Macroeconomic Variables And Their Impact On Exchange Rate Fluctuations: ARDL Bound Testing Approach

Khushboo Bhasin, Syeedun Nisa

Abstract: This paper endeavour to construct a model for the exchange rate taking into consideration the monetary model that comprise factors which are utilised by the RBI for intervention. The relationship between exchange rate and foreign exchange reserve, interest rate, current account deficit and money supply in India is analysed covering the period 2009-2019. Autoregressive Distribution Lag (ARDL) is employed to analyse the long run association among the exchange rate and its macroeconomic variables and Error Correction Model (ECM) is employed to determine short run dynamics with respect to exchange rate and its explanatory variables. The empirical analysis proved that foreign exchange reserve, money supply and interest rate have a significant influence on exchange rate in India while current account deficit have a non- significant influence on exchange rate. On the basis of this result, suggestion has been made that RBI should intervene in foreign exchange market to counteract the outflow and bring stability in the market by injecting dollars. Future researchers should try to cover longer duration of study of above 10 years with different variable like external debt, crude oil price, foreign institutional investment, gross domestic product.

Key Words: Exchange Rate, Macroeconomic variables, India, ARDL, ECM

1. INTRODUCTION

An exchange rate is the price of one nations' currency in terms of another currency, often termed as reference currency". (Shaprio, 2010). The decisions that are taken by foreign exchange investors, policymakers, exporters, bankers, tourists, importers, financial institutions, and businesses in both developed and developing world are all affected by exchange rate. (Mishra & Yadav, 2012). It does not remain stagnant on any two days as certain variation in price is always possible due to economic or political conditions or seasonal variations in demand and supply or the effects of extraneous factors such as investment climate in the country, interest rate, etc. (Bakshi,2013). This variation of price is predominantly referred as exchange rate fluctuation. According to Allen & Gale (2004), "Exchange Rate fluctuation or volatility is the main concern which determines the quantum and direction of foreign trade and commerce". Before 1991, India was viewed as a closed economy due to its limited trade engagement with rest of the world and with the minimal association with the outside world, the impact of depreciation or appreciation of currency was also very restricted. But after, 1991, when the span of LPG (Liberalisation, Privatisation and Globalisation) commenced, a modern era introduced where India broadened its horizons and became part of the global market. Also, the mechanism of exchange rate determination was altered in 1990s when flexible exchange rate system had been replaced by fixed exchange rate system. The Indian exchange rate system has developed from extreme fix to a middle position, but is not yet full float (Goyal, 2010). In March 1993 India embraced a Managed Floating System with the targets of lowering stabilising speculative activities, excess volatility, developing foreign exchange market and maintaining adequate level of reserves. According to this system, the exchange rate of rupee against dollar is ascertained by market forces and central bank of India keeps a close view on the fluctuation of the Indian Rupee value. Emerging exchange rate variations and the uncertainty in exchange rate markets have become issue of concern for all countries, but these issues are troublesome predominantly for developing countries like India. India has watched recently an excessive volatility leading to rapid devaluation of Indian Rupee against US Dollar. The Rupees has lost its value by around 3% since the beginning of 2018 and it is the second biggest loser after Russian ruble in the BRICS group that has lost more value than the rupee in 2018 so far. The decline in Indian currency can be credited to hike in crude oil prices because 80% of the country's fuel need are met by crude oil imported by India due to which money disbursed on importing crude oil are higher than any other commodity. Another contributor to decline in rupee value is widening trade deficit as import bill of India is increasing at a point when export's contribution to the GDP has thrashed a 14- year low and higher capital outflows.

