature and availability of data. To explore the factors determining the accumulation of forex reserves with the Central Bank, we use the two step ARDL approach. In the first step, we estimate the long-run relationship between the variables using the following equation:

$$LnFOREX_t = \alpha_i + \beta_1 LnBRMON_t + \beta_2 CAB_t + \beta_3 LnECB_t + \beta_4 LnFINV_t + \beta_5 LnCALL_t + \beta_6 FINDUM_t + \mu_t \quad (1)$$

where $FOREX_t$ implies the central bank's forex reserves.$BRMON_t$ symbolizes the broad money supply in the economy. CAB_t represents the ratio of current account balance to GDP. ECB_t and $FINV_t$ denotes to external commercial borrowings and foreign investments respectively and are considered as key components of capital account of the balance of payments. The $CALL_t$ refers to call money interest rate and $FINDUM_t$ is the financial crises dummy. The μ_t is the random disturbance term of the model. All variables are transformed into natural logarithms except CAB and FINDUM.

In the second step, we report the Error correction mechanism (ECM) results to check the rate of adjustment of the dependent variable towards the equilibrium due to any changes in the independent variable. Therefore, it is a useful tool for estimating the short term and long term effects of one-time series with the other. We use the V case as discussed in Pesaran et al. (2001) $\alpha_0 \neq 0$ and $\alpha_1 \neq 0$ as our model supports the unrestricted intercept and linear trend. Here, the deterministic trend restriction $\alpha_1 = -(\pi_{FOREX,FOREX}, \pi_{FOREXx,x})\varphi$ is not considered and the ECM is represented as:

$$\Delta FOREX_t = \alpha_0 + \alpha_{1t} + \pi_{FOREX,FOREX} FOREX_{t-1} + \pi_{FOREXx,x} X_t + \sum_{i=1}^{p-1} \psi' i \Delta z_{t-i} + \acute{\omega} \Delta x_t + u_t \quad (2)$$

Using the Eq. (2), we test the null hypothesis ($\pi_{FOREX,FOREX} = 0$, $\pi_{FOREXx,x} = 0$) keeping in view the absence of possible relationship between the regress and and regressors in level. The term *FOREX* implies forex reserves whereas *X* represents independent variables namely, BRMON, CAB, ECB, FINV, CALL, and FINDUM.

4. Results and Discussions

We present the summary statistics of the variables included in the Eqn. 1 in the Table 1. The mean of all the variables (except CAB) are positive. The low values of standard deviation of the variables imply that the observations are more concentrated around the mean. The skewness of major variables is negative except ECB, CALL and FINDUM which shows left skewed distribution than the normal distribution. The Jarque–Bera statistics validate normal distributions of the set of variables except FINV and FINDUM. We test the stationarity of the variables employing ADF, PP and KPSS unit root tests. The ADF and PP statistics show that the variables such as FINV is stationary including trend as well as without trend term whereas variables namely FOREX, BRMON, CAB, ECB, CALL and FINDUM are non-stationary (Table 2). The KPSS test results show that the variables such as CAB and FINDUM are stationary in level when both time trend and constant term is included.

Table 1. Descriptive statistics

Variables	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
FOREX	8.279	1.582	-0.569	2.157	2.424 (0.298)
BRMON	7.649	1.287	-0.088	1.729	1.986 (0.370)
CAB	-0.133	0.145	-0.073	4.041	1.334 (0.513)
ECB	7.337	1.317	0.212	1.916	1.639 (0.441)
FINV	6.211	2.033	-1.219	4.065	8.564 (0.014)
CALL	2.074	0.265	0.335	1.604	2.898 (0.235)
FINDUM	0.172	0.384	1.734	4.008	15.769 (0.000)

Note: FOREX implies forex reserves with the central bank. BRMON symbolizes broad money supply. CAB refers to current account balance to GDP. ECB explains the outstanding external commercial borrowings by Indian firms. FINV denotes foreign investment. CALL is the call money rate. FINDUM refers to financial crises dummy variable. Values in the paranthesis refers to the *p* values of Jarque-Bera normality test.

Source: Author's computations

The conventional cointegration techniques namely Engle and Granger (1987) and Johansen (1991) cointegration techniques discussed in the econometrics literature are crucial in examining relationship among variables in the long-run. However, the precondition to use these approaches is that all the variables must be of the same order of integration. The time series unit root tests show that the variables included in the model are neither integrated of the same order nor I (2) (Table 2).

