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- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

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- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–23

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- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

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DECADAL TRACKING OF FOREIGN EXCHANGE RATES: AN APPLICATION OF COINTEGRATION

MANGAL CHHERING
ASST. PROFESSOR
DEPARTMENT OF COMMERCE
COLLEGE OF VOCATIONAL STUDIES
UNIVERSITY OF DELHI
NEW DELHI

ABSTRACT

This paper reveals decadal foreign exchange cointegration (from beginning of July 2008 and ending June 2018) among US dollar, Great Britain Pound, Euro, and Japanese Yen with respect to Indian rupees. The cointegration tool has been used to study the relationship. The two methods of testing for cointegration are: Engle-Granger tests and Johansen-Juselius tests have been applied. When the variables are cointegrated, the estimates of the long-run equilibrium parameters are consistent and highly efficient. A decadal rupees/USD, rupees/GBP, a decadal rupees /USD, rupees/Euro, a decadal rupees /USD, rupees/yen, a decadal rupees /GBP, rupees/Euro, a decadal rupees /GBP, rupees/yen, a decadal rupees /euro, rupees/yen nexus, have been unearthed.

KEYWORD
Foreign exchange.

JEL CODE
F31

1. INTRODUCTION

Decadal tracking of foreign exchange rates: an application of cointegration is the study of foreign exchange rates namely four major foreign exchanges with respect to rupees that is US dollar, Great Britain Pound, EURO, and Japanese Yen on ten year time horizon, from beginning of July 2008 and ending June 2018. The need for study arises from following literatures that say foreign exchange market is very dynamic. Lasko Basnarkov, Viktor Stojkoski, Zoran Utkovsk, and Ljupco Kocarev (2020) studies the relationships between one-minute log returns on exchange rates.

The existence of statistically significant lagged correlations shows that, even though, the foreign exchange market is known to have very fast dynamics, information spreading is not instantaneous. They have discovered that the rates, which cause others to follow their dynamics, are mostly those that involve stock market indexes. Observing changes in the value of an index implies that certain currencies, or market indexes would more likely gain, while others would lose value. This was further confirmed by the calculation of the lagged partial correlation between the leader and the lagger exchange rate.

The above needs for study put forth immediate study of as for mentioned objectives.

OBJECTIVES OF THE STUDY

1. To unearth the cointegration among foreign exchange rate viz. US dollar, Great Britain Pound, EURO and Japanese Yen.
2. To analyse the cointegration between the US dollar and the Great Britain Pound.
3. To analyse the cointegration between US dollar and EURO.
4. To show the nexus between rupees/USD and rupees/yen.
5. To analyse the cointegration between rupees /GBP and rupees/EURO.
6. To unearth the cointegration between rupees/GBP and rupees/Yen.
7. To analyse the cointegration between rupees /EURO and rupees/Yen.

The evaluation of above-mentioned objectives descriptive research as well as empirical research has been used. The brief introduction of methodology is described here and detail of methodology used for research has been described in the methodology section of this paper.

RESEARCH METHODOLOGY

Data and sample: the four major foreign exchanges with respect to rupees: US dollar, Great Britain Pound, EURO, and Japanese Yen, over the period beginning July 2008 and ending June 2018 has been used. The sample consists of 2,409 observations. The descriptive statistics like minimum, first quartile, median, mean, third quartile, maximum, range and standard deviation are depicted in the Summary statistics table of all four foreign exchanges.

Stationary and nonstationary test and Cointegration: Cointegration test has been done after the order of integration of the foreign exchange rate is determined. Tests for unit roots are performed using the augmented Dickey-Fuller (ADF) tests. When the variables are cointegrated, the estimates of the long-run equilibrium parameters are consistent and highly efficient. Two methods of testing for cointegration are: Engle-Granger tests and Johansen-Juselius tests.

2. REVIEW OF LITERATURE AND HYPOTHESIS

Bing Li, Zefang Liao in "Finding changes in the foreign exchange market from the perspective of currency network" attempts to find changes in the foreign exchange market by focusing on the time horizon from January 2006 to December 2012, covering the pre and post periods of the 2008 global financial crisis.

The topological properties of the currency network in the pre- and post-crisis periods are studied and compared. The geographic and market classification are also used to test linking tendency between currencies. They construct the correlation-based networks in 2006-2007 and 2011-2012, corresponding to the pre- and post-crisis period separately.

