The Determinants of Foreign Exchange Reserves in India During 1983-2014

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Abstract

Emerging economies holding more than 40 per cent of the foreign exchange reserves total currency holdings and this reignited researcher’s interest on how countries are determining their optimum level of reserves and what are the factors responsible for reserve holdings in their respective countries. The main aim of the paper is to identify the determinants of foreign exchange reserves during 1983-2014. The unit root results shows that data, which are included in the model are non stationary in raw form and they become stationary at second difference i.e., they are integrated order of I (2). The Cointegration analysis reveals there is a relationship among the variables in the long run.

AMS Subject Classification: 91B60 & 91B62

Key Words: Foreign Exchange Reserves and Cointegration.
1 Introduction

India and China ranked fifth and second position in the world for having foreign exchange reserves. Asian emerging economies hold more than 40 per cent of the reserves in hand to influence the exchange rate fluctuation in the international market. To maintain the equilibrium exchange rate, country will purchase and sell its own currency to keep supply and demand in equilibrium, by providing consistent value in the market. There are merits and demerits for holding the huge amount of foreign exchange reserves. The practice of holding large amount of forex reserves is a monetary tool and also self insurance against the major external financial disaster. Therefore reserves should be maintained at some benchmark to cover the imports for certain period of time. India is in comfort level of foreign exchange reserves up to 361 billion, which will enough cover of twelve month needs.

If a country is following fixed exchange rate system, it has to hold large amount of reserves to maintain the stable exchange rate in the international market over the period of time. By doing so, competitive exchange rate provide the exports to have an advantage over the potential competitors. Countries following flexible exchange rate system need not to maintain huge amount, instead they can keep fewer corpus and leave to the market forces to determine the exchange rate in the market based on the supply and demand of the foreign currencies. If there is any disequilibrium in the exchange rate market will correct it automatically. It is very important to analyse the variables, which will influence the holding of foreign currencies.

2 Review of the Literature

Edison (2003) established that real gross domestic product per capita, level of population, ratio of imports to gross domestic product and exchange rate volatility are found to be important determinants of foreign exchange re-
Aizenman et al. (2003) found confirmation of a structural break in the data series after the Asian financial crisis, where external debt and financial openness are strong forecaster of the foreign exchange reserves, while openness of trade was not significant after the financial crisis. Empirical research on international reserves found the relationship among the variables, which will have impact on the same with limited quantity of independent variables. The variables can divided into five categories namely; opportunity cost, economics size, exchange rate, capital account and current account vulnerability. Large amount of empirical evidences are available in the literature indicating that high rate of foreign exchange reserve holding can insulate the economy from the financial crisis, whenever it occurs, even if it is strong enough to influence the domestic economy. If foreign trade policies are not sustainable, forex reserves will postpone the financial crisis for some time. Gross domestic product and gross domestic product per capita are the best indicators if the economy size. The deficit in the current account balance can be explained by exports and openness of trade. Central bank of any countries will accumulate the foreign exchange reserves against the external financial crisis. The IMF (2003) studied the determinants of foreign exchange reserves for the 122 countries during the period of 1980-1996 by employing panel data. The results of the study showing that data on population, GDP per capita, ratio of imports to GDP and exchange rate volatility found to be significant determinants for the foreign exchange reserves. A survey of existing literature, explaining very rare laboratory setting for the determinants of foreign exchange reserves in India. Thus India provides good case to analyse.
3 Methodology and Empirical Results

The objective of the section is to elucidate how this study has been achieved its objectives. The study employed secondary data (Annual) for the period 1983 - 2014 and they have been collected from the International Financial Statistics data base. The variables are real effective exchange rate, interest rate differentials, current account balance and average propensity to import. Definition of the variables:

\[ RES = \alpha + \beta_1(REER) + \beta_2(IRD) + \beta_3(CA) + \beta_4(API) + u_t \] (1)

The equation (1) consists of the factors which are influencing foreign exchange reserves in India.

The ordinary least square method is based on the assumption that time series data is stationary. If this assumption is not satisfied, then there will be a problem of unit root i.e., random walk.

To overcome the unit root problem, this study deploys the Augmented Dickey Fuller test (ADF), Phillips-Perron(pp) and Kwiatkosuki Phillips Schmidt Shin(KPSS) tests. In the first two tests, the unit root is the null hypothesis and the latter KPSS tests the stationary is the null hypothesis. A problem with classical hypothesis (i.e, ADF test tests the unit root is null hypothesis) is not rejected unless there is strong evidence against it. No.of ways to solve the problem of stationarity property of variables by increasing sample size and employing stationary test among others.

3.1 Unit root / Stationarity test

This study, employed formal as well as informal test to test the stationary property of the variables. The informal test for statinarity is to plot the variables on the graph and get the insight from the figure before going for any formal test. This inspection of data is essential as it allows the detection
of any structural break, errors in data and finally gives a idea of stationarity of the variables.

