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USD – INR Exchange Rate Movements: An Empirical Analysis of Macroeconomic Determinants

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Abstract

Exchange rate plays a key role in any country's trade levels. During times of high volatility, the Reserve Bank of India steps in through its regulatory and policy measures and focuses on reducing the fluctuations. The factors impacting exchange rate have been a topic of detailed study not only for policy making circles but also for business houses. Industry tries to hedge exchange rate risk via financial instruments. India being an open economy, liberalization has offered an international platform to companies to operate. In such a scenario, exchange rate plays a critical role in case of profit margins for many an industry. Thus, in order to help the industry strategise better it is imperative that a detailed study be conducted to understand the factors which can impact the exchange rate of a country. The research study seeks to analyse the impact of determinants such as differential interest rates (DINTR), differential gross domestic product (DGDP) and differential inflation (DINF) on the USD-INR exchange rate. It also seeks to develop the relationship between the independent and dependent variables based on Vector Auto Regression Model (VAR) / Vector Error Correction Model (VECM).

Key words: Exchange Rate, Differential interest rates (DINTR), Differential gross domestic product (DGDP), Differential inflation (DINF) rate

JEL Classification: E40, E43, E60

Paper Classification: Research Paper

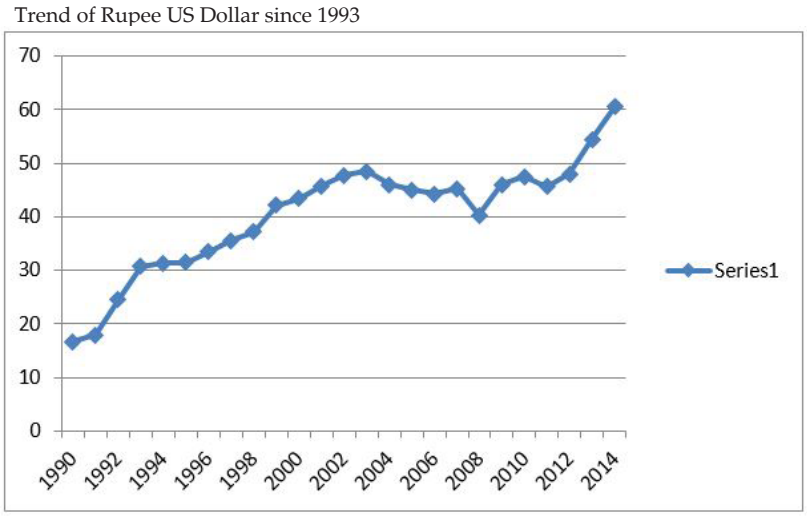
Introduction

Exchange rate has a focal place in any country's trade levels. Volatility in the exchange rate impacts international trade thereby affecting trade related industries leading to outflow of foreign investments. As a part of the liberalisation and privatization process in 1993 in India, a unified exchange rate system was put in place ie a freely floating exchange rate operating within a framework of exchange control. On an average, since 1993, the Rupee has largely depreciated against the dollar. The Reserve Bank of India through its monetary and regulatory measures is known to play a role in the foreign exchange market during times of high volatility. It was only in 2003–05 and 2007–08 the Rupee had appreciated against the US Dollar due to the weakening of the dollar and large capital inflows into India.

Factors impacting exchange rate has been a topic of detailed study not only for policy making circles but also for business houses. Industry tries to hedge exchange rate risk via various financial instruments. Keeping in mind that India is an open economy and liberalization and globalization has offered an international platform to all companies to operate within, exchange rate plays a critical role in profit margins for many an industry. As per Moosa (2003) innumerable companies are engaging in operating on a global platform in varied activities such as business processing outsourcing, exports imports of goods and services etc. As companies in today's date are largely operating on a global platform, fluctuations in exchange rate has a bearing on their margins and business decisions. Taking an example of the Indian automobile industry, depreciation of the Indian Rupee of more than 22.5% since Sept 2012 has created a negative outlook for this industry. Even with the revival of the US auto industry, automobile exports from India will be negatively hit by the volatility of the Indian rupee. Thus, in order to help the industry strategise better, it is imperative that a detailed study should be conducted to understand the factors which can impact the exchange rate of a country.

Trend of Rupee US Dollar since 1993

Figure I



The figure given above shows the trend of Rupee to US dollar since 1993. It shows that from the period 2000 till 2010 Rupee to US dollar has been fluctuating between 1US $ = Rs. 40-Rs. 50. Post 2013 Rupee has depreciated to over Rs. 60 to 1 USD. Macroeconomic determinants known to impact currency exchange rate are inflation, interest rates, gross domestic product, current account balance, prices of gold and crude oil etc.