Boudt, K., Neely, C. J., Sercu, P., & Wauters, M. (2019). Analyzed "The response of multinationals' foreign exchange rate exposure to macroeconomic news".

The intra-day estimate of daily foreign exchange exposure coefficients have co-varied with the value of the dollar at low frequencies and with news at high frequencies. Macroeconomic announcements affect foreign exchange exposure of U.S. multinational firms in a statistically and economically significant way.

Adler, G., Lisack, N., & Mano, R. (2019), in "Unveiling the effects of foreign exchange intervention (FXI): A panel approach" aimed to understand the relevance of FXI as a macroeconomic policy tool, that is, going beyond the intra-day or daily effects.

Yamani, E. (2020), in "Foreign Exchange Market Efficiency and the Global Financial Crisis: Fundamental (FUH) versus Technical Information" reported the comparative analysis of the FUH and technical trading rules reveals that the two hypotheses predict opposite conclusions on the direction of the change in the state of market performance in the crisis period. While the FUH results give some evidence that the forward puzzle is less prominent during the crisis period, simple technical trading rules react the opposite way in response to a volatility rise during the crisis period by showing that Foreign Exchange (FX) markets are profitable during the crisis period.

Choi, J. H. (2019), in "Capital Controls and Foreign Exchange Market Intervention" He considered the trade-off between capital controls and foreign exchange intervention. The model was constructed under the assumption that rational policymakers understand the trajectories of shadow exchange rates under different regimes and decide how much to float or peg by simply making series of regime choices. The current model assumes that the foreign exchange intervention decision is not constrained by the level of international reserves to simplify the dynamics of solutions.

Adler, G., Lama, R., & Medina, J. P. (2019) "Foreign Exchange Intervention and Inflation Targeting: The Role of Credibility" they find two key results, first, in a baseline scenario where the central bank is perfectly credible, FXI can improve macroeconomic outcomes by successfully stabilizing both output and inflation in response to foreign disturbances. Second, when central bank lacks credibility, FXI policies entail a trade-off by reducing output volatility at the expense of inducing higher inflation volatility.

Andrikopoulos, A., Wang, C., & Zheng, M. (2019) "Is there still a weather anomaly? An investigation of stock and foreign exchange markets" Behavioral finance holds that security market prices are determined not only by their intrinsic values but also by investor psychology. Weather can affect investors' moods and thus their behavior in financial markets. The weather variables used for New York and London has no apparent impact on the stock and FX markets during 2002–2018. As the economy is globalizing and investors increasingly dispersed, it is increasingly difficult to find significant relationships between weather and financial markets.

THE NULL HYPOTHESES OF THE STUDY

H_O 1. There is no cointegration among four foreign exchanges.
H_O 2. There is no cointegration between the US dollar and the Great Britain Pound. H_O 3. There is no cointegration between US dollar and EURO.
H_O 4. There is no cointegration between rupees/USD and rupees/Yen.
H_O 5. There is no cointegration between rupees /GBP and rupees/EURO.
H_O 6. There is no cointegration between rupees/GBP and rupees/Yen.
H_O 7. There is no cointegration between rupees/euro and rupees/Yen.

3. RESEARCH METHODOLOGY & ANALYSIS OF THE STUDY

COINTEGRATION

Consider two variables U and G is in single equation. An equilibrium or long-run relationship will be unique if it exists. Assume that theory suggests a long-run relationship described by equation (1) That is: Ut = bGt … (1). For Ut and Gt to be cointegrated it is required that: (a) the two series should be integrated to the same order; (b) a linear combination of the two series should exist which is integrated to a lower order than the individual series. Consider (a) in the form of the regression model: Ut = bGt + εt.. (2). Where εt ~ IN(0, σ^2) and so εt ~ I(0). Then, if Ut and Gt are integrated to different orders, there will not be any parameter b that satisfies (2). Thus, a meaningful long-run relationship implies requirement (1).

Secondly, consider the case where Ut and Gt are both I(1), and the linear combination (Ut- bGt) is I(0). (Ut - bGt) is I(0), then an error correction representation of the form: $\Delta U_t = \alpha\Delta G_t + \lambda(U - bG)_{t-1} + v_t$.. (3). Equation (1) leads to estimates of the parameter(s) of the equilibrium relationship postulated to exist, whilst an estimate of (3) informs us of the magnitudes of the dynamic adjustment coefficients, α and λ. Moreover, (3) possesses all of the well-known advantages of the error correction model.

