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The Efficiency of Exchange Rate Market: A Case Study on Pakistan

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Abstract: This study investigates the efficiency of foreign exchange market in Pakistan. Based on monthly data during the period of July 2000 to October 2012 for 13 currencies against the Pak Rupee, three techniques of regression analysis are applied. The result of regression on trended data portrayed that unbiased hypothesis does not hold in the exchange rate market owing to serial correlation and non-stationary time-series data. The regression analysis with de-trended data remarked exchange rate market of Pakistan is neither efficient nor speculative. The findings of regression analysis with orthogonality experiment explored incidence of bandwagon behavior in selected currencies. The results of this study suggested that concerned authorities should reinforce information dissemination procedure and regulate unofficial currency markets activities for maintaining the efficiency of foreign exchange market in Pakistan.

Keywords: Pakistan Exchange Rate Market, Market Efficiency, Fama Regression Analysis

1. Introduction

The efficiency of foreign exchange market entails market participants produce a bunch of exchange rates using all available information. This implies that the suitable value of exchange rate does not postulate any possibility to anomalous profit options. It means speculators or arbitrageurs who predict exchange rate on the basis of public information cannot produce super normal profits.

Pakistan followed numerous exchange rate regimes. Prior to 1971, Pak Rupee was allied with the Pound Sterling. However, in 1971 government proposed to ally the Rupee with US Dollar. Due to acute budget deficit as a result sudden drop in foreign remittances via legal ways which triggered large variances in Rupee per Dollar in 1981, Pakistan adopted managed floating exchange rate for lessening the disparity in official and black market rates. After nuclear test in 1998, Pakistan has been alleged by various international sanctions which caused devastating impact in foreign exchange flow in the country. Therefore, in order to manage such problems state bank of Pakistan followed three diverse rates consisting on; official rate in which Rupee was allied with Dollar at fix value, Floating Inter Bank Rate (FIBR) wherein commercial banks were permitted for quoting their rates, besides Composite rate following combination of official rate and floating interbank rates. However, that bunch of exchange rate regimes was abolished in 2000 after the introduction of floating exchange rate mechanism.

Exchange rate market in Pakistan has slightly increased in size especially the number of transactions has noticeably grown. Being an emerging economy, the foreign exchange volume of Pakistan is comparatively smaller than the rest of the world. However, with the increase in GDP size the volume of foreign exchange market is also growing. However, the evidence shows that the exchange rate market of Pakistan is still inefficient. Risk premium caused by the presence of KERB [1] markets on one hand and frequently changing information due to political uncertainty have some inferences for the effectiveness of foreign exchange market. Indeed, the market uphold profitable opportunities as exchange rate market of Pakistan is dominated by US Dollar which generates cross real exchange rate influence on almost every currency exchange. Similarly, deficiency of instruments for market to hedge against risk exposure and mostly overestimated spot rates also supports the profitable

[1] A Kerb market is one where trading takes place outside official market hours. The expression comes from the practice in years gone by of trading on the Kerb in the street.

options. Despite their consequence on exchange rate market, major macro-economic variables other than inflation and interest rates, are not imperative to the arbitrageurs in constructing exchange rate expectations.

The average daily volume of foreign exchange turnover is observed around $300 million. The figure pertain the official channel (interbank market) and non-official channel (KERB market). It sometime overshadows activities of authorized market by crafting problems for its main supervisory body State Bank of Pakistan. While the data of transactions in the KERB markets is officially unavailable, however, unofficial sources estimate of average daily turnover of foreign exchange inflows. This is a major problem which financial market may face while examining efficient market hypothesis. Central bank of Pakistan is trying to streamline this anomaly through formation of new exchange rate companies and by purchasing foreign exchange from KERB markets however still not succeeded in getting full control over this segment. Albeit, KERB market play significant role in shift of market flows and developing market attitude if government and state bank policies revise the demand and supply position of foreign currencies with respect to Pak Rupee.

Moreover, most of the times calculated spot rates are overstated. Certainly, the forward rate seems to contain risk premium however the sign of this premium move backward and forward most of the time. Consequently all these issues cause a wide impact while examining foreign exchange market efficiency. In this study we ask these questions; whether (i) currency's spot exchange rate reacts by way of a random walk, (ii) forward exchange rate become a neutral predictors of future spot rate for a selected currency, and (iii) incidence of bandwagon effect existing in the exchange rate market.

The organization of the paper follows a frame of presentation wherein section two contained review of literature. Section three presented the data requirements for testing coupled with methodology and model formulation. Results from the empirical study are estimated and discussed in section four. In the end, conclusions and policy recommendations followed in the section five.

2. Review of Literature

A lot of literature is available on the investigation of exchange rate market efficiency and the results of these studies are mixed. The pioneer study was conducted by Fama (1965) on the topic and found that if the market is efficient then a lot of exchange rates based on all available information bearing on the suitable value of exchange rate. He further identified that effectual markets never left vacant any possibility of earning huge returns. This is the most debatable matter of discussion in the exchange rate markets specifically. In latter study Fama (1984) further scanned the rationality of forward markets and deduced that both of these elements differ over time. In addition to that these fluctuations crop up due to inconsistency in the market premium, and projected the inverse relationship of future spot value and premium with the forward rate.

Levich (1979) performed an experiment on 20 values of floating rates and observed that exchange rate market is volatile therefore opportunities of huge gains are high. He concluded that markets generally attempt to follow all existing information although it did not reflect complete set of information in order to best forecast. In the earlier days many researchers have employed simple regression technique for testing the efficient market hypothesis during the decades of 1970s and the initial of 1980s which mainly includes Cornell (1977), Frankel (1981), and Bilson (1981).

Meng and Ahmad (2012) investigated the efficiency of Asia Pacific foreign currency markets. They employed Johansen co-integration technique and Fama's regression analysis. They found co-integration between forward and spot exchange rates. Based on bivariate co-integration they further determined that market is efficient across the countries. However, they applied multivariate technique they found market is inefficient.

The idea that speculation is stabilizing relates to the inference of Friedman (1953), whereas McKinnon (1976) uncovered insufficient inferences due to excessive unsteadiness in exchange rates. Cheung *et al* (2001) focused the variability, speculation and stability in the US foreign exchange market. The results indicated that speculations not only significantly amplify the instability but also impetus exchange rates to their primary values besides soaring up market liquidity and efficacy.

Timmermann and Granger (2004) expressed that hypothesis for market efficiency upsurge the prediction experiments from the specified set of information while investigating the best forecast. They pointed out that the existence of non-stationery behavior due to gainful chances in the financial market. In their recent study, Guerrien and Gun (2011), described that market efficiency hypothesis is universal and argued that it has not been explained by Fama in his publication produced in 1970 therefore that issue caused many ambiguities regarding its definition.

