An Empirical Study on Exchange Rate Volatility in India

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Abstract

Currency market is the most volatile & liquid in all financial markets of the world. The present study was conducted to know a good theoretical approach to Indian Currency Market & Rupee position in the global market. It analyzed the volatility of rupee and the normality in the daily changes in the value of rupee with respect to four currency pairs i.e. JPY/INR, GBP/INR, EUR/INR, and USD/INR during one last year. Kolmogorov-smirnov Test and Shapiro Wilks W Tests were used for the testing normality of data. The data was analyzed through Descriptive Statistics of the daily reference rates given by RBI. The study concluded that the rupee was highest volatile in the month of August during last year 2013 in respect of all the four currencies. The daily changes in the value of the rupee were not normally distributed. The study also found that rupee was more volatile to GBP currency in comparison of other three currencies.

Keywords: *Foreign Exchange Market, Currency Market, Volatility, USD & INR.*

1. Introduction

The currency witnessed a large volatility in the past two years. This volatility became acute in the past three months affecting major macro-economic data, including growth, inflation, trade and investment. At that time of independence the Indian rupee was associated to the British pound and its value was at par with the American dollar. There were no foreign borrowings on India's balance sheet. With the introduction of the Five-Year Plan in 1951, the government started external borrowings for achieving the objectives. This required the devaluation of the rupee. After independence; Indian chooses to accept a fixed rate currency management. The rupee was pegged at 4.79 against a dollar between 1948 and 1966. Two consecutive wars, one with China in 1962 and another one with Pakistan in 1965, resulted in a huge deficit on India's budget, forcing the government to devalue the currency to 7.57 against the dollar. The rupee's

link with the British currency was broken in 1971 and it was linked directly to the US dollar. In 1975, the Indian rupee was linked to a basket of three currencies comprising the US dollar, the Japanese yen and the German mark. The value of the Indian rupee was pegged at 8.39 against a dollar. In 1985 it was further devalued to 12 against a dollar. India faced a serious balance of payment crisis in 1991 and was forced to sharply devalue its currency. The country was in the grip of high inflation, low growth and the foreign reserves were not even worth to meet three weeks of imports. Under these situations, the currency was devalued to 17.90 against a dollar. The year 1993 is very important in Indian currency history. From this year the currency was let free to flow with the market sentiments. The exchange rate was freed to be determined by the market, with provisions of intervention by the central bank under the situation of extreme volatility. In 1993, one was required to pay Rs.31.37 to get a dollar. The rupee traded in the range of 40-50 between 2000- 2010. It was mostly at around 45 against a dollar. It touched a high of 39 in 2007. The Indian currency has gradually depreciated since the global 2008 economic crisis. Former finance minister Manmohan Singh, who is now the prime minister, was instrumental in liberalising the currency regime. The move led to a sharp jump in foreign investment inflows and boosted the economic growth. Currency prices are affected by a variety of economic and political conditions, but most important are interest rates, international trade, inflation, and political stability. It does not have any regular market timings, operates 24 hours 7 days week 365 days a year, characterized by ever-growing trading volume, exhibits great heterogeneity among market participants with big institutional investor buying and selling millions of dollars at one go to individuals buying or selling less than 100 dollar. The Indian currency market has been highly volatile in the last year 2013 and

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record the highest low of 68.8 rupees per Dollar due to several changes in the global environment of the foreign exchange market. Soit is essential to study some of the important historical events relating to currencies and currency exchange.

2. Review of Literature

Lingareddy (2009) studied the state of currency derivatives in India with a comparison to futures and forwards from September2008 to March 2009 using correlation, T test, Standard deviation and coefficient of variation for volatility measure. Results indicate the foreign exchange market become more efficient due to the introduction of currency futures but introduction of currency futures had no impact on the volatility of spot market.

Pandey (2011) assessed the speed of growth and volatility of currency futures in India. author employed ANOVA test for a 10 month sample period starting from Feb. to Dec. 2010.study include all the four currencies traded under currency futures (EURO , Dollar ,YEN , Pound) in India. Findings showed a positive growth pattern in currency futures but highest in the case of USD-INR currency futures and least in the EURO-INR as the value of rupee for Euro has been more volatile that creates negative return.