When the variables are cointegrated, the estimates of the long-run equilibrium parameters are consistent and highly efficient. This consistency property does not require the absence of correlation between the right-hand-side variables and the error term, unlike consistency results in the usual classical regression-model context. The estimators of the short-run parameters are not only consistent, but are as efficient asymptotically as those that would be obtained if the true (rather than estimated) value of the cointegrating vector were known and used in the second stage.

Two methods of testing for cointegration are:

1. Engle-Granger tests
2. Johansen-Juselius tests

1. ENGLE-GRANGER COINTEGRATION TESTS

It is developed by Engle and Granger (1987), and is four step process:

Step 1: Test for stationary of underling time series variables. Two methods are informal and formal methods. Informal methods are by examination of a graph and the autocorrelation function of the series for various lags. For non-stationary variables, the lag one-autocorrelation coefficient should be very close to one and decay slowly as the lag length increases.

The formal methods are by employing the Dickey-Fuller statistic and the Augmented Dickey-Fuller statistic. These statistics test the hypothesis that the variables have a unit root, against the alternative that they do not. If it is determined that the variable is non-stationary and the differenced variable is stationary, proceed to step 2

Step 2: Estimation of regression: $U_t = c + d\ G_t + z_t$. U_t represents U.S. dollar, G_t GBP, and z_t the error term; c and d are regression parameters. The null hypothesis states that there is no cointegration and the alternative claims that they are cointegrated.

Step 3: The Dickey-Fuller test. Cointegration test, test for stationarity in zt. Consider the following autoregression of the error term: $\Delta zt = p\ zt{-}1 + ut$. Where zt is the estimated residual. The test focuses on the significance of the estimated p. If the estimate of p is statistically negative, we conclude that the residuals, zt, are stationary and reject the hypothesis of no cointegration.

The residuals of equation $\Delta zt = p\ zt{-}1 + ut$ should be checked to ensure they are white noise. If they are not, we should employ the augmented Dickey-Fuller test (ADF). The augmented Dickey-Fuller test is analogous to the Dickey-Fuller test but includes additional lags of Δzt. The ADF test for stationarity, like the Dickey Fuller test, tests the hypothesis of p = 0 against the alternative hypothesis of p < 0 for the equation: $\Delta zt = p\ zt{-}1 + a1\ \Delta zt{-}1 + \cdots + an\ \Delta zt{-}n + ut$.

In Rstudio, The two-step Engle Granger procedure searches for parameters α, β, and ρ that yield the best fit to the following model:

Y [i] = α + β ∗ X[i] + R[i] R[i] = ρ ∗ R[i − 1] + [i] [i] ∼ N(0, σ2).

In the first step, alpha and beta are found using a linear fit of X[i] with respect to Y[i]. The residual sequence R[i] is then determined. Then, in the second step, ρ is determined, again using a linear fit. Engle and Granger showed that if X and Y are cointegrated, then this procedure will yield consistent estimates of the parameters.

2. JOHANSEN-JUSELIUS COINTEGRATION TESTS

The Engle-Granger method does have some problems in a multivariate (three or more variables) context. As the sample size approaches infinity, Engle and Granger (1987) showed that the cointegration tests produce the same results irrespective of what variable you use as the dependent variable. A second problem is that the errors we use to test for cointegration are only estimates and the not the true errors. Finally, the Engle-Granger procedure is unable to detect multiple cointegrating relationships.

Consider the following multivariate model: $yt = Ayt{-}1 + ut$. Where yt is an n × 1 vector (y1t, y2t,..... ynt)'. ut is an n-dimensional error term at t. A is an n × n matrix of coefficients.

DATA AND SAMPLE

The study concentrates on the four major foreign exchanges with respect to rupees: US dollar, Great Britain Pound, EURO, and Japanese Yen. Daily closing data for all four exchanges has been collected over the period beginning July 2008 and ending June 2018.

The sample consists of 2,409 observations. On national holidays, bank holidays or severe weather conditions, the exchange level was assumed to remain the same as that on the previous trading day. In table 1, initial and last six rows of data have been presented.

In Table 1, shows the summary statistics of different foreign exchanges rates, USD, GBP, EURO, and YEN.

