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REVIEW OF LITERATURE

NEED/IMPORTANCE OF THE STUDY

STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

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CONTRIBUTIONS TO BOOKS

- 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.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

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

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WEBSITES

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

A STUDY ON INDIAN FOREIGN EXCHANGE MARKET EFFICIENCY – APPLICATION OF RANDOM WALK HYPOTHESIS

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ABSTRACT

This main purpose behind this research study is to test for the weak form efficiency of the Indian foreign exchange market and for this purpose daily exchange rate of four nominal exchange rates which are US Dollar, Japanese Yen, Euro, and Pound Sterling from April 2004 to December 2011 are analyzed using unit root tests i.e., Augmented Dickey Fuller Test and Phillip Perron test. As per the results all the exchange rate currencies such as US dollar, Japanese Yen, Euro, and Pound Sterling are found to be stationary in 1st difference. This implies that all exchange rate currencies support the hypothesis of weak form inefficiency and information of any nature that can have an impact on the market will take more time to reflect or create an impact on the prices or rates existing in the market. So this time gap and the constant movement of change between the data points can be used to create a pattern of movement before the markets could adjust to new information, and this constant rate of change can be used by investors to predict future exchange rates of respective currencies with the use of past data and thus leading to super normal profits.

KEYWORDS

Efficient market hypothesis, foreign exchange market, random walk hypothesis, India.

INTRODUCTION

Information has always been a source for change and improvisation throughout all activities of human life, and as such information pays a very important role in the change that occurs throughout the world markets. World markets evolved and connected itself overtime due to globalization undertaken by all nations to expand their horizons of operation. Therefore any information in the world can lead to a chain of reactions minor or major throughout the world markets, i.e., information triggers a change in the demand and supply of assets and instruments existing in the market thereby creating volatility and fluctuation which is a resultant effect of the overreactions or under reactions of the investors or traders based on such information. So information should reflect all aspects of change that occur in the market and it should adjust itself to the changing past, present and future circumstances. Any sort of information can create certain expectations and reactions which will be speculated on, some may be over reactions and others under reactions. These expectations and reactions are a continuous chain of events and also form information for every other change. And hence if this information does not adapt itself to the changes in the corresponding factors, then this would lead to the improper functioning of the world markets, which is nothing but exploitation of markets based on patterns of information which can result in abnormal profitability of few investors or traders. So the information as it occurs should change and adapt itself such that it can sustain the operations of the world markets and hence prevent predictability. This adaptation and change of the information to the various occurrences in the world markets is referred to as the efficient market hypothesis.

The concept of efficient market hypothesis (EMH) was developed by Prof. Eugene Fama at the university of Chicago booth school of business as part of his Ph.D. thesis work. Now according to this concept the financial markets are "informationally efficient". In an informationally efficient market, price changes must be unforecastable if they are properly anticipated, that is, if they fully incorporate the information and expectations of all market participants therefore, one will not be in a position to consistently achieve returns in excess of average market returns on a risk-adjusted basis, given the information available at the time the investment is made.

The concept of efficient market hypothesis is associated with the idea of random walk which implies that if the flow of information is uninterrupted and information is immediately reflected in stock prices, then tomorrow's price change will reflect only tomorrows news and will be independent of the price changes today. But the news is unpredictable and random and thus the resulting changes in prices must also be unpredictable and random. As a result, the prices will fully reflect all known information.

The efficient market hypothesis also states that when faced with new information, some investors may overreact and some may under-react. All that is required by the efficient market hypothesis is that investors' reactions be random and follow a normal distribution pattern so that the net effect on market prices cannot be reliably exploited to make an abnormal profit, especially when considering transaction costs (including commissions and spreads). Thus, any one person can be wrong about the market and indeed, everyone can be. But the market as a whole is always right. There are three common forms in which the efficient-market hypothesis is commonly stated; again this classification is based on the different forms of information that is available to the participants and how efficient is the market in using this information to reflect random change. Therefore the classifications are weak-form efficiency, semi-strong-form efficiency and strong-form efficiency, each of which has different implications for how markets work.