Pandey (2011) assess the speed in which the growth of currency futures in India has accelerated. It also aims at analysing the volatility of the currency futures. In order to study the growth of the currency futures, the number of contracts traded and open interest at NSE and MCX have been inclusively compared. It is also check whether the daily returns of the NSE and MCX on currency futures are normally distributed. For this purpose the changes in the daily value of Rupee as compared to Dollar has been calculated for every month separately and the data have been used for the Kolmogorov Smirnov Test to test the hypothesis that the returns are normally distributed. With the measure of skewness and kurtosis it has been found that the returns are normally distributed and, thus, the null hypothesis is accepted. The currency futures have received a good response from the investors as well as the hedgers. Initially currency futures were started for USD-INR contracts but recently trading in Euro-INR, Yen-INR and Pound-INR contracts have been introduced in January 2010. Average turnover of these instruments in the National Stock Exchange and MCX Stock Exchange (MCX–SX) in December was nine times higher than a year earlier. These exchanges are currently clocking an average daily turnover of over Rs 20,000 crore in currency products while it was just Rs 2,400 crore

in January last year. The risk involved is comparatively low in this case and currency futures has proved to be a good tool for hedging the risk involved in the currency of a country(Currency risk).

Sahu (2012) aimed at examining the impact of currency futures on exchange rate volatility of EURO after the introduction of currency futures trading in India. The data used in this paper comprises of daily exchange rate of EURO in terms of Indian rupees for the sample period January 02, 2008 to December 31, 2011. To explore the time series properties, Unit Root Test and ARCH LM test have been employed and to study the impact on underlying volatility, GJR GARCH (1, 1) model has been employed. The results indicate that the introduction of currency futures trading has had no impact on the spot exchange rate volatility of the foreign exchange market in India. Further, the results are also indicative of the fact that the importance of recent news on spot market volatility has increased and the persistence effect of old news has declined with the introduction of currency futures trading.

Murari (2013) aimed at finding out the crucial factors of the economy that cause impact on Indian rupee fluctuation against US dollar. There are several factors affecting the exchange rate but among all factors the study is based on six major factors: Forex Reserve (Rs Billion), Foreign Institutional Investment (Rs Billion), Money supply (Rs Billion), Trade Balance (Rs Billion), Inflation (%) , Interest Rate (%). Yearly data for the six Independent variables was considered for the period 2001 -2013. Also data for the dependent variable Rupee Exchange Rate against Dollar (ER) was considered for the same period. The data was obtained from RBI database on Indian economy. Contribution of each independent variable individually and their collective impact on the dependent variable was observed through regression analysis. The result of analysis shows that these variables can explain the exchange rate dynamics to the extent of 94.8%. Since there are various internal as well as external reasons behind rupee appreciation and depreciation to a large extent, It takes time to bring back the situation to the Normal state.

Maitra, Mitra & Mandal (2013) aimed to stimulate and predict the exchange rate of Indian rupee in terms of major currency like US dollar under market based regime of exchange rates. Authors employed monthly average series of nominal exchange rates of Indian rupee against US dollar, over the period August, 1994 to August 2013. GARCH(1,1) based ARIMA(1,1,6)forecasts were found to be efficient and regarded as the appropriate model for forecasting Rupee/Dollar

exchange rate in India under the market based exchange rate regime.

Kotai, V. (2013) studied the fluctuation rates of four pairs of currencies (INR/USD, JPY/USD, EURO/USD, GBP/USD, and CNY/USD) of last quarter (July 2013 to Sep.2013).Study also focused on the Indian Currency volatility with other countries fluctuations rates to find out that which currency is more stable in the global market. Mean and Standard deviation used to analyse the data and concluded that in last 3 months only the Indian Currency market had more volatility and showed that Indian currency market is more sensitive due to the external factors.

