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## A STUDY OF EFFICIENCY IN INDIAN FOREX MARKET

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### ABSTRACT

*Forex market commonly known as 'Foreign Exchange Market' and has crucial role in development of an economy. Exchange rates are taken as critical factor while determining various macroeconomic policies and major issues in economy. This paper attempts to examine the weak and semi-strong form efficiency in Indian Forex market using major eight bilateral exchange rates. Data constitutes daily exchange rates over the study period of eleven years i.e., January 2010 to December 2020. Augmented Dickey Fuller (ADF), Kwiatkowski Phillips Schmidt Shine (KPSS) and Phillips Perron (PP) tests are used to test weak form efficiency, and Johansen co-integration model is used for testing semi-strong form efficiency. The results indicate that Indian Forex market is efficient in the forms.*

### KEYWORDS

co-integration, exchange rate, forex market, market efficiency.

### JEL CODES

C58, F31, G14.

### INTRODUCTION

In this competitive and rapidly developing era, the Indian organizations upsurge in international involvement as India forges strong linkage with the world. Forex Market plays a very crucial role in the development of an economy, as it is one of the most important factors that is considered for various policy determination in an economy. Forex market is defined in Investopedia as "over the counter (OTC) global marketplace that determines the exchange rate for currencies around the world." It deals with the large volume of funds and currencies. The development is sure, when the market is Efficient. Rustagi (2015) stated "a market is efficient with respect to a given piece of information, if no investor can make abnormal profit by using this piece of information". Fama (1984) asserts that if forex market fully considers all the available information, then no devices like statistical techniques or trading rules are used to forecast patterns in forex market. Fama (1991) divides market efficiency in three categories: weak form, semi-strong form and strong form efficiency. Weak form efficiency states that prices reflect all the past information, semi strong form efficiency states that prices reflect all the past and public information, while strong form efficiency includes private, public and past information. This paper attempts to assess the weak and semi strong form efficiency in context of Indian Forex market.

### REVIEW OF LITERATURE

Various studies had been conducted across the globe in order to analyze the efficiency of Forex market, some of them are briefly presented as: Hakio (1981) and Fama (1984) analyzed the efficient market hypothesis using exchange rates against US \$. Both the studies rejected the efficiency hypothesis. Wickremasinghe (2004) examined the weak and semi-strong form efficiency of forex in Sri Lanka over the study period from January 1986 to November 2000. Data taken was monthly spot exchange rates for GBP, USD, INR, FRF and DM. ADF, Unit Root Test, Johansen co-integration test, Granger causality test and variance decomposition test were used. The result found weak form efficient and semi-strong inefficient market. Chakrabarti (2005) tested the random walk hypothesis regarding Indian rupees (Rs) over the period from 1997 to 2002. For this Rs to \$ exchange rate was used and ADF test and PP test were applied as statistical tool. The study found that the Indian Rs follow random walk, hence accepted the hypothesis and similar results were found by Nath (2006) over the period March 1993 to May 2004. Chaudhry & Javid (2012) checked market efficiency in India, Pakistan, Bangladesh and Sri Lanka using foreign stock exchange rate over the time frame from 1995 to 2010. Unit root test, co-integration and granger causality tests were used and the result supports weak form efficiency in all 4 forex markets but found against semi strong form efficiency. Mabakeng & Sheefeni (2014) investigated the semi strong efficiency regarding Namibia's forex market. Time period taken was from 1993 to 2011 and the data constitutes monthly spot exchange rate with three countries (UK, US and European). For analysis purpose Johansen co-integration and granger-causality test were applied. The study concluded that market is weak and semi strong efficient during the study period. Firoj & Khanom (2018) investigated the efficiency of forex rate of Bangladesh. Daily bilateral spot exchange rate of 7 currencies used as data over the study period from 2010 to 2017. Unit root test and co-integration test was applied. The results showed that 7 exchange rates support random walk, but found co-integrated. In the study weak form found efficient and semi strong market resulted inefficient. Mukherjee (2018) investigated the efficiency of foreign exchange market (FX) in BRICS countries that are, India, China, Brazil, South Africa, and Russia. Time period for the research was taken from 2004 to 2018 and OLS, VECM, VAR, Johansen co-integration test were used to test the hypotheses (UIP, UFH, REH and EMH). The study concluded that only China market was found efficient and rest of the market found inefficient. Although there have been voluminous studies regarding efficiency of Forex market for countries all around the world, but there is paucity of research on Indian market.