In weak-form efficiency, future prices cannot be predicted by analyzing prices from the past. Excess returns cannot be earned in the long run by using investment strategies based on historical share prices or other historical data. But there have been researches that claim to have found patterns, but this does not mean the markets are inefficient. Over a period of time any movement of rates or prices can shows possible patterns, but once discovered they seem not to exist anymore since everyone tries to capitalise on the opportunity and the market will adjust itself to phase out such a pattern with the available information

In semi-strong-form efficiency, it is implied that share prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no excess returns can be earned by trading on that information. Semi-strong-form efficiency implies that neither fundamental analysis nor technical analysis techniques will be able to reliably produce excess returns. And if semi strong form exists it implies that weak form efficiency also exists. But if weak form exists it does not mean semi strong form efficiency exists.

In strong-form efficiency, share prices reflect all information, public and private, and no one can earn excess returns. If there are legal barriers to private information becoming public, as with insider trading laws, strong-form efficiency is impossible, except in the case where the laws are universally ignored. This is one area that is not yet researched mainly due to the non availability of reliable and significant data. And if strong form exists, semi-strong form also exists. But if semi-strong form exists it does not mean strong form exists. And thus the concept of efficiency will vary according to how these three forms of information are incorporated into the prices or rates that prevail in the market

RANDOM WALK HYPOTHESIS

The concept of random walk does not imply price change "randomly," but what it implies as per the efficient market hypothesis is that, price changes due to a lot of factors such as prospect change of companies or a general economic change and investor perception change because of these characteristics and prospect changes. In other words what it implies is that an investors knowledge evolves with the continuous supply of new information and with revisions of old information. So this means that at any given moment in time the next period price change is random with respect to the state of knowledge at this moment.

Moreover the hypothesis of efficiency asserts that the current price fully reflects the present state of knowledge in the sense that it is equal to the discounted mean value of the distribution of the next period's price as given by the present state of knowledge.

Therefore under the efficient market hypothesis all the information available at any given moment is discounted into the current market price. The market price at any moment is an unbiased estimate of the next period price. In an efficient market no investor can expect consistently to obtain information not already discounted into the market price by actions of other investors. Consequently no investor can consistently achieve abnormal returns, which are returns in excess of that paid for risk taking.

REVIEW OF LITERATURE

Kamaiah (2011) has tried to study the weak form efficiency of Indian foreign exchange market. Parametric as well as non parametric tests have been used to analyse the data. And form the results it can be concluded that, randomness exists in GBP, CHF, AUD, NZD and JPY in Indian market, while USD and HKD rejects Random Walk, suggesting predictability for these two currencies with respect to INR.

Kumar (2011) attempted to examine the weak form of market efficiency in the Indian foreign exchange market using a family of variance ratio tests. Monthly Nominal Effective Exchange Rate (NEER) data from April 1993-June 2010 were used for the analysis. NEER series was considered for the analysis as it is supposed to capture more information compared to the bilateral exchange rates. Three individual variance ratio tests as well as three joint variance ratio tests were used for the purpose of analysis. After analyzing the results from both individual and joint variance ratio test, it was concluded that Indian foreign exchange market does not exhibit weak form of market efficiency.

Ibrahim, Long, Ghani, and Mohd Salleh (2011) have tried to study the weak-form efficiency of the foreign exchange market in thirty, Organizations for Economic Cooperation and Development (OECD) countries. And from the results they were able to conclude that the current value of the exchange rate cannot be predicted using its past values. In addition, the OECD foreign exchange market is consistent with the weak-form of the Efficient Market Hypothesis.

Li, Bihong, and Jing (2010) tried to study china's foreign exchange market efficiency by using U.S. dollars, Japanese yen and Hong Kong dollars from 1997 to 2007 daily quote data. The result showed that China's foreign exchange market has not reached the validity of the weak form. And as such the empirical results show that, China's foreign exchange market does not satisfy weak-form efficient, and it is also in the developmental stages of market inefficiencies.

Noman, and Ahmed (2008) tried to examines the weak form efficiency of the foreign exchange markets in seven SAARC countries, which are India, Pakistan, Bangladesh, Sri- Lanka, Nepal, Bhutan, Maldives, using monthly return series for each of these markets over a period of 21 years (1985 – 2005). Unit root tests and variance ratio tests (individual and multiple) were applied to see whether the return series (and also, the raw data) follow random walk process. The results arrived at suggest that the increments of the return series are not serially correlated. Therefore, it is possible to conclude that foreign exchange markets in SAARC countries are weak form efficient.