From the review of literature, it was observed that previous research explored the exchange rate and political stability, money stock, export –import gap, returns on BSE sensex, inflation, interest rate, GDP growth rate etc. Akram (2000), in his study found that higher inflation in one country in comparison to its trading partners resulted in a tendency for that country's currency to depreciate. Aguire and Calderon (2007) found a negative correlation between GDP per capita and real exchange rate. Interestingly, the research did not take into account the period with regards to India from post liberalisation till 2014 and also it did not study the differential rates ie differential GDP growth rate, differential interest rate and differential inflation rate. The present research aims to study the differential rates by a more robust analysis.

Thus, the research study seeks to understand and analyse the impact of determinants such as differential interest rates (DINTR), differential gross domestic product (DGDP) and differential inflation (DINF) rates between United States of America and India on the USD-INR exchange rate. It also aims to develop the relationship between the variables of DINTR, DGDP, DINF and Rupee Dollar exchange rate (ER) movement from 1993-2014 based on Vector Autoregression model / Vector Error Correction model.

Literature Review

Aguire and Calderon (2007) found that real exchange rate correlates negatively with GDP per capita growth. Based on an econometric analysis, Uddin et.al. (2013), in the study of USD against Bangladeshi currency, found that real exchange rate and macroeconomic determinants are cointegrating in nature. Increase of money stock and debt servicing burden results in currency depreciation while rising foreign exchange reserves leads to strengthening of the currency. The stability of the political environment has an inverse relationship with the value of the home currency. Hossain (2002) studied the correlation of inflation and exchange rate in Bangladesh in 2002 and found that during the time of the exchange rate being fixed, the aftermath of devaluation of the currency on persistent increase in general price levels was not significant. Hossain (1997) in his research has stated that inflow of foreign capital, foreign aid and remittances from residents working abroad has resulted in appreciation of the currency. Papadopoulos and Zis (2000) have in their research study stated that fluctuation in exchange rate is influenced by the two factors of interest rate levels and money supply. Fullerton et al (2000) based their research on balance of payment and monetary policy. Karfakis (2003) states that money and exchange rates are positively related and increased money supply leads to depreciation. Liew et al (2009) in his research findings on the correlation between Japanese Yen and Baht (Thailand) found that exchange rate is determined by a monetary model dependent on demand and supply. Hsieh (2009) states that more real money, higher interest rates and higher inflation rate lead to depreciation of home currency. Higher stock prices and higher government spending result in appreciation of currency. Egert (2010) in his research states that change in price of gold and an insight of risk levels has a bearing on the exchange rate. In her study, Mirchandani (2013) found that exchange rate either has a direct, or inverse correlation with inflation, interest rate, and GDP growth rate. Akram (2000), state that if there is higher inflation in one country in comparison to its trading partners there is a propensity for the currency of that country to depreciate. Rahman and Barua (2006) did an indepth analysis of the correlation between movement of exchange rate and found a moderate inverse relationship between export-import gap and depreciation, increased import bills resulting in high seasonal demand for foreign currency, quicker credit expansion and higher interest rates can be some of the factors impacting depreciation of exchange rates. Interest rate and inflation have been found to be statistically significant in case of impact on exchange rates. Rahman and Barua (2006) in their research established that there is a strong negative correlation between the depreciation of currency levels and export import gap and higher the L/C openings, higher are volatility levels in the exchange rate. They found that more requirement of foreign currency due to rise in imports and higher interest rate levels result in depreciation of the home currency. Divakaran D & Gireeshkumar G (2014) state 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 influence the rate of exchange of any economy. As per the research study of Saini and Dhameja (2014) factors such as global events, returns on BSE sensex, crude oil prices and intervention by RBI has an impact on exchange rates. They state that there is a negative correlation between dollar and BSE sensex performance ie with increasing returns on BSE sensex rupee appreciates. Increase in price levels