3. Research Methodology

Review of literature has a mixed response about the volatility of Indian currency as Lingareddy(2009) and Sahu(2012) revealed that there is no significant changes in the volatility of rupee .While Pandey(2011) and Murari, Mandal,Kotai(2013) reported that there is significant changes in the value of rupee due to the change in different economic factors.Research design for the study isanalytical. For the volatility measure standard deviation and variance analysis were used following the study of Pandey(2011). Data has been collected from the official website of Reserve Bank of India i.e. www.rbi.com.The period of the study is full one year 2013. Kolmogorov-smirnov Test and Shapiro Wilks W Test were used for checking the normality of data.

Based upon the reviews,the following objectives of the study were formulated

- To analyse the volatility of rupee with respect to four currency pairs (JPY/INR, GBP/INR, EUR/INR, USD/INR).
- To check the normality in the daily changes in the value of rupee for all the four pairs.

The hypothesis tested in the study is as follows:
H0: The distribution of daily changes in value of rupee are normally distributed.
H1: The distribution of daily changes in value of rupee arenot normally distributed.

4. Data analysis and Interpretation

The volatility of all four markets (JPY/INR, GBP/INR, EUR/INR, and USD/INR.) for the last year 2013 was assessed by analysing Descriptive Statistics.

4.1 Volatility and Normality of USD/INR

The positive mean of US dollar reveals that it has profitable returns for the investors.When it comes for volatility, the value of Rupee has been highly volatile in the case of US dollar in the month of August, 2013 and least volatile in the month of April, 2013.The distribution of thechanges in the value of Rupee is not symmetric as the skewness is notzero in any case. Presence of positive skewness in the month of March, April, May ,July August , September ,October, November means that the distribution has a right tail and the negative skewness in rest of the months means that the distribution has a left tail. In case of kurtosis, it can be concluded that the distribution during the whole year was not normally distributed. Adetailed statistic is given in the **Table 1**.The statistical results based on skewness and kurtosis and the normality test i.e. Kolmogorov- Smirnov test and Shapiro Wilks W test says that the distribution is not normal .P <0.05, so null hypothesis is rejected.. The detailed statistics of normality test are given in the **Table 2 and 3. Exhibit 1, 2 and 3** are depicting that the daily changes in the value of rupee for USD are not normally distributed.

Table-1 Descriptive Statistics of Daily Changes in the Value of Rupee (Month- Wise) USD/INR

	N	Min.	Max.	Mean	Standard Deviation	Var.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Standard Error	Statistic	Standard Error
January	22	53.29	55.33	54.3168	.56806	.323	-.174	.491	-1.117	.953
February	19	52.97	54.48	53.7737	.44207	.195	-.322	.524	-.706	1.014
March	19	54.10	55.05	54.4046	.23785	.057	1.258	.524	1.790	1.014
April	18	53.94	54.88	54.3757	.24139	.058	.300	.536	-.079	1.038
May	22	53.74	56.50	55.0108	.80549	.649	.223	.491	-.992	.953

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June	20	56.42	60.59	58.3973	1.29272	1.671	-.118	.512	-1.225	.992
July	23	58.91	61.12	59.7754	.56496	.319	.816	.481	.833	.935
August	20	60.74	68.36	63.2088	2.46167	6.060	.807	.512	-.578	.992
September	20	61.75	67.03	63.7521	1.69628	2.877	.819	.512	-.637	.992
October	21	61.16	62.36	61.6156	.29204	.085	.921	.501	.840	.972
November	19	61.79	63.65	62.6330	.52521	.276	.399	.524	-.229	1.014
December	21	61.18	62.38	61.9103	.35246	.124	-.798	.501	-.011	.972
Valid N (list wise)	18									

Table-2 Case Processing Summary

	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
USD	**244**	**100.0%**	**0**	**.0%**	**244**	**100.0%**

Table-3 Test of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
USD	.192	244	.000	.894	244	.000

