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INVESTIGATING THE CAUSAL RELATIONSHIP BETWEEN EXCHANGE RATE OF THE INDIAN RUPEE: A STUDY ON US DOLLAR, POUND STERLING, EURO AND YEN

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ABSTRACT

Generally international trades are exaggerated by changes in the exchange rates and consequently it influences the Indian rupees per unit. The present paper investigates the causal relationship between four exchange rates of the Indian rupees for the period starting from 1970-71 to 2014-15 using yearly data. The present paper has been designed with the application of unit root test, Johansen cointegration test and Granger causality test. Four indicators of exchange rate of the Indian rupees per unit, to be exact, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro have been used for the purpose of the study. Johansen cointegration test result indicates that there exists a long-term relationship among the selected variables. Granger causality test result shows that there must be either bidirectional or no causality among the variables.

Keywords: US Dollar, the Pound Sterling, Japanese Yen, Deutsche Mark/Euro, unit root test; Granger causality test, Johansen cointegration test.

1. INTRODUCTION

Money is not a natural creature but its value keeps changing with the society and its economic conditions. One rupee in 1947 is not the same as one rupee today, both in terms of appearance and purchasing power. The value of a currency depends on factors that affect the economy such as imports and exports, inflation, interest rates, growth rate, trade deficit, foreign exchange reserves, macroeconomic policies, foreign investment inflows etc. (Patel, 2012). Income levels control currencies through consumer spending. When incomes increase, people spend more. Higher demand for imported goods increases demand for foreign currencies and, thus, weakens the local currency. A country that sells more goods and services in overseas markets than it buys from them has a trade surplus. This means more foreign currency comes into the Country than what is paid for imports. This strengthens the local currency. Empirical studies point up that Indian currency counting rupee is very much prejudiced through numerous international currencies directly or indirectly. This study takes into consideration four indicators of exchange rate of the Indian rupees per unit, to be exact, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro.

Generally international trades are exaggerated by changes in the exchange rates and consequently it influences the Indian rupees per unit. A depreciation of the domestic currency against foreign currencies increases export. However, Indian rupee is increasing and importer of India has to disburse lower amount in exchange of dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro at the time of import, it reduces the import bill and while such imported item is sold at matching price, the profit for the firm goes up (Arora, 2012). But, at the same time, depreciation of domestic currency increases the cost of imports which indicates a positive relationship between them. Hence, the relationship between the four exchange rates of Indian rupees per unit needs to be checked. Keeping in view of this, this paper examines the causal relationship between four exchange rates of the Indian rupees for the period starting from 1970-71 to 2014-15 using yearly data. The remainder of the paper is organized in the following sections. Section 2 provides Review of Literature. Section 3 discusses Materials and Methods. Empirical Analysis is presented in Section 4. The study is concluded in Section 5.

2. Review of Literatures

Samanta et al. (2012) examined the co-movements of four macro-economic variables in terms of gold price, stock price, real exchange rate and the crude oil price based on 21 years data using econometric models for the periods from January 1989 to September 2009. The study exposes that there is a cointegration relationship between the variables. Sharma et al. (2012) has made a study to examine the long-run and short-run relationships between Sensex and four key macroeconomic variables (wholesale price index, index of industrial production, exchange rate and call money rate) of Indian economy by using monthly data from April, 2007 to March, 2012 with the application of financial econometrics. Empirical results of the study showed that there are no short-run causal relationships between Sensex and four macro-economic variables but confirmed long-run relationships between BSE Sensex with index of industrial production and call money rate. Le et al (2011) have made a study to investigate the relationships between the prices of two strategic commodities, that is, gold and oil in terms of index of US dollar by using monthly data from January, 1986 to April, 2011 with the application of financial econometrics. Empirical results of the study showed that there is a long-run relationship existing between the prices of oil and gold and the oil price can be used to predict the gold price. Sharma et al (2010) estimated the long-term relationship between BSE and four macroeconomic variables consisting of exchange rates, foreign exchange reserve and inflation rate and gold price based on the secondary data between January 2008 and January 2009 using multiple regression models. Mukherjee et al. (1995) investigates the relationship between stock market and exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate in Japan. Their findings support a cointegration relation. Keminsky et al (1998) explored the time series correlation between daily exchange rates and interest rates for six countries by using daily data during the second half of 1997. The study found the signs of unstable correlations and concluded that interest rates in those countries must not be an exogenous variable. Goldfajn et al. (1998) it observed the linkage between real interest rate and real exchange rate for the Asian countries during July 1997 to July 1998 by using Vector Autoregression (VAR) based on the impulse response function from the daily interest rates and exchange rates. They have not found any strong conclusion regarding the relationship between interest rate and exchange rate. The study divulges that exchange rate and gold price influences the stock prices in India.