Bilson (1981) is applied rational expectation theory in the form of speculation efficiency theory and found that market is efficiently speculative when forward rates are equivalent to the projected spot money values if flows of reserves were perfectly elastic. Hartley (1983) examined the hypothesis that expectations of exchange rate movements are formed rationally. Stefano *et al* (1993) observed that forward discount instability is caused by the disparity in risk premium and found market contestants irrational in Asian currencies. In context of Pakistan Bhatti (1997), performed co-integration and coefficient restriction test and analyzing whether expectations contributed to determine the currency rates, and supported that viewpoint while assuming efficient markets having future expectations. The results also favored purchasing power parity inferring that currency rates pursued random walk.

In south Asian region Wickremasinghe (2004), examined weak and semi strong form efficiencies of exchange market in Sri Lanka. Used unit root tests for weak efficiency form

and Granger causality tests and variance decomposition for semi strong efficiency his findings did not support for semi strong efficiency in Sri Lankan foreign exchange market. In later study Wickremasinghe (2008) he found more clear evidence of weak forms of efficiency for the foreign exchange market by using autocorrelation, Box-Pierce Q-Statistic familiar as Ljung-Box (LB) statistic.

Sasikumar (2011) examined the weak efficiency test in Indian foreign exchange market by applying variance ratio tests. Few analyses have been also conducted to explore the weak degree of efficiency of Pakistan foreign exchange market. Ahmed *et al* (2008) applied various unit root tests and variance ratio test for testing the weak form efficiency of SAARC countries exchange rate markets and found evidence of weak form of efficiency. Similarly, Chaudhry *et al* (2012) have examined weak-form efficiency using unit root tests and reported weak efficiency in South Asian foreign exchange markets. In the same experiment they examined semi-strong form using co-integration and Granger causality tests however results provided evidence against semi strong form of efficiency.

3. Data and Methodology of the Study

3.1. Data

The data used in this study is monthly covered from July 2000 to October 2012 for 13 currencies against the Pak Rupee. Those countries' currencies are selected whose are major export partners, major import partners or total trade partners to Pakistan. The data for spot and forward exchange rate is consist on monthly averages [2] comprising the currencies- the Bangladeshi Taka (BDT), Chinese Yuan (CNY), European Common Currency (EURO), German Mark (DKK), Hong Kong Dollar (HKD), Indian Rupee (INR), Japanese Yen (JPY), Kuwaiti Dinar (KWD), Malaysian Ringgit (MYR), Saudi Arabian Riyal (SAR), UAE Dirham (AED), British Pound (GBP) and US Dollar (USD) against the Pak Rupee (PKR). The data set was obtained from the official website of State Bank of Pakistan (www.sbp.org.pk), apart from Bangladeshi and Chinese forward exchange rates against Pak Rupee were calculated through covered interest rate parity (CIP) condition[3] due to non-availability of information.

3.2. Methodology

This study is conducted the relationship between spot and forward exchange rates in selected currencies. This has observed that the economists are exercising regression methodology. In this regard, the researchers assumed that the financiers are risk neutral and therefore relates the expected value of future spot rate to the forward currency rate. This relation expressed in terms of equation which is given following;

$$E(S_{t+1}) = f_{t,1} \tag{1}$$

Where $f_{t,1}$,is the log of forward exchange rate at time *t*, and $E(S_{t+1})$ is the log of expected value of spot exchange rate in one lead period of time. After the application of rational expectations for the forecast of future exchange rates, the equation (1) become as;

$$S_{t+1} = E(S_{t+1}) + u_{t+1} \tag{2}$$

Where S_{t+1} is the log of spot exchange rate with one lead period of time, expressing local money value per unit of foreign exchange, and u_{t+1}described the residual error term with normal distribution. By substituting the expected value of future spot exchange rate in equation (2), then;

$$S_{t+1} = f_{t,1} + u_{t+1} \tag{3}$$

The above equation reveals that economic forecasters have rational potentials and foreign exchange have no evidence regarding risk premium. Therefore future value of spot exchange rate must be equivalent to the forward exchange rate in addition to random error term.

The above formulation constitutes the mutual investigation of both rationality and risk neutrality. Many studies such as Cornell (1977), Levich (1978) and Frenkel (1980) investigated this topic on the basis of regression analysis of log of future spot exchange rate S_{t+1} and $f_{t,1}$ the log of forward exchange rate. Therefore the equation (3) become as;

$$S_{t+1} = a_0 + a_1 f_{t,1} + u_{t+1} \tag{4}$$

In the above equation the null hypothesis of forward exchange rate is considered as $a_0 = 0$ and $a_1 = 1$. Consistent with that experiment, forward rates are deliberated as impartial estimator of future value of existing currency rates when foreign exchange market is reflected as effective in the way that currency rates are exploiting maximum possible information set besides no risk advantage.

In order to determine the impartiality in forward exchange rates, it is essential to minimize the possibility of time fluctuating risk advantages in the market or the causes of inconsistency in coherent market opportunities. Many researches like as Hansen *et al* (1980), Bilson (1981), Meese *et al* (1982), Cumby *et al* (1984), Fama (1984) and Froot *et al* (1989), Levich (1989) has conducted the topic and contain risk premium by Frankel and Cornell. The equation (4) become;

$$E(S_{t+1}) = f_{t,1} + rp_t \tag{5}$$

[2] Initially data was selected on daily basis, however the results earned from the data were not providing sufficient information, and therefore data was converted on monthly averages.

[3] Covered interest rate parity condition is the formula used by banks to calculate their forward exchange quotation by $F = \frac{(1+r_d)S}{(1+r_f)}$, where r_f is one year foreign interest rate and r_d is one year domestic interest rate. Data for interest rates are collected from World Bank official website.

Where rp_t denotes the risk premium on the foreign currency. After substituting the equation (5) into equation (3), the following result in terms of another equation drawn;

$$S_{t+1} = f_{t,1} + rp_t + \mathrm{u}_{t+1} \quad (6)$$

Then further researches have focused on the incidence of risk fluctuating advantages while conditional on the assumption that forward markets are rational. Algebraically, the regression equation will then be;

$$\Delta S_{t+1} = a_0 + a_1 rp_t + \mathrm{u}_{t+1} \quad (7)$$

Where ΔS_{t+1} represents the change in log spot rate, which is future percentage devaluation expressed as $(S_{t+1} - S_t)$, while $(f_{t,1} - S_t)$ is the forward risk premium rp_t of the ex post depreciation, S_t is the log of the spot exchange rate at time *t,* and $f_{t,1}$ is the log of the one period forward exchange rate at time *t*. Now the more elaborate form of equation (7) is;

$$(S_{t+1} - S_t) = a_0 + a_1 (f_{t,1} - S_t) + \mathrm{u}_{t+1} \quad (8)$$

The equation (8) de-trends the equation (2) and constitute a more powerful test of the efficient market hypothesis (EMH), which explained that x percent of currency's forward discount $(f_{t,1} - S_t)$ must decreased by x percent while the currency at forward premium $(S_{t+1} - S_t)$ must increase by x percent.