Kühl (2007) investigated the market efficiency of the foreign exchange market since the introduction of Euro against seven most important exchange rates, The author takes into consideration an argument provided by Granger (1986) as a Base, which states that, a market is not efficient if co integration between pairs of exchange rates can be considered, because the observation of co integration means the predictability of atleast one exchange rate. From the analysis he was able to conclude that, the foreign exchange market is broadly consistent with market efficiency as per Granger (1986). As a result it was considered that the introduction of Euro has not resulted in an inefficient market.

Belkacem, Meddeb, and Boubaker (2005) have tried to investigate the weak efficiency hypothesis in the case of the Tunisian exchange market. Fractional co-integration tests based essentially on estimation of an error correction bi-variate ARFIMA model has been used. And from the results they have been able to conclude that there exists evidence of fractional co-integration between the one-month forward rate and the spot rate relative to these parities (TND/USD) and (TND/Euro). And therefore the Tunisian forward exchange market is efficient

Wickremasinghe (2004) has questioned the weak and semi-strong form efficiency of the foreign exchange market in Sri Lanka during the recent float using six bilateral exchange rates. The results of this study indicate that the exchange rates follow a random walk and the Sri Lankan market is weak form efficient. But the results of co-integration tests, error-correction model estimates, and variance decomposition analysis indicate that the movement in one or more of the currencies can be predicted using the other exchange rates. These results are inconsistent with the efficient market hypothesis in its semi-strong form.

Jeon, and Seo (2003) have tried to investigate whether the Asian financial crisis in the second half of 1997 affected the foreign exchange market efficiency in four Asian countries hit hard by the crisis, which are Thailand, Indonesia, Malaysia and Korea. From the results arrived at they were able to conclude that within country market efficiency also appears to have become weaker immediately after the crisis than before the crisis, but market efficiency was recovered quickly, evidenced by the regained co-integrating relationship for the pairs of the spot-forward exchange rates in the Asian countries. The findings of the threshold effects in the forward market equation and asymmetrical responses of the spot rate to the forward spread imply that there has been a strong force of recovering new equilibrium exchange rate levels in the Asian foreign exchange markets once the rates have been disturbed, especially when their currencies are significantly undervalued compared to the rationally expected level of exchange rates.

Balaban and Kunter, (1997) tried to study semi strong form efficiency in the stock market, the foreign exchange market and inter- bank money market in Turkey. The results suggest significant deviations from the efficient market hypothesis with respect to changes in market liquidity in all these markets for the period of January 1989 to July 1995. The empirical results further go on to convey that Turkish financial markets are not informationally efficient with respect to daily changes in market liquidity. Hence proving it as semi strong form inefficient.

Burt, Kaen and Booth, (1979) tried to investigate the price changes of the Canadian dollar, German mark, and British pound to determine whether the efficient market hypothesis is applicable for these currencies. The hypothesis was tested using weak form. And from the analysis it can be concluded that the efficient market hypothesis can be accepted for the mark and the pound but it is rejected for the Canadian dollar. And this inefficiency of the Canadian dollar could be because it tends to under respond to new information.

STATEMENT OF THE PROBLEM

The theory of Efficient Market Hypothesis came about as an extension of the random walk model, which has been tested to a vast extent in the stock markets of world economies. Most of the earlier studies were directed towards developed economies and in the recent years of financial crisis the concept of efficient market has been contended to know the validity of its existence in the market.

This particular theory has its origins from the stock market and in the recent years there has been a slow and steady growth in the research towards extending this theory to other forms of markets. And once again the majority of research in terms of foreign exchange markets are directed towards developed economies and as such research of this concept in the Indian context is of recent origin with very few literatures in this front. And hence a study is undertaken to test the theory of random walk of efficient market as given by Fama (1965) on the foreign exchange market of India.