Macroeconomic variables such as national income, current account balance, crude oil price, interest rate, external debt, inflation rate, etc. affect the exchange rate randomly and are considered to be volatile and uncertain keeping in view the state of the economy prevailing in the country. In international finance literature, several conceptual models exist to scrutinize exchange rate determination and its behaviour. (Raithatha, 2012) studies the merits and demerits of currency depreciation and appreciation as bane and boon for economic development. Apart from this, it has furnished the necessary recommendations to sway as well as to overcome the adverse effects of superlative volatility in rupee-dollar exchange rates. (Mishra & Yadav, 2012) divulged some facts about rupee-dollar exchange rate by correlating it with certain macroeconomic factors namely; trade balance, inflation rate, money supply, output and real inflation rate and for both foreign as well as domestic economy and the empirical findings confirmed that the money supply and inflation rate have the most notable effect on exchange rate. This study endeavour to construct a model for the exchange rate taking into consideration the monetary model that comprise factors which are utilised by the RBI for intervention. Here, spotlight is on the exchange rate of Indian rupee against the US dollar.

- *Khushboo Bhasin: Research Scholar, Department of Management, Jamia Hamdard, International Finance*
- *Syeedun Nisa: Assistant Professor, Department of Management, Jamia Hamdard, International Business, Sustainable Business Model*

OBJECTIVE OF THE STUDY

The objective of the study is to examine the relationship between exchange rate and foreign exchange reserve, interest rate, current account deficit and money supply in India. This paper endeavour to construct a model for the exchange rate taking into consideration the monetary model that comprise factors which are utilised by the RBI for intervention.

JUSTIFICATION OF THE STUDY

Exchange Rate is significant to India's economy as they influence financial flows and trade among India and other countries. It also influences the way Reserve Bank of India carries out monetary policy. This study will be beneficial in exploring the association of India's exchange rate and its macroeconomic variables. Besides it will also be beneficial for the regulators in undertaking the measures from time to time to make sure that there stability in the foreign exchange market.

CONCEPTUAL FRAMEWORK

The current paper has formed conceptual framework using four variables which have been chosen in order to evaluate its effect on exchange rate. Refer Figure 1 for conceptual framework.

Foreign Exchange Reserves and Exchange Rate

In terms of foreign exchange reserves, Cady & Gonazalea-Garcia (2007) examined the effect of international reserves on exchange rate fluctuations for 48 countries which indicated that, rising reserves sufficiency leads to low exchange rate fluctuations. Prebheesh, et.al. (2007) had analysed the co-integration among foreign exchange reserves and exchange rate in India and showed that foreign exchange reserve accumulation leads to reduction in power of country's policy. While Liao (2008) concluded that there prevails long run linkage between foreign exchange reserve and currency appreciation which was also proved by Frenandes (2017), who used OLS modelling and indicated that foreign exchange reserve has a significant effect on exchange rate fluctuation and on the growth prospect as respective foreign exchange reserve balance would uplift the value of exchange rate.

Interest Rate and Exchange Rate

Goldfajn & Baig (1998) have analysed the relationship among exchange rate and real interest rate for the Asian countries using VAR. Any optimum inference regarding the association among exchange rate and interest rate has not been identified by the author. However, a study by Saritha (2016) shows that the, domestic interest differentials and interest yield differentials have a prominent effect on the Indian Rupee and the US Dollar exchange rate. Majority of studies have been tested and examined the effect of interest rate differential on exchange rate movements formed on the theory of International Fisher Effect and thus earlier studies declares that high rate of interest is efficient in restraining exchange rate fluctuations. (Mirchandani, 2013) (Ramasamy & Abar, 2015) studied the factors determining exchange rate volatility and inferred that interest rates are highly negatively correlated which also confirmed by (Megaravalli & Vikram, 2016) (Khan & Teng, 2019). While Wong (2013) used Johansen integration and (Frenandes, 2017) used OLS modelling and indicated that interest rate is highly positively correlated with exchange rate.

Money Supply and Exchange Rate

Money supply in the country constitutes the value of total commodities and services and on the basis of this global market calculates the external value of the currency. However, if money supply doubles, the currency will be placed at half the preceding value in order to maintain the money stock constant. Levin (1997) said that "Domestic currency depreciates on impact in response to money supply growth". (Mishra & Yadav, 2012) (Kakar, et.al, 2010) confirmed the statement using VAR model that there exist indirect and significant association between money supply and exchange rate. Also, Saeed et.al (2012) inferred that a rise in relative stock of money has increased the exchange rate.