Figure 1

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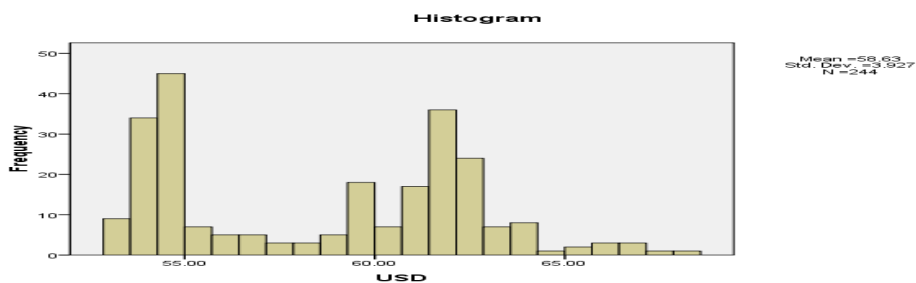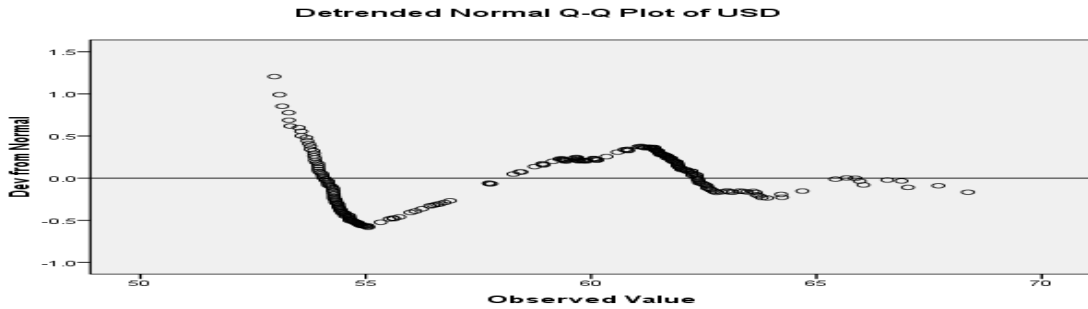**ISSN (Online): 2319-6564**
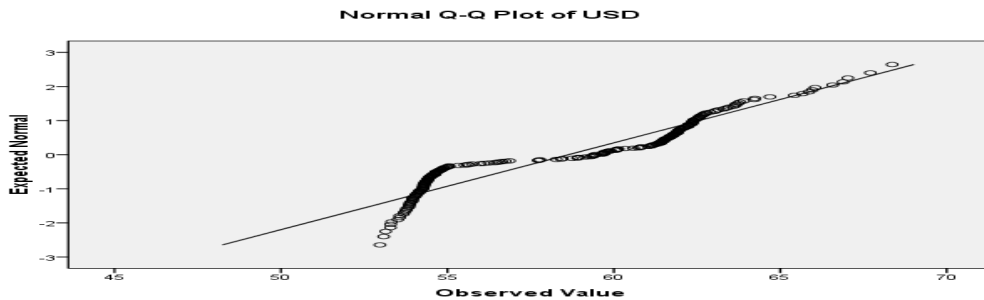**www.ijesonline.com**

Figure 2

Figure 3

4.2 Volatility and Normality of GBP/INR

The positive mean of Pound sterling indicates that it has also profitable returns for the investors. Volatility for the value of Rupee has been highly volatile in the case of GBP in the month of August, 2013 and least volatile in the month of May, 2013.The distribution of the changes in the value of Rupee is not symmetric as the skewness is not zero in any case. Presence of positive skewness in the four months , May ,July August ,September ,October, means that the distribution has a right tail and the negative skewness in rest of the months means that the distribution has a left tail. In case of kurtosis, it can be concluded that the distribution during the whole year was not normally distributed. A detailed statistic is given in the **Table 4**.The statistical results based on skewness and kurtosis and results of the normality test i.e. Kolmogorov- Smirnov test and Shapiro Wilks W test both are revealing that the distribution is not normal .The value of P <0.05, so null hypothesis is rejected. The detailed results are given in the **Table 5 and 6. Exhibit 4,5 and 6** are depicting that the daily changes in the value of rupee for GBP are not normally distributed.

