

Determinants of exchange rate of Indian rupee against us dollar

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Abstract

Exchange rate plays a denominated role in a country's international trade there by influencing the country's balance of payment. It is highly volatile in nature and it is determined by the market forces of the economy. The fluctuations in the movement of exchange rate is affected by the several macro-economic variables. This paper focuses on the macro economic variables Balance of payment-current and capital account, Foreign exchange reserve, foreign investment inflows, Inflation rate, Interest rate, Net purchases and sales of US dollar, GDP at factor cost affecting the exchange rate of Indian rupee against US dollar. The study covers the period of seven years from 2008-09 to 2014-15. Augmented Dickey Fuller test (ADF) test was conducted to determine the stationarity of the variables. It is observed that three variables Balance of Payment-Current account, Foreign exchange reserves and GDP at factor cost are the most significant variables affecting the exchange rate of Indian rupee against US dollar during the period of study.

Keywords: International trade, Exchange rate, Market forces

1. Introduction

Foreign exchange market is the largest financial market in the world. It is the market where the currency of one country is exchanged for the currency of another country. Most currency transactions are channelled through the world wide interbank market. It is an informal network of telephone, telex and satellite and computer communications between the forex market participants. The players in the foreign exchange market include exporters, importers, investors, bankers, financial institutions, firms, commercial banks, foreign employees, NRIs, tourists and policy makers and service providers etc., and others who deal with multiple currencies of all over the world (Samsudheen. K and Dr. G. Shanmugasundaram 2012) ^[13]. Foreign exchange markets in India have witnessed explosive growth in trading capacity. Traders engage in the export or import of goods to a number of countries, where exporters prefer to get payment in its own currency and importers need foreign exchange to make payments in foreign currency for their imports. So they also operate in the foreign exchange market to hedge their risk through dealers. Exchange rate facilitates trade of goods and services in different currencies. It is important from a policy perspective to understand the nature of Indian rupee against US dollar given that the United States of America is India's single largest trading partner (Seyed Hashem Kamyab and Meysam Amani 2013) ^[14]

1.1 Foreign exchange market in India

Foreign exchange market is an over the counter market which is regulated by Reserve bank of India through the exchange control department of a country. RBI takes initiatives to strengthen the market. The Indian foreign exchange market is made up of buyers, sellers, market intermediaries and the monetary authority of India. It involves transactions of strong, stable and convertible currencies which include leading

currencies namely US dollar, UK Pound-sterling, Euro and Japanese yen. One of the function of a foreign exchange market is the transfer of purchasing power from one country to another and from one currency to another. The other functions such as provision of credit and provision of hedging facilities covers the foreign trade risks and provides a mechanism to exporters and importers to guard themselves against losses arises from fluctuations in exchange rates (Robert J. Carbaugh 2000). There are two types of exchange rate system-Fixed and floating. In fixed exchange rate system the rate doesn't fluctuate because of government intervention while the floating exchange rate keeps changing constantly. India has adopted a managed floating exchange rate system it means the Indian government intervenes only if the exchange rate seems to go out of hand by increasing or reducing the money supply as the situation demands (Dr. Pratap Singh 2013) ^[12]

1.2 Objective of the study: This paper focuses on the macroeconomic determinants affecting exchange rate of Indian rupee against US dollar.

1.3 Hypotheses used in the study

The following null hypotheses were tested

H₀₁: Exchange rate has no correlation with the macro economic variables like inflation rate, interest rate, foreign investment inflows, GDP at factor cost

1.4 Review of literature

CS Shylajan and Sreejesh S (2011) ^[15] examined the link between Indian rupee-US dollar and macro economic fundamentals using flexible-price monetary model. Johanson-Juselius cointegration and Vector error correction model (VECM) analysis are used to examine the relationship between exchange rate and macro economic fundamentals. It indicates exchange rate is related to macro economic fundamentals in

long run, while there is no short run casual relationship in VECM analysis. Samsudheen. K and Dr. G. Shanmugasundaram (2012) [13] researched to understand the behaviour of Indian foreign exchange rate and its volatility using ARCH models to measure the impact of structural changes in the exchange rate system of India in pre and post liberalised exchange rate management system (LERMS). Sunil Kumar (2010) [16] conducted a study on, “Determinants of Real Exchange Rate in India: An ARDL Approach” identified theoretically the determinants of real exchange rate in India using the statistical tool autoregressive distributed lag (ARDL) modelling approach. Yamini Karmarkar and Muskan Karamchandani (2012) [18] conducted a study on “Exchange Rate and Macro-economic indicators: A Causal Study for India of the Past Decade” identified and analysed the critical macro-economic variables which have influenced exchange rate of Rupee with respect to Dollar in post liberalization era using multivariate VAR framework, Granger causality tests and other tests with respect to hetroscedasticity, autocorrelation and multicollinearity are used to test the long run causal relationships between the exchange rates and other key macroeconomic indicators of the economy.