Current Account Deficit and Exchange Rate

Balance of payments constitutes the demand for and supply of foreign exchange which eventually leads to determination in the currency value. A current account deficit displays that country is speeding more on foreign goods than its earnings. Were,et.al (2011) used VECM model and showed that improvement in current account balance are associated with an appreciation of the domestic currency and deterioration in current account balance are associated with depreciation of the currency. However, Denga & Kiptui (2016) conducted the study using ARDL methodology and showed the negative but non-significant long run relationship.

RESEARCH METHODOLOGY

In order to analyse the factors affecting the exchange rate in India, the Augmented Dickey Fuller (ADF) is employed to test stationary of variables, Autoregressive Distribution Lag (ARDL) is employed to analyse the long run association among the exchange rate and its macroeconomic variables and Error Correction Model (ECM) is employed to determine short run dynamics with respect to exchange rate and its explanatory variables.

Data Source

The study covers the period of 10 years from April, 2009 to March, 2019 and the data is in 3- month series form. The study is wholly designed on secondary data and has been obtained from various sources such as RBI Database of Indian Economy, WDI Database, trading economics from the year 2009-2019.

Tools Used

This study has utilised Eviews Version 8 software and statistical tools of Unit Root test, ARDL Model, Diagnostic test and Stability test are employed for analysis of data.

Model Specification

Four macroeconomic variables are explained in this study that have an influence on exchange rate which is shown in the equation and ARDL model to co-integration is employed to analyse the association of factors through OLS estimation as shown in the equation. To analyse the long run and short run association, Autoregressive Distributed Lag (ARDL) bounds testing approach is employed among dependent and independent variables. In literature, distinct but well accepted co-integration models were used by distinct researchers for distinct situations. For instance, Engle and Granger co-integration method is the first approach of co-integration that is appropriate for variables I (1) order. While, the second

approach Johansen and Juselius is used for large size data and series having integration of same order. But, the above mentioned co-integration models have certain restrictions, that the order of integration for all series should be at the same level. Therefore, researchers desired for the establishment of a novel approach that can treat the factors with distinct series of I (0) and I (1). In order to solve this issue, Pesaran et.al. (2001) at last established ARDL co- integration approach. This methodology is implemented to handle the variables possessing stationary of series mixture of I (0) and I (1). Autoregressive Distributed Lag approach is better than the other co-integration methods as it provides more reliable results. The model identified is five variable models which hypothesize the exchange rate as a function foreign exchange reserve, interest rate, inflation rate, current account deficit and money supply.

$$EXG_t = F(FOREX_t, INR_t, CAD_t, MS_t)$$

As per the economic theory, the long term linkage in the exchange rate equation can be also displayed in a model of logarithmic as follows:

$$Ln(EXG_t) = \beta_0 + \beta_1 Ln(FOREX_t) + \beta_2 Ln(INR_t) - \beta_3 Ln(LnCAD_t) - \beta_4 (LnMS_t) + \mu_t \quad (1)$$

where, Ln(EXG) represents quarterly exchange rate in India(□/$), Ln(FOREX) represents foreign exchange reserve, Ln(INR) represents interest rate, Ln(CAD) represents current account deficit, Ln(MS) represents money supply, μ represents error term with normal distribution and t- sign represents time trend, β_0, β_1, β_2, β_3, β_4, β_5 represents estimated parameters while, parameters represents exchange rate fluctuations related to explanatory variables .