NEED OF THE STUDY

This particular research study is mainly directed towards testing the random walk hypothesis of stock market with respect to the foreign exchange market in the Indian context. So though the evolution of efficient market hypothesis with reference to stock market has taken place over a period of time with many theoretical and conceptual advancement, all such factors are not taken into consideration. In the Indian context a study pertaining to the foreign exchange market is still in its developing stages with very few researches in this front. And hence it opens a wide area for research and development with respect to these aspects.

OBJECTIVE OF THE STUDY

1. To examine the random walk process of the foreign exchange rate series of India to analyse weak form efficiency.

HYPOTHESIS

1. a) Ho – Dollar rate series follow random walk process
2. a) Ho – Euro rate series follow random walk process
3. a) Ho –Japanese Yen series follow random walk process
4. a) Ho – Pound Sterling series follow random walk process

RESEARCH METHODOLOGY

Data source: The data for the study comprises of secondary data that is daily data of foreign exchange rates of Euro, pound sterling, Japanese yen, US dollar taken from past 7 years i.e., 2004-2011 and it is collected from RBI. The purpose behind the kind of data that is used is to test for stationarity and non-stationarity and for better results of the occurrence of these factors smaller time horizons must be undertaken. Hence daily data has been used for this study. Apart from that, the concept of 7 years has been used due to the data availability of foreign exchange rates and it is as per the available published data by the RBI.

ECONOMETRIC TECHNIQUE

The usage of unit root test is substantiated by the fact that if the variables are non stationary the regression model will be spurious or meaningless. If the variables don't have unit root problem or it is stationary then the explanatory power of independent variable on dependant variables can be found by using ordinary least squares. But this final process is not applied in this study since the main objective of the study is to investigate random walk process of each exchange rate series. For this purpose two techniques of unit root is used i.e., the Augmented Dickey Fuller Test and the Philip Perron test. Now both these test are conducted in level series and 1st difference in three forms, which is unit root with Drift, unit root with drift and trend, unit root without drift and trend. The results of the study will be obtained with the use of E- Views Software.

UNIT ROOT TEST

A. AUGMENTED DICKEY FULLER TEST

If ut which is the error term is correlated then Dickey and Fuller have developed a test, known as the augmented Dickey–Fuller (ADF) test. This test is conducted by "augmenting" the preceding three equations by adding the lagged values of the dependent variable. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The augmented Dickey–Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence.

The testing procedure for the ADF test is the same as for the Dickey–Fuller test but it is applied to the model

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t,$$

Where α is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process. Imposing the constraints $\alpha = 0$ and $\beta = 0$ corresponds to modelling a random walk and using the constraint $\beta = 0$ corresponds to modelling a random walk with a drift.

Consequently, there are three main versions of the test,

1. Test for a unit root:

$$\nabla y_t = \delta y_{t-1} + u_t$$

2. Test for a unit root with drift:

$$\nabla y_t = a_0 + \delta y_{t-1} + u_t$$

3. Test for a unit root with drift and deterministic time trend:

$$\nabla y_t = a_0 + a_1 t + \delta y_{t-1} + u_t$$

Each version of the test has its own critical value which depends on the size of the sample. In each case, the null hypothesis is that there is a unit root, δ = 0. The tests have low statistical power in that they often cannot distinguish between true unit-root processes (δ = 0) and near unit-root processes (δ is close to zero). This is called the "near observation equivalence" problem.

The intuition behind the test is as follows. If the series y is stationary (or trend stationary), then it has a tendency to return to a constant (or deterministically trending) mean. Therefore large values will tend to be followed by smaller values (negative changes), and small values by larger values (positive changes). Accordingly, the level of the series will be a significant predictor of next period's change, and will have a negative coefficient. If, on the other hand, the series is integrated, then positive changes and negative changes will occur with probabilities that do not depend on the current level of the series; in a random walk, where you are now does not affect which way you will go next.

By including lags of the order p the ADF formulation allows for higher-order autoregressive processes. This means that the lag length p has to be determined when applying the test. One possible approach is to test down from high orders and examine the t-values on coefficients. An alternative approach is to examine information criteria such as the Akaike information criterion, Bayesian information criterion or the Hannan-Quinn information criterion.