of crude oil leads to a fall in value of the Indian rupee. In India, the RBI uses its foreign exchange reserves to intervene in the market and too much of volatility with regards to exchange rate. FII inflows have a direct relationship with the Indian Rupee. Khattak N R et. al.(2012) in their research by using Ordinary Least Square Method and Johansen Co Integration Techniques established that factors such as balance of trade, money supply, reserves in terms of foreign exchange balances, gross domestic product, increase in price levels and interest rates are known to have a relationship in the long term with exchange rate levels. By using the Granger Causality test they also affirmed that the relationship between real gross domestic product, inflation, trade balance, foreign exchange reserves and exchange rate is bi-directional whilst for interest rate, money flow and exchange rate the relationship is uni directional. For purpose of avoiding spurious regression, it is necessitated that the factors are stationary in regression (Granger and Newbold 1974). In case the stochastic process has resulted in a time series change overtime, it is required to ensure that the factors and all the series are non-stationary or have a unit root. For purpose of establishing stationarity of variables, the Augmented Dickey Fuller (ADF) test is used. It is the autoregressive distributive lag (ARDL) approach to co-integration which is used in order to estimate the relationship in the long run between the USD exchange rate and independent variables. The Error correction mechanism (ECM) is used to estimate the short run dynamics relating to the independent macro economic variables and the dependent variable ie exchange rate.

Clarida and Gali (1994) studied the volatility in rate of exchange through the vector autoregressive model. The variables considered by them was output levels, change in prices and real exchange rate. As per Cartensen & Hansen (1997) monetary shocks were the reasons behind exchange rate fluctuations. Basurto and Ghosh (2002) found that real interest rates resulted in the strengthening of the currency. Lyons (2001) observed that short run exchange rates are not determined by macroeconomic fundamentals. Frenkel (1999) concluded that rate of interest had a positive impact on exchange rates. Tanner (2001) used a vector autoregressive model and concluded that monetary policy results in appreciation of currency. Aleisa and Diboglu (2002) used a VAR model and stated that fluctuations in real exchange rates were due to real shocks. Hau (2002) in his study investigated the influence of trade openness and concluded that there is a negative relationship between trade levels and real exchange rate. Drine and Christophe (2005) found that degree of development and openness of the economy are influencing factors as far as exchange rate is concerned. Xiaopu (2002), Mc Donald and Ricci (2003) stated that it was the openness of the home economy and flow of capital which influences exchange rate in the long run.

As per Dua and Ranjan (2010) prior to 1970, most of the studies on exchange rate were based on assumption of fixed prices. However, it was the monetary approach which was analysed for fluctuation in exchange rate levels, as soon as floating exchange rate regime begun in 1970s in developed countries. Mussa (1976) studied the monetary approach ie the intervention of the monetary authorities in exchange rates and intervention by the Central Bank in the foreign exchange market. Mishra and Yadav (2012) investigated the relationship of exchange rate with inflation rate trade balance and money supply by using Vector Autoregressive model. Krishna and Rajesh (2013) identified six independent variables which affect exchange rate. Dash (2014) studied the relation between interest rates and exchange rate. Thus on the basis of review of literature, it was seen that it is important to analyse the macroeconomic determinants which impact Rupee Dollar exchange rate and understand the relationship between ER and DINF, DINTR, DGDP.

Hypothesis

Null Hypothesis

H01: DGDP does not have a significant effect on USD – INR exchange rate

H02: DINF does not have a significant effect on USD – INR exchange rate

H03: DINTR does not have a significant effect on USD – INR exchange rate

Alternate Hypothesis

H11: DGDP does have a significant effect on USD – INR exchange rate

H02: DINF does have a significant effect on USD – INR exchange rate

H03: DINTR does have a significant effect on USD – INR exchange rate

Hypothesis Testing was to be done to estimate the impact of DGDP, DINF and DINTR on USD-INR exchange rate. The actual numerical values of GDP, INF, DINTR and USD-INR exchange rate were taken into account while calculating differential.

Research Gap

From the review of literature it was observed that previous research explored the exchange rate and political stability, money stock, export –import gap, returns on BSE sensex, inflation, interest rate, GDP growth rate etc. Interestingly, the research did not take into account the period with regards to India from post liberalisation till 2014 and it also did not study the differential rates ie differential GDP growth rate, differential interest rate and differential inflation rate. The present research aims to study the differential rates for a more robust analysis.

Thus, the research study seeks to understand and analyse the impact of determinants such as differential interest rates (DINTR), differential gross domestic product (DGDP) and differential inflation (DINF) rates between United States of America and India on the USD-INR exchange rate. It also aims to develop the relationship between the variables of DINTR, DGDP, DINF and Rupee Dollar exchange rate (ER) movement from 1993-2014 based on Vector Autoregression model / Vector Error Correction model.

