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AN EMPERICAL STUDY OF THE FACTORS THAT AFFECTS THE EXCHANGE RATE OF INDIA (2007-2016)

Kushal Dey
Research Scholar
Ph.D., Session: 2018-23
St Xavier's College (Autonomous), Kolkata
and
Part-time (Guest) Lecturer,
St Xavier's College (Autonomous), Kolkata;
Heramba Chandra College (South City College)
University of Calcutta

ABSTRACT

Accurate prediction of foreign exchange rate is critical for formulating robust monetary policies and developing effective trading and hedging strategies in the foreign exchange market. The models that are found in this investigation aims to show the effect of the increase or decrease in the independent variables on the dependent variable, exchange rate and hence to predict the exchange rate. The independent variables are the following: Debt to Gross Domestic Product, Balance of Payment, Gross Domestic Product growth (annual %), Inflation, Net Foreign Assets, Remittances, Foreign Direct Investment as a % of Gross Domestic Product received in year from 2007 to 2016.

Key Words: Foreign Exchange Rate, Debt, Balance of Payment, Gross Domestic Product, Inflation, Net Foreign Assets, Remittances, Foreign Direct Investment.

INTRODUCTION

Transactions worth billions of dollars a day take place in the foreign exchange market, making it one of the largest financial markets in the world. Exchange rates are expressed in terms of a base-quote currency pair that represents the number of units of quote currency that may be exchanged for each unit of the base currency. Accurate prediction of forex rate is

critical for formulating robust monetary policies and developing effective trading and hedging strategies in the foreign exchange market. Regarding the size and importance of financial markets, forex market is the biggest and the most important one in the world. Individual investors who are considering participating in the forex market need to completely understand the market and its unique characteristics. Different parameters such as political, economic, and psychological ones affect the exchange rate fluctuations. The interaction of these factors is in a very complex fashion. Therefore, forex trading is generally very risky and difficult. Like many other economic time series, forex has its own trend, cycle, season, and irregularity. Thus, in order to give a satisfactory forex forecasting the major challenge is to identify the model, extrapolate and recombine the aforementioned patterns. The results of this study may be of help to the people who are responsible for the policy making and managing the economy of the country by using the exchange rate as the dependent variable and watch how it reacts with changes in amount of Debt to Gross Domestic Product (D/GDP), Balance of Payment (BOP), Gross Domestic Product (GDP) growth rate, Inflation (INF) rate, Net Foreign Assets (NFA), Remittances (RMT), Foreign Direct Investment (FDI) and Import of crude oil from OPEC(OILM). This is for the benefit of the economy's performance through application of the characteristics and tendencies of the exchange rate, which would result, to a country having a higher GDP if the variables in this study would prove to be significant. Exchange rate has a huge role in the development of a country's economy and its movements also affect the people in a micro manner wherein the people in the certain country directly experience the effects of the movement of exchange rate. This study may provide new information as how or why the exchange rate moves like it does, and how it reacts to the independent variables. The results of this study may be able to provide information on how to control exchange rate in a manner that all sectors would benefit, and none would be left to suffer negative consequences. These informations may be used by the government as additional information in order to help our country with its economic issues, or the information of this paper could be used by other researchers as a reference or just any additional information to support their claims. Either way, this study would be of help to people of whom information such as the one this paper is to produce are in need.

OBJECTIVES

- To find out if the selected factors, affects the Foreign Exchange Rate for India.
- To show the relationship and dependency of the significant factors affecting the Exchange Rate of India with respect to
    a) Any other country in the world considering the factors influencing the exchange rate, of all the countries used in the research work.
    b) Only one country, using only one countries factor influencing the exchange rate.
    c) Only one country, using two countries factor influencing the exchange rate, one being that of India itself.

REVIEW OF EXISTING LITERATURE

In the past, a number of studies have been conducted for foreign exchange. Accurate prediction of Forex rate is critical for formulating robust monetary policies and developing effective trading and hedging strategies in the foreign exchange market as found out in the paper of Lukas and Taylor (2007). Different models were structured for prediction of the foreign exchange rate. These are categorized into econometric models, time series models, and machine language techniques.

