

An Investigation of the Factors Affecting Indian Exchange Rate: An Analysis

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Abstract

Exchange rate plays a key role in the country's level of trade and has a large impact on world trade and financial flows. In case of multinational companies, a precise forecasting and less volatility of exchange rate helps in improving their overall profitability.

Both political and economic factors influence exchange rates. (Huang W, 2004). In India, exchange rate has been highly volatile due to many a factors such as fluctuation in FII money flows, differences in rate of return or interest rates between countries, inflation, oil prices etc. Exchange rate has been a topic of detailed study for policy making circles.

The present research study seeks to investigate and analyse the impact of determinants such as GDP at constant prices, inflation levels, interest rates, current account deficit, inflow of foreign institutional investment, foreign exchange reserves and price of crude oil and gold on the USD-INR exchange rate based on quarterly data from April 1999- January 2017. The study also seeks to determine the relationship between the independent variables and the dependent variable ie Exchange Rate in the short run and long run based on the Johansen Cointegration test, Augmented Dickey Fuller Test and Vector Error Correction model.

Keywords: USD-INR Exchange Rate, macroeconomic determinants, Long run and short run, Johansen Cointegration test and Vector Error Correction Model

Introduction

As per the Central Statistical Organisation and the International Monetary Fund, India has emerged as the fastest growing economy world over. World Bank numbers state that the Indian economy has grown at 7% in 2016-17 and is expected to grow by 7.6% in 2017-18. However, as per the report of India Ratings and Research, Indian economic growth is set to slow down to 6.7% in 2017-18. During 2016-17, Indian exports grew by 4.7% to USD 274.65 billion while imports registered a negative growth of 0.17% thereby clocking, USD 380.36 billion. The Economic Survey 2017 has projected that Indian exports could increase GDP by 1% in the next fiscal year. Overall, the trade balance in 2016-17 has improved with the trade deficit being 14.49% lower in dollar terms in comparison to 2015-16. Of late in August 2017

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the rupee has been appreciating due to consistent foreign inflows and this trend might change only in case of US interest rates hardening thereby triggering a safe haven rush. Investor friendly taxation policies and sectoral ownership reforms add to India's attractiveness as a destination for debt, equity and foreign direct investment flow. However, the appreciation of the Indian rupee has worsened India's export competitiveness.

In the recent past in mid September 2017, the current account deficit has increased to 2.4% of the Gross Domestic Product during April – June 2017 up from 0.1% in the same period a year ago. Exports growth was 8.57% in April – August 2017 period while imports increased 26.63%. Indian foreign exchange reserves with the Reserve Bank of India have crossed USD 400 billion mark.

As per Department of Industrial Policy & Promotion, Foreign Direct Investments totalled to USD 14.55 billion, for the quarter April – June 2017. It was the services sector which attracted the highest FDI equity inflow, of USD 1.88 billion followed by computer services and hardware. According to AT Kearney's Global Services Location Index (Index, 2017), India has topped the index and also extended its lead over other countries especially China. "Its attractiveness as a global services destination continues to increase with its growing cost advantage against the United States, and the improving performance of Indian students on standardised tests. The combination of these factors continues to strengthen India's position as the destination of choice for companies looking to outsource business processes," said Ajay Gupta, Partner at A.T. Kearney India. The Ernst & Young Global Capital Confidence Parameter Technology Report (Technology, 2017) has ranked India as the third most attractive investment destination for technology transactions in the world. The expectations of falling interest rates, economic recovery and improved earnings perspective have been the attractions for Foreign Institutional investors.

Exchange rate plays a key role in the country's level of trade and has a large impact on world trade and financial flows. In case of multinational companies, a precise forecasting and less volatility of exchange rate helps in improving their overall profitability. Both political and economic factors influence exchange rates. (Huang W, 2004). In situations of high volatility, the Reserve Bank of India intervenes in the market through its monetary and regulatory policies and seeks to reduce the fluctuations. India has a freely floating exchange rate operating within a framework of exchange control

Exchange rate is the value or price of the currency of the home country in the currency of the other country. A depreciation in the exchange rate works in favour of exporters while on the other hand an appreciation of the currency is favourable for importers. Many a countries keen to maintain high economic growth depend on sustained levels of high export growth. The exchange rate is considered to be one of the principal determinants of trade balance. It depends on the extent to which exchange rate adjustment is transferred to export and import prices ie the degree of pass through.