Research Methodology

Annual data for the period 1993-2014 was collected from secondary sources such as Economic Survey, worldbank.org, trading economic.com and indiastats.com. The independent variables considered were Differential Gross Domestic Product, Differential Interest Rates and Differential Inflation Rates between US and India. The dependent variable is the Exchange Rate of USD-INR. Eviews was used for purposes of mathematical and statistical analysis.

Tests

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. The series was checked for cointegration by the Johansen Cointegration Test. Subsequently based on outcome of the Johansen Cointegration test, Vector Auto Regression model or Vector Error Correction model was developed to estimate the relationship between DINTR, DINF, DGDP and ER. In case of Cointegration between the variables, VECM was explored. Eviews was used for purpose of mathematical and statistical analysis.

Thus, the model can be defined as:

$ER\$=C_1+C_2(DGDP)+C_3(DINF)+C_4(DINTR)+et$

Wherein:

Independendent Variables are

DGDP: Differential GDP between India and US

DINF: Differential Inflation rate between India and US

DINTR: Differential Interest Rate between India and US

Dependent Variable is: ER: Exchange Rate of Indian Rupee to a USD and C1....C4 are the parameters of the model

Data Analysis and Results

On application of the Augmented Dicker Fuller Test on the level data, it was seen that the 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 was found to be stationary or having no unit root. Thus, the first difference of the series for each of the variables was computed, named as DDGDP, DDINF, DER and DDINTR and considered for calculations.

Thereafter the Johansen Cointegration test for the variables was conducted to check for cointegration amongst the variables. 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 Johansen Cointegration showed that there is cointegration or longrun 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.

Table 1: Johansen Cointegration Test

Johansen Cointegration Test:
Date: 09/07/15 Time: 11:44
Sample (adjusted): 4 22
Included observations: 19 after adjustments
Trend assumption: Linear deterministic trend
Series: ER DGDP DINF DINTR
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value
None *	0.967445	111.0603	47.85613
At most 1 *	0.823783	45.98868	29.79707
At most 2	0.463399	13.00396	15.49471
At most 3	0.060040	1.176436	3.841466

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value
None *	0.967445	65.07160	27.58434
At most 1 *	0.823783	32.98472	21.13162
At most 2	0.463399	11.82752	14.26460
At most 3	0.060040	1.176436	3.841466

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values Normalized cointegrating coefficients (standard error in parentheses)			
ER	**DGDP**	**DINF**	**DINTR**
1.000000	-2.621523	0.806701	-2.814360
	(0.13793)	(0.15627)	(0.22814)

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. For cointegrated data or data which exhibits a long run relationship it is not advisable to develop a VAR model but it is recommended to develop the Vector Error Correction model.

Table 2: Vector Error Correction Estimate

Vector Error Correction Estimates Date: 09/06/15 Time: 18:40 Sample (adjusted): 4 22 Included observations: 19 after adjustments Standard errors in ( ) & t-statistics in [ ]				
Cointegrating Eq:	**CointEq1**			
ER(-1)	1.000000			
DGDP(-1)	-2.621523 (0.13793) [-19.0069]			
DINTR(-1)	-2.814360 (0.22814) [-12.3360]			
DINF(-1)	0.806701 (0.15627) [5.16235]			
C	-30.87390			
Error Correction:	D(ER)	D(DGDP)	D(DINTR)	D(DINF)
CointEq1	0.488036	0.256219	0.380495	-0.393302
	(0.16236)	(0.14615)	(0.09617)	(0.17168)
	[3.00584]	[1.75314]	[3.95663]	[-2.29096]
D(ER(-1))	-0.716926	-1.062217	-0.708653	0.065785
	(0.38619)	(0.34762)	(0.22874)	(0.40834)
	[-1.85642]	[-3.05566]	[-3.09812]	[0.16110]
D(ER(-2))	-0.582911	-0.026819	0.282109	-0.243482
	(0.36971)	(0.33279)	(0.21898)	(0.39092)
	[-1.57668]	[-0.08059]	[1.28831]	[-0.62285]
D(DGDP(-1))	0.575461	0.472921	0.823876	-1.324225
	(0.47953)	(0.43164)	(0.28402)	(0.50704)
	[1.20005]	[1.09563]	[2.90074]	[-2.61170]