Different Models Used

Economic Models predict exchange rate based on economic factors. The Mundell-Fleming model (1962), Dornbusch's Model (1976), Wilson (1979), and New Keynesian models are examples of such models and a good survey of such models are found in Engel (2013).These models are widely used by Central Bankers around the world. However research shows that Monetary Models are unable to forecast exchange rate better as in Neely and Saron (2002). Messe and Rogoff(1983) demonstrated that for short periods where time is less than twelve months, Random Walk Model outperforms all other asset- market approach model, but in the long run asset-market model finding provide better prediction.

An excellent survey of time series forecasting models is found in Box et. al (2015). Autoregressive Integrated Moving Average Models (ARIMA) and Exponential Smoothing Models (ETS) are most commonly used time series models for time precision. However these models are highly complex in nature.

The Artificial Neural Networks (ANN) outperforms time series models in providing estimates for exchange rate as in Dunis (2011), Thinyane and Milin (2011), Nag (2002), Galeshchuk (2016). However, the direction of the change is unacceptable.

Galeshchuk and Mukherjee (2017) in his paper found that deep network produces significantly higher predictive accuracy than the baseline models and used macro economic indicators and time series data as inputs.

Exception to the Normal Outcome

Babu and Reddy (2015) in his paper compared the ARIMA models with the Neural Network and found out that though generally Neural Networks predicts more accurately the foreign exchange rate, but for India ARIMA predicts better.

Different Factors Which Influence the Exchange Rate Prediction

Messe and Rogoff (1983) in there paper identified that macro economic factors like

- Domestic (U.S.) Money Supply
- Output
- Interest rates
- Expected inflation
- Trade balances

as factors that influence the exchange rate of a country.

Dornbusch's Model (1976) in his paper stated that implementation of an expansionary policy will cause the exchange rate to jump

Wilson (1979) in his paper stated that expectation of implementation of an expansionary policy will cause the exchange rate to jump

Hughes (2013) identified that very few factors are needed to capture even more of the variation in expected returns and that the same factors give expected returns for all currencies.

RESEARCH GAP

Review of Literature reveals that a lot of models have been prescribed and compared, but no model has been prepared for predicting the foreign exchange rate keeping India in concern. It is also found in Babu and Reddy (2015) that the best model for prediction of the developed

countries is not the best model for prediction of exchange rate for India, and it differs from country to country.

The present study focuses on finding models for prediction of the foreign exchange rates for India. There was a death in the research work in the area as there were no studies carried out for prediction of exchange rate for the Indian Market and only a few reaches have been carried out on this field to elicit the Indian context.

RESEARCH METHODOLOGY

Empirical research relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. Through Empirical Research Method we establish a cause-effect relationship between independent and dependent variables. It uses quantitative data. The underlying model is that the world works in a linear, cause-and-effect way.

It contains the evaluation of the factors affecting Exchange Rate for India (ER) in Indian rupee specifically and for this we have chosen 7 factors from 5 different countries for a period of 10 years i.e. from 2007 to 2016.

The factors were chosen on judgmental sampling and the factors chosen are D/GDP (measured in % terms), BOP, GDP (growth as annual %), INF, NFA, RMT, FDI, OILM. The countries chosen are India, USA, UK, China and Japan. These countries excluding India were chosen from the top 10 countries with which India has trading relations, by convenience sampling.

$ER = \alpha + \beta 1 D/GDP + \beta 2 BOP + \beta 3 GDP + \beta 4 INF + \beta 5 NFA + \beta 6 RMT + \beta 7 FDI + \beta 8 OILM + Ui.$

Where α stands for the constant term.

$\beta i_{(i=1,\ldots,8)}$ refers to the change in Exchange rate (in Indian rupee) [dependent factor] due to 1 unit change in the independent factors.

Ui stands for error term.

This is the model that the whole research would be based upon. The model would be regressed using software that is renowned internationally and is used by professionals, SPSS. The software would do all the derivation for the user; thus, all the research that is to transfer

the data prepared and tabulated in the excel file and move them to the SPSS software then set up the model thereafter SPSS would start to regress.