The aim of an efficient exchange rate system would be to ensure that the economic fundamentals of the country are truly reflected. A stable exchange rate helps reduce volatility and works towards ensuring that an economy has an adequate level of foreign exchange reserves.

The variation in exchange rate governs the economic performance of the country through its impact on exports and imports and money flows. In India, exchange rate has been highly volatile due to many a factors such as fluctuation in FII money flows, differences in rate of return or interest rates between countries, inflation, oil prices etc. Exchange rate has been a topic of detailed study for policy making circles. The macroeconomic factors known to impact exchange rates are inflation levels, rate of interest, foreign institutional investment, prices of crude oil and gold, GDP, foreign exchange reserves and current account deficit.

The present research study seeks to investigate and analyse the impact of determinants such as GDP at constant prices, inflation levels, interest rates, current account deficit, inflow of foreign institutional investment, foreign exchange reserves and price of crude oil and gold on the USD-INR exchange rate based on quarterly data from April 1999- January 2017. The study also seeks to determine the relationship between the independent variables and the dependent variable ie Exchange Rate in the short run and long run based on the Johansen Cointegration test and Vector Autoregression / Vector Error Correction model. Thereby, the study adds to the extant literature the implications of changes in factors such as GDP at constant prices, inflation, interest rates, current account deficit, inflow of FIIs, foreign exchange reserves and prices of crude oil and gold on Exchange rate. Through exchange rate policy making, a country is able to influence the economy via export competitiveness and price stability. Based on outcomes of the study, it would be possible to blend monetary policy tools with fiscal tools and thereby help in effective policy making, thus constructively impacting trade levels with the rest of the world. This will help policy makers in controlling

so that movement of any factor does not adversely impact exchange rate and trade levels in turn.

Literature Review

A volatile exchange rate affects growth and trade levels in any country. (Rodrik, 2008) states that a poorly managed exchange rate can result in negative economic growth for any country. Studies prior to 1970s on exchange rate were centred around fixed price assumption (Dua & Ranjan, 2014). With the exchange rates becoming floating in nature, monetary factors began influencing exchange rates (Mussa, 1976). In a study by (Hayakawa & Kimura, 2008) it was stated that variability in exchange rate should be controlled through macroeconomic variables. Policies should be made which lessen exchange rate volatility.

Economic and non-economic elements play an important role in determination of exchange rate (Saeed, Awan, Sial, & Sher, 2012). Some of the factors that can impact exchange rate are openness of the economy, interest rate, inflation, investors decisions. The purchasing power and interest rate parity theories state that inflation differentials and interest rate differentials influence currency exchange rate of a country. (Dash, 2004) has discussed the relationship between interest rates and exchange rate in India. He states that based on the Mundell Fleming model, increased interest rates help stabilize exchange rate depreciation. (Gali & Monacelli, 2002) found that interest rates are changed in the monetary policy of a country to control exchange rates. It was seen that rise in interest rates results in appreciation of the home currency (Sanchez, 2005). (Mirchandani, 2013) in her research studied exchange rate and macroeconomic variables such as interest rate, balance of trade, inflation, foreign direct investment and GDP. She found that exchange rate is correlated with interest rate, inflation, GDP and mildly with FDI. However, it has no correlation with the Current Account.

The effect of macroeconomic factors on exchange rate was studied by (Khera & Singh, 2015). The findings suggested that FDI impacts exchange rate fluctuations. The correlation of exchange rate, inflation and interest rate was studied by (Raju, 2014). It was concluded that inflation and interest rate had a short term relationship with exchange rate.