D(DGDP(-2))	0.104582	0.161927	0.582828	-0.994915
	(0.36228)	(0.32610)	(0.21458)	(0.38306)
	[0.28868]	[0.49655]	[2.71620]	[-2.59730]
D(DINTR(-1))	1.140444	0.638765	0.369877	-0.341476
	(0.45947)	(0.41359)	(0.27214)	(0.48583)
	[2.48208]	[1.54445]	[1.35913]	[-0.70288]
D(DINTR(-2))	0.675625	0.796390	0.007079	0.479790
	(0.35333)	(0.31805)	(0.20928)	(0.37360)
	[1.91215]	[2.50399]	[0.03382]	[1.28424]
D(DINF(-1))	0.051693	0.209074	0.102014	-0.212545
	(0.25369)	(0.22836)	(0.15026)	(0.26824)
	[0.20376]	[0.91556]	[0.67892]	[-0.79236]
D(DINF(-2))	0.132648	-0.062557	-0.062983	0.226223
	(0.23267)	(0.20943)	(0.13781)	(0.24601)
	[0.57012]	[-0.29870]	[-0.45704]	[0.91956]
C	2.705298	1.201857	0.713932	0.226925
	(0.77167)	(0.69461)	(0.45706)	(0.81593)
	[3.50578]	[1.73026]	[1.56203]	[0.27812]
R-squared	0.716431	0.796297	0.881205	0.791773
Adj. R-squared	0.432862	0.592594	0.762410	0.583546
Sum sq. Resids	45.02429	36.48107	15.79513	50.33763
S.E. equation	2.236671	2.013319	1.324769	2.364967
F-statistic	2.526476	3.909107	7.417853	3.802455
Log likelihood	-35.15608	-33.15720	-25.20483	-36.21581
Akaike AIC	4.753272	4.542863	3.705771	4.864823
Schwarz SC	5.250345	5.039936	4.202844	5.361896
Mean dependent	1.531737	0.005263	0.268421	-0.136842
S.D. dependent	2.970008	3.154269	2.717853	3.664728
Determinant resid covariance (dof adj.)		22.11183		
Determinant resid covariance		1.113218		
Log likelihood		-108.8583		
Akaike information criterion		16.09034		
Schwarz criterion		18.27746		

Equation determining the relationship between USD-INR exchange rate and DGDP, DINTR, DINF based on Vector Error Correction model:

D(ER) = C(1)*(ER(-1) - 2.62152316955*DGDP(-1) + 0.806700633839*DINF(-1) - 2.81436020187*DINTR(-1) - 30.8738991522) + C(2)*D(ER(-1)) + C(3)*D(ER(-2)) + C(4)*D(DGDP(-1)) + C(5)*D(DGDP(-2)) + C(6)*D(DINF(-1)) + C(7)*D(DINF(-2)) + C(8)*D(DINTR(-1)) + C(9)*D(DINTR(-2)) + C(10)

Table 3

Dependent Variable: D(ER) Method: Least Squares Date: 09/07/15 Time: 12:27 Sample (adjusted): 4 22 Included observations: 19 after adjustments				
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C(1)	0.488036	0.162362	3.005842	0.0148
C(2)	-0.716926	0.386187	-1.856422	0.0964
C(3)	-0.582911	0.369709	-1.576675	0.1493
C(4)	0.575461	0.479529	1.200054	0.2608
C(5)	0.104582	0.362277	0.288680	0.7794
C(6)	0.051693	0.253690	0.203762	0.8431
C(7)	0.132648	0.232666	0.570120	0.5825
C(8)	1.140444	0.459471	2.482081	0.0349
C(9)	0.675625	0.353332	1.912153	0.0882
C(10)	2.705298	0.771669	3.505776	0.0067
R-squared	0.716431	Mean dependent var		1.531737
Adjusted R-squared	0.432862	S.D. dependent var		2.970008
S.E. of regression	2.236671	Akaike info criterion		4.753272
Sum squared resid	45.02429	Schwarz criterion		5.250345
Log likelihood	-35.15608	Hannan-Quinn criter.		4.837396
F-statistic	2.526476	Durbin-Watson stat		2.120157
Prob(F-statistic)	0.091792			

As we had obtained a unit root problem at the level series, it is important to note that instead of the explanatory variables assumed in the initial model, we have developed the VECM on the first difference of the series ie D(ER), D(DGDP), D(DNTR), D(DINF). Also, the short run coefficients show that C(2) (first lag Exchange Rate), C(8) (first lag differential interest rate) and C(9) (second lag differential interest rate) are significant individually at 10% level.

C(2) and C(3) jointly cannot affect ER, P value >0.05 ie 0.0896 in the short run.

C(4) and C(5) jointly cannot affect ER, P value >0.05 ie 0.4116 in the short run.