A significant number of studies on the impact of exchange rates on other macroeconomic variables have already been undertaken. Though causal relationship and association between various macroeconomic variables have become most fascinating area for study but with the view of growth in economy, the importance of investigating the long-term association and pair-wise connection between exchange rates of the Indian rupees per unit cannot be ignored. The comparative analysis between four indicators of exchange rate of the Indian rupees per unit, to be exact, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro is an area which has not yet explored. Keeping in view of this, this paper examines the long-term association and pair-wise causal connection between four exchange rates of the Indian rupees for the period starting from 1970-71 to 2014-15 using yearly data.

3. Materials and Methods

3.1 Data source

The study is based enormously on secondary data acquired from RBI database for the period from 1970-71 to 2014-15. The data on exchange rate for Japanese Yen is based on Rupees per 100 Yen. Data from 1970-71 to1991-92 are based on official exchange rates. Data from 1992-93 onwards are based on FEDAI (Foreign Exchange Dealers' Association of India) indicative rates. Data from 1971 to 1972-73 for the Deutsche Mark and the Japanese Yen are cross rates with the US Dollar. The Euro replaced the Deutsche Mark w.e.f. January 1, 1999.

3.2 Sample design

This study considers yearly data encircling the average yearly exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro. After appropriate fitting the data, there are 43 observations. Eviews 9 package program has been used for arranging the data and execution of econometric analyses.

3.3 Tools used

In the course of analysis of the present study, only econometric tools include Augmented Dickey Fuller (ADF) and Phillips- Perron (PP) test both at levels and 1st differences, Johansen's system of co-integration test and Granger causality test have been used.

3.4 Hypotheses taken

Hypothesis-1

H_0: Exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are not stationary.

H_1: Exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are stationary.

Hypothesis-2

H_0: Exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are not associated in the long period.

H_1: Exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are particularly associated in the long period.

Hypothesis-3

H_0: Exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are not related pairwise.

H_1: Exchange rate of the Indian rupees per unit of US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are very much related pairwise.

4. Empirical Results and Analysis

4.1 Unit root test results

Cointegration test technique is greatly supportive to detect the cointegration association between the two variables in the long period and it is realistic if the two variables are stationery in any case. In the present research paper, four indicators of exchange rate of the Indian rupees per unit, namely, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro may be connected in the long period on the prerequisite that they are not unpredictable or stationery. For the purpose of stationarity test, the present study use ADF and PP unit root test, both at levels and at 1st differences (intercept without trend and intercept with trend) in hopethesis-1 above.

Table-1: Unit Root Test Results

ADF		
Test equation-intercept	at level	at 1st difference
LUSD	-0.320819(0.9133)	-4.552590(0.0007)
LPDS	-0.413284(0.8977)	-3.913271(0.0042)
LYEN	-1.508525(0.5198)	-5.040290(0.0002)
LEURO	-0.775448 (0.8161)	-5.741602(0.0000)

Critical values		
1% 5% 10%	-3.588509 -2.929734 -2.603064	-3.592462 -2.931404 -2.603944
PP		
Test equation-intercept	at level	at 1st difference
LUSD LPDS LYEN LEURO	-0.421342(0.8964) -0.150617(0.9371) -1.264622(0.6376) -0.772498(0.8169)	-4.51998(0.0007) -3.829816(0.0053) -5.040290(0.0002) -5.689265(0.0000)
Critical values		
1% 5% 10%	-3.588509 -2.929734 -2.603064	-3.592462 -2.931404 -2.603944

*MacKinnon (1996) one-sided p-values.

Table-1 demonstrate the ADF and PP unit root test results at level and at 1st difference where it authenticates that four indicators of exchange rate of the Indian rupees per unit, to be precise, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are not stationary at levels [I(0)] and are stationary at 1st difference [I(1)] because test statistics are less than critical value at level and are more than critical value at 1st difference at 1% level of significant both in the intercept without trend and intercept with trend. The unit root test moreover authenticates that constant variance is seen in case of error terms that indicates statistical dependency, as supported in (Shahzadi and Chohan, 2012).

4.2 Cointegration test results

Since four indicators of exchange rate of the Indian rupees per unit, to be exact, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro are stationary, for that reason, multivariate cointegration method in Johansen approach can be applied to identify the cointegration association between the variables in the long period. Simultaneously, this method can be determined by the cointegration vectors. Since we make out two likelihood ratios, specifically, the Trace Test and the Maximum Eigen Value test can decide the cointegration vectors. At the time of testing, the present research study accepts linear deterministic trend unrestricted with intercepts without trends on account of using a lag of 1 to 1 at 1st differences derived from Swartz Information Criterion (SIC) for the selected indicators under the study.

Table-2 reveals the multivariate cointegration test results in the course of Johansen approach that offers surety regarding connection between US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro in the long period as trace statistics is more than critical value in case of both the likelihood ratio test, to be exact, the trace test and the maximum eigen value test. Consequently, the results of the multivariate cointegration test do not accept the null hypothesis (talked about in hypothesis-2 above). This test also established the number (two) of cointegration vectors. Trace test and Max-eigen value test indicates 1 cointegration at the 0.05 level It is moreover indicating that two common stochastic trends or a degree of market integration are present there.