TABLE 1: INITIAL AND LAST SIX ROWS OF DATA

Date USD. GBP. EURO. YEN.	Date USD. GBP. EURO. YEN.
Initial six rows	Last six rows
01/07/2008 43.3 86.3 68.2 41.0	22/06/2018 67.8 90.0 78.9 61.6
02/07/2008 43.3 86.5 68.5 40.9	25/06/2018 68.2 90.3 79.4 62.3
03/07/2008 43.3 86.1 68.7 40.8	26/06/2018 68.2 90.5 79.7 62.2
04/07/2008 43.2 85.7 67.9 40.4	27/06/2018 68.5 90.6 79.9 62.4
07/07/2008 43.1 85.1 67.4 40.2	28/06/2018 68.9 90.2 79.6 62.5
08/07/2008 43.4 85.5 68.1 40.6	29/06/2018 68.6 89.9 79.8 62.0

On 29th June 2018 USD had been 68.6 that risen from 43.3 on 1st July 2008, similarly GBP grown 89.9 from 86.3, EURO rose 79.8 from 68.2 and YEN risen to 62 from 41 in the respective period.

SUMMARY STATISTICS

In the table 2 given below the Summary statistics of all four foreign exchanges rates has been elucidated on minimum (Min), first quartile (1st Qu.), median, mean, third quartile (3rd Qu.), maximum (Max.), range and standard deviation (SD).

TABLE 2: SUMMARY STATISTICS OF ALL FOUR FOREIGN EXCHANGES RATES

Statistics	USD	GBP	EURO	YEN	Statistics	USD	GBP	EURO	YEN
Min.	41.89	65.65	56.07	38.15	3rd Qu.	64.36	95.22	75.81	61.15
1st Qu.	48.17	76.75	66.16	53.1	Max.	68.94	106.03	91.47	72.12
Median	58.91	85.13	70.67	57.4	Range	27.05	40.38	35.4	33.97
Mean	56.63	85.65	71.19	57.38	SD	8.362	10.379	6.848	6.036

FIGURE 1

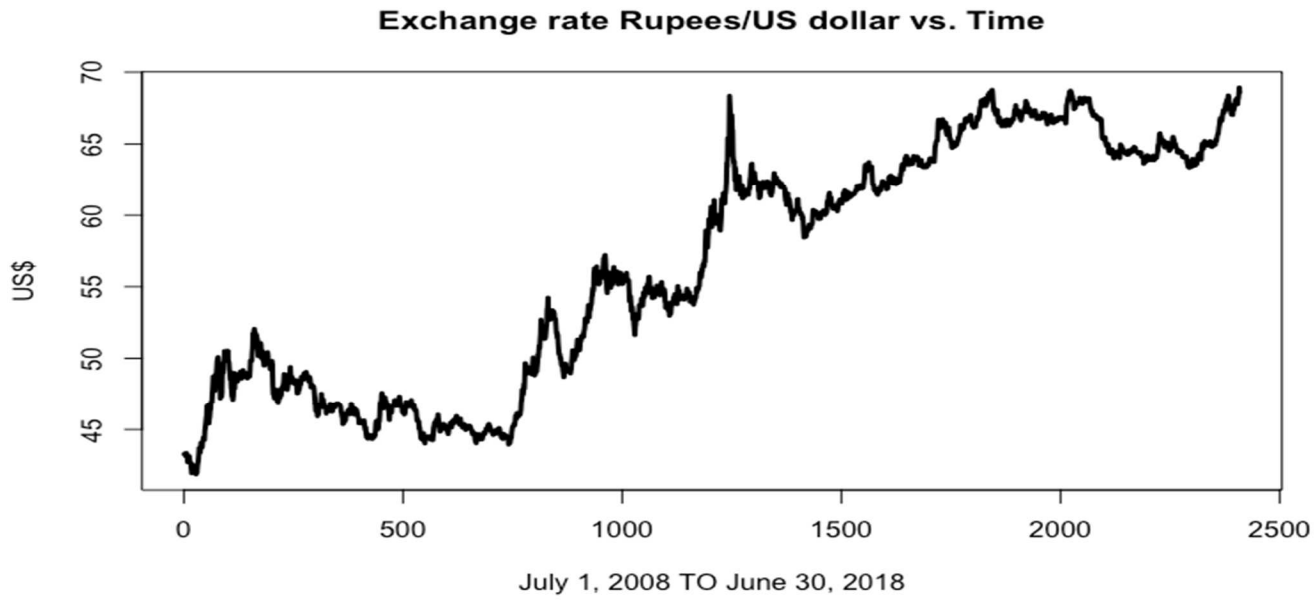

Figure 1, depicts exchange rate of rupees per unit US dollar over the period of 1st July 2008 to 30th June 2018.