Table 2. Unit root statistics

Variables	ADF		PP		KPSS	
	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend
FOREX	-1.864	-2.756#	-1.883	-4.584	0.188##	0.679##
CAB	-2.779	-1.602	-2.874	-2.543	0.099	0.186
ECB	-1.898	-0.567	-2.013	-0.579	0.116	0.682##
FINV	-3.329###	-3.977#	-3.561###	-3.585##	0.167##	0.667##
BRMON	-0.423	-1.951	0.565	-2.186	0.133###	0.691##
CALL	-1.206	-1.602	-1.560	-1.239	0.136###	0.386###
FINDUM	-1.864	-2.893###	-2.334	-2.445##	0.077	0.079

Note: Variables are as defined in Table 1. # , ## and ### indicate significance at 1%, 5% and 10% level respectively.

Source: Author's computations

To cope up with the problem of different order of integration, ARDL approach is used which examine the long-run and dynamic relationships among the variables. The development in the ARDL framework is the two stage bound testing (BT) approach. The BT approach is applied to test the null hypothesis of no long-run relationship between the variables in the model. We applied the OLS procedure and compute F-statistics or Wald statistics for the joint significance of the lagged levels of variables and confirm the long-run relationships among the variables included in the model. If the value of the computed F statistics or the Wald statistics is greater than the upper bound or I(1) tabulated values (Pesaran and Shin, 1998), then the null hypothesis can be dismissed. Alternatively, if the computed F-statistic or the Wald statistics value is smaller than the lower bound or I (0) tabulated values, then we fail to reject the null hypothesis. The results are inconclusive, when the calculated F-statistic value falls between the I (0) and I (1) tabulated values.

Table 3. F test result of the variables in the equation

Model A	
Variables	F test
F(FOREX, CAB, ECB, FINV, CALL, BRMON)	9.653*
F(CAB, ECB, FINV,CALL, FOREX, BRMON)	24.743*
F(ECB, FINV, CALL, FOREX, CAB, BRMON)	6.537*
F(FINV, CALL,FOREX, CAB, ECB, BRMON)	16.045*
F(CALL,FINV,FOREX, CAB, ECB, BRMON)	1.087
F(BRMON, CALL,FINV,FOREX, CAB, ECB)	1.813
Model B	
Variables	F test
F(FOREX, CAB, ECB, FINV, CALL, BRMON, FINDUM)	6.267*
F(CAB, ECB, FINV,CALL, BRMON, FINDUM, FOREX)	2.233
F(ECB, FINV, CALL, BRMON, FINDUM, FOREX, CAB)	1.357
F(FINV, CALL,BRMON, FINDUM, FOREX, CAB, ECB)	42.269*
F(CALL, BRMON, FINDUM,FOREX, CAB, ECB, FINV)	0.614
F(BRMON, FINDUM,FOREX, CAB, ECB, FINV, CALL)	0.748
F(FINDUM,BRMON, FOREX, CAB, ECB, FINV, CALL)	3.453***

Note: Variables are as defined in Table 1. F test values confirm the long run relationship between the variables. The critical bounds for F test are 3.47 and 4.57 at 5%level for I(0) and I(1) respectively. ## indicates statistical significance at 5% level.

Source: Author's computations

A second step is followed to check the presence of a distinctive long-run relationship between the dependent and independent variables. The similar exercise is repeated by considering every variable in the system as dependent variable and calculating the corresponding F statistics or the Wald statistics.

After the confirmation of a unique long-run equilibrium relationship, the two-step ARDL method is applied to estimate the long-run and short-run parameters selected based on lag length information criterions such as Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) to choose appropriate ARDL models (Pesaran and Shin, 1998). Nevertheless, the selection of the lag length of the

model in this case is based on SBC. The SBC criteria hold not only the characteristics of the small sample similar to AIC but also parsimonious, consistent, and show better performance in most of the experiments (Morimune and Mantani, 1995; Quinn, 1988). In the Table 3, we were able to reject the null hypotheses in the FOREX equation, implying the existence of a long-run relationship among the variables specified in the system. Therefore, the variables CAB, ECB, FINV, BRMON, CALL and FINDUM are exogenous and define a long-run relationship with the dependent variable specified in the equation.

Pesaran and Shin (2006) explain the usefulness and the reliability of ARDL model while analyzing the data with small samples[3]. The computed F-statistics is greater than the upper bound critical value and rejects the null of no cointegration at 5 per cent level of significance which indicates a long-run cointegrating relationship of the central equation with forex reserves (dependent variable) and its determinants—BRMON, CAB, ECB, FINV, CALL and FINDUM (Table 3). However, we were unable to find a unique long-run relationship since the F statistics of the central equation is significant at 5 per cent along with the other equations when ECB, FINV and FINDUM were considered as dependent variables.