The SPSS software would do a multivariable regression and Ordinary Least Squared (OLS) Regression on the model in order to determine which of the independent variables (D/GDP, OLS GDP, INF, NFA, FDI, BOP, OILM and RMT) would have a significant effect on the dependent variable, ER (Exchange Rate). The regression would be done considering all the factors of all countries takes together, factor of one country taken at a time and factor of two country influencing exchange rate.

After the regression, further tests would be applied on the model in order to take a closer look on model if there is any complication that occurred due to any violations the model has committed upon regression.

By performing these steps, the researcher would be able to determine if the independent variables (D/GDP, GDP, INF, NFA, FDI, BOP, OILM and RMT) significantly affects the dependent variable (ER). The condition that must be met in order to say that the independent variables affect the dependent variable significantly simply requires that the P-value must be equal or less than .05 as the confidence level was said to be 95%.

Data Analysis and Interpretations

Test of Multi-colinearity

The following tables show if there is any multicollinearity among the independent variables. If any multicollinearity is found that independent variable will be deleted (VIF above 10 is the benchmark for deletion)

Coefficients[a] (Table 1)

Model		Colinearity Statistics	
		Tolerance	VIF
1	BOP	.242	4.125
	GDP	.306	3.272
	INF	.290	3.443
	NFA	.385	2.598
	RMT	.366	2.729
	FDI	.582	1.717
	OILM	.469	2.130

a. Dependent Variable: DEBTTOGDP

Coefficients[a] (Table 2)

Model		Colinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.155	6.435
	GDP	.384	2.603
	INF	.339	2.954
	NFA	.281	3.558
	RMT	.355	2.821
	FDI	.445	2.245
	OILM	.745	1.343

a. Dependent Variable: BOP

Coefficients[a] (Table 3)

Model		Colinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.125	8.017
	BOP	.149	6.721
	GDP	.309	3.231
	INF	.282	3.546
	NFA	.113	8.877
	RMT	.392	2.550
	OILM	.342	2.926

a. Dependent Variable: FDI

Coefficients[a] (Table 4)

Model		Colinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.313	3.196
	BOP	.356	2.806
	GDP	.306	3.267
	INF	.288	3.467
	RMT	.358	2.791
	FDI	.428	2.339
	OILM	.422	2.367

a. Dependent Variable: NFA

Coefficients[a] (Table 5)

Model		Colinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.087	11.526
	BOP	.131	7.637
	GDP	.308	3.249
	INF	.428	2.334
	NFA	.104	9.581
	FDI	.434	2.307
	OILM	.267	3.747

a. Dependent Variable: RMT

Coefficients[a] (Table 6)

Model		Colinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.148	6.774
	BOP	.365	2.737
	GDP	.345	2.902
	INF	.356	2.811
	NFA	.163	6.118
	RMT	.355	2.820
	FDI	.502	1.992

a. Dependent Variable: OILM

It is observed from table (1-6) that DEBTTOGDP (D/GDP) is having high multi-colinearity especially with respect to GDP, NFA and RMT where the Variance Inflation Factor (VIF) is above 10. So, for better results, D/GDP is removed as an independent variable

For the rest of the Independent variables VIF is well below 10, so the multi-colinearity of the model is said to be tolerable.

REGRESSION EQUATIONS

Regression equation (All country factors)

This regression model has been made by taking the factors of all the countries taken together affecting the exchange rate with India.

This model shows what the regression will be to predict Exchange Rate for India with respect to any other currency in the world

Total number of samples 50, no of samples dropped due to insufficiency 2, So 48 samples are used in the prediction of the model.

Model Summary (Table 7)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970[a]	.941	.931	8.250735611

a. Predictors: (Constant), OILM, GDP, NFA, RMT, FDI, INF, BOP

ANOVA[a] (Table 8)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	43414.119	7	6202.017	91.106	.000[b]
	Residual	2722.986	40	68.075		
	Total	46137.104	47			

a. Dependent Variable: ER

b. Predictors: (Constant), OILM, GDP, NFA, RMT, FDI, INF, BOP

Coefficients[a] (Table 9)

Model		Collinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.084	11.853
	BOP	.165	6.046
	INF	.327	3.059
	NFA	.104	9.620
	RMT	.359	2.786
	FDI	.399	2.507
	OILM	.302	3.306

a. Dependent Variable: GDP

Coefficients[a] (Table 10)