Table-4 Descriptive Statistics of Daily Changes in the Value of Rupee (Month- Wise) GBP/INR

Descriptive Statistics

	N	Min.	Max.	Mean	Standard Deviation	Var.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Standard Error	Statistic	Standard Error
January	22	84.22	89.23	86.8899	1.71731	2.949	-.367	.491	-1.538	.953
February	19	81.24	84.85	83.3510	1.05830	1.120	-.592	.524	-.519	1.014
March	19	80.84	82.79	82.0190	.62913	.396	-.617	.524	-.717	1.014
April	18	82.05	84.23	83.2005	.64856	.421	-.114	.536	-1.199	1.038

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May	22	83.31	86.01	84.1087	.59250	.351	1.675	.491	4.300	.953
June	20	86.15	92.92	90.4729	2.15850	4.659	-1.037	.512	-.338	.992
July	23	89.52	92.97	90.7757	.77732	.604	.814	.481	1.603	.935
August	20	91.95	106.03	97.8656	4.38317	19.212	.386	.512	-1.073	.992
September	20	99.50	104.32	1.0110E2	1.45906	2.129	1.093	.512	.065	.992
October	21	97.77	101.20	99.2048	.79004	.624	.484	.501	1.058	.972
November	19	98.66	102.06	1.0088E2	.90982	.828	-1.117	.524	.990	1.014
December	21	100.01	102.18	1.0140E2	.63472	.403	-.319	.501	-.792	.972
Valid N (listwise)	18									

Table-5Case Processing Summary

Cases					
Valid		Missing		Total	
N	Percent	N	Percent	N	Percent
244	100.0%	0	.0%	244	100.0%

Table-6Tests of Normality

Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Statistic	df	Sig.	Statistic	df	Sig.
.166	244	.000	.882	244	.000

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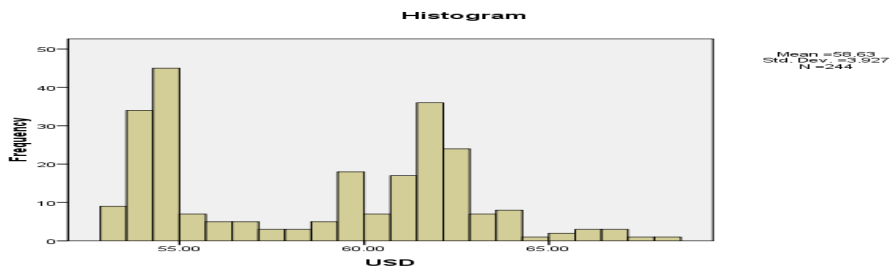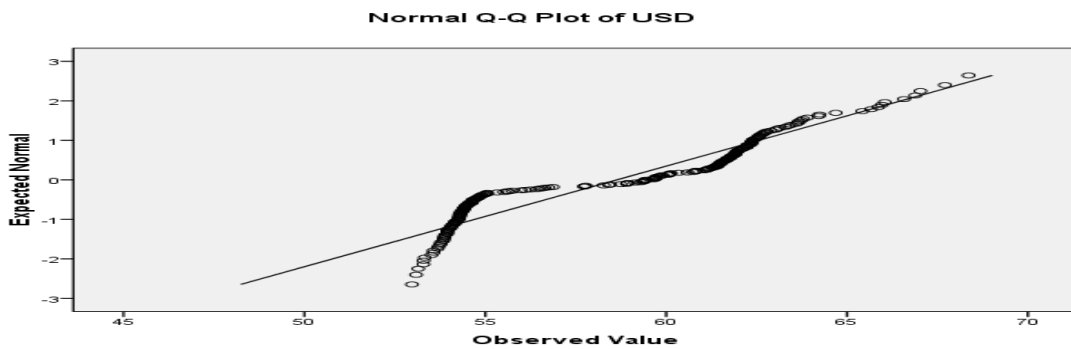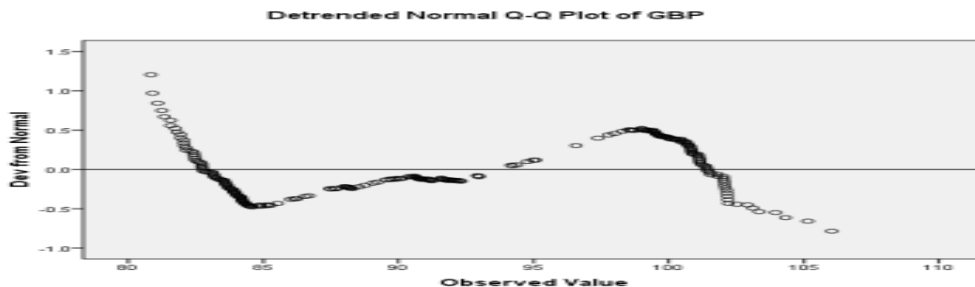**www.ijesonline.com**