We report the long-run coefficients of the variables in the equation in the Table 4 and ECM test in the Table 6. We include two models in the present analysis. In model A, we include all the variables as dictated by the theoretical literature. In the model B, we assess the role of major financial crises happening during the study period on reserves holdings of the central bank.

Table 4. Long-run estimates

Models	Model A (ARDL 1,0,1,0,0,0)		Model B (ARDL 1,0,0,0,1,0,1)	
Variables	Coefficient	*P* values	Coefficient	*P* values
CAB	1.055	(0.002)	0.784	(0.010)
ECB	-0.755	(0.001)	-0.524	(0.011)
BRMON	2.484	(0.000)	2.382	(0.000)
FINV	0.172	(0.001)	0.144	(0.003)
CALL	0.104	(0.649)	-0.059	(0.805)
FINDUM			-0.161	(0.107)
C	-4.550	(0.092)	-5.094	(0.069)
T	-0.117	(0.094)	-0.129	(0.108)
Adj.R^2	0.996		0.996	

S.E. of Regression	0.093	0.092
F statistics	819.238	676.946
	(0.000)	(0.000)
AIC	23.135	23.139
SBC	17.139	15.812
DW-statistics	1.889	1.956

Note: Variables are as defined in Table 2. C refers to the constant term, and T denotes time trend.

Source: Author's computations

The signs of the coefficients of the variables of both the models (A and B) along with the results of both the long-run and short-run are consistent with the theoretical propositions. The current account includes trade balance, net foreign income from domestic assets and unilateral transfers. The central bank would raise the reserve holdings with the increase in current account deficit. This is because of the increase in imports, which would decrease the foreign currency assets as these assets will be employed to finance the deficit. Therefore, high current account deficit would increase the demand for forex reserves with the central bank and high current account surplus would decrease the demand of reserve holdings with the central bank. These results are also consistent with the previous studies (e.g., Dash and Narayanan, 2011) and in contrast to Aizenman and Lee (2007).

Capital account of the balance of payment include components such as foreign investments, external commercial borrowings, external assistance, NRI deposits, Rupee debt service and other deposits. In this study, we include two important components of capital account namely foreign investments and corporate ECBs. Past studies explain that a high ratio of capital account deficit to GDP is associated with higher capital account susceptibility which leads to a rise in the demand of forex reserves by the central bank. Fischer (2001) opine that emerging economies with open capital accounts need abundant reserves because these economies are accustomed to volatile capital flows. Current account deficit in India and lack of domestic capital increase the demand of foreign capital which includes trade credits, ECBs, foreign investments, and NRI deposits. We find a negative and statistically significant sign of the coefficient of the variable ECBs. The negative sign of the ECBs is due to the moral hazard problem. The stocks of reserves held with the central bank do not imply implicit insurance guarantee to the corporate sector to increase their borrowings in foreign currency which might be detrimental for the firms and the economy during exchange rate volatility. This indicates no provision of bailout programs to the corporate firms during any default by the central bank.

We include another capital account variable namely the foreign investments which include components such as FDI and FII. Such foreign investments are used to finance the domestic investments and consumptions. In concord with the theory, we find a positive and statistically significant sign of the variable foreign investments. International reserves serve as a collateral which attracts foreign investment since these buffers increases the credibility of the recipient country, boost investor's and business confidence, and lowers the dollar value of real assets. Furthermore, forex reserves are held responsible to bridge unexpected gaps in the net flow of foreign

currency. Nayak and Ray (2017) also hold that increase in forex reserves is basically to lure portfolio flows into the economy which build up investors' credence. Corporate firms and private entities in emerging economies sell the required foreign exchange to its central bank in order to receive foreign investment. FE Bureau (2017) posits that foreign portfolio flows into the Indian debt and equity shoot up the central bank's forex reserves.

Table 5. Diagnostic tests of the long-run estimates

Model A (ARDL 1,0,1,0,0,0)		
Tests	LM Statistics	F-Statistics
Serial Correlation	0.045	0.029
	(0.831)	(0.866)
Ramsey's Functional Form	2.500	1.765
	(0.114)	(0.201)
Normality test	1.305	NA
	(0.521)	
Heteroscedasticity test	2.910	3.016
	(0.088)	(0.094)
Model B (ARDL 1,0,0,0,1,0,1)		
Tests	LM Statistics	F-Statistics
Serial Correlation	0.000	0.000
	(0.993)	(0.995)
Ramsey's Functional Form	1.365	0.819
	(0.243)	(0.379)
Normality test	0.587	NA
	(0.746)	
Heteroscedasticity test	2.611	2.673
	(0.106)	(0.114)

Note: The values in the table are *p* values of each test.