Econometric Analysis

This research study employs ARDL bound testing approach to co-integration established by Pesaran, et.al (2001) to analyse the long run and short run association among exchange rate and its determinants. Stationary of data is checked before proceeding to ARDL Bound testing with Augmented dickey fuller (ADF) test. Basically, ARDL approach includes the estimation of conditional error correction of the ARDL model to co-integration for exchange rate and its determinants:

$$\Delta lnEXG_t = \beta_0 + \beta_1 \Sigma \Delta lnEXG_{t-1} + \beta_2 \Sigma \Delta lnFOREX_{t-1} + \beta_3 \Sigma \Delta lnINR_{t-1} + \beta_4 \Sigma \Delta lnCAD_{t-1} + \beta_5 \Sigma \Delta lnMS_{t-1} + \delta_1 lnEXG_{t-1} + \delta_2 lnFOREX_{t-1} + \delta_3 lnINR_{t-1} + \delta_4 lnCAD_{t-1} + \delta_5 lnMS_{t-1} + \epsilon_t \quad (2)$$

Where Δ denotes the different operators; β_0: presents drift constant; l is the optimal lag length; i is number of lags; the β_i (1....5) with the summation signs represents the short run dynamics of the variable; δ_1 (1....5) represents the long run relationship of variables; ϵ_t is the Gaussian white noise.

To obtain the ARDL bounds testing approach, several steps and procedures are conducted. The F-test is utilized to examine the presence of the long run association among the variable for which the null hypothesis is formed:

H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$; No co-integration
H_1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$; Co-integration

To decide whether their exist co-integration or not among variables, value of F-statistic is utilized to compare with the critical value in the lower bound and upper bound. In case, F-statistics value is higher than upper bound value, the null hypothesis of no co-integration would be rejected, indicating the presence of long run association among the factors, unless estimated F- statistics are greater than upper bound value. On contrast, if the value of F-statistic is less than critical bound value, the null hypothesis of no co-integration would be accepted. In case, the existence of long run relationship i.e co-integration among the variables is witnessed, the following long run model is estimated:

$$LnEXG_t = \beta_0 + \Sigma \delta_1 lnEXG_{t-1} + \Sigma \delta_2 lnFOREX_{t-1} + \Sigma \delta_3 lnINR_{t-1} + \Sigma \delta_4 lnCADt_{-1} + \Sigma \delta_5 lnMS_{t-1} \quad (3)$$

And, the Error Correction Model is employed to obtain the short-run dynamic co-efficient, ECM (t-1) indicates the correction mechanism in stabilizing the disequilibrium in the model, called speed of adjustment. Hence, the ARDL specification of short run dynamics can be derived:

$$\Delta lnEXG_t = \beta_0 + \beta_1 \Sigma \Delta lnEXG_{t-1} + \beta_2 \Sigma \Delta lnFOREX_{t-1} + \beta_3 \Sigma \Delta lnINR_{t-1} + \beta_4 \Sigma \Delta lnCAD_{t-1} + \beta_5 \Sigma \Delta lnMS_{t-1} + \gamma ECM_{t-1} \quad (4)$$

To ensure the goodness of fit of the ARDL model, a number of diagnostic tests including serial correlation test, normal distribution, heteroscedasticity are employed and the CUSUM of recursive residuals is employed to determine the stability of the model.

RESULTS AND DISCUSSIONS

Unit Root Test

To assert the level of integration, stationary test is significant for the study in order to elude spurious results. In this study, ADF test for stationary is used in order to certify the robustness of the results. Refer Table 1 and 2 for Unit Root Test at Level and First Difference respectively. The ADF test results for examining the stochastic properties of the sample are estimated for each variable. Results specify that all variables except current account deficit and interest rate are non-stationary at level with intercept. And, interest rate and money supply are the only variables which are stationary at level with trend and with intercept. However, the first difference result specifies that all variables are stationary. Therefore, it has been indicated that the order of integration is a mix of I (0) and I (1), implying the employment ARDL bound test approach valid.

Optimum Lag Length Selection

ARDL model is applied after the determination the optimal lag length of variables as it is essential for the research. The two popular mechanisms to choose the optimum lags for variables are Akaike information criterion and Schwarz information criterion. Between the two, we have utilised AIC for lags selection. Table 3 given below outlines lag-order selection statistics. The report displays lag order at four.

ARDL Bound tests for co-integration

The existence of long run relationship among exchange rate (dependent variable) and macroeconomic variables is assessed through the equation that is run by least squares (OLS). The null hypothesis is tested and results are interpreted by evaluating the computed F- statistic with the critical values.