In their research, (Parveen, Khayyam, & Ismail, Analysis of the factors affecting Exchange Rate Variability in Pakistan, 2012) found that based on OLS inflation, growth rate and imports and exports impact exchange rate variability. With inflation being the major factor followed by economic growth. Based on selected ASEAN countries analysis, (Abdoh, Yusuf, & Zulkili, 2016) state that amongst exports, interest rate and inflation, only exports exhibited

a significant relationship with exchange rate. (Monica & Santhiyavalli, 2017) studied the influence of current and capital account, foreign exchange reserves, FIIs, inflation, interest rates and GDP at factor cost on exchange rate of rupee against US dollar. (Uddin K M, 2013) in their study undertook an econometric analysis of the factors that impact Bangladeshi currency in terms of USD. They examined the short run and long run behaviour and found that exchange rate and the macroeconomic variables considered are cointegrating in nature. They state that rise in debt service burden and money stock, political instability results in depreciation while increasing foreign exchange reserves leads to appreciation of currency. (Uddin, Quaasar, & Nandi, 2013) conducted their analysis on impact of a decrease in budget deficit for a stable exchange rate. The research was done on the basis of determining the relationship of exchange rate with monetary variables such as stock of money, foreign exchange reserves and total debt of Bangladesh. They checked for stationary in the time series data through the Augmented Dickey Fuller test and Autoregressive Distributive Lag approach was used to estimate the long run relationship between the dependent and independent variables. For understanding the short run dynamics, Error Correction method (ECM) was employed. The study found that borrowing of government was a major cause of depreciation of the exchange rate.

(Obstfeld & Rogoff, 1995) state that as per their research there is a weak relationship between exchange rate and macroeconomic variables in the short run. (Tanner, 2001) used Vector Autoregression (VAR) for the period 1990-1998 and found that a tight monetary policy leads to appreciation of the currency. (Hau, 2002) found that there is an inverse relationship between trade integration and exchange rate.

On studying the determinants of exchange rate in Pakistan, (Raza & Afshan, 2017), the authors stated that the long run relationship between the independent variables and exchange rate was established. It indicated a negative association between terms of trade, trade openness and economic growth. On the other hand, money supply and inflation has a positive impact on exchange rate. Also, based on the granger causality test, the authors found a bi-directional causal relation of exchange rate with economic growth and trade openness.

In case of oil importing countries it was seen that due to its effect on macroeconomic variables such as exchange rate, countries must respond to changes in oil price through effective policies (Kuncoro, 2011). Macroeconomic variables has a bearing on exchange rates and there is a long run relationship between the two especially in case of emerging economies

Policies can consider oil price movements impact on exchange rates of the country (Kucuk, 2012). (Goudarzi, Khanarnejad, & Ardakan, 2012) in their research of factors impacting exchange rate in Iran for the period 1978-2008 used the VAR model and found that GDP has a negative effect on exchange rate in the short run but in the long run it has increased the exchange rate of Iran. They also state that oil prices account for 29% and import restrictions account for 2.5% of the variation in exchange rate of Iran. (Fowowe, 2014) analysed the relationship using GARCH model between oil prices and exchange rate and found that oil prices led to a depreciation of the exchange rate. (Ghosh, 2016) studied the dynamic relationship between movements in oil prices and exchange rates with macroeconomic variables like price, output, interest rate and money by using structural vector auto regression (SVAR) approach. In their research (Apergis & Papoulakos, 2013) have analysed the data for AUS Dollar and USD based on gold prices for 2000-2011. They found that there is a relationship between exchange rate and gold price changes. The analysis by (Ranjusha, Devasia, & Nandakumar, 2017) showed that there exists a longrun cointegrating relationship between the two variables of exchange rate and gold prices. On investigating gold prices and exchange rate, (Chen, Wang, & Pan Y, 2017) found that a negative relation exists between gold prices and weak currencies whilst a positive relation exists between price of gold and strong currencies.

(Patel, Patel , & Patel, 2014) used Purchasing Power Parity as the basis of their study and concluded that foreign investors are attracted to a country with a stronger GDP which in turn leads to appreciation of the currency. They studied the following factors ie inflation, rate of interest, capital account balance, role of speculators, cost of manufacture, country debt, GDP, political stability and economic performance, employment data and macroeconomic and geopolitical events, purchasing power parity, interest rate parity and balance of payments theory and its impact on the exchange rate of a country. (Divakaran & Gireeshkumar, 2014) found that factors such as demand and supply of dollars and rupee, strength of the economy, price of crude oil, current account deficit, forex reserves, economic growth, demand for gold, difference in interest rates and inflation levels have an impact on the exchange rate of any economy.