The null hypothesis is $a_0 = 0$ and $a_1 = 1$. Since 1980 the above model is widely used in the study of risk-neutral efficient markets hypothesis. Equation (8) is considered as Fama's regression in which a_1 is not only significantly different from unity but found to be closer to negative unity. The negative resultant of a_1 implies that extrapolations derived from forward premium are considered as incorrect even though no evidence of biasness observed. This finding means that it is profitable to trade against the prediction provided by the forward premium.

An alternative methodology has been followed for observing the best fit of regression model by inserting an additional variable. Therefore by adopting that technique the equation (3) can be re-designed as;

$$S_{t+1} = a_0 + a_1 f_t + a_2 f_{t-1} + \mathrm{u}_{t+1} \quad (9)$$

Where f_{t-1} express the log of lagged forward exchange rate. For efficient market hypothesis a_1 should also restricted to be zero. The research conducted by Edwards (1983) in the US exchange rate market against European currencies was found very supportive of that model for market efficiency hypothesis.

However another move towards the conception of market efficiency has been followed by analyzing of residual errors amidst expected and actual future values of exchange rates. The new equation was considered as;

$$u_{t+1} = a_0 + a_1 I_t + v_{t+1} \quad (10)$$

Where u_{t+1} represents the forecast error, I_t expressed group of information accessible at the given period, and v_{t+1} is a residual error term. The coefficient a_1 should be equal to zero. This efficiency test is famous for orthogonality property and it refer that agents used all relevant information in making their precisions by averting expected forecast errors. Therefore orthogonality hypothesis is employed for analyzing whether the projection error $S_{t+1} - f_t = u_{t+1}$ is impartial of projected error of preceding duration of time $u_t = S_t - f_{t-1}$ .Then this can be expressed in regression form as;

$$(S_{t+1} - f_t) = a_0 + a_1 (S_t - f_{t-1}) + v_{t+1} \quad (11)$$

In this equation v_{t+1} is a random normally distributed error. Equation (11) can be reshuffled and generated as:

$$S_{t+1} = a_0 + a_1 (S_t - f_{t-1}) + a_2 f_t + v_{t+1} \quad (12)$$

According to the market efficiency hypothesis of unbaisedness and risk neutrality then $a_0 = 0$, $a_1 = 0$ and a_2 ought to be equivalent to unity. This test has been performed by Frankel (1980).

4. Estimation and Empirical Results

4.1. Descriptive Statistics

Table 1 shows the descriptive statistics of monthly data for spot exchange rates for selected currencies of foreign exchange with respect to Pakistan. It indicates that the frequency distributions of selected foreign currencies are not normal. In a Gaussian distribution, the coefficients of Skewness in all selected foreign currencies are positive which indicates that all series are right skewed. However, the accurate zero value of coefficient of Skewness is fairly improbable for real world data sets. Therefore according to Bulmer (1979)for standard law defining the Skewness explained that Chinese Yuan (CNY), UAE (Dirham), Hong Kong Dollar (HKD), Japanese Yen (JPY), Kuwaiti Dinar (KWD), Malaysian Ringgit (MYR), Saudi Arabian Riyal (SAR), and US Dollar (USD) are moderately skewed because the coefficient of Skewness of these currencies lies between +½ and +1. Moreover, the Bangladeshi Taka (BDT), European Common Currency (EURO), German Mark (DKK), Indian Rupee (INR), and British Pound (GBP) are symmetric because the coefficient of Skewness of these currencies lies between −½ and +½. The kurtosis coefficient is observed less than 3 which indicate that all selected foreign currencies are Platykurtic indicating that all series of selected foreign

currencies are slim and has a long tail. The highest coefficient of kurtosis is observed in Japanese Yen (2.2298) and lowest observed in Chinese Yuan (0.7335).

Table 1. *Descriptive Statistics for Monthly Average Spot Rates*

Currencies	Mean	Std. Dev.	Skewness	Kurtosis	CV	JB	Prob.	Obs.
Bangladesh(Taka)	1.0447	0.1157	0.0414	1.6970	11.0734	10.5121	0.0052	148
China (Yuan)	9.3439	2.7300	0.7335	0.7335	29.2167	20.8838	0.0000	148
UAE (Dirham)	18.7107	3.4401	0.7271	1.8274	18.3856	21.5185	0.0000	148
EURO	85.743	24.6280	0.2082	1.5740	28.7230	13.6092	0.0011	148
Germany (Mark)	11.5133	3.3051	0.2098	1.5760	28.7067	13.5897	0.0011	148
Hong Kong(Dollar)	8.8329	1.6374	0.7285	1.8289	18.5378	21.5494	0.0000	148
India (RS)	1.4856	0.2387	0.4938	1.7353	16.0662	15.8777	0.0004	148
Japan (Yen)	0.6857	0.2415	0.9117	2.2298	35.2239	24.1613	0.0000	148
Kuwait (Dinar)	238.2619	50.0828	0.6569	1.7758	21.0200	19.8860	0.0001	148
Malaysia (Ringgit)	19.7712	5.2332	0.8061	2.0777	26.4687	21.2721	0.0000	148
Saudi Arabia(Riyal)	18.325	3.3684	0.7273	1.8287	18.3812	21.5086	0.0000	148
UK (Pound)	114.5042	19.7311	0.0081	1.8069	17.2318	8.7804	0.0124	148
US (Dollar)	68.722	12.6361	0.7271	1.8274	18.3873	21.5208	0.0000	148

Notes: This table shows means, standard deviations, skewness, kurtosis, coefficients of variation, Jarque-Bera and probabilities for the spot exchange rate variables. The sample consists on 148 average monthly observations of 13 currencies and the data covers the period from July 2000 to October 2012. The critical value Jarque-Bera statistic for normality from a χ^2 distribution with 2 degrees of freedom is 5.99 for the 5% level of significance.