Refer Table 4 for Wald Test. From Table 4, it can be stated that there is co-integration among LnEXG and other macroeconomic variables, i.e. existence of long run association. Since, value of F-statistic is more than the upper bound critical value at the 5 per cent of significance, the null hypothesis of no co-integration is rejected.

ARDL Long Run Estimates

Table 5 represents the results generated from the ARDL model which estimates the long-run coefficients of the variables of the study. The model is established with exchange rate as a dependent variable and foreign exchange reserve, interest rate, current account deficit and money supply as independent variables. Refer Table 5 for ARDL Long Run Estimates ARDL model results indicate that foreign exchange reserves have positive and significant influence on exchange rate. Considering the fact that India is accumulating foreign exchange reserve at a high level and this accumulation of reserves will inevitably make the value of rupee to appreciate, therefore we observed that 1% increase in foreign exchange reserves causes increase in value of rupee by 0.19%. Basically, exchange rate is fundamentally determined by the supply of the US Dollar within the country, Reserve Bank of India can influence this by swaying the supply of currencies. The rupee value can be appreciated or depreciated by selling and buying the US dollars through money market operations respectively. Reserve Bank of India sells certain dollars from its foreign exchange reserves into the market and in exchange purchases rupees, if supply of US dollar supply is low in India. This results in increases of dollar supply and reduces rupee supply and ultimately this increases the value of the rupee and lead to appreciation of currency. Coefficient of interest rate indicates positive and statistically significant influence on exchange rate in the long run in India. The increase in interest rate strengthens the Indian Rupee value through high inflow of investment and minimisation of outflow of investment by the residents of the country. This inference is approved by the positive coefficient which shows 1% increase in interest rate increases the exchange rate by 0.06%. Coefficient of current account deficit indicates the negative and non-significant influence on exchange rate in the long run. It showed that the reduction in value of Rupee is caused by the increase in current account deficit in the economy, about 0.05%. The balance of payment of India is continuously at deficit, implying the demand for the Indian Rupee is lesser than its supply. Thus, the value of Rupee in the market declines. Related to money supply, we can state that increase in supply of money relative to unchanged demand of it will lower the rate of interest. The reduction in the interest rate will further decrease the flow of investment in India due to the possibility of earning higher returns in foreign markets with higher interest rates. This lead to fall in the demand of rupee as price of a thing is suppose to fall which have low demand in the market, indicating depreciation in the value of Indian currency against other currencies. Thus, it is observed that the lesser Rupees there are in circulation, the higher is the value of the rupee; therefore decrease in money supply increase the exchange rate by 0.04%. Descriptive statistics specifies that 66% variation in exchange rate is explained by macroeconomic variables of study while the value of Durbin Watson is 2.50 which specify the existence of no issue of autocorrelation in the data. The value of F statistics indicates that the model is fit.

ARDL Short Run Approach

In the table 6, results are generated for short run ARDL approach which indicates that foreign exchange reserve has direct and significant influence on exchange rate in short run in India, making it accordant with long run results. However, interest rate posses an indirect as well as statistically non-significant influence on exchange rate. The interest rate results indicate that 1% increase in interest rate decrease the exchange rate in India in short run by 0.04%. It is on par with the existing literature where interest rate posses negative impact on exchange rate which has already been proved by the study of Danga & Kiptui (2016), Khan & Teng (2019). The current account deficit has negative as well as significant effect on the exchange rate in the short run. The money supply has positive and statistically significant effect on exchange rate. The result of money supply indicates that 1% increase in money supply increases the exchange rate by 0.045%, which is inconsistent with ARDL long run model. Refer Table 6 for ARDL Short Run Approach. The result shows that coefficient for Error Correction Term is -0450832 (0.00), which is highly significant and has an accurate sign (negative). It indicates the evidence of co-integration relationship among variables in the model. However, the value of ECT_{t-1} implies that the adjustment speed to the long run equilibrium in response to the disequilibrium due to the short run shocks in the preceding period is 45% and this propose that LnEXG exceed the long run relationship with LnFOREX LnINR LnCAD LnMS which gets adjusted at a 45% per quarter. Diagnostic TestssRobustness, credibility and goodness of the model are checked through certain diagnostic tests which are indicated below: Refer Table 7 for Diagnostic Test. Table 7 indicates the diagnostic tests for normality, serial correlation and heteroskedasticity distribution. The Jacque- Bera normality test shows that normal distribution prevails among residues. Result also indicates that residues tested did not possess serial correlation as well as they do not suffer from heteroskedasticity.