2. Methodology

The study is descriptive in nature and covers a period of seven years from 2008-09 to 2014-15. Secondary data was collected from Hand book of statistics on the Indian economy -RBI monthly bulletins and RBI annual reports were the main sources for the data collection. Data from journals, articles, publications, e-books were also utilised for the study. The macro economic variables such as India’s balance of payment –current account and capital account, foreign exchange reserves, foreign investment inflows, inflation rate differential, interest rate differential, net purchases and sales of US dollar and GDP at factor cost were considered as indepedent variables, exchange rate of Indian rupee against US dollar being dependent variables. Multiple regressions is an extension of simple linear regression in which more than one indepedent variables(X) is used to predict a single dependent variable(Y). The predicted value of Y is a linear transformation of the X variables such that the sum of the squared deviations of the observed and predicted Y is a minimum. The inter relationship between all the variables are taken.

The exchange rate is taken to be a function of the indepedent variables

- Y= Exchange rate (ER) (INR/USD)
- X₁= Current account (CUAC) (Rs in billion)
- X₂= Capital account (CAPAC) (Rs in billion)
- X₃=Foreign exchange reserve (FR) (US \$ million)
- X₄= Foreign investment inflows (FII) (In percent)
- X₅=Inflation rate differential (IFD) (In percent)
- X₆= Interest rate differential (IRD) (In percent)
- X₇= Net purchases and sales of US dollar (RBINI) (US\$ million)
- X₈= GDP at factor cost(Rs in billion)

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8$$

$$INR/USD = a + b_1CUAC + b_2CAPAC + b_3FR + b_4FII + b_5IFD + b_6IRD + b_7RBINI + b_8GDP$$

3. Results and discussion

ADF test was conducted to test the stationarity among the select variables. The results are presented in Table 1

Table 1: Augmented Dickey Fuller (ADF) test

Variables	Without trend		With trend		Results
	t-statistic	p-values	t-statistic	p-values	
ER - INR/US\$	-9.041	0.0351	-8.987	0.0497	S
CUAC	-2.998	0.0213	-2.775	0.0332	S
CAPAC	-3.804	0.0089	-4.612	0.0066	S
FR	-8.544	0.0000	-8.487	0.0000	S
FII	-9.035	0.0000	-8.969	0.0000	S
RBINI	-5.651	0.0000	-6.235	0.0000	S
IRD	-5.104	0.0001	-5.179	0.0003	S
IFD	-2.903	0.0188	-1.949	0.0418	S
GDP	-3.100	0.0042	-12.463	0.0000	S

*S -stationary

Table 1 shows the results of ADF statistic for the variables considered for the study. The results of t- statistic and p-values state that there is stationary among the select variables namely exchange rate, current account, capital account, foreign exchange reserves, foreign investment inflows, inflation rate differential, interest rate differential, netpurchase and sales of US dollar, GDP at factor cost. The p-values indicates that the variables capital account, foreign exchange reserve, foreign investment inflows, Net purchase/sales of USD by RBI, Interest rate differential, GDP at factor cost are stationary at 1 per cent level of significance and exchange rate of rupee against dollar, current account, Inflation rate differential are stationary at 5 per cent level of significance.

A brief description of the select macro-economic determinants is presented below:

1) Exchange rate of INR/USD

Exchange rate is the rate at which one currency can be exchanged with other currency. It is important to establish an exchange rate between two currencies to facilitate trade of goods and services priced in different currencies. The exchange rate of Indian rupee (INR) against American dollar (USD) has witnessed excessive volatility leading to sharp depreciation in recent years. The average of exchange rate of Indian rupee agaainst US dollar stood INR /USD at 51.84 during 2009-09 to 2014-15.

2) Balance of payment

Balance of payment is a statistical statement that systematically summarises the receipts and payments of international transactions of a country over a certain period of time presented in the form of double-entry book keeping. It shows inflows and outflows of foriegn exchange, the credit balance shows the receipts of foriegn exchange from abroad and debit balance shows payments in foriegn exchange to foriegn residents. Current account and capital account are the two components of balance of payment. The average of Current account stood deficit at – Rs 577.43 bn and Capital account stood surplus at Rs 615.48 bn during 2008-09 to 2014-15.

3) Foreign Exchange Reserves with RBI

Foreign exchange reserves held by RBI include Special Drawing Rights(SDR) of IMF, gold, foreign currency assets(in US dollar, euro, pound sterling, Canadian dollar, Australian dollar and Japanese yen etc.), and Reserve tranche position in the IMF. Forex reserves are expressed in US dollars, hence it declines when US dollar appreciates against major international currencies. The average of Foreign exchange reserve was at Rs 15505.56 bn during 2008-09 to 2014-15.