Jarque Bera (JB) test demonstrates more evidently the normal distribution of series. All selected foreign currencies showed positive and higher value of Jarque Bera (JB). Generally, the distribution is perfectly normally distributed if the value for Skewness is zero, kurtosis value is three and the value of Jarque Bera is zero. Hence, the results obtained for Skewness and Platykurtic frequency distribution of foreign currencies specifies not normal distribution. Further, the coefficient of variation is employed for comparison of the variability of two series. The data for which the coefficient of variation is significantly high expresses that the variable is more volatile which implies that the series is less stable or less uniform. The highest coefficient of variation is found in Japanese Yen (JPY) and the lowest found in Bangladeshi Taka (BDT). It implies that Japanese Yen (JPY) is less consistent and Bangladeshi Taka (BDT) is more consistent. The same pattern is followed in forward exchange rates with one month maturity and is given in Table 2. This information provides a very clear signal of none existence of stationary process. (Follow Appendix I)

Table 2. *Descriptive Statistics for Forward Rates with One Month Maturity.*

Currencies	Mean	Std. Dev.	Skewness	Kurtosis	CV	JB	Prob.	Obs.
Bangladesh(Taka)	1.0418	0.1173	0.0722	1.6863	11.2580	10.7708	0.0046	148
China (Yuan)	9.3926	2.7594	0.7301	1.8796	29.3782	20.8876	0.0000	148
UAE (Dirham)	18.8040	3.5082	0.7236	1.8179	18.6567	21.5332	0.0000	148
EURO	86.1766	24.9558	0.2187	1.5678	28.9589	13.8282	0.0010	148
Germany (Mark)	11.5700	3.3491	0.2204	1.5708	28.9461	13.7951	0.0010	148
Hong Kong(Dollar)	8.8798	1.6700	0.7247	1.8165	18.8069	21.5942	0.0000	148
India (RS)	1.4892	0.2402	0.4980	1.7325	16.1320	16.0256	0.0003	148
Japan (Yen)	0.6904	0.2443	0.9093	2.2229	35.3808	24.1199	0.0000	148
Kuwait (Dinar)	238.9833	51.2461	0.6517	1.7665	21.4434	19.8604	0.0001	148
Malaysia (Ringgit)	19.8601	5.2901	0.8004	2.0647	26.6368	21.1976	0.0000	148
Saudi Arabia(Riyal)	18.4155	3.4386	0.7233	1.8167	18.6723	21.5373	0.0000	148
UK (Pound)	114.9561	20.0837	0.0326	1.7850	17.4708	9.1292	0.0104	148
US (Dollar)	69.0606	12.8947	0.7237	1.8156	18.6715	21.5704	0.0000	148

Notes: This table shows means, standard deviations, skewness, kurtosis, coefficients of variation, Jarque-Bera and probabilities for the forward exchange rate variables. The sample consists on 148average monthly observations of 13 currencies and the data covers the period from July 2000 to October 2012. The critical value Jarque-Bera statistic for normality from a χ^2 distribution with 2 degrees of freedom is 5.99 for the 5% level of significance.

Table 3. *Export Import and Total Trade of selected countries with Pakistan*

	EXPORT	PERCENTAGEX	IMPORT	PERCENTM	TRADE	PERCENTTRADE
Bangladesh	662	2.6806	63	0.1557	725	1.1127
China	2085	8.4427	4278	10.5731	6363	9.7656
ECC	3399	13.7634	3511	8.6775	6910	10.6052
Germany	1151	4.6607	1175	2.9040	2326	3.5698
Hong Kong	525	2.1259	504	1.2456	1029	1.5793
India	333	1.3484	1253	3.0968	1586	2.4341
Japan	226	0.9151	1557	3.8482	1783	2.7365
Kuwait	94	0.3806	3804	9.4016	3898	5.9825
Malaysia	229	0.9273	2156	5.3286	2385	3.6604

	EXPORT	PERCENTAGEX	IMPORT	PERCENTM	TRADE	PERCENTTRADE
Saudi Arabia	456	1.8465	4796	11.8534	5252	8.0605
UAE	1947	7.8839	1947	4.8120	3894	5.9763
UK	1304	5.2802	699	1.7276	2003	3.0741
US	3949	15.9904	789	1.9500	4738	7.2717
Total	16360	66.2455	26532	65.5743	42892	65.8287

Note: The import, export and total trade details of selected countries with Pakistan are from economic survey of Pakistan 2012.

4.2. Regression Analysis Between Spot Exchange Rate and Forward Exchange Rate

For the analysis of efficiency of foreign exchange market the regression focuses on the casual relationship between dependent variable and independent variable. The spot exchange rate with one lead period of time is taken as dependent variable and the forward exchange rate at time t as independent variable. The regression analysis concentrated on the hypotheses that the coefficient (intercept) a_0 is zero and the coefficient (slope) a_1 is equal to one. The regression result is reported in Table 4. The coefficient of a_0 is statistically significant in Bangladeshi Taka (BDT), European Common Currency (EURO), German Mark (DKK), Hong Kong Dollar (HDK), Kuwaiti Dinar (KWD), Saudi Arabian Riyal (SAR), and British Pound (GBP). It indicates that the forward exchange rates is systematically over or under predict the future spot exchange rate, and rational economic agents use information to make systematic profit in these currencies.

Table 4. *Exchange Rate Market Efficiency Test.*

Currencies		α_0	α_1	R^2	D W	F-value
Bangladesh (Taka)	Coefficient	0.0045	0.9807	0.9830	1.4107	6.7936
	SD	0.0013	0.0107			
	t-values	3.5965	-1.8077			
	p-values	0.0004	0.0727			
China (Yuan)	Coefficient	0.0002	1.0004	0.9978	1.1020	0.6747
	SD	0.0084	0.0038			
	t-values	0.0287	0.1143			
	p-values	0.9771	0.9091			
European Common Currency (EURO)	Coefficient	0.0628	0.9862	0.9927	1.4955	2.3555
	SD	0.0309	0.0069			
	t-values	2.0322	-1.9773			
	p-values	0.0440	0.0499			
Germany (Mark)	Coefficient	0.0358	0.9859	0.9928	1.5029	2.5050
	SD	0.0169	0.0069			
	t-values	2.1194	-2.0168			
	p-values	0.0358	0.0455			
Hong Kong (Dollar)	Coefficient	0.0213	0.9898	0.9953	1.2539	1.9161
	SD	0.0122	0.0056			
	t-values	1.7523	-1.8174			
	p-values	0.0818	0.0712			
India (RS)	Coefficient	0.0048	0.9889	0.9870	1.3550	0.7847
	SD	0.0039	0.0093			
	t-values	1.2497	-1.1906			
	p-values	0.2134	0.2357			
Japan (Yen)	Coefficient	0.0009	1.0024	0.9930	1.5694	0.0721
	SD	0.0036	0.0067			
	t-values	0.2526	0.3719			
	p-values	0.1320	0.7105			
Kuwait (Dinar)	Coefficient	0.0997	0.9822	0.9960	1.2321	9.2126
	SD	0.0276	0.0051			
	t-values	3.6135	-3.5250			
	p-values	0.0004	0.0005			
Malaysia (Ringgit)	Coefficient	0.0033	0.9994	0.9970	1.5658	0.9271
	SD	0.0132	0.0044			
	t-values	0.2467	0.9271			
	p-values	0.8055	0.3554			
Saudi Arabia (Riyal)	Coefficient	0.0330	0.9885	0.9950	1.2725	2.2352
	SD	0.0160	0.0055			
	t-values	2.0568	-2.0828			
	p-values	0.0415	0.0390			
UAE (Dirham)	Coefficient	0.0300	0.9896	0.9950	1.2776	1.8784
	SD	0.0162	0.0055			
	t-values	1.8538	-1.8845			