Stability Test

The graph of CUSUM test on recursive residuals is employed to ensure the constancy of the coefficients of the long run model in the data. The stability test result show that the calculated ARDL long run model is dynamically and structurally stable within the 5% critical bound. Refer Graph 1 For CUSUM Test.

CONCLUSION

The empirical study investigates the factors that lead to exchange rate fluctuation in the short run and long run relationship through the period of April, 2009- March, 2019 by employing ARDL bound testing approach. Results reveal that there exists long run relationship among EXG and its macroeconomic variables. However, empirical analysis proved that foreign exchange reserve, money supply, interest rate have significant influence on the exchange rate in India while current account deficit have non- significant influence on the exchange rate. Long run model indicate that money supply and current account deficit have an indirect effect on exchange rate while foreign exchange reserve have a positive effect on the exchange rate in India. Foreign Exchange reserve has a very significant role to play in the appreciation of Indian currency because accumulation of foreign exchange rate reserve increases dollar supply and reduces rupee supply and

ultimately this increases the value of the rupee and lead to appreciation of currency. On the basis of this result, Reserve bank of India should intervene in foreign exchange market to counteract the outflow and bring stability in the market by injecting dollars. The error correction term is highly significant and is possessing correct sign (negative), implying that around 45% of disequilibrium is corrected in the current year. Future researchers should try to cover longer duration of study of above 10 years with different variable like external debt, crude oil price, foreign institutional investment, gross domestic product.

REFERENCES

[1] Allen, F. & Gale, D. (2004). Competition and Financial Stability. Journal of Money, Credit and Banking, 36(3), 453- 480.

[2] Bakshi, G.(2013). Fluctuating exchange rates and their impact on international trade with special reference to India exports (Dissertation, University of Delhi, Delhi).

[3] Cady, J. & Gonzalez- Garcia, J. (2007). Exchange Rate Volatility and Reserves Transparency. IMF Staff Papers, 54(4), 741-754.

[4] Cherni, A. B. E. L. B. A. K. I. (2016). Modeling the nonlinear adjustment of the Dinar/Euro exchange rate: An application of the STAR modelⅡ. International Journal of Economics Commerce and Research, 6(2), 13-26.

[5] Danga, K. & Kitptui, M.C. (2016). Determinants of Nominal Exchange rate Fluctuations in Kenya. International Journal of Economics, Commerce and Management,4(6),137-172.

[6] Fernandes, K. (2017). Macroeconomic Factors Causing Variations in Exchange Rate of Indian Rupee. International Journal of Global Business Management, 6(2), 49-57.

[7] Tyagi, A. (2016). Fiscal Policy: As a Stabilization Tool for Discretionary and Non Discretionary Policies. International Journal of Economics, Commerce and Research (IJECR), 6(3).

[8] Goldfajn, I. & Gupta, P. (1999). Does Monetary Policy Stablize the Exchange Rate Following a Currency Crisis?. International Monetary Fund Working Paper.

[9] Goyal, A. (2010). Evolution of India's Exchange Rate Regime. Retreived from http://www.igidr.ac.in/pdf/publication/WP-2010-024.pdf

[10] Kakar, M.K., Kakar, R. & Khan, W. (2010). The Determinants of Pakistan's Trade Balance: An ARDL Cointegration Approach. The Lahore Journal of Economics, 15(1).