(Oyinlola, Adeniyi, & Omisakin, 2011) explored the short run and long run relationship between stock prices and exchange rate and based on Johansen and Gregory-Hansen co integration analysis, causality test and Exponential General Autoregressive Conditional Heteroskedasticity modelling concluded that there is no long run relationship between stock

prices and exchange rate and that there is a uni-directional relationship from stock prices to exchange rate and suggested that as per the EGARCH model a 100% increase in stock prices leads to a 1.66% increase in exchange rates. (Rahman & Uddin, 2009) conclude that a rise in stock prices motivates investors to buy domestic assets and sell foreign assets leading to an appreciation of domestic currency. (Lommatzsch, & Tober, 2004) in their research concluded that the currency strengthens foreign GDP, net foreign assets, and autonomous exports increase.

(Due & Sen, 2006) in their research investigated the association between real exchange rate, level of capital flows, volatility of flows, fiscal and monetary policy indicators and current account surplus in case of India for the period 1993Q2 to 2004 Q1. The results showed that the variables are cointegrated and each Granger causes to the real exchange rate. (Bogoev, et al., 2008) investigated the real exchange rate dynamics with the help of cointegration techniques like the Engle and Granger method, Dynamic OLS, Autoregressive Distributive Lags model, and the VAR-based cointegration technique and found that with trade openness the country's currency would depreciate.

From the review of Literature it was seen that based on data from April 1999 to January 2017 it was important to analyse the relationship that exists, if any, between Indian exchange rate and macroeconomic factors such as Gross Domestic Product (GDP), inflation, interest rates, prices of crude oil and gold, current account deficit, foreign exchange reserves and foreign institutional investment. It was also felt that the strength of relationship be determined between the macroeconomic factors and Indian exchange rate in terms of USD based on Johansen Cointegration test and Vector Autoregression model / Vector Error Correction model.

Hypothesis:

Null Hypothesis:

H01: GDP does not have an effect on USD – INR exchange rate

H02: Inflation does not have an effect on USD – INR exchange rate

H03: Interest rate does not have an effect on USD – INR exchange rate

H04: Crude Oil Prices does not have an effect on USD – INR exchange rate

H05: Gold prices does not have an effect on USD – INR exchange rate

H06: Current account deficit does not have an effect on USD – INR exchange rate

H07: Foreign Exchange Reserves do not have an effect on USD – INR exchange rate

H08: Foreign Institutional investment does not have an effect on USD – INR exchange rate

Alternate Hypothesis:

H01: GDP does have an effect on USD – INR exchange rate

H02: Inflation have an effect on USD – INR exchange rate

H03: Interest rate does have an effect on USD – INR exchange rate

H04: Crude Oil Prices does have an effect on USD – INR exchange rate

H05: Gold prices does have an effect on USD – INR exchange rate

H06: Current account deficit does have an effect on USD – INR exchange rate

H07: Foreign Exchange Reserves do have an effect on USD – INR exchange rate

H08: Foreign Institutional investment does have an effect on USD – INR exchange rate

Research Methodology:

Quarterly data for the period April 1999-January 2017 was collected from secondary sources such as Economic Survey, worldbank.org, trading economic.com and indiastats.com. The independent variables considered were Gross Domestic Product (GDP), inflation, interest rates, prices of crude oil and gold, current account deficit, foreign exchange reserves and foreign institutional investment. Eviews was used for purposes of mathematical and statistical analysis.

Tests:

The methodology adopted in this research is to use an unrestricted vector autoregressive model (VAR) / Vector error Correction model (VECM) in case of cointegration in the variables as it is one of the most flexible model in a multivariate time series analysis and the VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting. As the data being investigated is time series data, test for Unit Root / whether the data is stationary or not was done by applying the Augmented Dickey Fuller Test on each variable. In case of the series having a Unit Root, the series was differentiated and tested for unit root. Eviews was used for purposes of mathematical and statistical analysis.