Currencies		α_0	α_1	R^2	D W	F-value
UK (Pound)	p-values	0.0658	0.0614	0.9830	1.5758	2.5103
	Coefficient	0.1110	0.9767			
	SD	0.0504	0.0107			
	t-values	2.1995	-2.1821			
	p-values	0.0294	0.0307			
US (Dollar)	Coefficient	0.0466	0.9888	0.9954	1.2475	2.0375
	SD	0.0238	0.0056			
	t-values	1.9689	-1.9859			
	p-values	0.0509	0.0489			

Notes: This table estimates the following model; $S_{t+1} = a_0 + a_1 f_t + u_{t+1}$, for t= 1,2,...T; and where S_{t+1} is the log of actual spot rate in one month's period time; f_t is the log current forward rate. Based on parameter estimates the hypothesis is that a_0= 0 and a_1 = 1. In this table R^2 is calculated to observe the relationship between spot and forward rate.

The coefficient of a_0 is statistically insignificant for rest of currencies which pointed out that the role of information is poor and cannot make systematic profit in these currencies. If the coefficient a_1 is equal to unity it shows that forward exchange rate correctly predict the future spot exchange rate. However at 5 percent significance level null hypothesis for slope coefficient is rejected for EURO, German Mark (DKK), Kuwaiti Dinar (KWD), Saudi Riyal (SAR), UK Pound (GBP) and US Dollar (USD). It implies that forward exchange rate does not predict the future spot exchange rate. The remaining currencies have admitted the assumption that forward exchange rates are impartial conjecturers of future spots rates. Moreover, The coefficient of a_0 does not differ significantly from zero while the coefficient a_1 does not differ significantly from unit in Bangladeshi Taka (BDT), European Common Currency (EURO), German Mark (DKK), Hong Kong Dollar (HDK), Kuwaiti Dinar (KWD), Saudi Arabian Riyal (SAR), British Pound (GBP) and US Dollar (USD). The coefficient R square is very high in all currencies which indicate that all information has incorporated in forward exchange rate. Moreover, the joint hypothesis test has been performed for examining the efficiency of exchange rate market and none existence of risk premium in Pakistan. The F-statistic[4] shows that the majority of the currencies have accepted the null hypotheses and identified rationality and risk neutrality. This is also noted that joint hypothesis is only denied for Bangladeshi Taka (BDT) and Kuwaiti Dinar (KWD). The values of Durbin-Watson test indicate that the exchange rate for Bangladeshi Taka (BDT), Chinese Yuan (CNY), European Common Currency (EURO), German Mark (DKK), Hong Kong Dollar (HDK), Indian Rupee (INR), Japanese Yen (JPY), Kuwaiti Dinar (KWD), Malaysian Ringgit (MYR), Saudi Arabian Riyal (SAR), British Pound (GBP) and US Dollar (USD) contain positive serial correlation which is sign of inefficient of exchange market. These results tell us that market manager could project future errors on the basis of past errors which are the symptom of exchange market inefficiency that there has been a significant chance identified for unexploited profit opportunities. Moreover, this is also found that Durbin Watson Static is greater than R^2 which verify that regression analysis is not spurious.

From the above analysis it is concluded that the unbiased hypothesis does not embrace in the Pakistani exchange rate market owing to existence of serial correlation substantiating either presence of a risk premium and/or that of market inefficiency. It is also observed that both $f_{t,1}$ and S_{t+1} are generated by non-stationary time-series processes, thus test conducted for equation (4) seemed incompatible with linear regression model. Therefore, the next technique to be followed is Fama's regression analysis by de-trending the sample data for keeping regression estimates unbiased and avoiding the non-stationery processes.

4.3. Regression Analysis between Spot Exchange Rate and Forward Exchange Ratewith de-Trended Data

In this experiment the de-trended data used in order to minimize the possibilities of non stationarity which is based on equation (8). The forward exchange rate market efficiency has been examined by regressing the four week change in the spot exchange rate as forward premium $\left(S_{t+1} - S_t\right)$ on the thirty days forward discount rate $\left(f_{t,1} - S_t\right)$. The results are presented in Table 5. The coefficient of a_0 is observed statistically insignificant in, European Common Currency (EURO), German Mark (DKK), and Kuwaiti Dinar (KWD). It indicates that the forward discount rates not systematically over or under predicts the forward premium. If the coefficient a_1 is equal to unity it shows that average change in exchange rate is correctly forecast forward premium or discount. The slope coefficient of a_1 is witnessed statistically insignificant in European Common Currency (EURO), German Mark (DKK) and Kuwaiti Dinar (KWD). It implies that change in exchange rate is not correctly forecast forward premium or discount in above mentioned currencies. It infers that mostly available information is not used in a systematic manner in these currencies. The slope coefficient of a_1 is statistically significant in remaining currencies which indicates that change in exchange rate is correctly forecast forward premium or discount. The slope coefficient of a_1 is not only noticed significantly different from one but find to be closer to negative unity in various studies (Fama 1984; Froot & Thaler, 1990; Sarno, 2005). Instead of providing an unbiased prediction to the changes of future spot rate, the negative

[4] The value for F- statistic has been calculated through Wald test by employing coefficient Restriction where; $\alpha_0 = 0$, $\alpha_1 = 1$.

slope coefficient of a_1 implies that the prediction provided by the forward premium is not only biased but also not correct. It implies that it is profitable to trade against the prediction provided by the forward premium. In this study only European Common Currency (EURO), German Mark (DKK) proved this hypothesis. Most of the a_1 parameter results are positive concluding that Pakistan is an emerging economy. This finding is support to the finding of Bansal *et al* (2000) and Chinn *et al* (2005).