[11] Raza, H., Hena, S., & Saeed, A. (2017). The Effects of Interest Rate, on Savings and Deposits in Pakistan. International Journal of Business and General Management (IJBGM), 6(6), 67-74.

[12] Khan, M. K. & Teng, J. (2019). Cointegration between macroeconomic factors and the exchange rate USD/CNY. Financial Innovation, 5(5), 1-15.

[13] Levin, J. H. (1997). Money Supply Growth and Exchange Rate Dynamics. Journal of Economic Integration, 12(3), 344-358.

[14] Liao, H. (2008). The Empirical Research between China's Foreign Exchange Reserves and the Exchange Rates. China Collective Economy, 24, 89-90.

[15] Megaravalli, A. V. & Vikram, K. A. Exchange Rate Volatility & its Impact on Macroeconomic factors with Respect to Indian Economy. International Journal of Social Science& Management, 4(6), 1-18.

[16] ZEB-OBIPI, I. S. A. A. C. (2015). Corporate productivity performance: A harmonist framework. International Journal of Business and General Management, 4(1), 19-28.

[17] Mirchandani, A. (2013). Analysis of Macroeconomic Determinant of Exchange Rate Volatility in India. International Journal of Economics and Financial Issues, 3(1), 172-179.

[18] Mishra, A. K., & Yadav, R. (2012). Exchange Rate Behaviour and Management in India: Issues And Empirics. International Journal of Economics, Commerce and Research, 2(4), 9-16

[19] Pesaran, M. H., Shin, Y. & Smith, R. J. (2001). Bound Testing Approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326.

[20] Krishnan, D. S. G., & Rajesh, A. (2018). Gulf Cooperation Council Banking Performance Analysis–An Exploratory Study. IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL) ISSN (P), 2347-4564.

[21] Prabheesh, K.P., Malathy, D. & Madhumati, R. (2007). Demand for foreign Exchnage Reserves in India: A co-integration approach. South Asia Journal of Management, 14, 36-46.

[22] Raithatha, M. (2012). A Conceptual Study on Fluctuation of Rupee in relation to Dollar. ZENITH International Journal of Business Economics and Management Research, 2(3), 266-274.

[23] Ramasamy, R. & Abar, S.K. (2015). Influence of Macroeconomic Variables on Exchange Rates. Journal of Economics, Business Management, 3(2), 276-281.

[24] Purnomo, S. H., & Rapanna, P. (2018). Micro, Small Medium Businesses Empowerment (SMEC) in Suppressing the Rate of Poverty in Indonesia.

[25] Saeed, A., Awan, R. U., Sial, M. H. & Sher, F. (2012). An Econometric Analysis of Determinats of Exchange Rate in Pakistan. International Journal of Business and Economics, 3(6), 184-196.

[26] Saritha, B. (2016). A Study of Exchange Rate between Indian Rupee and Dollar. SUMEDHA Journal of Management, 5(3), 116-132

[27] Shaprio A C (Ed.) (2010), "Multinational Financial Management", John Wiley & Sons.

[28] Were, M., Kamau, A. W. & Kisinguh, K. N. (2013). An Empirical Investigation of Exchange Rate Determination in Kenya: Does Current Account Imbalance Play a Role? Advances in Management & Applied Economics, 3(2), 165- 178.

[29] Wong, H. T. (2013). Real Exchange Rate misalingnment and economic growth in Malaysia. J.Econ Stud, 40(3), 298-313.