Source: Author's computations

We find a positive and statistically significant parameter of the variable BRMON in both model A and model B. This implies an increase in money supply in the economy is influential in determining the demand of reserve holdings by the central bank. In other words, the forex reserves increases with the increase in the overall money supply in the economy. Our results are in accord with the previous studies. Similar to our findings, Azar (2014) use the monthly data since January 1993 through November 2003 and finds a long-run cointegration relationship between foreign exchange reserves and the money supply in domestic currency measured by M2. In another study, Panda and Trivedi (2014) use the quarterly data from the period 1996-97 to 2014-15 and finds a positive relationship between international reserves and money supply.

Table 6. ECM test statistics

Models	Model A (ARDL 1,0,1,0,0,0)		Model B (ARDL 1,0,0,0,1,0,1)	
Variables	Coefficient	P values	Coefficient	P values
CAB	0.767	0.001	0.592	0.005
ECB	-0.277	0.102	-0.395	0.011
FINV	0.125	0.013	0.109	0.024
BRMON	1.807	0.000	3.771	0.002
FINDUM			-0.023	0.702
CALL	0.076	0.644	-0.045	0.806
C	-3.309	0.084	-3.844	0.056
T	0.085	0.087	-0.098	0.093
ECM(-1)	-0.727	0.000	-0.755	0.000
Adj.R^2	0.828		0.764	
S.E. of Regression	0.093		0.092	
F statistics	13.144		12.202	
	(0.000)		(0.000)	
AIC	23.135		23.139	
SBC	17.139		15.812	
DW-statistics	1.889		1.956	

Note: Variables are as defined in Table 2.

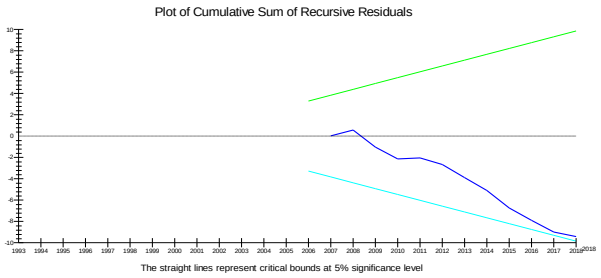
Source: Author's computations

We find insignificant coefficient of the financial crises dummy variable. We include major crises such as 1997-1998 East Asian crisis, 2000-2002 dot com bubble burst, and 2007-2008 subprime mortgage crisis to capture the effect of these crises on the level of forex reserves. We find the variable call money rate that measures opportunity cost of holding forex reserves to be statistically insignificant. With the inclusion of the FINDUM variable in the model, we find that the variable ECB turns significant with the priori signs. The overall results indicate that central bank forex reserves are meant for mercantilist motives but not for the precautionary motives. The long-run estimates are similar to the short run results.

The negative and statistically significant sign of the ECM coefficients imply 72.7 per cent and 75.5 per cent of disequilibrium due to shocks in the previous year converges back to the long-run equilibrium in the current year for model A and model B respectively.The results of the short-run estimates are similar to the long-run estimates. We also find theoretically expected signs of all the variables.

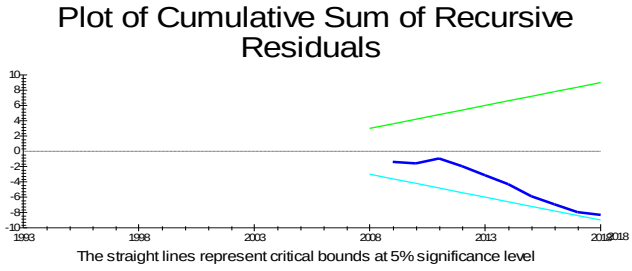
The diagnostic checks are documented in Table 4 and 6. We find the values of F statistic to be significant for both the models A and B. This implies that the selected regressors can best define the possible variations in the regressand. We find a high value of the adjusted R^2 which suggests that the model is a good fit. The Eqn. 1 passes through numerous diagnostic tests such as Jarque–Bera test for normality, Lagrange Multiplier for serial correlation, Ramsey RESET for specification bias, and heteroscedasticity problems in the model (Table 5).