![Figure 1: The Determinants of Foreign Exchange Reserves](image)

The idea that we derive from the above in figure is that of reserves and average propensity to import are seem to be upward trend, albeit with fluctuations and have a time variant mean and variance indicating that they are non stationary in raw form. Whereas real effective exchange rate seem to be downward trend and have a time variant mean and covariance suggesting that non stationary. But the interest rate differential and current account sustainability have a constant mean and variance around the mean and it seems to be stationary series. At this juncture no one can be sure about the stationary property of the variables, which requires formal tests. So this study makes use of the Augmented Dickey Fuller test, Phillips-Perron and KPSS test to identify the stationary properties of the variables.
<table>
<thead>
<tr>
<th></th>
<th>ADF</th>
<th>PP</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REER</td>
<td>-2.081</td>
<td>-2.034</td>
<td>-0.702</td>
</tr>
<tr>
<td>IRD</td>
<td>-3.887*</td>
<td>-3.768*</td>
<td>0.148*</td>
</tr>
<tr>
<td>CA</td>
<td>-3.344*</td>
<td>-1.829</td>
<td>0.136*</td>
</tr>
<tr>
<td>RES</td>
<td>10.817</td>
<td>10.223</td>
<td>0.550</td>
</tr>
<tr>
<td>API</td>
<td>8.701</td>
<td>7.306</td>
<td>0.625</td>
</tr>
<tr>
<td><strong>First Difference</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REER</td>
<td>-4.788*</td>
<td>-4.792*</td>
<td>0.206*</td>
</tr>
<tr>
<td>IRD</td>
<td>-10.185*</td>
<td>-9.790*</td>
<td>0.086*</td>
</tr>
<tr>
<td>CA</td>
<td>-4.109*</td>
<td>-4.014*</td>
<td>0.125*</td>
</tr>
<tr>
<td>RES</td>
<td>1.579</td>
<td>0.121</td>
<td>0.533</td>
</tr>
<tr>
<td>API</td>
<td>-0.246</td>
<td>-0.246</td>
<td>0.482</td>
</tr>
<tr>
<td><strong>Second Difference</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RES</td>
<td>-5.485*</td>
<td>-5.829*</td>
<td>0.272*</td>
</tr>
<tr>
<td>API</td>
<td>-4.775*</td>
<td>-4.776*</td>
<td>0.228*</td>
</tr>
</tbody>
</table>

** 5 per cent * 1 per cent significance level respectively.

### 3.2 Unit Root Results

The recorded results of the Augmented Dickey Fuller (ADF), Phillips Perron (PP) and Kwiatkoski Phillips Schmidt Shin (KPSS) tests in table (2) indicates that no variables are stationary in raw form except interest rate differentials and current account sustainability confirms what we got it from the visual plot. Since their test statistics are smaller than MacKinnon 1 per cent critical value of -3.485. When the test is apply to second difference of the variables, they are become stationary i.e., they are integrated order of I (2). It seems the results from ADF, PP and KPSS are same. Therefore to conclude the series are integrated order of I (2) and they have a relationship
among them during the long period.

### 3.3 Engle - Granger Cointegration

Given that variables are I(2) Engle - Granger method of Cointegration technique comes in handy to analyse long run relationship. The practice involves checking the residuals for stationary obtained from an OLS regression equation (1). The equation (1) represents a long term relationship among the variables. The estimated results are reported in table (2).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std.Error</th>
<th>t-static</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>REER</td>
<td>54.48138</td>
<td>29.03211</td>
<td>1.876591</td>
<td>0.0714</td>
</tr>
<tr>
<td>IRD</td>
<td>-190.5236</td>
<td>130.0135</td>
<td>-1.465414</td>
<td>0.1544</td>
</tr>
<tr>
<td>CA</td>
<td>1.719772</td>
<td>0.134895</td>
<td>12.74895</td>
<td>0.0000</td>
</tr>
<tr>
<td>API</td>
<td>0.780874</td>
<td>0.016650</td>
<td>46.89983</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>-8558.096</td>
<td>3012.173</td>
<td>-2.841170</td>
<td>0.0084</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.992 \quad \text{adj}R^2 = 0.992 \quad \text{D.W} = 1.46 \]

Dickey Fuller Test on \{\hat{c}\} = 0

Test Static: -4.17

5% Critical Value: -3.37


The estimated equation (1) coefficient indicates that there is a long run relationship among the variables and the results obtained from the regression are not spurious because D-W statistic is higher than \( R^2 \). If an \( R^2 > d \) is a good rule of thumb to suspect that the estimated regression is spurious (Op. Cit., Gujarati, 2004). So in order to check whether the equation represents a long run relationship between the variables, we need to check whether the residuals from regression (1) constitute stationary series. If they do, variables said to be cointegrated in the long run, otherwise not. The critical values
provided by Engle and Granger (1987) were used and the absolute value of
-4.17 is greater than the -3.37, which is 5 per cent significance level. So, the
null hypothesis of non stationary is rejected. That is to say, the residuals are
stationary, and the variables are cointegrated.

4 Conclusion

The foremost objective of the study is to identify the factors influencing the
foreign exchange reserve holding in India during 1983-2014. The value of
adjusted R2 indicates that all three variables can explain 99 per cent vari-
tions in the dependent variable and it means that almost 99 per cent of the
variations in foreign exchange reserves explained by the average propensity
to import and balance of current account, real effective exchange rate and
interest rate differentials. The unit root results indicate that data are non
stationary in raw form and become stationary at second difference i.e., they
are integrated order of I (2). The Cointegration analysis reveals there is a
long run relationship among the variables and they are significance at 1%
and 10% levels. This finding is consistent with Flood and Marion (2002)
and Batton (1998), were established above variables are strong forecasters of
foreign exchange reserves.

References

and Capital Mobility: Policy Considerations and a Case Study of Korea,

[2] Batton, D., Central Banks demand for foreign reserves under fixed and