The unit root test is then carried out under the null hypothesis $\gamma = 0$ against the alternative hypothesis of $\gamma < 0$.

$$DF_\tau = \frac{\hat{\gamma}}{SE(\hat{\gamma})}$$

Once a value for the test statistic is computed it can be compared to the relevant critical value for the Dickey–Fuller Test. If the test statistic is less (this test is non symmetrical so we do not consider an absolute value) than (a larger negative) the critical value, then the null hypothesis of $\gamma = 0$ is rejected and no unit root is present.

PHILLIPS-PERRON (PP)

The Dickey–Fuller test involves fitting the regression model

Δyt = ρyt−1 + (constant, time trend) + ut ..... (1)

by ordinary least squares (OLS), but serial correlation will present a problem. To account for this, the augmented Dickey–Fuller test's regression includes lags of the first differences of yt. The Phillips– Perron test involves fitting (1), and the results are used to calculate the test statistics. They estimate not (1) but:

yt = πyt−1 + (constant, time trend) + ut .....(2)

In (1) ut is I(0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors ut non-parametrically by modifying the Dickey Fuller test statistics.

Phillips and Perron's test statistics can be viewed as Dickey–Fuller statistics that have been made robust to serial correlation by using the Newey–West (1987) heteroskedasticity- and autocorrelation-consistent covariance matrix estimator.

Under the null hypothesis that ρ = 0, the PP Zt and Zπ statistics have the same asymptotic distributions as the ADF t-statistic and normalized bias statistics. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term ut. Another advantage is that the user does not have to specify a lag length for the test regression.

The Dickey Fuller test produces two test statistics. The normalized bias T (π− 1) has a well defined limiting distribution that does not depend on nuisance parameters it can also be used as a test statistic for the null hypothesis H0 : π = 1. This is the second test from DF and relates to Zπ in Phillips and Perron. This

perspective helps us understand that the PP test corrects the DF one for autocrrelation amongst error terms non-parametrically (i.e. outside of a regression framework). The critical values have the same distribution as the Dickey–Fuller statistic.

DATA ANALYSIS

TABLE 1.1 - SHOWING RESULTS OF AUGMENTED DICKEY FULLER TEST IN LEVEL SERIES

	Dollar[1]	EURO[2]	JAPANESE YEN[3]	POUND[4]
Test statistics	-0.507035[a]	-1.734237[a]	0.301569a	-2.115857a
	-0.929992[b]	-2.576094[b]	-1.534798b	-2.428040b
	0.961913[c]	0.890773[c]	1.301380c	0.014017c
Probability	0.8874[a]	0.4138[a]	0.9784a	0.2385a
	0.9510[b]	0.2915[b]	0.8175b	0.3647b
	0.9113[c]	0.9004[c]	0.9516c	0.6871c
Critical values	**1%**	**5%**	**10%**	
	-3.433628[a1]	-2.862874[a1]	-2.567527[a1]	
	-3.962931[b1]	-3.412200[b1]	-3.128025[b1]	
	-2.566193[c1]	-1.940992[c1]	-1.616586[c1]	
	-3.433631[a2]	-2.862876[a2]	-2.567528[a2]	
	-3.962936[b2]	-3.412203[b2]	-3.128027[b2]	
	-2.566194[c2]	-1.940992[c2]	-1.616586[c2]	
	-3.433628[a3]	-2.862874[a3]	-2.567527[a3]	
	-3.962931[b3]	-3.412200[b3]	-3.128025[b3]	
	-2.566193[c3]	-1.940992[c3]	-1.616586[c3]	
	-3.433628[a4]	-2.862874[a4]	-2.567527[a4]	
	-3.962931[b4]	-3.412200[b4]	-3.128025[b4]	
	-2.566193[c4]	-1.940992[c4]	-1.616586[c4]	