FIGURE 2

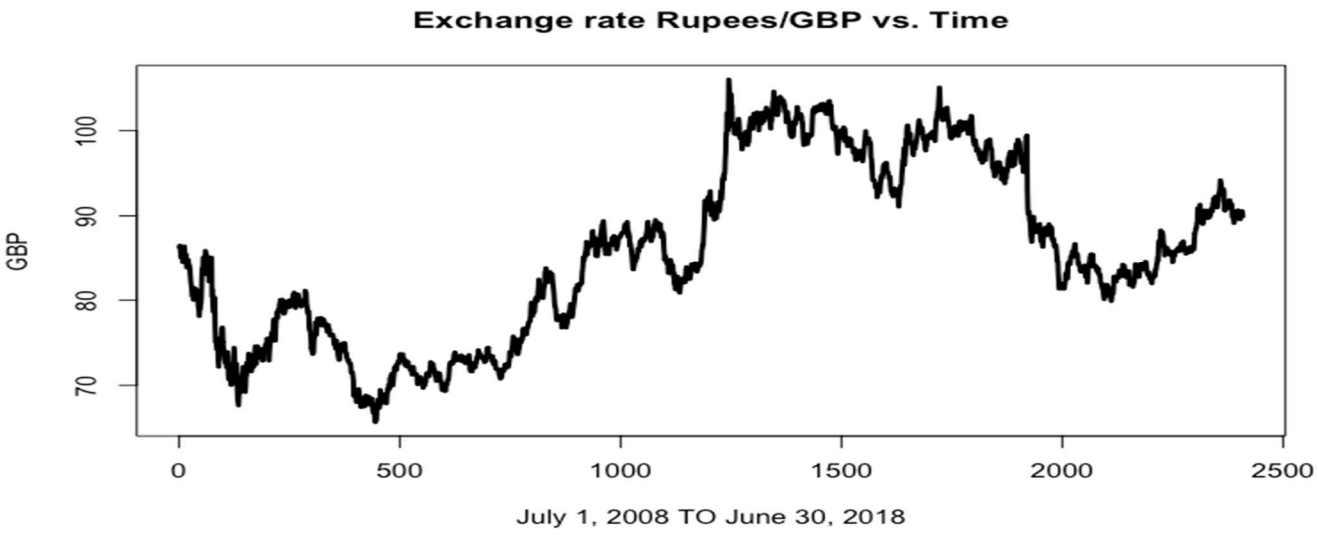

Figure 2, depicts exchange rate of rupees per unit GBP over the period of 1st July 2008 to 30th June 2018.