Figure 1 CUSUM test of the model A



Source: Author's computations

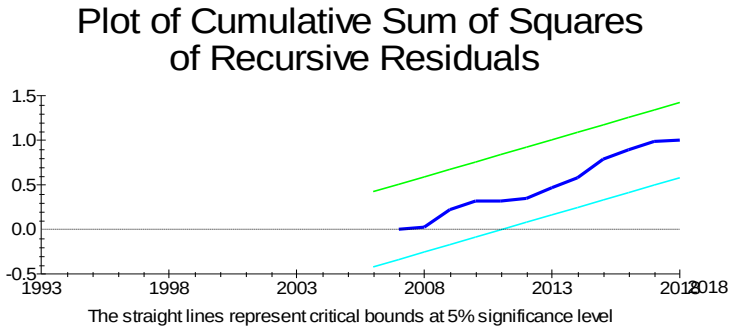
Figure 2 CUSUM Square test of the model A



Source: Author's computations

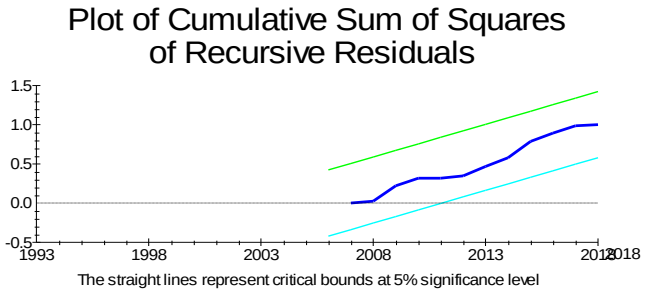
One of the important concern, concomitant to the policy perspective, is the possible instability of the estimated coefficients of the forex reserve function. To estimate stability, we applied CUSUM, and CUSUM squared tests. Figures 1 and 3 present CUSUM and Figures 2 and 4 present CUSUM Squared tests for the forex reserves model estimated for the sample period from 1991–2018 for the parsimonious specification. The results show that there is no instability problem with the specification.

Figure 3 CUSUM test of the model B



Source: Author's computations

Figure 4 CUSUM Square test of the model B



Source: Author's computations

The present findings indicate that central banks motive of keeping forex reserves is for export competitiveness and improving the current account balance by intervening into the exchange rate market. However, according to a recent study by CARE Ratings Ltd., depreciation in the exchange rate along with its lag component is found to be an insignificant variable in determining India's export growth. Similarly, other analysis suggests that there was a 4 % dip in India's exports despite a 13% depreciation in India's

nominal exchange rate in the year 2012 (Kwatra, 2018) Indian exports are sensitive to global prices, world demand, and shortages in energy (Raissi and Tulin, 2015). Therefore, it is advisable to consider crucial policy prescriptions related to India's trade policies (including the existence of pro-consumer bias which has deprived Indian farmers of remunerative returns in global markets) instead of overdependence on forex reserves in order to correct the capital account and the current account of balance of payments by intervening into the forex market. We also find a strong motive of central bank to keep forex reserves because of the expected volatility of the capital account. Our results also did not support the theoretical framework postulating central bank forex reserves as an implicit guarantee for the corporate firms to borrow in foreign currency. Furthermore, we find that the central bank demand forex reserves based on the growing money circulation in the economy.

5. Conclusion

The results from the ARDL analysis show the crucial role of current account balance, volatility of foreign investment and broad money in determining the forex reserves accumulation. Hence, we confirm that RBI's motivation for forex reserves accumulation is because of mercantilist motives by improving the current account of balance of payments and capital account of balance of payments by stabilizing the foreign investments. Furthermore, we could not find any evidence of moral hazard problem based on the forex reserves holdings with the central bank. This imply that the corporate sectors borrowings are to be made at their own risk and central banks forex reserves does not give any implicit guarantee on the corporate bailout during defaults. We also found that money supply is a vital determinant of foreign exchange reserves held by the central bank in conformity with the findings of Lane and Burke (2001) and Bussiere et al. (2015). However, call money rates are found to be not significant in determining the demand of foreign exchange reserves by the central bank.

These results endorse existing policy framework of the central bank on the reserves accumulation. In this direction, the present findings suggest that the central bank must maintain optimum international reserves with itself so that the excess of forex reserves can be channelized to better investment projects which might generate higher returns. Hence, it is advisable that the adequacy of forex reserves must be based on the recommendations made by Greenspan-Guidotti rule and Reddy (1997).

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