Model		Collinearity Statistics	
		Tolerance	VIF
1	DEBTTOGDP	.087	11.547
	BOP	.157	6.350
	GDP	.353	2.831
	NFA	.106	9.451
	RMT	.540	1.853
	FDI	.393	2.547
	OILM	.337	2.965

a. Dependent Variable: INF

Coefficients[a] (Table 9)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	81.207	4.710		17.242	.000	71.689	90.726
	BOP	-.090	.009	-.760	-9.737	.000	-.109	-.072
	GDP	-.081	.517	-.011	-.157	.876	-1.126	.964
	INF	-2.855	.683	-.298	-4.179	.000	-4.235	-1.474
	NFA	.000	.000	-.516	-8.336	.000	-.001	.000
	RMT	.543	.092	.375	5.913	.000	.357	.729
	FDI	-.057	.957	-.003	-.060	.953	-1.990	1.876
	OILM	-.008	.001	-.663	-11.821	.000	-.009	-.006

a. Dependent Variable: ER

The regression output can be analysed as follows:

- In terms of goodness of fit, R^2=97%. It implies that the variance in Exchange Rate is explained by changes in the level of Balance of Payment, GDP growth rate, Inflation, Net

Foreign Assets, Foreign Direct Investment and Import of Oil from OPEC countries. Actually 97 % gets explained and 3 % remains unexplained, This confirms % explained > % unexplained. Hence the model has better goodness of fit.

- In terms of ANOVA , the F-statistic is highly significant at 5 % level which confirms that the independent variables are explaining a significant proportion of the variables in dependent variables, taken together,
- The estimated equation is given by

ER=81.207 (0.000) - 0.090 BOP (0.000) - 0.081 GDP (0.876) - 2.855 INF (0.000) + 0.000 NFA (0.000) + 0.543 RMT (0.000) – 0.057 FDI (0.953) - 0.008 OILM (0.000)

The following observations can be made:

- In this case the $\tilde{\alpha}$ is significant at 5 % level.
- Here estimated value of BOP is significant at 5 % level. It is significantly affects Exchange Rate. A 1 unit increase in the level of BOP will reduce Exchange Rate by -0.090 units.

  A 1 unit increase in the level of BOP will reduce Exchange Rate by at least -0.109 units and at most by - 0.072units
- Here estimated value of GDP is insignificant at 5 % level.
- Here the estimated value of INF is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of INF will reduce Exchange Rate by -2.855 units.

  A 1 unit increase in the level of INF will reduce Exchange Rate by at least -4.235 units and at most by -1.474 units
- Here the estimated value of NFA is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of NFA will cause no change in the Exchange Rate.

  A 1 unit increase in the level of NFA will increase Exchange Rate by at least -0.001 units and at most by 0.000 units
- Here the estimated value of RMT is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of RMT will increase Exchange Rate by 0.543 units.

  A 1 unit increase in the level of RMT will increase Exchange Rate by at least 0.357 units and at most by 0.729 units

- Here estimated value of FDI is insignificant at 5 % level.
- Here the estimated value of OILM is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of OILM will reduce Exchange Rate by -0.008 units.

  A 1 unit increase in the level of OILM will reduce Exchange Rate by at least -0.009 units and at most by -0.006 units

The final equation that can therefore give us the Exchange Rate is:-

MODEL 1: ER=81.207 (0.000)-0.090 BOP (0.000) - 2.855 INF (0.000) + 0.000 NFA (0.000) + 0.543 RMT (0.000) -0.008 OILM (0.000) [GLOBAL MODEL]

Regression equation (India factors)

Model Summary (Table 10)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.999[a]	.999	.995	.655005441

a. Predictors: (Constant), OILM, BOP, GDP, INF, FDI, RMT, NFA

ANOVA[a] (Table 11)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	765.999	7	109.428	255.059	.004[b]
	Residual	.858	2	.429		
	Total	766.857	9			

a. Dependent Variable: ER

b. Predictors: (Constant), OILM, BOP, GDP, INF, FDI, RMT, NFA

Coefficients[a] (Table 12)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	56.584	5.698		9.930	.010	32.066	81.102
	BOP	.054	.023	.150	2.305	.148	-.047	.154
	GDP	-1.751	.241	-.365	-7.272	.018	-2.787	-.715
	INF	-.373	.219	-.102	-1.702	.231	-1.317	.570
	NFA	.001	.000	.702	5.143	.036	.000	.003
	RMT	.250	.077	.354	3.236	.084	-.082	.581
	FDI	-3.328	.732	-.244	-4.547	.045	-6.476	-.179
	OILM	-.004	.001	-.251	-2.638	.119	-.010	.002

a. Dependent Variable: ER

The regression output can be analysed as follows:

- In terms of goodness of fit, R^2=99.9%. It implies that the variance in Exchange Rate is explained by changes in the level of Balance of Payment, GDP growth rate, Inflation, Net Foreign Assets, Foreign Direct Investment and Import of Oil from OPEC countries. Actually 99.9 % gets explained and 0.1 % remains unexplained, This confirms % explained > % unexplained. Hence the model has better goodness of fit.
- In terms of ANOVA , the F-statistic is highly significant at 5 % level which confirms that the independent variables are explaining a significant proportion of the variables in dependent variables, taken together,
- The estimated equation is given by

ER=56.584 (0.010) + 0.054 BOP (0.148) – 1.751 GDP (0.018) - .373INF (0.231) + 0.001 NFA (0.036) + 0.250 RMT (0.084) – 3.328 FDI (0.045) - 0.004 OILM (0.119)

The following observations can be made:

- In this case the $\tilde{\alpha}$ is significant at 5 % level.
- Here estimated value of BOP is insignificant.
- Here estimated value of GDP is significant at 5 % level. It significantly affects Exchange Rate. A 1 unit increase in the level of GDP will decrease Exchange Rate by 1.751 units.

A 1 unit increase in the level of GDP will decrease Exchange Rate by at least -2.787 units and at most by -.715 units.

- Here the estimated value of INF is insignificant.
- Here the estimated value of NFA is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of NFA will increase Exchange Rate by 0.001 units.

  A 1 unit increase in the level of NFA will increase Exchange Rate by at least 0.000 units and at most by 0.003 units.
- Here the estimated value of RMT is significant at 10% level. It significantly affects Exchange Rate. A 1 unit increase in the level of RMT will increase Exchange Rate by 0.250 units.

  A 1 unit increase in the level of RMT will increase Exchange Rate by at least -0.082 units and at most by 0.581 units.
- Here estimated value of FDI is insignificant at 5 % level. . It significantly affects Exchange Rate. A 1 unit increase in the level of FDI will reduce Exchange Rate by -3.328 units.

  A 1 unit increase in the level of FDI will reduce Exchange Rate by at least -6.476 units and at most by - 0.179 units.
- Here the estimated value of OILM is insignificant at 5% level.

MODEL 2: ER = 56.584 (0.010) – 1.751 GDP (0.018) +0.001 NFA (0.036) + 0.250 RMT (0.084) – 3.328 FDI (0.045)

Regression equation (India and China factors)

Model Summary[b] (Table 13)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.959[a]	.920	.873	.546664655

a. Predictors: (Constant), OILM, FDI, GDP, INF, RMT, BOP, NFA

b. Dependent Variable: ER

ANOVA[a] (Table 14)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	41.078	7	5.868	19.637	.000[b]
	Residual	3.586	12	.299		
	Total	44.664	19			

a. Dependent Variable: ER

b. Predictors: (Constant), OILM, FDI, GDP, INF, RMT, BOP, NFA

Coefficients[a] (Table 15)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	4.269	1.516		2.815	.016	.965	7.573
	BOP	.001	.002	.134	.702	.496	-.003	.005
	GDP	-.129	.076	-.187	-1.695	.116	-.295	.037
	INF	.068	.074	.157	.916	.378	-.093	.229
	NFA	.000	.000	.897	4.159	.001	.000	.000
	RMT	.032	.014	.454	2.314	.039	.002	.061
	FDI	-.192	.258	-.115	-.742	.472	-.754	.371
	OILM	-9.484E-005	.000	-.086	-.396	.699	-.001	.000

The regression output can be analysed as follows:

- In terms of goodness of fit, R^2=95.9%. It implies that the variance in Exchange Rate is explained by changes in the level of Balance of Payment, GDP growth rate, Inflation, Net Foreign Assets, Foreign Direct Investment and Import of Oil from OPEC countries. Actually 95.9 % gets explained and 4.1 % remains unexplained, This confirms % explained > % unexplained. Hence the model has better goodness of fit.
- In terms of ANOVA , the F-statistic is highly significant at 5 % level which confirms that the independent variables are explaining a significant proportion of the variables in dependent variables, taken together,
- The estimated equation is given by

ER=4.269 (0.016)+0.001 BOP (0.496) – 0.129 GDP (0.116) +0.068INF (0.378) + 0.000 NFA (0.001) + 0.032 RMT (0.039) – 0.192 FDI (0.472) --9.484E-005 OILM (0.699)

The following observations can be made:

- In this case the α̃ is significant at 5 % level.
- Here estimated value of BOP is insignificant
- Here estimated value of GDP is insignificant at 5 % level.
- Here the estimated value of INF is insignificant at 5 % level.
- Here the estimated value of NFA is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of NFA will increase Exchange Rate by 0.000 units i.e. no change.
- Here the estimated value of RMT is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of RMT will increase Exchange Rate by 0.032units.

A 1 unit increase in the level of RMT will increase Exchange Rate by at least 0.002 units and at most by 0.061 units

- Here estimated value of FDI is insignificant at 5 % level
- Here the estimated value of OILM is insignificant at 5% level

The final equation is:-

MODEL 3: ER=4.269 (0.016) + 0.000 NFA (0.001) + 0.032 RMT (0.039) [INDIA-CHINA MODEL]

Regression equation (India and USA factors)

Model Summary[b] (Table 16)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.812[a]	.660	.461	6.593522476

a. Predictors: (Constant), OILM, FDI, INF, NFA, GDP, BOP, RMT

b. Dependent Variable: ER

ANOVA[a] (Table 17)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1012.020	7	144.574	3.325	.033[b]
	Residual	521.694	12	43.475		
	Total	1533.714	19			

a. Dependent Variable: ER
b. Predictors: (Constant), OILM, FDI, INF, NFA, GDP, BOP, RMT

Coefficients[a] (Table 18)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	78.457	20.562		3.816	.002	33.656	123.258
	BOP	-.045	.033	-1.192	-1.375	.194	-.117	.026
	GDP	-.417	.986	-.165	-.423	.680	-2.566	1.732
	INF	-4.085	.947	-1.768	-4.315	.001	-6.148	-2.023
	NFA	-.001	.001	-1.343	-1.253	.234	-.004	.001
	RMT	.926	.396	2.762	2.338	.038	.063	1.789
	FDI	-.118	3.557	-.008	-.033	.974	-7.869	7.633
	OILM	-.005	.003	-1.581	-1.615	.132	-.011	.002

The regression output can be analysed as follows:

- In terms of goodness of fit, R^2=81.2%. It implies that the variance in Exchange Rate is explained by changes in the level of Balance of Payment, GDP growth rate, Inflation, Net Foreign Assets, Foreign Direct Investment and Import of Oil from OPEC countries. Actually, 81.2 % gets explained and 18.8 % remains unexplained. This confirms % explained > % unexplained. Hence the model has better goodness of fit.
- In terms of ANOVA , the F-statistic is highly significant at 5 % level which confirms that the independent variables are explaining a significant proportion of the variables in dependent variables, taken together,
- The estimated equation is given by

ER=78.457 (0.002)-0.045 BOP (0.194) – 0.417 GDP (0.680) – 4.085INF (0.001) - 0.001 NFA (0.234) + 0.926 RMT (0.038) – 0.118 FDI (0.974) -0.005 OILM (0.132)

The following observations can be made:

- In this case the $\tilde{\alpha}$ is significant at 5 % level.
- Here estimated value of BOP is insignificant

- Here estimated value of GDP is insignificant at 5 % level.
- Here the estimated value of INF is significant at 5 % level. It significantly affects Exchange Rate. A 1 unit increase in the level of INF will decrease Exchange Rate by 4.085 units.