Table-2: Cointegration Test Results

Included observations: 43 after adjustments
Trend assumption: Linear deterministic trend
Series: LUSD LPDS LYEN LEURO
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.447188	50.25001	47.85613	0.0293
At most 1	0.312035	24.76232	29.79707	0.1701
At most 2	0.121511	8.679597	15.49471	0.3959
At most 3	0.069747	3.108855	3.841466	0.0779

Trace test indicates 1 cointegration 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	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.447188	27.48770	25.58434	0.0406
At most 1	0.312035	16.08272	21.13162	0.2200
At most 2	0.121511	5.570743	14.26460	0.6687
At most 3	0.069747	3.108855	3.841466	0.0779

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

4.3 Pairwise causal test

To establish the causal relationship with movement of causation between four indicators of exchange rate of the Indian rupees per unit, explicitly, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro, pairwise causal (Granger) test has been utilized in the present study. Table-3 illustrates the results of pairwise causal test and point up that there is no causal relationship exist (talked about in hypothesis-2 above) between, (i) Deutsche Mark/Euro and the Pound Sterling, (ii) Deutsche Mark/Euro and US Dollar, (iii) Yen and Deutsche Mark/Euro (iv) Deutsche Mark/Euro and Yen, (v) the Pound Sterling and US Dollar, (vi) the Pound Sterling and Yen, (vii) Yen and US Dollar, (viii) US Dollar and Yen because the probability is more than 0.05. Table-3 also shows that there is bi-directional causal relationship exist between (i) the Pound Sterling and Deutsche Mark/Euro (ii) US Dollar and Deutsche Mark/Euro (iii) US Dollar and the Pound Sterling (iv) Yen and the Pound Sterling because the probability is less than 0.05. Hence, pairwise causal assertion linking four indicators of exchange rate of the Indian rupees per unit, in particular, US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro indicates that trend in one indicator is not the grounds for trend in other indicator under the study. Therefore, this study may conclude that causal relationship is merely a trend of the selected data under the period of study, as supported in (Awe, 2012).

Table-3: Pairwise Granger Causality Tests (Lags: 2)

Null Hypothesis	Obs	F-Statistic	Prob.	Decision	Type of Causality
the Pound Sterling ↑ DeutscheMark/Euro	43	4.77442	0.0141	Reject H_0	Bi-directional causality
Deutsche Mark/Euro ↑ the Pound Sterling		2.29516	0.1145	DNR H_0	No causality
US Dollar ↑ Deutsche Mark/Euro	43	3.75991	0.0324	Reject H_0	Bi-directional causality
Deutsche Mark/Euro ↑		0.32564	0.7241	DNR H_0	No causality

US Dollar					
Yen ↑ Deutsche Mark/Euro	43	2.39149	0.1051	DNR H_0	No causality
Deutsche Mark/Euro ↑ Yen		0.81273	0.4512	DNR H_0	No causality
US Dollar ↑ the Pound Sterling	43	4.55918	0.0168	Reject H_0	Bi-directional causality
the Pound Sterling ↑ US Dollar		0.03128	0.9692	DNR H_0	No causality
Yen ↑ the Pound Sterling	43	6.75886	0.0031	Reject H_0	Bi-directional causality
the Pound Sterling ↑ Yen		2.39784	0.1045	DNR H_0	No causality
Yen ↑ US Dollar	43	3.00202	0.0616	DNR H_0	No causality
US Dollar ↑ Yen		3.14994	0.0542	DNR H_0	No causality

Note: Decision rule: reject H_0 if P-value < 0.05, DNR = Do not reject; ↑ = does not Granger cause.

5. Conclusions

The primary finding of the present study is that selected four macroeconomic variables of exchange rates of Indian rupee are stationery time series data at I(1) that is an indication of the affiliation between US Dollar, the Pound Sterling, Japanese Yen and Deutsche Mark/Euro in the long period. The empirical results of cointegration method in the course of Johansen approach mention that protected cointegration association between the selected variables under the study are greatly present in the long period. This research moreover illustrates that there are bidirectional causal connection present between the Pound Sterling and Deutsche Mark/Euro, US Dollar and Deutsche Mark/Euro, US Dollar and the Pound Sterling, Yen and the Pound Sterling. The findings of this study have some significant policy implications. First, Reserve Bank of India should maintain a healthy exchange rate as it contains some important information to predict the effect on Indian rupees. Second, Regulatory body should try to control Inflation through Repo and Reverse Repo rates as this is one of the major factors affecting the devaluation of Indian rupees. Third, commodity prices like Gold, Silver and Oil are also major determinants of valuation of Indian rupees. Mostly prices of these commodities are determined at the global level. Policy makers should try to maintain competitive price levels by proper import duty and local taxes. Finally, autonomous regulatory bodies and visionary system of government can definitely contribute in efficient working and development of the valuation system of Indian rupees.

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