Table 5. *Exchange market efficiency test with de-trended data.*

Currencies		α_0	α_1	R^2	DW	F-value
Bangladesh (Taka)	Coefficient	0.0016	0.2337	0.0016	1.4209	6.4177
	SD	0.0019	0.4785			
	t-values	0.8376	-1.6016			
	p-values	0.4036	0.1114			
China (Yuan)	Coefficient	-0.0014	1.5560	0.0561	1.1153	1.2234
	SD	0.0027	0.5301			
	t-values	-0.5295	1.0490			
	p-values	0.5972	0.2959			
European Common Currency (EURO)	Coefficient	0.0075	-0.2988	0.0018	1.5284	2.9439
	SD	0.0032	0.5763			
	t-values	2.3199	-2.2538			
	p-values	0.0217	0.0257			
Germany (Mark)	Coefficient	0.0076	-0.3110	0.0019	1.5327	3.0337
	SD	0.0032	0.5795			
	t-values	2.3657	-2.2623			
	p-values	0.0193	0.0251			
Hong Kong (Dollar)	Coefficient	0.0004	0.7595	0.0398	1.2344	0.5615
	SD	0.0017	0.3096			
	t-values	0.2437	-0.7767			
	p-values	0.8078	0.4386			
India (RS)	Coefficient	0.0028	0.0352	0.0003	1.3511	1.5264
	SD	0.0019	0.5666			
	t-values	1.4397	-1.7028			
	p-values	0.1521	0.0907			
Japan (Yen)	Coefficient	0.0039	0.3549	0.0019	1.5651	0.4791
	SD	0.0047	0.6610			
	t-values	0.8352	-0.9757			
	p-values	0.4050	0.3308			
Kuwait (Dinar)	Coefficient	0.0035	0.5582	0.0727	1.1964	6.4582
	SD	0.0011	0.1655			
	t-values	3.1412	-2.6683			
	p-values	0.0020	0.0084			
Malaysia (Ringgit)	Coefficient	0.0010	1.1231	0.0719	1.5721	0.9862
	SD	0.0017	0.3351			
	t-values	0.5628	0.3672			
	p-values	0.5745	0.7140			
Saudi Arabia (Riyal)	Coefficient	0.0007	0.7563	0.0455	1.2482	0.4237
	SD	0.0016	0.2877			
	t-values	0.4494	-0.8471			
	p-values	0.6538	0.3983			
UAE (Dirham)	Coefficient	0.0001	0.8714	0.0552	1.2575	0.1929
	SD	0.0016	0.2992			
	t-values	0.0831	-0.4299			
	p-values	0.9339	0.6679			
UK (Pound)	Coefficient	0.0036	0.2595	0.0021	1.5906	1.3475
	SD	0.0025	0.4740			
	t-values	1.4131	-1.5620			
	p-values	0.1598	0.1205			
US (Dollar)	Coefficient	0.0012	0.6583	0.0323	1.2258	0.7168
	SD	0.0016	0.2992			
	t-values	0.6961	-1.1420			
	p-values	0.4875	0.2553			

Notes: This table estimates the following model;$(S_{t+1} - S_t) = a_0 + a_1 (f_{t,1} - S_t) + u_{t+1}$ for t= 1,2,...T; and where$(S_{t+1} - S_t)$ is the log of change in actual spot rate in one period's time;$(f_{t,1} - S_t)$ is the log current forward rate minus spot rate in one month's time. Based on parameter estimates the hypothesis is that $a_0 = 0$ and $a_1 = 1$. In this table R^2 is calculated to observe the relationship between de-trended spot and forward rate.

The joint hypothesis is statistically significant for all selected currencies which indicates that exchange rate market

is rational and risk neutral. However, Pakistani exchange rate market is inefficient with the presence of risk premium for Bangladeshi Taka and Kuwaiti Dinar. The coefficient of determination R^2 for all models is observed very low signifying that available information is not properly and fully incorporated in the forward rates. However, the Durbin Watson statistic revealed presence of serial correlation in the regression of spot exchange rates with their lagged forward rates. It shows that non stationary process still existing in the de-trended sample data.

In Pilbeam's words, 'these results reveal that once the trend applied in the exchange rate, market partakers have on average mis-projected the trajectory of its movements". Hence, this is proposed that currencies at forward discount have actually strengthened by the incidence of first degree serial correlation between the residual errors. In this situation, by purchasing the currency of a country with extraordinary interest rates the customers can make profits, which were hence at a forward discount rate $\left(f_{t,1}-S_t\right)$. Interest rate in Pakistani economy is observed comparatively higher than all selected majorly exporting, importing and totally trading countries with Pakistan. Therefore countries with whom particularly Pakistan have export transactions [Bangladesh, China, Germany, Hong Kong, India, United Kingdom and United States] are considerably gaining benefit both from high interest rates and currency value appreciation due to increase in inflation.

4.4. Regression Analysis between Spot Exchange Rate and Forward Exchange Rate by Using Orthogonality Property.

The regression analysis examines to get the drift if another variable that can improve the results of regression. Numerous analysts have considered distinct methodologies for this approach. Frankel (1980) conducted this approach famously known for orthogonality property and this is expressed by the equation (12). It implies that market managers exploit all accessible information in making their conjectures by avoiding predictable projection errors. According to the efficient market hypothesis if there is no risk advantage and foreign market exploits all information efficiently then null hypotheses of rationality and risk neutrality for forward exchange rate market from equation (12) implies that the coefficient of a_0 is zero, the coefficient of a_1 is zero, and the coefficient of $a_2=1$.

The results for the above test are reported in Table 6. The overall findings indicated a slightly mixed result for foreign exchange market of Pakistan. The exchange rate market is significantly efficient with no risk premium for Japanese Yen (JPY) and Malaysian Ringgit (MYR). However, the results of remaining selected currencies decisively negate the joint hypotheses for efficiency due to the presence of risk premium. Non-stationary problem is still present in the model. However, the problem of autocorrelation has been properly accommodated. Moreover, relationship between future spot exchange rates and forward exchange rates is found very strong showing that all available information is to the large extent is utilized. Furthermore, no evidence of spurious regression analysis has noticed.