### RESEARCH OBJECTIVES

1. To test the weak form of EMH in Indian Forex market.
2. To analyze semi-strong form of EMH in Indian Forex market.

**METHODOLOGY**

The study period is taken from 1<sup>st</sup> January 2010 to 31<sup>st</sup> December 2020. The data employed in the study consist of daily exchange rate of major currencies i.e., Australian dollar (AUD), Canadian dollar (CAD), US dollar (USD), British Pound (GBP), Euro (EUR), New Zealand dollar (NZD), Japanese yen (JPY), & Swiss Franc (CHF) against Indian Rs. (INR). The data set regarding daily exchange rates are collected from the website [www.investing.co](http://www.investing.co). In order to achieve the objectives econometric tools are used. For testing weak form of EMH, unit root test is used, while for testing semi-strong form, Johansen co-integration test is used. All the tests are applied using "R-Studio" software and the significance level is taken at 5 percent.

**DATA ANALYSIS AND INTERPRETATION**

Unit root test is framed to test the weak form efficiency. These tests are conducted to test whether the series has unit root or not, if it contains unit roots then it is said that it follows random walk. ADF test and PP test of unit root is based on null hypothesis and series have unit root or is non-stationary, while KPSS test has null hypothesis that the data are stationary or it has no unit root. It means the acceptance of null hypothesis of ADF & PP test and rejection of KPSS test indicates that the series or data have unit root, which means series follow random walk, hence one can say that there exists weak form efficiency, as the series follows random walk, so no one can predict future using past or historical data. The outcomes are explained in table 1.

**TABLE 1: ANALYSIS THE OUTCOMES OF UNIT ROOT TESTS**

Variables	ADF test statistics	PP test statistics	KPSS test statistics
CAD	-1.9832 (0.5855)	-8.8006 (0.6189)	6.4915 (0.01)
AUD	-1.4851 (0.7963)	-6.8196 (0.7294)	3.11 (0.01)
CHF	-2.2349 (0.4789)	-15.506 (.2449)	22.342 (0.01)
NZD	-1.4927 (0.7931)	-6.1766 (0.7652)	13.374 (0.01)
USD	-2.7795 (0.2483)	-13.194 (0.3739)	25.891 (0.01)
JPY	-2.2711 (0.4635)	-10.85 (0.5046)	7.1789 (0.01)
GBP	-1.7394 (0.6887)	-7.3235 (0.7013)	10.34 (0.01)
EUR	-2.3298 (0.4387)	-11.675 (0.4586)	15.732 (0.01)

Source: authors' calculation.

Table no. 1 depicts the outcomes of unit root tests for stationary checking at level data. The ADF test results shows that all the variables that is exchange rates (CAD, AUD, CHF, NZD, USD, JPY, GBP, EUR) against INR have insignificant test statistics as the p-values (shown in brackets) are greater than 0.05. This leads to acceptance of null hypothesis that series has unit root or are non-stationary. PP test results are also consistent with the results of ADF test. KPSS test statistics' corresponding p-values are found less than 0.05, hence the null hypothesis for the test (data do not have unit root) is rejected, which highlights all the series have unit root. As presence of unit root indicates that the series follows random walk, which proves no one, either investors or analyzer or experts etc. can use historical data to predict the future data. The result reports that the exchange rates follow random walk and the Indian Forex market on this basis is found weak form efficient.