FIGURE 3

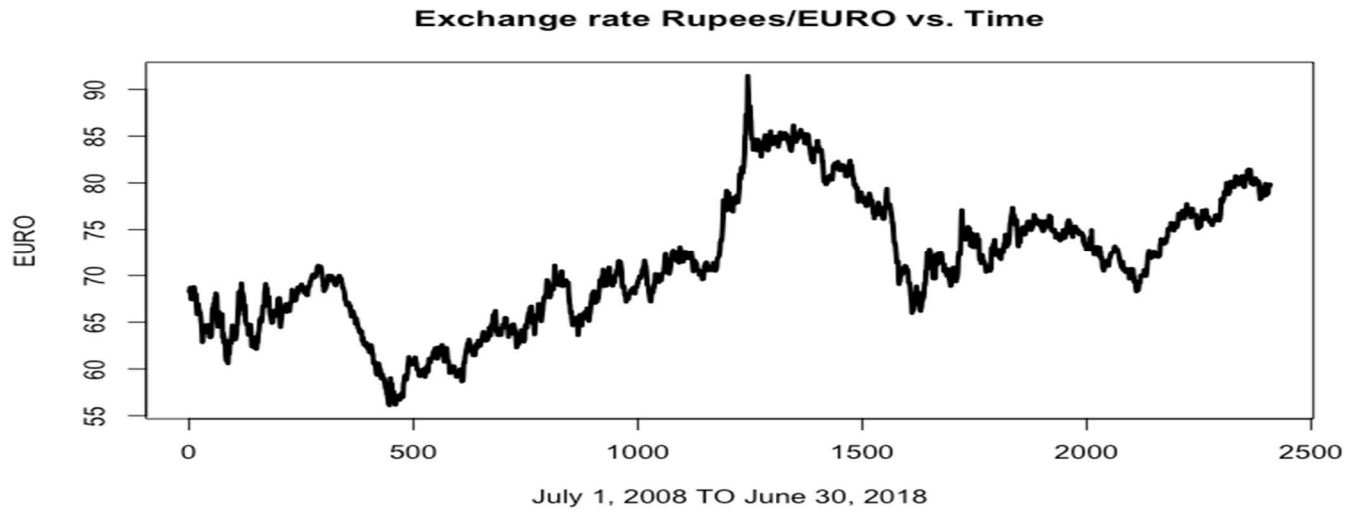

Figure 3, depicts exchange rate of rupees per unit EURO over the period of 1st July 2008 to 30th June 2018.

FIGURE 4

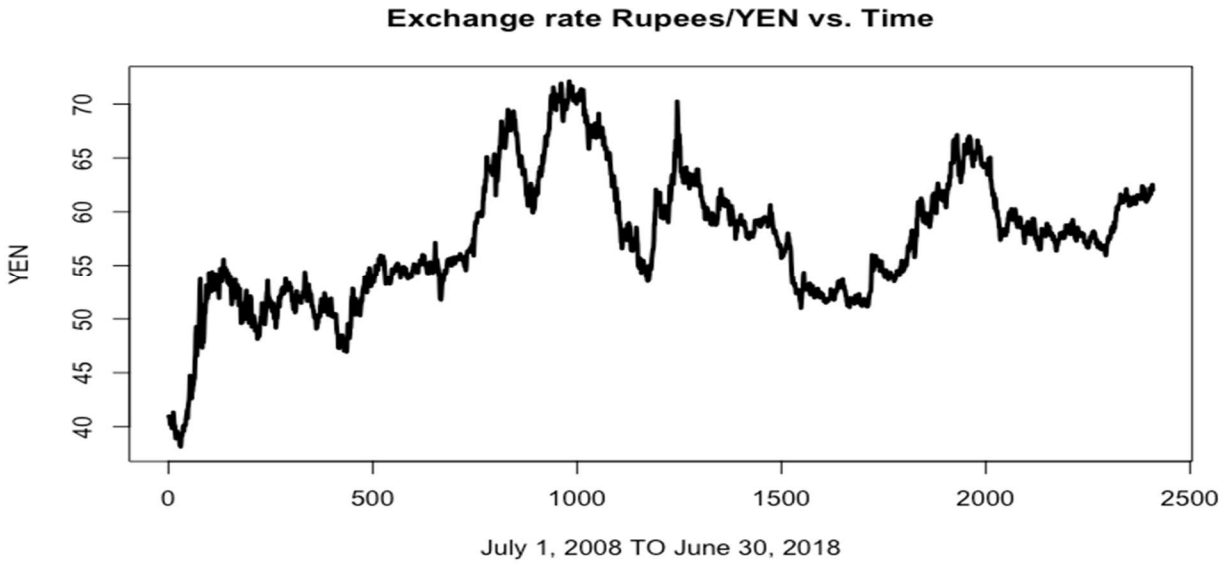

Figure 4, depicts exchange rate of rupees per unit Japanese Yen over the period of 1st July 2008 to 30th June 2018.

STATIONARY AND NONSTATIONARY TEST

Cointegration test has been done after the order of integration of the foreign exchange rate is determined. Tests for unit roots are performed using the augmented Dickey-Fuller (ADF) tests. The null hypothesis is that the foreign exchange rates have a unit root, against the alternative that they do not. The results of the unit root tests based on local currency units i.e. rupees are presented in table 3. Column 1 reports four foreign exchange, column 2 reports augmented Dickey-fuller statistics (ADF tests) for the entire period, column 3 presents lag order, column forth presents p-value and last column reports alternative hypothesis.

The reported results indicate the presence of a unit root in the lag order 13 of all foreign exchange (i.e., the null hypothesis cannot be rejected). However, there is no evidence to support the presence of a unit root in first differences of the foreign exchange. The null hypothesis of a unit root in first differences is rejected for all foreign exchange series. These results are broadly consistent with the hypothesis that the foreign exchange series are individually integrated of order one, I(13).