Thus, the model can be defined as:

$$ER_{\$} = C1 + C2(GDP) + C3(INFLATION) + C4(INTEREST \quad RATES) + C5(CRUDE \quad OIL \quad PRICES) + C6(GOLD \quad PRICES) + C7(CURRENT \quad ACCOUNT \quad DEFICIT) + C8(FOREIGN \quad EXCHANGE \quad RESERVES) + C9(FOREIGN \quad INSTITUTIONAL \quad INVESTMENT) + e_t$$

Data Analysis and Results:

On application of the Augmented Dicker Fuller Test on the level data it was seen that other than FII (data was stationary), the other independent variables had a unit root or were not stationary. Subsequently, ADF was applied on the first difference of the series for each of the variables and the data found to be stationary or having no unit root.

Thereafter the Johansen Cointegration test for the variables was conducted to check for cointegration amongst the variables. The Johansen Cointegration Test checks for whether the variables are co-integrated or not or whether these variables have long run association or not. The assumption for Johansen cointegration test is that variables must be non stationary or unit root at level series but after converting the variables into first difference they become stationary. The lag selection was done based on the Akaike Information Criterion (AIC value). The Johansen Cointegration showed that there is cointegration or long run association between the variables at 5% level. The guideline states that if variable are cointegrated then Vector Error Correction model should be run. However, if they are not cointegrated then VAR model should be run. Thus the Vector Error Correction model was run for the sample.

Johansen Cointegration Test

Lag Interval (in first differences): 1 to1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob **
None *	0.838129	377.4577	239.2354	0.0000
At most 1 *	0.656032	249.9907	197.3709	0.0000
At most 2 *	0.463059	175.2862	159.5297	0.0052
At most 3 *	0.431725	131.7555	125.6154	0.0200
At most 4	0.332476	92.19507	95.75366	0.0857
At most 5	0.315872	63.90248	69.81889	0.1354
At most 6	0.199352	37.32979	47.85613	0.3321
At most 7	0.167652	21.76640	29.79707	0.3117
At most 8	0.117014	8.921104	15.49471	0.3727
At most 9	0.002994	0.209870	3.841466	0.6469

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max Eigen Statistic	0.05 Critical Value	Prob **
None *	0.838129	127.4670	64.50472	0.0000
At most 1 *	0.656032	74.70453	58.43354	0.0007
At most 2	0.463059	43.53066	52.36261	0.2980

At most 3	0.431725	39.56044	46.23142	0.2170
At most 4	0.332476	28.29259	40.07757	0.5411
At most 5	0.315872	26.57270	33.87687	0.2869
At most 6	0.199352	15.56339	27.58434	0.7025
At most 7	0.167652	12.84529	21.13162	0.4666
At most 8	0.117014	8.711234	14.26460	0.3110
At most 9	0.002994	0.209870	3.841466	0.6469

*denotes rejection of the hypothesis at the 0.05 level

Using trace statistics the results showed that there are 4 cointegration equations at the 0.05 level. Also, max eigenvalue test indicates that there are at least 2 cointegrating equations at the 5% level or in the long run the variables have association.

Vector Error Correction Model

After the ADF test and the Johansen Cointegration test, it was seen that the variables are stationary at the first level and are cointegrated. Time series models for integrated series are generally based on application of VAR to first differences. However, on differentiation valuable information about the relationship gets eliminated. Thus, for cointegrated data or data which exhibits a long run relationship it is not advisable to develop a Vector Autoregression (VAR) model but it is recommended to develop the Vector Error Correction model.