Figure 4

Figure 5

Figure 6

4.3 Volatility and Normality of EUR/INR

The positive mean of EURO indicates that investment was proved profitable during the last year 2013 in EURO. Rupee has been highly volatile in the month of August, 2013 and least volatile in the month of December, 2013.The non-zero value of skewness it is clear that the distribution of the changes in the value of Rupee is not symmetric for any month. There is a positive skewness in the months of January, March , May ,July August ,September and the distribution has a right tail and the distribution has a left tail in the rest of months due to negative skewness. In case of kurtosis, it can be concluded that the distribution during the whole year was not normally distributed for any month. A detailed statistic is given in the **Table 7**.The statistical results based on skewness and kurtosis revealed that the distribution of value of Rupee is not normal and results of the normality test i.e. Kolmogorov- Smirnov test and Shapiro Wilks W test both are also rejecting the null hypothesis as the value of P <0.05. The detailed results are given in the **Table 8 and 9. Exhibit 7, 8 and 9** are depicting that the daily changes in the value of rupee for EUR are not normally distributed.

Table-7 Descriptive Statistics of Daily Changes in the Value of Rupee (Month- Wise) EUR/INR

Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Standard Error	Statistic	Standard Error
January	22	71.32	73.13	72.1286	.51458	.265	.129	.491	-.956	.953
February	19	70.39	72.63	71.8743	.65606	.430	-1.277	.524	.761	1.014
March	19	69.54	71.61	70.5951	.58227	.339	.151	.524	-.900	1.014
April	18	69.59	71.42	70.7652	.50275	.253	-1.096	.536	.800	1.038
May	22	70.46	73.68	71.3803	.82647	.683	1.223	.491	1.401	.953
June	20	73.64	79.19	77.0683	1.83261	3.358	-.887	.512	-.679	.992
July	23	76.89	80.95	78.2026	.80366	.646	1.719	.481	5.738	.935
August	20	80.37	91.47	84.1814	3.40684	11.607	.711	.512	-.663	.992
September	20	83.42	88.24	85.1190	1.45708	2.123	1.086	.512	.115	.992
October	21	82.78	85.14	84.1044	.60419	.365	-.275	.501	-.306	.972
November	19	83.42	85.55	84.5334	.52751	.278	-.453	.524	.216	1.014
December	21	83.82	85.43	84.8162	.49082	.241	-.431	.501	-.905	.972
Valid N (listwise)	18									

Table8:Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
EUR	244	100.0%	0	.0%	244	100.0%

Table9: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
EUR	.198	244	.000	.866	244	.000