C(6) and C(7) jointly cannot affect ER, P value >0.05 ie 0.8445 in the short run.

C(8) and C(9) jointly can affect ER, P value <0.05 ie 0.0337 in the short run.

Thus, in the short run individually and jointly, differential interest rates have a significant relationship with Exchange rate while individually differential GDP and differential Inflation rates do not have a significant relationship with exchange rate.

R square value is 71.64%. The Prob (F statistic) is >0.05 but <0.1 at 0.091792 shows that the model is significant at the 10% level and not at 5% level. Thus all the independent variables ie DINF, DINTR and DGDP jointly impact the dependent variable – Exchange Rate in the long run at the 10% significance level. The value of R2 shows that the developed model explains for 71.64% of the variation in the USD-INR exchange rate.

On checking for Serial Correlation, the p value was >0.05 ie 28.43% which states that there is no serial correlation in the Error Correlation model. Also, the Durbin-Watson statistic being >2.0 indicates that there is no autocorrelation amongst the variables.

Table 4

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.534155	Prob. F(2,7)	0.6083
Obs*R-squared	2.515754	Prob. Chi-Square(2)	0.2843
Null Hyp: Model is homoskedastic.			
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.443149	Prob. F(12,6)	0.8915
Obs*R-squared	8.927361	Prob. Chi-Square(12)	0.7091
Scaled explained SS	2.749269	Prob. Chi-Square(12)	0.9971

P value is 70.91 which is more than 5%. Thus model is homoskedastic and not heteroskedatic.

Discussion and Findings of the Study

Based on annual data from 1993-2015, the analysis shows that in the long run at 10% significance level, differential interest rate, differential inflation rates and differential GDP growth rate together impact the USD – INR exchange rate. Also, the signs of the coefficients of the independent variables show the relationship of these variables ie DINF, DINTR and DGDP with USD- INR exchange rate. The coefficient of DINF is positive which shows that higher DINF results in depreciation of the INR against the USD and vice versa (ie in statistical terms DINF and Exchange rate has a positive relationship). A relatively high rate of inflation lowers the competitiveness of exports of the country in the international market, reducing the flow of dollars into India against Indian rupee resulting in depreciation of INR.

On the other hand, the equation derived from the Vector Error Correction Model shows that DINTR and DGDP have an inverse relationship with USD – INR exchange rate in statistical terms. Relatively higher interest rates existing in India and higher Indian GDP results in attracting foreign investments in the form of FII and FDI in India, ensuing increased inflow of dollars into the country leading to appreciation of the Indian rupee against USD and vice versa. Rather, post 2008 with interest rates being relatively higher in India and Indian GDP being better than US GDP has resulted in large inflow of dollars into the Indian stock market especially around 2010-11 leading to appreciation of the INR. However, one of the reasons for the depreciation of the INR on August 24, 2015 to a low of Rs. 66.24 to USD is also attributed to the impending US rate hike decision. A US rate hike will lead to outflow of investments from economies across the world and inflow of money into the United States of America leading to increased demand for dollars against the home currency thereby resulting in depreciation of the home currency against USD. Also, in August 2013, Rupee reached lifetime low of 68.85. The rupee was recorded as the most affected Asian currency and it depreciated 3.7% in a single day. One of the factors responsible for this sharp depreciation was the signs indicating a large probability of tapering of the Quantitative Easing Program of the US. The Vector Error Correction model also shows that in the short run differential interest rate can impact the USD-INR exchange rate which is corroborated by the abovementioned impact of signs of impending Fed rate hike leading to depreciation of the Indian Rupee. This model also shows that in the short run, DGDP and DINF do not impact the USD-INR exchange rate. This is corroborated by Lyons (2001) analysis which observed that short run exchange rates are not determined by macroeconomic fundamentals. The result of the Johansen Co-integration test showed that the dependent and independent variables are co-integrating in nature and have a long run association which is substantiated by Uddin et.al.'s anlysis (2013) which states that real exchange rate and macroeconomic determinants are co-integrating in nature.

As per the review of literature, Saini and Dhameja (2014) state factors such as global events, returns on BSE sensex, crude oil prices and intervention by RBI has an impact on exchange rates. FII inflows have a direct relationship with the Indian Rupee. Divakaran D and Gireeshkumar G (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, prices of crude oil, current account deficit, forex reserves and demand for gold has not been investigated. Future research can look into the same. Also, another limitation of the research is that annual data figures have been considered. Future research can be done based on quarterly data.

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