A 1 unit increase in the level of INF will decrease Exchange Rate by at least -6.148 units and at most by -2.023 units

- Here the estimated value of NFA is insignificant at 5% level.
- Here the estimated value of RMT is significant at 5% level. It significantly affects Exchange Rate. A 1 unit increase in the level of RMT will increase Exchange Rate by 0.926 units.

A 1 unit increase in the level of RMT will increase Exchange Rate by at least 0.063 units and at most by 1.789 units

- Here estimated value of FDI is insignificant at 5 % level.
- Here the estimated value of OILM is insignificant at 5% level.

The final equation is:-

MODEL 4: ER=78.457 (0.002) – 4.085INF (0.001) + 0.926 RMT (0.038)

[INDIA-USA MODEL]

Regression equation (India and UK factors)

Model Summary[b] (Table 19)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.847[a]	.717	.470	6.638848683

a. Predictors: (Constant), OILM, FDI, BOP, GDP, INF, NFA, RMT

b. Dependent Variable: ER

ANOVA[a] (Table 20)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	895.326	7	127.904	2.902	.079[b]
	Residual	352.594	8	44.074		
	Total	1247.921	15			

a. Dependent Variable: ER
b. Predictors: (Constant), OILM, FDI, BOP, GDP, INF, NFA, RMT

Coefficients[a] (Table 21)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	64.734	15.658		4.134	.003	28.628	100.841
	BOP	-.218	.092	-1.099	-2.356	.046	-.431	-.005
	GDP	-.075	.790	-.033	-.094	.927	-1.897	1.747
	INF	-.500	1.601	-.205	-.312	.763	-4.193	3.192
	NFA	.004	.002	3.212	1.586	.151	-.002	.009
	RMT	-.695	.720	-1.999	-.965	.363	-2.356	.965
	FDI	-.828	.871	-.195	-.951	.370	-2.837	1.181
	OILM	-.001	.013	-.118	-.068	.947	-.031	.029

The regression output can be analysed as follows:

- In terms of goodness of fit, R^2=84.7%. It implies that the variance in Exchange Rate is explained by changes in the level of Balance of Payment, GDP growth rate, Inflation, Net Foreign Assets, Foreign Direct Investment and Import of Oil from OPEC countries. Actually 84.7 % gets explained and 15.3 % remains unexplained, This confirms % explained > % unexplained. Hence the model has better goodness of fit.
- In terms of ANOVA , the F-statistic is significant at 10 % level which confirms that the independent variables are explaining a significant proportion of the variables in dependent variables, taken together,
- The estimated equation is given by

ER=64.734 (0.003) - 0.218 BOP (0.046) – 0.075 GDP (0.927) - .500INF (0.763) + 0.004 NFA (0.151) - 0.695 RMT (0.363) – 0.828 FDI (0.370) - 0.001 OILM (0.947)

The following observations can be made:

- In this case the $\tilde{\alpha}$ is significant at 5 % level.
- Here estimated value of BOP is significant at 5 % level. . It significantly affects Exchange Rate. A 1 unit increase in the level of GDP will decrease Exchange Rate by 0.218 units

A 1 unit increase in the level of GDP will decrease Exchange Rate by at least -0.431 units and at most by -.005 units.

- Here estimated value of GDP is insignificant at 5 % level
- Here the estimated value of INF is insignificant at 5 % level.
- Here the estimated value of NFA is insignificant at 5% level.
- Here the estimated value of RMT is insignificant at 5% leve
- Here estimated value of FDI is insignificant at 5 % level
- Here the estimated value of OILM is insignificant at 5% level

The final equation is:-

MODEL 5: ER=64.734 (0.003) -0.218 BOP (0.046)

[INDIA-UK MODEL]

IMPORTANT OBSERVATIONS

- The significant factor which causes maximum change in the Exchange rate of India with respect to any other country in the world is Inflation.
- While considering the factors only for the country India, Inflation is considered insignificant to determine the Exchange Rate. Whereby the point to be taken into concern it is to determine the exchange rate of India w.r.t. USA.
- While considering the factors for both India and USA Inflation is not only found to be a significant factor but also the factor which causes a large change in the Exchange Rate.
- Individual country factors except for the home country India are all found to be insignificant to determine the Exchange rate. So, as regard to the trend the reliability of only Indian factor concerned model is lesser w.r.t. the other models.
- In all the established equations Remittances is found to be the most common significant factor.
- Import of oil from OPEC countries is significant when considered on a world basis but the rest of the time it is always found insignificant because all the countries are oil importing nations considered in study so its cancelling the impact, but in world all

countries are not oil importers some are exporters as well so in world basis its having an impact on the Exchange Rate.