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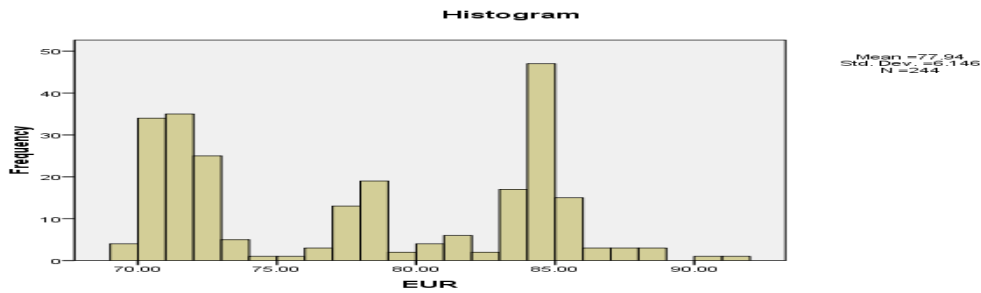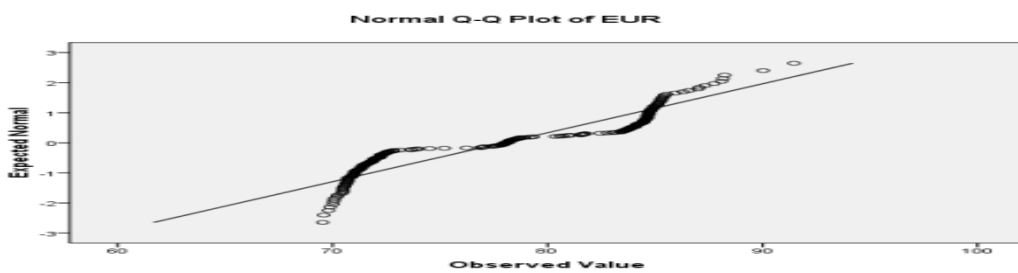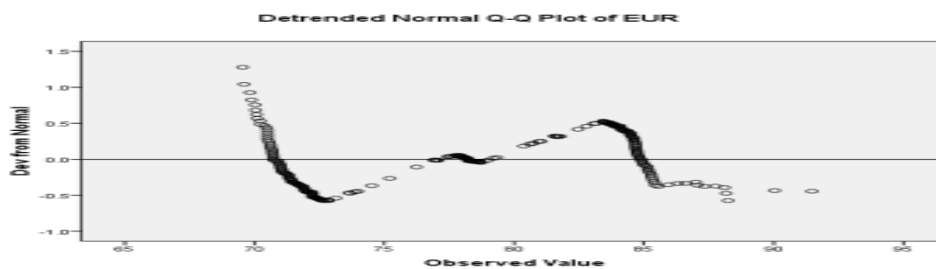**www.ijesonline.com**

Figure 7

Figure 8

Figure 9

4.4 Volatility and Normality of JPY/INR

JPY has a positive mean and provide good returns for the investors in the last year 2013. Rupee has been highly volatile in the month of August, 2013 and least volatile in the month of October, 2013. The non-zero value of skewness it is clear that the distribution of the changes in the value of Rupee is not symmetric for any month. For the months of March ,April , May ,July August ,September the distribution has a right tail and the distribution has a left tail in the rest of months due to negative skewness. In case of kurtosis, it can be concluded that the distribution during the whole year was not normally distributed for any month. A detailed statistic is given in the **Table 10**.The statistical results based on skewness and kurtosis revealed that the distribution of value of Rupee is not normal and results of the normality test i.e. Kolmogorov- Smirnov test and Shapiro Wilks W

test both are also rejecting the null hypothesis as the value of P <0.05 for the Japanese Yen also. The detailed results are given in the **Table 11 and 12. Exhibit 10, 11 and 12** are depicting that the daily changes in the value of rupee for JPY are not normally distributed.

Table-10 Descriptive Statistics of Daily Changes in the Value of Rupee (Month- Wise) JPY/INR

Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Standard Error	Statistic	Standard Error
January	22	58.66	63.33	61.1800	1.45003	2.103	-.244	.491	-1.184	.953
February	19	56.59	58.81	57.8037	.59889	.359	-.329	.524	-.214	1.014
March	19	56.36	58.97	57.4426	.88872	.790	.580	.524	-1.010	1.014
April	18	54.31	58.56	55.7067	1.22812	1.508	1.348	.536	.805	1.038
May	22	53.50	56.03	54.5105	.73753	.544	.192	.491	-.860	.953
June	20	56.35	62.08	59.9905	1.88901	3.568	-.971	.512	-.417	.992
July	23	59.01	62.44	60.0039	.71714	.514	1.827	.481	5.050	.935
August	20	61.04	70.25	64.5710	2.54564	6.480	.786	.512	-.082	.992
September	20	62.66	67.18	64.2670	1.53498	2.356	.981	.512	-.429	.992
October	21	62.15	63.62	62.9957	.46379	.215	-.144	.501	-1.357	.972
November	19	60.97	63.97	62.6268	.99139	.983	-.197	.524	-1.091	1.014
December	21	58.86	60.77	59.8338	.57743	.333	-.028	.501	-1.146	.972
Valid N (listwise)	18									