4) Foreign Investment Inflows

Foreign investment in India is the amount invested by non-residents in the equity of entities in India. There are two types- Foreign direct investment and Portfolio investment. Foreign direct investment reflects a lasting interest of the investor in the equity and intention to take active role in the management of the company investment in equity by the direct investor and the amounts accruing on the original investment but retained in the country fall under the category of direct investment. Portfolio investment mainly includes FIIs’ investment, funds raised through ADRs/GDRs by Indian companies and through offshore funds. The average of foreign investment inflows was at US\$ 3674.21 million during the period of the study.

5) Inflation rate differential between WPI of India and CPI of US

Inflation rate is a key parameter on the basis of which central bank of a country and central government propose monetary and fiscal policy from time to time. Consumer price index is a measure of average price which consumers spend on a market-based basket of goods and services. Wholesale price index is more closely observed than the consumer price index as it includes a higher number of products. If the inflation rates in India is higher than the rates in USA, the increase in prices would be higher in India than it is in USA. It leads to depreciation in the value of rupee against dollar. The average of inflation rate differential stood at 5.23 per cent during 2008-09 to 2013-14.

6) Interest rate differential between repo rates of India and LIBOR rates of US

Interest rate differential is one of the major factor for the movements in exchange rate. As per interest rate parity theory

if the domestic interest rate is higher than that of foreign interest rate, the domestic currency is expected to depreciate. India’s repo rates and LIBOR rates of 3 months tenor of US has been taken for interest rate differential. London Inter-bank offer rate (LIBOR) is an indicative average interest rate at which a select banks are prepared to lend one another unsecured funds on the London money market. The average of interest rate differential was at 1.79 per cent during the study period.

7) Net purchases and sales of US dollar by RBI

RBI’s intervention i.e purchases and sales of US dollar in the market which helps in smoothening the volatility in foreign exchange rate. RBI purchases and sells foreign currency in the domestic market. When they sell foreign currency, its supply increases and domestic currency appreciates against the foreign currency. When they purchase foreign currency its demand increases and domestic currency tends to depreciate the foreign currency. RBI helps to move the value of domestic currency up or down also through the expectations channel. The negative sign indicates RBI has sold more US dollars in foreign exchange market to arrest further fall in the Indian rupee. RBI intervention in foreign exchange market is found to be higher by way of purchase and sales of US dollar during the period 2008-09, 2012-13, 2013-14, 2014-15. The average of net purchases and sales of US dollar by RBI was at – Rs 115.66 bn during the study period.

8) GDP at factor cost

GDP at factor cost is a broad measure of the output of goods and services in an economy. It is not merely a sum total of the value of all the output but a sum of total of ‘value – added of output. GDP at factor cost can be measured at the production stage or at the sum of total consumption. The production stage is broadly divided in to three sectors agriculture, industry and services while measuring output from the total consumption the GDP is equal to the sum of private consumption, government consumption, investment and net exports. The average of GDP at factor cost stood at Rs 12861.14 bn during 2008-09 to 2014-15.

The descriptive statistics of macro-economic factors affecting exchange rate of INR/USD for the period of seven years were shown in Table 2

Table 2: Descriptive statistics of Macro economic factors affecting Exchange rate (2008-09 to 2014-15)

Variables	Mean	S.D	C.V (%)	Skewness	Kurtosis	Jarque bera test	P-values	No of observations
ER (INR/USD)	51.84	6.79	13.09	0.64	-1.78	2.43	0.2699	72
CUAC (Rs in billion)	-577.43	370.74	-64.20	-0.77	-0.06	1.20	0.0154	72
CAPAC (Rs in billion)	615.48	386.43	62.78	-0.07	-0.11	0.01	0.0000	72
FR (Rs in billion)	15505.56	3045.65	19.64	1.20	1.03	3.45	0.1774	72
FII (US\$ million)	3674.21	1701.95	46.32	-0.00	-0.00	4.53	0.3999	72
IFD (in per cent)	5.23	1.41	27.01	1.24	2.14	5.40	0.0671	72
IRD (in per cent)	1.79	1.27	71.22	0.08	-0.70	0.26	0.8753	72
RBINI (US \$million)	-115.66	2676.25	-2313.89	0.72	1.22	1.79	0.0407	72
GDP at factor cost (Rs in billion)	12861.14	1627.35	12.65	-0.37	-1.09	0.88	0.0064	72

Source: Study results obtained using SPSS, 2009-2015.