TABLE 3: UNIT ROOT TEST STATISTICS IN FOREIGN EXCHANGE RATE: JULY I, 2008 & JUNE 1, 2018

Foreign exchange	Dickey-fuller	Lag order	P-value	Alternative hypothesis
USD	-2.4429	13	0.3908	Stationary
GBP	-1.9405	13	0.6035	Stationary
EURO	-2.1876	13	0.4989	Stationary
YEN	-2.9225	13	0.1878	Stationary

The ADF test (augmented Dickey-Fuller test) is based on following regression:

$$Dx_t = a_0 + a_1 x_{t-1} + \sum_{j=1}^{m} b_j Dx_{t-j} + v_t,$$

Where b_j, equals zero for the DF tests, x_t, denotes the foreign exchange rate and v_t, the error term.

4. EMPIRICAL RESULTS

I. A DECADAL RUPEES/USD, RUPEES/GBP NEXUS

Y[i] = 0.9547 X[i] + 31.5773 + R[i], R[i] = 0.9988 R[i-1] + eps[i], eps ~ N(0, 0.5389^2). (0.0162) (0.9638) (0.0017)

R[2409] = -7.1231 (t = -1.074). X and Y do not appear to be cointegrated.

The first line of the output shows the fit that was found. The parameters were determined to be β = 0.9547, α = 31.5773 and ρ = 0.9988. The standard deviation of the sequence was found to be 0.5389.

Unit Root Tests of Residuals

	Statistic	p-value
Augmented Dickey Fuller (ADF)	-2.251	0.40181
Phillips-Perron (PP)	-9.237	0.43126
Johansen's Trace Test (JOT)	-11.930	0.46601

II. A DECADAL RUPEES /USD, RUPEES/EURO NEXUS

Y[i] = 0.6155 X[i] + 36.3399 + R[i], R[i] = 0.9980 R[i-1] + eps[i], eps ~ N(0, 0.4257^2)
(0.0110) (0.6653) (0.0019)

R[2409] = 1.3023 (t = 0.288). X and Y do not appear to be cointegrated.

Unit Root Tests of Residuals

	Statistic	p-value
Augmented Dickey Fuller (ADF)	-2.324	0.36780
Phillips-Perron (PP)	-11.840	0.29086
Johansen's Trace Test (JOT)	-10.777	0.56565

III. A DECADAL RUPEES /USD, RUPEES/YEN NEXUS

Y[i] = 0.2892 X[i] + 40.9972 + R[i], R[i] = 0.9983 R[i-1] + eps[i], eps ~ N(0, 0.4522^2)
(0.0135) (0.8041) (0.0017)

R[2409] = 1.1875 (t = 0.215). X and Y do not appear to be cointegrated.

Unit Root Tests of Residuals

	Statistic	p-value
Augmented Dickey Fuller (ADF)	-2.737	0.18434
Phillips-Perron (PP)	-9.885	0.39628
Johansen's Trace Test (JOT)	-12.114	0.45234

IV. A DECADAL RUPEES /GBP, RUPEES/EURO NEXUS

Y[i] = 0.5551 X[i] + 23.6535 + R[i], R[i] = 0.9981 R[i-1] + eps[i], eps ~ N(0, 0.3717^2)
(0.0073) (0.6540) (0.0020)

R[2409] = 6.2778 (t = 1.696). X and Y do not appear to be cointegrated.

Unit Root Tests of Residuals

	Statistic	p-value
Augmented Dickey Fuller (ADF)	-1.822	0.60064
Phillips-Perron (PP)	-10.821	0.34581
Johansen's Trace Test (JOT)	-8.380	0.79173

V. A DECADAL RUPEES /GBP, RUPEES/YEN NEXUS

Y[i] = 0.1636 X[i] + 43.3659 + R[i], R[i] = 0.9977 R[i-1] + eps[i], eps ~ N(0, 0.4791^2)
(0.0114) (1.0101) (0.0017)

R[2409] = 3.9425 (t = 0.681). X and Y do not appear to be cointegrated.

Unit Root Tests of Residuals

	Statistic	p-value
Augmented Dickey Fuller (ADF)	-3.105	0.08621
Phillips-Perron (PP)	-11.354	0.31704
Johansen's Trace Test (JOT)	-12.775	0.40307

VI. A DECADAL RUPEES /EURO, RUPEES/YEN NEXUS

Y[i] = 0.3584 X[i] + 31.8575 + R[i], R[i] = 0.9977 R[i-1] + eps[i], eps ~ N(0, 0.4563^2)
(0.0164) (1.1959) (0.0017)

R[2409] = 1.5407 (t = 0.279). X and Y do not appear to be cointegrated.