Table 6. *Alternative Exchange Rate Market Efficiency Test.*

Currencies		α_0	α_1	α_2	R^2	DW	F-value
Bangladesh (Taka)	Coefficient	0.0034	0.2916	0.9816	0.9845	2.0554	9.4588
	SD	0.0012	0.0792	0.0103			
	t-values	2.7332	3.6809	-1.7818			
	p-values	0.0071	0.0003	0.0768			
China (Yuan)	Coefficient	0.0001	0.4395	1.0002	0.9983	2.1729	12.0462
	SD	0.0076	0.0746	0.0034			
	t-values	0.0181	5.8943	0.0568			
	p-values	0.9856	0.0000	0.9547			
European Common Currency (EURO)	Coefficient	0.0595	0.2467	0.9868	0.993	1.9737	5.0824
	SD	0.0304	0.0799	0.0068			
	t-values	1.9541	3.0889	-1.9085			
	p-values	0.0526	0.0024	0.0582			
Germany (Mark)	Coefficient	0.0337	0.2432	0.9867	0.9932	1.9752	5.0925
	SD	0.0167	0.0799	0.0068			
	t-values	2.0224	3.0427	-1.9392			
	p-values	0.0450	0.0028	0.0544			
Hong Kong (Dollar)	Coefficient	0.0146	0.3610	0.9929	0.9960	2.1267	8.7274
	SD	0.0114	0.0765	0.0052			
	t-values	1.2836	4.7182	-1.3403			
	p-values	0.2013	0.0000	0.1822			
India (RS)	Coefficient	0.0047	0.3162	0.9891	0.9884	1.8248	5.7573
	SD	0.0037	0.0801	0.0089			
	t-values	1.2537	3.9448	-1.2205			
	p-values	0.2120	0.0001	0.2242			
Japan (Yen)	Coefficient	0.0001	0.2154	1.0007	0.9938	2.0674	2.3608
	SD	0.0035	0.0821	0.0066			

Currencies		α_0	α_1	α_2	R^2	DW	F-value
	t-values	0.0253	2.6240	0.1190			
	p-values	0.9798	0.0096	0.9054			
	Coefficient	0.0661	0.3749	0.9881			
Kuwait	SD	0.0265	0.0759	0.0048	0.9967	2.1114	14.6685
(Dinar)	t-values	2.4920	4.9382	-2.4428			
	p-values	0.0138	0.0000	0.0157			
	Coefficient	0.0021	0.2101	0.9996			
Malaysia	SD	0.0129	0.0815	0.0044	0.9973	2.0222	2.7556
(Ringgit)	t-values	0.1652	2.5788	-0.0833			
	p-values	0.8690	0.0109	0.9337			
	Coefficient	0.0225	0.3505	0.9921			
Saudi Arabia	SD	0.0153	0.0766	0.0052	0.9961	2.1277	8.4181
(Riyal)	t-values	1.4890	4.5720	-1.5166			
	p-values	0.1387	0.0000	0.1315			
	Coefficient	0.0206	0.3484	0.9927			
UAE	SD	0.0152	0.0768	0.0052	0.9961	2.1212	8.0730
(Dirham)	t-values	1.3529	4.5352	-1.3836			
	p-values	0.1782	0.0000	0.1685			
	Coefficient	0.1045	0.2105	0.9780			
UK (Pound)	SD	0.0504	0.0805	0.0106	0.9833	2.0284	3.9715
	t-values	2.0747	2.6153	-2.0622			
	p-values	0.0398	0.0099	0.0409			
	Coefficient	0.0318	0.3636	0.9923			
US (Dollar)	SD	0.0222	0.0763	0.0053	0.9960	2.1236	8.8994
	t-values	1.4330	4.7641	-1.4509			
	p-values	0.1540	0.0000	0.1489			

Notes: This table estimates the following model; $S_{t+1} = a_0 + a_1(S_t - f_{t-1}) + a_2 f_t + v_{t+1}$ for t= 1,2,...T; and where s_{t+1} is the log of actual spot rate in one month's period time;$(s_t - f_{t-1})$ is the orthogonalized exchange rates referring agents are using relevant information in making their decisions by avoiding errors. f_t is the log current forward rate. Based on parameter estimates the hypothesis is that a_0= 0, a_1= 0 and a_2= 1. In this table R^2 is calculated to observe the relationship between spot and forward rate.

The presence of risk premium denied orthogonality experiment for forward currency forecast errors as market agents are using all randomly available information in making their forecasts which are causing the predictable forecast errors. In return purchasers of the foreign currency are taking advantage of profit.

This is suggested that due to the presence of risk premium buyers of all selected major exporting countries'[5] currencies[6] and the currencies of countries[7] having total trade[8] terms with Pakistani Rupee are enjoying profitable opportunities with the consequences of high interest rates, inflation and presence of KERB markets. However, the currency of importing countries Japan and Malaysia found efficient and implies that these exchange rate markets are using all relevant available information. Besides this other two highly importing countries' currencies Kuwaiti Dinar (KWD) and Saudi Arabian Riyal (SAR) rejects the market efficiency or speculated and responded to the herd effect in the market. This has happened because of very frequent number of trade transactions by being largest importing countries of Pakistan.

These results reveal that Pakistani exchange rate market in general is neither efficient nor speculative due to the presence of risk premium and non-stationary process. More importantly, it is observed that exchange rate market by and large uses randomly available information and frequently reflected on rumors. This experiment in a wide extent favored the existence of herd or bandwagon effect in the Pakistani exchange rate market for all selected currencies. The corroboration of the incidence of bandwagon or herd effect furthermore concluded that Pakistani exchange rate market is semi strongly efficient.

5. Conclusion

This study examines the efficiency of exchange rate market of Pakistan during the study period from July 2000 to October 2012 in which Pakistani exchange rate market has slightly increased in size and the number of transactions has noticeably grown. The results indicate that have the exchange rate market of Pakistan is still inefficient. The reasons are risk premium which are caused by the presence of KERB markets, and frequently changing information due to political uncertainty in the country have some inferences for the effectiveness of foreign exchange market. Pakistan exchange rate market supports the profitable opportunities even though Pakistan's economy is dominated by US Dollar which generates cross real exchange rate influence on almost every currency exchange. Similarly, deficiency of instruments for market to hedge against risk exposure and mostly overestimated spot rates also supports the profitable options. Despite their consequence on exchange rate market, major

[5] According to Economic survey of Pakistan 2011-12.

[6] i.e. Bangladeshi Taka (BDT), Chinese Yuan (CNY), EURO, German Mark (DKK), Indian Rupee (INR), UAE Dirham (AED), British Pound (GBP) and US Dollar (USD)

[7] [EURO, German Mark (DKK), Indian Rupee (INR), UAE Dirham (AED), British Pound (GBP) and US Dollar (USD)]

[8] According to Economic survey of Pakistan 2011-12.

macro-economic variables other than inflation and interest rates, are not imperative to the arbitrageurs in constructing exchange rate expectations.

This study has identified some key issues that should be handled to improve the efficiency of the foreign exchange market in Pakistan.