$$\begin{aligned}
 D(\text{EXCHANGERATE}) = & C(1)*(\text{EXCHANGERATE}(-1) + 1.89472805573\text{E-}05*\text{FOREXRESERVES}(-1) + \\
 & 0.866828170779*\text{GDP}(-1) - 0.0330660772395*\text{GOLDPRICES}(-1) + 2.39200674203*\text{INFLATION}(-1) + \\
 & 0.2324557656*\text{INTERESTRATE}(-1) - 49.6631376494) + C(2)*(\text{CURRACCDEFICIT}(-1) - 4.82439232401\text{E-} \\
 & 06*\text{FOREXRESERVES}(-1)+0.271372453003*\text{GDP}(-1)+.00102004285029*\text{GOLDPRICES}(-1) + \\
 & 0.265012113528 *\text{INFLATION}(-1) + 1.28868787614*\text{INTERESTRATE}(-1) - 11.1019374097) + C(3)* \\
 & (\text{CRUDEOILPRICES}(-1) + 5.48295713614\text{E-}05*\text{FOREXRESERVES}(-1) - 2.47675502923*\text{GDP}(-1) - \\
 & 0.0534631044274*\text{GOLDPRICES}(-1) - 3.07111576572 *\text{INFLATION}(-1) + \\
 & 5.0299159029*\text{INTERESTRATE}(-1) - 25.2681971243) + C(4)*(\text{FII}(-1) + \\
 & 0.0794121307036*\text{FOREXRESERVES}(-1) - 1172.66942152*\text{GDP}(-1) - 24.6009838355*\text{GOLDPRICES}(-1) \\
 & - 454.902876886*\text{INFLATION}(-1) - 661.981690747*\text{INTERESTRATE}(-1) + 13229.9877295)
 \end{aligned}$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.31057	0.065741	-4.72409	0.0001
C(2)	-0.28703	0.27171	-1.05637	0.0305

C(3)	-0.07428	0.023476	3.164064	0.0039
C(4)	-0.00022	7.82E-05	2.744805	0.0108
R-squared	0.816409	Mean dependent var		0.300881
Adjusted R-squared	0.533963	S D dependent var		1.895049
S.E. of regression	1.293692	Akaike info criterion		3.630162
Sum squared resid	43.51463	Schwarz criterion		4.979302
Log likelihood	-80.6104	Hannan-Quinn criter		4.16402
F-statistic	2.890488	Durbin-Watson stat		1.871227
Prob(F-statistic)	0.002799			

R square for the model is 81.64 % and Prob (F statistic) is 0.002 ie it is significant at the 5 level. With the Durbin Watson at 1.87, it shows that the model has no autocorrelation. Also based on the Breusch Godfrey Serial Correlation LM test it was seen that the model has no serial correlation. There is no heteroskedasticity. Residual is normally distributed based on the Jarque Bera test, probability is 0.88 which is > than 0.05. The Vector Error Correction model showed that the developed model was strong and that there exists a long run relationship between the independent variables and the dependent variable.

Breusch Godfrey Serial Correlation LM Test

F Statistic	0.576	Prob F(4,22)	0.683
Obs R squared	6.357	Prob Chi-Square	0.174

Heteroskedasticity Test: Breusch –Pagan-Godfrey

F Statistic	0.4043	Prob F(45,21)	0.995
Obs R squared	31.102	Prob Chi-Square	0.943
Scaled Explained SS	3.8672	Prob Chi-Square	1

Long Run Relationship:

C(1), C(2), C(3) and C(4) are the error correction term or speed of adjustment towards equilibrium. Long run causality requires C(1), C(2), C(3) and C(4) to be negative in sign and significant. Since the same is significant and has a negative sign it shows that there is long run relationship between the independent variable of crude oil prices, current account deficit, FIIs, gold prices, GDP, interest rate, inflation, Forex reserves and the dependent variable of Exchange Rate.

Short Run Relationship:

The short run relationship between the independent and dependent variables was checked by the Wald test. For short run causality or relationship between the dependent and independent variables, for each independent variable the probability of Chi Square has to be less than 5% in the Wald test. The test showed that there exists no short run relationship between exchange rate and crude oil prices, exchange rate and current account deficit, exchange rate and gold prices. However, there does exist a short run relationship from FII to exchange rate; forex reserves to exchange rate, GDP to exchange rate; Interest rate to Exchange rate, Inflation to Exchange rate

Wald Test

FII

Test Statistic	Value	df	Prob
F-statistic	3.899065	(4, 26)	0.0131
Chi-square	15.59626	4	0.0036