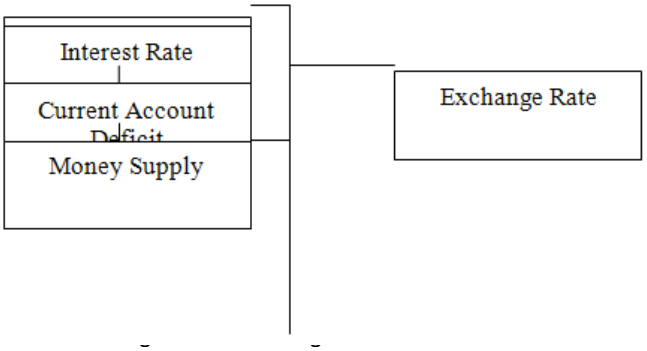

Table 1: *Unit root test at level (ADF)*

Variables	Intercept	P Value	Status	Trend & Intercept	P Value	Status
LnEXG	-0.468751	0.887	Non- Stationary	-2.053365	0.555	Non-Stationary
LnFOREX	-0.279567	0.919	Non- Stationary	-2.674428	0.252	Non-Stationary
LnINR	-3.094454	0.035	Stationary	-4.915164	0.002	Stationary
LnCAD	-3.386408	0.018	Stationary	-3.369466	0.072	Non-Stationary
LnMS	-2.634768	0.095	Non- Stationary	-6.16836	0.000	Stationary

Table 2: *Unit root test at first difference (ADF)*

Variables	Intercept	P Value	Status	Trend & Intercept	P Value	Status
LnEXG	-5.426364	0.000	Stationary	-5.335085	0.000	Stationary
LnFOREX	-7.156976	0.000	Stationary	-7.086963	0.000	Stationary
LnINR	-6.007566	0.000	Stationary	-5.936138	0.000	Stationary
LnCAD	-7.67409	0.000	Stationary	-7.654963	0.000	Stationary
LnMS	-10.44071	0.000	Stationary	-10.29538	0.000	Stationary

Table 3: *Optimum Lag Length Selection*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	26.89770	NA	1.60e-07	-1.459847	-1.226314	-1.385138
1	168.3191	226.2742*	6.99e-11	-9.221270	-7.820073*	-8.773015
2	197.6449	37.14608	6.10e-11*	-9.509660	-6.940799	-8.687859
3	219.2424	20.15763	1.18e-10	-9.282824	-5.546298	-8.087478
4	268.2301	29.39263	6.89e-11	-10.88201*	-5.977814	-9.313112*

* indicates lag order selected by the criterion

Table 4: *Wald Test*

Test Statistic	Value	df	Probability
F-statistic	6.012519	(5, 25)	0.0009
Chi-square	30.06259	5	0.0000

Table 5: *ARDL Long Run Estimates (3,2,1,4)*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.457655	0.243172	-1.882020	0.0731
LnFOREX	0.188194	0.052556	3.580806	0.0017*
LnCAD	-0.005172	0.004888	-1.058102	0.3015
LnINR	0.060753	0.034489	1.761488	0.0920***
LnMS	-0.037281	0.016130	-2.311326	0.0306**
R-squared	0.662799	Durbin-Watson stat		2.495829
F-statistic	4.324301			
Prob(F-statistic)	0.002011			

Note:(*), (**) and (***) represents 1%, 5% and 10% level of significance respectively.

Table 6: *ARDL Short Run Approach*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.004718	0.004786	-0.985645	0.3334
D(Ln(FOREX(-3)))	0.255940	0.112148	2.282163	0.0309**
D(Ln(INR(-2)))	-0.046121	0.073466	-0.627785	0.5356
D(Ln(CAD(-1)))	-0.007597	0.003354	-2.265373	0.0321**
D(Ln(MS(-4)))	0.045338	0.010916	4.153515	0.0003*
ECM(-1)	-0.450832	0.093755	-4.808595	0.0001*
R-squared	0.622380	Durbin-Watson stat		2.395396
Adjusted R-squared	0.535237			
F-statistic	7.142055			
Prob(F-statistic)	0.000141			

Note:(*), (**) and (***) represents 1%, 5% and 10% level of significance respectively.

Table 7: *Diagnostic Test Results*

	H_0	F-statistic	Prob
Residual Normality Test	Residuals are multivariate normal	0.548233	0.6525
Breusch-Godfrey Serial Correlation LM Test	No serial correlation at lag order h	0.608588	>0.05
Breusch-Pagan-Godfrey Heteroskedasticity	Residuals are homoskedastic	0.762241	0.6060

Graph 1 CUSUM *Test Graph*