- Japan is found to have the least impact on the Exchange Rate of India.

CONCLUSION AND FURTHER SCOPE OF STUDY

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It is observed that all factors are not significant in predicting exchange rate of India w.r.t. all countries in the world. Factors such as BOP, INF, RMT, NFA and OILM are found to be significant. The most interesting thing is that what factors seems to be significant for the world (global model) when seen for particular countries w.r.t. India are found to be insignificant and some factors which are found to be significant for two country model (i.e. considering two country factors) are found to be insignificant for the global model. This gives us an Idea that the global model will give us results but when wanted to have perfect and nearest results for exchange rate of India w.r.t a particular country, two country model will give us better results. We also conclude that only one country's factor except for the home country (India) are not by itself significant to determine the Exchange rate. But all in all reliability of one factor model is low.

Even though all the tests that were performed in this study had a positive result, the study could be made better still with a few tweaks. One of the tweaks that have to be done is the selection of the countries that are to be used in the paper. The further studies can be done taking all top ten countries with which India has trade relations. The study can be made for a single year with daily or monthly data by any future researcher to predict the models more accurately. Also, other factors which might be thought relevant and new and could significantly affect Exchange Rate for India w.r.t. a particular country should be taken into consideration which might give us better results. But all in all, the paper was merely a few tweaks from becoming a more relevant and significant paper in order to aid the society in any ways possible.

REFERENCES

Box G. E. P., Jenkins G. M., Reinsel G. C., Ljung G. M. 2015. Time Series Analysis: Forecasting and Control, 5th Edition, Wiley.

Babu A.S., Reddy S.K. 2015. Exchange Rate Forecasting using ARIMA, Neural network and Fuzzy Neuron, 4th Volume, Journal Of Stock & Forex Trading: 155.

Dornbusch R. 1976. Exchange Rate Expectations and Monetary Policy. Journal of International Economics 6 (3):pp. 231–244.

Dunis C. L., Laws J., Sermpinis G. 2011. Higher order and recurrent neural architectures for trading the EUR/USD exchange rate. Quantitative Finance 11(4):pp. 615-629.

Engel. C. 2013. Exchange rates and interest parity. National Bureau of Economic Research: 77.

Fleming J. M. 1962. Domestic financial policies under fixed and floating exchange rates. IMF Staff Papers 9:pp. 369–379.

Galeshchuk S. 2016. Neural networks performance in exchange rate prediction. Neurocomputing 172:pp. 446-452.

Galeshchuk S., Mukherjee S. 2017. Deep Learning for Predictions in Emerging Currency Markets. In Proceedings of the 9th International Conference on Agents and Artificial Intelligence (ICAART 2017) - Volume 2, pp. 681-686

Hughes R. C. 2013. Common Factors in Foreign Exchange Returns, Department of Economics, University of Chicago.

ICSI, Financial Treasury and Forex Management- Study Material

Khan 2012, Academic Research International, Analysis of factors affecting exchange rate variability in Pakistan,ISSN:2223-9944,VOL.2, NO.3

Lukas M., Taylor M. 2007. The Obstinate Passion of Foreign Exchange Professionals: Technical Analysis. Journal of Economic Literature 45 (4):pp. 936–972

Meese R., Rogoff K. 1983. The Out-of-Sample Failure of Empirical Exchange Rate Models: Sampling Error or Misspecification? NBER Chapters, in Exchange Rates and International Macroeconomics: pp. 67–112.

Mundell R. A. 1963. Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economic and Political Science 29 (4):pp. 475–485.

Nag A. 2002. Forecasting daily foreign exchange rates using genetically optimized neural networks. Journal of Forecasting 21(7), pp. 501- 511.

Neely C., Sarno L. 2002. How well do monetary fundamentals forecast exchange rates? Federal Reserve Bank of St. Louis Working Paper Series*:* 2002-2007.