Table 2 shows the descriptive statistics of the factors affecting exchange rate of INR/USD. The Mean, Standard deviation, Covariation, Skewness, Kurtosis, Jarque bera test and Number of observation for the sample period 2008-2015 are presented. The average of exchange rate at INR 51.84 USD, Current

account balance stood deficit at -Rs 577.43 bn, Capital account of balance of payment stood surplus at Rs 615.48 bn, Foreign exchange reserve was at Rs15505.56 bn, foreign investment inflows was at US\$3674.21million, inflation and interest rate differential stood at 5.23 per cent and 1.79 per cent, net

purchase/sale of US dollars by RBI stood negatively at - Rs 115.66 bn and gross domestic product was at Rs 12861.14 bn

To identify the relationship between the select variables of the exchange rate of Rupee against Dollar the multiple correlation was carried out and presented in Table 3

Table 3: Results of Multiple Correlation

Variables	ER	CUAC	CAPAC	FR	FII	IFD	IRD	RBINI	GDP
ER(Y)	1								
CUAC(X1)	.183	1							
CAPAC(X2)	.024	-.889**	1						
FR(X3)	.928**	.258	-.122	1					
FII(X4)	.304	.151	.043	.497	1				
IFD(X5)	-.485	-.306	.243	-.385	-.152	1			
IRD(X6)	-.814*	.346	-.200	.746	-.042	-.086	1		
RBINI(X7)	.727	.466	-.168	.787*	.731	-.225	.605	1	
GDP(X8)	.870*	-.107	.302	.887**	.444	-.151	.664	.655	1

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2- tailed)

Table 3 shows the correlation results that among the variables taken, the exchange rate was correlated with foreign exchange reserve at 0.01 level and GDP at factor cost at 0.05 level. Foreign exchange reserve was correlated with net purchases and sales of US dollar at 0.05 level and GDP at factor cost at 0.01 level. Balance of payment-Capital account was correlated

negatively with Balance of payment -Current account at 0.01 level and exchange rate was correlated negatively with Interest rate differential at 0.05 level and found to be that the correlated variables are statistically significant.

To find the factors affecting exchange rate, multiple regression was carried out. The results are presented in Table 4

Table 4: Results of Multiple Regression

Variables	Regression coefficient	Standard error	t	Significance
Constant	255.256	22.011	11.597	.001
BOP-Current Account(CUAC)X1	.057	.019	2.939	.061**
BOP-Capital Account(CAPAC)X2	-.003	.012	-.237	.828
Foreign Exchange Reserve(FR)X3	-.001	.000	-2.502	.088**
Foreign Investment Inflows(FII)X4	.000	.000	-1.918	.151
Inflation Rate differential (IFD)X5	.985	.578	1.703	.187
Interest Rate differential (IRD)X6	-.296	.132	-2.237	.111
Net Purchase / Sales of US dollarX7	.000	.000	-2.051	.133
GDP at Factor Cost(GDP)X8	.014	.004	3.657	.035*

Dependent variable – Exchange rate * Significant at 0.05 level (2-tailed). **Significant at 0.10 level (2- tailed)

Table 5: Model Summary

Model	R	R Square	Adjusted R S square	Std. Error of the Estimate	D-W Statistic	F value
1	.989	.978	.919	2.212321	2.660	16.65

Table 4 shows the regression results that the Balance of payment -current account and GDP at factor cost have positive impact and foreign exchange reserve has negative impact of exchange rate of Indian rupee against US dollar and the results are found to be statistically significant. R square value was at 97.8 per cent implying the extent of influence of the three variables namely Balance of payment -Current account, Foreign exchange reserve and GDP at factor cost on the exchange rate Rupee against Dollar. Durbin-Watson statistic is a test for first-order serial correlation and it measures the linear association between adjacent residuals from a regression model. DW statistics of 2.66 shows that there is no serial correlation. The above analysis resulted in the following multiple regression equation.

- $Y = a + b_1X_1 - b_3X_3 + b_8X_8$
- $INR/USD = 255.256 + .057 CUAC - .001FR + .014GDP$

4.1 Limitations of the study

The study covered a limited period of seven years and was based on secondary data. Among several macro-economic

variables affecting exchange rate of Indian rupee against US dollar only select variables are considered for the current study.

5. Conclusion

The study was an attempt to identify the macroeconomic determinants affecting exchange rate of Rupee against Dollar. It is mainly dependent on the market forces of the economy. The variables inflation rate, interest rate and foreign exchange reserve were considered in the studies reviewed. An attempt has been done in the current study to include the variables such as Balance of payment-Current and Capital account, Foreign exchange reserve, foreign investment inflows, Net purchase and sales of US dollar and GDP at factor cost besides inflation rate, interest rate and foreign exchange reserve. Indian rupee has shown high volatility over the period of study. RBI can take policy measures to create the healthy environment for economic growth.

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