Forex Reserves

Test Statistic	Value	df	Prob
F-statistic	2.482294	(4, 26)	0.0685
Chi-square	9.929177	4	0.0416

GDP

Test Statistic	Value	df	Prob
F-statistic	3.214547	(4, 26)	0.0286
Chi-square	12.85819	4	0.0120

Inflation

Test Statistic	Value	df	Prob
F-statistic	3.310167	(4, 26)	0.0255
Chi-square	13.24067	4	0.0102

Interest Rate

Test Statistic	Value	df	Prob
F-statistic	3.859698	(4, 26)	0.0136
Chi-square	15.43879	4	0.0039

Discussion and Findings of the Study:

The variation in exchange rate governs the economic performance of the country through its impact on exports and imports and money flows. In case of multinational companies, a precise forecasting and less volatility of exchange rate helps in improving their overall profitability. Both political and economic factors influence exchange rates. (Huang W, 2004). In India, exchange rate has been highly volatile due to many a factors such as fluctuation in FII money flows, differences in rate of return or interest rates between countries, inflation, oil prices etc. With the exchange rates becoming floating in nature, monetary factors began influencing exchange rates (Mussa, 1976). In a study by (Hayakawa & Kimura, 2008) it was stated that variability in exchange rate should be controlled through macroeconomic variables.

Based on quarterly data from April 1999-January 2017, the Johannsen Cointegration Test in the analysis showed that there are 4 cointegration equations at the 0.05 level ie in the long run the variables have association which is substantiated by (Uddin K M, 2013) who states that real exchange rate and macroeconomic determinants are cointegrating in nature. Thereafter the analysis through the Vector Error Correction Model (VECM) confirms that that there exists a long run relationship between the independent variables ie Gross Domestic Product (GDP), inflation, interest rates, prices of crude oil and gold, current account deficit, foreign exchange reserves and foreign institutional investment and the dependent variable- USD-INR exchange rate.

The value of R^2 shows that the developed model explains for 81.64% of the variation in the USD-INR exchange rate and it is significant at the 5% level. This corroborates the study by (Kucuk, 2012) which states that macroeconomic variables has a bearing on exchange rates and there is a long run relationship between the two especially in case of emerging economies. India being an emerging economy the research confirms that in case of India there is a long run relationship between the macroeconomic variables and exchange rate. Also, the established long run relationship indicates that policies can consider oil price and gold price movement impact on exchange rates of the country in the long run.

The Wald Test for the short run relationship between the independent and dependent variables test showed that in case of India there exists a short run relationship from FII to exchange rate; forex reserves to exchange rate, GDP to exchange rate; Interest rate to Exchange rate, Inflation to Exchange rate. This is substantiated by the research done by

(Obstfeld & Rogoff, 1995) which states that there is a weak relationship between exchange rate and macroeconomic variables in the short run. Additionally, (Gali & Monacelli, 2002) also state that interest rates are changed in the monetary policy of a country to control exchange rates which establishes the fact there exists a causal relationship from interest rates to exchange rate.

However, the Wald test for exchange rate and crude oil prices, exchange rate and current account deficit, exchange rate and gold prices showed there does not exist a short run relationship between these variables. (Mirchandani, 2013) in her research also stated that on studying exchange rate and macroeconomic variables such as interest rate, balance of trade, inflation, foreign direct investment and GDP, she found that exchange rate is correlated with interest rate, inflation, GDP and mildly with FDI but on the other hand, it has no correlation with the Current Account. As per the review of literature (Divakaran & Gireeshkumar, 2014) found that factors such as demand and supply of dollars and rupee, strength of the economy, price of crude oil, current account deficit, forex reserves, economic growth, demand for gold, difference in interest rates and inflation levels have an impact on the exchange rate of any economy.

Limitations and Scope for Future Research

In this research study factors such as returns on BSE sensex and money supply has not been investigated. Future research can look into the same. In addition, keeping the financial crisis of 2007-08 in mind, data for the pre and post crisis period can be separately investigated. Also, another limitation of the research is that quarterly data figures have been considered. Future research can be done based on monthly data.

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