Table-11 Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
JPY	244	100.0%	0	.0%	244	100.0%

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Table-12 Tests of Normality

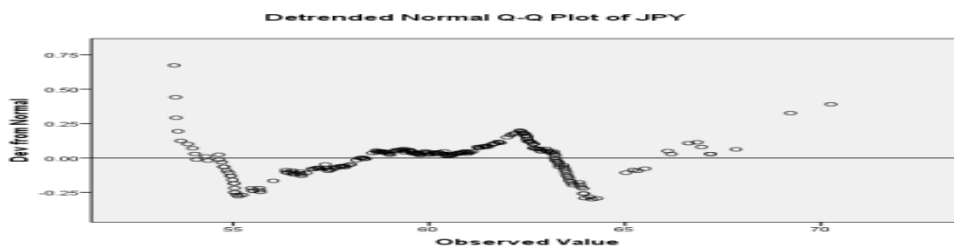|	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
JPY	.071	244	.005	.981	244	
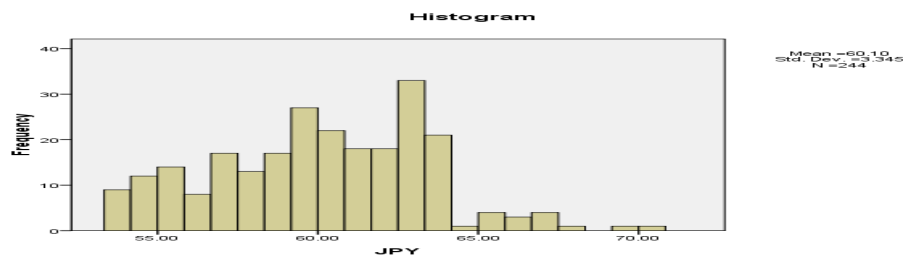
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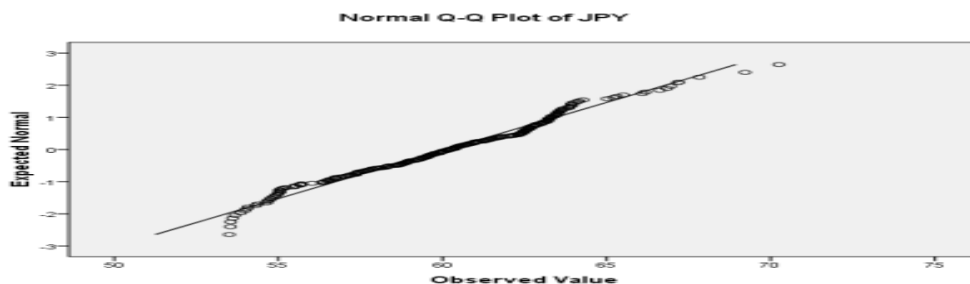
Figure 11

Figure 12

5. Conclusion

India allows fully convertibility in four currencies i.e. Dollar, Euro, Yen, Pound sterling. The study aimed to trace the fluctuations in the exchange rate of Indian Rupee with respect to all these four currencies. Exchange rates play a vital role in a country's level of trade, which is critical to almost every free market economy in the world. Therefore, exchange rates are among the most monitored analyzed and governmentally manipulated economic measures. Exchange rate matters on a

smaller scale as well: it impacts the real return of an investor's portfolio, profitability of firms, and growth of specific sectors amongst various other determinants of the economy.

The study concluded that in last year in all the four market the rupee is highly volatile during August,2013 and the daily changes in the value of the rupee is not normally distributed, results are supported by the study by Pandey(2011) .The study concluded that the rupee was volatile throughout the year 2013 supported by Pandey(2011) and Murari, Mandal,Kotai(2013). Rupee was highest volatile in the month of August during last year 2013 in respect of all the four currencies. The study also found that rupee was more volatile to GBP currency in comparison of other three currencies.

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