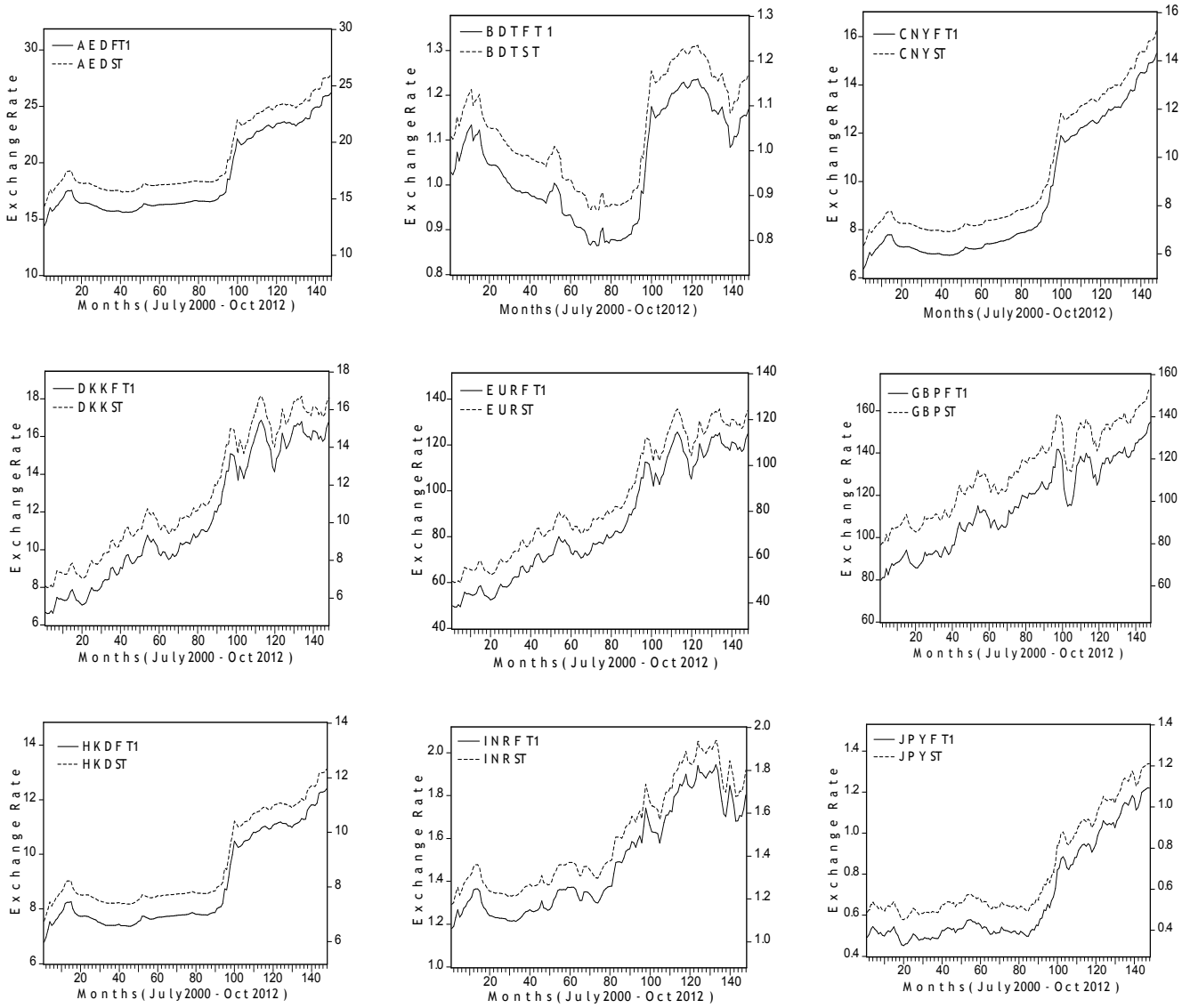
Firstly the information should be disseminated and make realize the investors on the meaning of major macro-economic tools and their implications to the economy. This would be productive for those investors who have deep interest and also to those who perform some role in price formation in the exchange rate market. These market players will be helpful for quality and improved information incorporation which in turn probably alter the exchange rate market behavior.

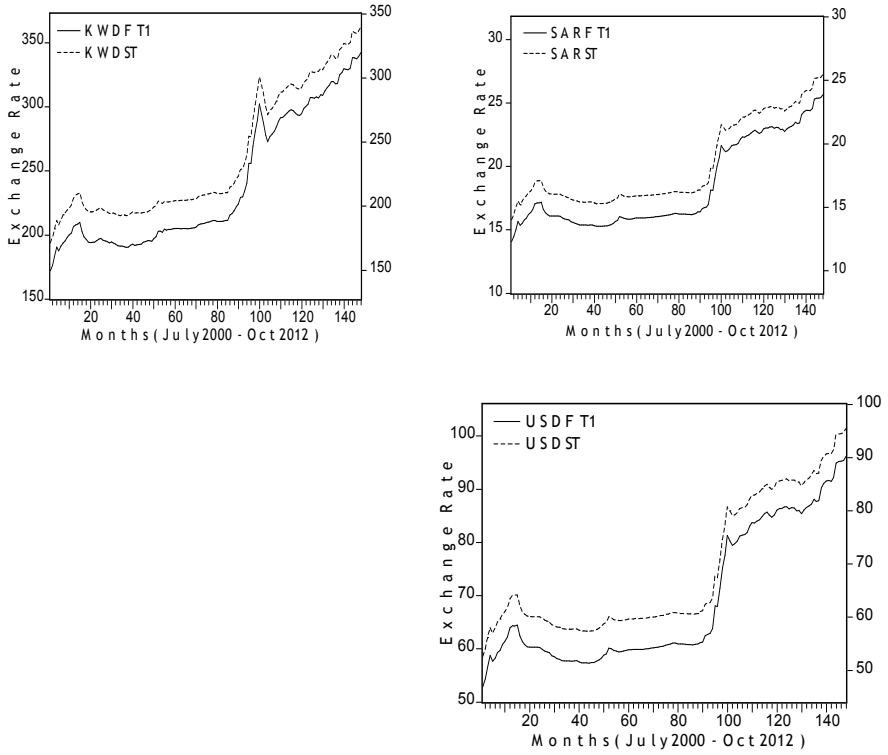
Secondly, the KERB markets- Non official channels of exchange rate markets are very active in the Pakistan. Central bank should intervene into these unofficial markets for regulating their activities.

Thirdly, by reducing exchange rate misalignments in restoring efficiency of exchange rate market of Pakistan. Market players have identified that continued central bank interventions and presence of KERB markets causing fluctuations in exchange rate without any noticeable variation in its fundamentals. Conversely, donor resource imbursement and other organizations like IMF, World Bank and USAID etc. may also affect the directions exchange rates. Therefore, increase in export generating activities and tax revenue base could help in reducing the dependency on donor financings and their repercussions for exchange rates.

As final remarks, the government and central bank should make informed to take actions to reduce exchange rate volatility and evaluate the outcomes of numerous economic policies for exchange rates.

Appendix I. *Trend Graphs of Average Monthly Spot Rates and One Month Maturity Forward Rates for the Selected Currencies*





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