*MacKinnon (1996) one-sided p-values

TABLE 1.2 - SHOWING RESULTS OF AUGMENTED DICKEY FULLER TEST IN FIRST DIFFERENCE

	Dollar1	EURO2	JAPANESE YEN3	POUND4
Test statistics	-42.81750[a1]	-37.73718[a2]	-44.77711[a3]	-33.12931[a4]
	-42.83928[b1]	-37.72706[b2]	-44.83524[b3]	-33.12395[b4]
	-42.80720[c1]	-37.72729[c2]	-44.74692[c3]	-33.13788[c4]
Probability	0.0000[a1]	0.0000[a2]	0.0001[a3]	0.0000[a4]
	0.0000[b1]	0.0000[b2]	0.0000[b3]	0.0000[b4]
	0.0001[c1]	0.0000[c2]	0.0001[c3]	0.0000[c4]
Critical values	1%	5%	10%	
	-3.433629[a1]	-2.862875[a1]	-2.567527[a1]	
	-3.962933[b1]	-3.412202[b1]	-3.128026[b1]	
	-2.566193[c1]	-1.940992[c1]	-1.616586[c1]	
	-3.433631[a2]	-2.862876[a2]	-2.567528[a2]	
	-3.962936[b2]	-3.412203[b2]	-3.128027[b2]	
	-2.566194[c2]	-1.940992[c2]	-1.616586[c2]	
	-3.433629[a3]	-2.862875[a3]	-2.567527[a3]	
	-3.962933[b3]	-3.412202[b3]	-3.128026[b3]	
	-2.566193[c3]	-1.940992[c3]	-1.616586[c3]	
	-3.433631[a4]	-2.862876[a4]	-2.567528[a4]	
	-3.962936[b4]	-3.412203[b4]	-3.128027[b4]	
	-2.566193[c4]	-1.940992[c4]	-1.616586[c4]	

*MacKinnon (1996) one-sided p-values
[a]- intercept ,[b]- intercept and trend, [c]- none
[1]-DOLLAR ,[2]-EURO ,[3]-JAPANESE YEN ,[4]-POUND

TABLE 1.3: SHOWING RESULTS OF PHILIP PERRON TEST IN LEVEL SERIES

	Dollar1	EURO2	JAPANESE YEN3	POUND4
Test statistics	-0.663529a1	-1.680694a2	0.528698a3	-2.064047a4
	-1.069355b1	-2.758262b2	-1.381225b3	-2.378844b4
	0.909765c1	0.838851c2	1.432842c3	0.016815c4
Probability	0.8537a1	0.4410a2	0.9877a3	0.2596a4
	0.9323b1	0.2132b2	0.8663b3	0.3906b4b4
	0.9034c1	0.8919c2	0.9627c3	0.6880c4
Critical values	1%	5%	10%	
	-3.433628a1	-2.862874a1	-2.567527a1	
	-3.962931b1	-3.412200b1	-3.128025b1	
	-2.566193c1	-1.940992c1	-1.616586c1	
	-3.433628a2	-2.862874a2	-2.567527a2	
	-3.962931b2	-3.412200b2	-3.128025b2	
	-2.566193c2	-1.940992c2	-1.616586c2	
	-3.433628a3	-2.862874a3	-2.567527a3	
	-3.962931b3	-3.412200b3	-3.128025b3	
	-2.566193c3	-1.940992c3	-1.616586c3	
	-3.433628a4	-2.862874a4	-2.567527a4	
	-3.962931b4	-3.412200b4	-3.128025b4	
	-2.566193c4	-1.940992c4	-1.616586c4	

TABLE 1.4: SHOWING RESULTS OF PHILIP PERRON TEST IN FIRST DIFFERENCE

	Dollar1	EURO2	JAPANESE YEN3	POUND4
Test statistics	-42.87752a1	-60.13313a2	-44.95423a3	-42.57215a4
	-42.88524b1	-60.11606b2	-45.11190b3	-42.56317b4
	-42.87176c1	-60.06895c2	-44.87338c3	-42.58383c4
Probability	0.0000a1	0.0001a2	0.0001a3	0.0000a4
	0.0000b1	0.0000b2	0.0000b3	0.0000b4
	0.0001c1	0.0001c2	0.0001c3	0.0001c4
Critical values	1%	5%	10%	
	-3.433629a1	-2.862875a1	-2.567527a1	
	-3.962933b1	-3.412202b1	-3.128026b1	
	-2.566193c1	-1.940992c1	-1.616586c1	
	-3.433629a2	-2.862875a2	-2.567527a2	
	-3.962933b2	-3.412202b2	-3.128026b2	
	-2.566193c2	-1.940992c2	-1.616586c2	
	-3.433629a3	-2.862875a3	-2.567527a3	
	-3.962933b3	-3.412202b3	-3.128026b3	
	-2.566193c3	-1.940992c3	-1.616586c3	
	-3.433629a4	-2.862875a4	-2.567527a4	
	-3.962933b4	-3.412202b4	-3.128026b4	
	-2.566193c4	-1.940992c4	-1.616586c4	