In order to test semi-strong form popularly known co-integration test is used. The pre-condition for applying co-integration test is that the series must be integrated at same level. So, exchange rate series' first differencing is done and their stationary is again checked, employed unit root tests in Table no. 2.

**TABLE 2: ANALYSIS OF OUTCOME OF UNIT ROOT TESTS AT FIRST DIFFERENCING**

Variables	ADF test statistics	PP test statistics	KPSS test statistics
CAD	-13.742 (0.01)	-3067.9 (0.01)	-0.081578 (0.01)
AUD	-14.331 (0.01)	-3016.4 (0.01)	.12575 (0.1)
CHF	-15.545 (0.01)	-2735.2 (0.01)	0.062592 (0.1)
NZD	-14.096 (0.01)	-2953.7 (0.01)	.12298 (0.1)
USD	-12.407 (0.01)	-2778.9 (0.01)	.084232 (0.1)
JPY	-13.279 (0.01)	-2794.9 (0.01)	.066508 (0.1)
GBP	-13.922 (0.01)	-2960.8 (0.01)	.07627 (0.1)
EUR	-14.068 (0.01)	-2964 (0.01)	.0647 (0.1)

Source: authors' calculation

Table no. 2 confirms the same result as per ADF and PP test. Exchange rates have p-value less than 0.05, which proves that null hypothesis rejected (i.e., data have unit roots or are non-stationary), hence shows the presence of unit root. Also, the results of KPSS test after 1<sup>st</sup> differencing of exchange rate series confirms the presence of unit root. So, after performing first differencing, the series of exchange rates becomes stationary i.e. I(1), so we may now proceed to apply co-integration test.

TABLE 3: ANALYSIS THE RESULT OF JOHANSEN CO-INTEGRATION TEST

Johansen co-integration test using "trace statistics"			Johansen co-integration test using "Eigen Value"		
	Test-statistic	Critical value at 5%		Test-statistic	Critical value at 5%
r <= 7	2.65	9.24	r <= 7	2.65	9.24
r <=6	7.46	19.96	r <=6	4.81	15.67
r <=5	17.48	34.91	r <=5	10.02	22.00
r <=4	30.53	53.12	r <=4	13.05	28.14
r <=3	46.69	76.07	r <=3	16.16	34.40
r <=2	70.89	102.14	r <=2	24.20	40.30
r <=1	105.92	131.70	r <=1	35.03	46.45
r = 0	154.04	165.58	r = 0	48.12	52.00

Source: authors' calculation

Table no. 3 depicts the results of Johansen's co-integration test on 'Trace statistics' and 'Eigen value' are used to analyze. Many co-integration tests are available in order to test co-integration among series, but here we have chosen Johansens' co-integration test, as it is widely used and most appropriate measure to determine whether three or more time series are co-integrated or not. If the series found co-integrated, which witnesses the existence of long run co-movement among the series, which further be used to predict one series with the help of other, and hence violate the EMH. The null hypothesis for Johansen co-integration test is that there is no co-integration among series or variables. Here in our case, the results of both the tests (shown in table no. 3) shows that the test statistic value is less than that of critical value at 5%. Hence the null hypothesis (there is no co-integration among series) in both the case accepted, it means it is not possible to predict one exchange rates from another. Hence the results reported consistent in semi-strong form of efficient market hypothesis in case of Indian Forex market.

## CONCLUSION

The study analyzed the efficiency in Indian Forex market over the period of January 2010 to December 2020. The results reveal that past exchange rate is not applicable for future exchange rates prediction. So, trading rules are not performed to gain abnormal return in Indian Forex market. Further to examine semi-strong form efficiency Johansen's co-integration test using both 'trace value' and 'eigen value' is applied, and the results are consistent with semi strong form efficiency. That means, movement of exchange rates cannot be predicted using other exchange rates. Hence the study concluded that the Indian Forex market based on unit root tests and co-integration test is found efficient during the study period.

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