Unit Root Tests of Residuals

	Statistic	p-value
Augmented Dickey Fuller (ADF)	-3.135	0.08117
Phillips-Perron (PP)	-11.171	0.32692
Johansen's Trace Test (JOT)	-15.055	0.23337

VII. JOHANSEN-PROCEDURE

Test type: maximal eigenvalue statistic (lambda max), without linear trend and constant in cointegration. Eigenvalues (lambda): [1] 6.358527e-03 3.387231e-03 2.196880e-03 8.192158e-04 1.030844e-18.

Values of test-statistic and critical values of test:

	Test	10pct	5pct	1pct
r <= 3 |	1.97	7.52	9.24	12.97
r <= 2 |	5.28	13.75	15.67	20.20
r <= 1 |	8.14	19.77	22.00	26.81
r = 0 |	15.30	25.56	28.14	33.24

Eigenvectors normalized to first column: (These are the cointegration relations)

	USD.l1	GBP.l1	EURO.l1	YEN.l1	constant
USD.l1	1.0000000	1.0000000	1.000000	1.000000	1.0000000
GBP.l1	-1.2329991	0.4996497	-1.927498	3.320078	-0.5455442
EURO.l1	0.4331092	-2.3966105	1.161714	-2.254249	0.5582187
YEN.l1	1.8188376	0.1942730	-1.565801	-1.797876	-0.5772077
Constant	-91.4634041	61.0022802	109.617970	-107.177244	-13.4335556

Weights W: (This is the loading matrix)

	USD1.l1	GBP1.l1	EURO1.l1	YEN1.l1	constant
USD.d	-0.0010420547	0.0002735402	-0.0001395311	-1.403585e-04	2.402797e-17
GBP.d	0.0004162503	0.0000798201	0.0010066285	-3.481939e-04	-4.440442e-17
EURO.d	0.0003762953	0.0023456033	0.0002067531	-1.989772e-04	1.151137e-17
YEN1.d	-0.0020686867	0.0014709521	0.0007021557	-6.884138e-05	2.956037e-18

5. DISCUSSIONS AND CONCLUSION

The results (Johansen-Juselius Cointegration Tests) from the entire sample show that the foreign exchange rate of US dollar, Great Britain Pound, EURO and Japanese Yen appear not to be integrated. The value of r = 0 test 15.30 is less than 5% critical value i.e. 28.14, hence we fail to reject null hypothesis i.e. there is no cointegration among four foreign exchanges. The null hypothesis of no cointegration between the US dollar and the Great Britain Pound cannot be rejected applying Engle-Granger Cointegration Tests. At the 5 percent level the critical value of the ADF statistic is -2.251 and p- value is 0.40181. Engle-Granger Cointegration Tests shows null hypothesis of no cointegration between US dollar and EURO cannot be rejected. The reported ADF statistic, -2.324 and p-value is 0.36780. We can say the linkage between the US dollar and EURO less.

Another interesting observation from a decadal rupees/USD, rupees/yen nexus were found to be non-cointegrated with the help of Engle-Granger Cointegration Tests. The reported ADF statistic, -2.737 and p-value is 0.18434. A decadal rupees /GBP, rupees/EURO nexus and its null hypothesis of no cointegration between GBP and EURO cannot be rejected by applying Engle-Granger Cointegration Tests. The reported ADF statistic, -1.822 and p-value is 0.60064. A decadal rupees/GBP, rupees/Yen nexus reveals there is no cointegration between them revealed by Engle-Granger Cointegration Tests and the reported ADF statistic, -3.105 and p-value is 0.08621. Engle-Granger Cointegration Tests shows there is no cointegration between GBP and Yen. The ADF statistic is -3.105 and p-value is 0.08621.

Lastly, a decadal rupees /euro, rupees/yen nexus reveals that there is no cointegration between them with the help of Engle-Granger Cointegration Tests and the reported ADF statistic is -3.135 and p-value is 0.08117.

In sum, the evidence from the entire sample that foreign exchange movement is not cointegrated among the USD, GBP, EURO and YEN. This implies that the four major currencies are not related to the each other. These results also imply that the performance of the USD vs. GBP, USD vs. EURO, USD vs. YEN, GBP vs. EURO, GBP vs. YEN, EURO vs. YEN have no impression on the other foreign exchanges.

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