[a]- intercept ,[b]- intercept and trend, [c]- none
[1]-DOLLAR ,[2]-EURO ,[3]-JAPANESE YEN ,[4]-POUND

FINDINGS AND CONCLUSION

In this paper the main focus has been to test the weak form efficiency of the Efficient Market Hypothesis concept on the foreign exchange market of India. For this purpose daily data from 2004- 2011 was taken and analyzed with the use of unit root test (Augmented Dickey Fuller and Philips Perron). As per the results all the exchange rate currencies such as US dollar, Japanese Yen, Euro, and Pound Sterling are found to be Non-stationary in their levels and after 1st differencing, become stationary. And this implies that all exchange rate currencies support the hypothesis of weak form inefficiency. Now this means that the information of any nature that can have a impact on the market takes more time to reflect or create an impact on the prices or rates existing in the market, so this time gap and the constant movement of change between the data points can be used to create a pattern of movement or before the market could adjust, investors by assuming the future change will also be constant as it has been in the past can take advantage of the available information and therefore it becomes easy for the investors to forecast or predict the future exchange rates of respective currencies with the use of past data and thereby leading to super normal profits.

SCOPE FOR FURTHER RESEARCH

The concept of efficient market hypothesis as given by Eugene Fama (1965) has grown and evolved to accommodate the various anomalies that were spotted in the initial theory. From the year of 1965 this particular concept has been tested in many of the developed economies and also with respect to the different methodologies to identify inefficiency. Now this concept has slowly and steadily grabbed the attention of the developing economies to test their market efficiency and since this theory has evolved over a period of time it's just a matter of application. But this is completely possible in the stock market front but in terms of foreign exchange market it's still an evolving concept and hence the scope of future research could be to check for covered interest parity, uncovered interest parity and risk premia effects on market efficiency of India. Studies can also be directed towards finding various anomalies such as interest rate differentials and its effect on market efficiency of Indian foreign exchange market.

REFERENCES

1. Balaban, E. and Kunter, (1997) A note on the efficiency of financial markets in a developing country.*Applied economics letters*, 4 p.109- 112.
2. Belkacem, L. et al. (2005) Foreign exchange market efficiency: fractional cointegration approach .*International Journal of Business*, 10 (3).
3. Burt, J. et al. (1979) Foreign exchange market efficiency under flexible exchange rates: Reply. *The Journal of Finance*, 34 (3), p.791-793.
4. Ibrahim, J. et al. (2011) Weak-form efficiency of foreign exchange market in the organisation for economic cooperation and development countries: Unit root test. *International Journal of Business and Management*, 6 (6).
5. Jeon, B. and Seo, B. (2003) The Impact of the Asian Financial Crisis on Foreign Exchange Market Efficiency: The case of east asian countries. *Pacific Basin Finance Journal*, 11 p.509- 525.
6. Kamaiah, B. (2011) Is there a random walk in indian foreign exchange market? . *International Journal of Economics and Finance*, 3 (6), p.157- 165.
7. Kühl, M. (2007) Co integration in the Foreign Exchange Market and Market Efficiency Since the Introduction of the Euro: Evidence based on Bi- variate Co-integration analysis. *Centre for European Governance and Economic Development Research*.
8. Kumar, A. (2011) Testing for weak form of market efficiency in Indian foreign exchange market . *Selected works* . Li, L. et al. (2010) An Empirical study of the Weak Efficiency of China's Foreign Exchange Market. International Conference on E- Business and E- Government.
9. Li, L. et al. (2010) An Empirical study of the Weak Efficiency of China's ForeignExchangeMarket.*International Conference on E- Business and E- Government*.
10. Noman, A. and Ahmed, M. (2008) Efficiency of the foreign exchange markets in south Asian countries .*American International University-Bangladesh*.
11. Wickremasinghe, G. (2004) Efficiency of foreign exchange markets: A developing country perspective .*Monash University*.

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