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The Efficiency of Foreign Exchange Markets in Pakistan: An Empirical Analysis

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Abstract

This study investigates the empirical relationship between spot and forward exchange rate efficiency with reference to Pakistan and the efficiency of its foreign exchange market. We use monthly data from the State Bank of Pakistan and KIBOR rates for the period July 2006 to December 2013. Our results indicate that the forward exchange rate does not fully reflect all the information available. Market players may gain the benefits of volatility speculation due to market inefficiency. Pakistan's foreign exchange market is still small compared to those of other emerging economies, implying that substantial policy work is required.

Keywords: Foreign exchange markets, forward exchange rate efficiency, efficient market hypothesis, emerging economy, real effective exchange rate, Pakistan.

JEL classification: F30, F31, G10.

1. Introduction

The importance of the foreign exchange market is fairly evident in today's globalized world, and the exchange rate literature has produced a rich body of empirical research that addresses three key questions:

1. How efficient is the foreign exchange market?
2. Which is the most suitable model for exchange rate movements?
3. How can we model the expectations of foreign exchange market participants?

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The objective of this study is to answer these questions empirically by establishing the relationship between the spot exchange rate and forward exchange rate based on the regression analyses put forward by Frenkel (1980) and Levich (1979). Our study is with reference to Pakistan and also investigates the efficiency of its foreign exchange market. In this context, "efficiency" means that the market's players have processed all the available information at the time of determining the forward exchange rate. The forward exchange rate should then be able to predict the future spot rate with reasonable accuracy. On the other hand, if the future spot rate deviates from the forward rate, this will lead to inefficiency or imperfection.

In Pakistan's case, the most significant issue is to determine whether or not the financial markets can efficiently allocate economic resources based on the information available. The exchange rate of the Pakistani rupee (PKR) is influenced chiefly by the market mechanism and the forward exchange rate is determined by the interaction of demand and supply. The intercession of the State Bank of Pakistan (SBP) in the currency market does not have a significant impact on the determination of the forward exchange rate. Its only role is to smooth out any foreign exchange market shakiness.

The determinants of the forward exchange rate include the interest rate differential of the two economies in the interbank market, the current account surplus of imports in relation to exports, and capital receipts. When determining the forward exchange rate, market players are assumed to have complete information on these factors and to consider all the available information at that time. Thus, the forward exchange rate encompasses all the available information relating to these factors.

A number of tests help determine the efficiency of the foreign exchange market, of which the efficient market hypothesis (EMH) is the most useful (Roberts, 1967). The EMH is considered the cornerstone of modern foreign exchange theory, and it takes into account both the rational expectations hypothesis and the risk-neutral behavior of investing agents. The EMH holds that, in an efficient market, price will reflect the available information fully (Fama, 1984). It also considers issues related to reliability, variance, seasonality, volatility, and market instability. Studying all these issues enables market analysts to gauge the efficiency of a country's financial market.

Market efficiency with respect to the EMH is classified as weak, semi-strong, or strong. In its weak form, efficiency implies that the information available reflects only the history of prices or returns. Semi-strong efficiency suggests that prices reflect the information available to all market individuals. In its strong form, efficiency means that prices reflect inside information in addition to past prices and publicly available information (Fama, 1970, 1991).

Sections 2 and 3 review the theoretical and empirical aspects of the efficiency of the foreign exchange market. Sections 4 and 5 present the model and variables used. Section 6 provides a detailed empirical analysis. Sections 7 and 8 conclude the study and point out some research limitations.

2. Review of the Literature

Earlier studies on the EMH involved conducting regression analyses by taking the logs of the future spot exchange rate and current forward exchange rate. Their results suggested that the forward exchange rate was an unbiased predictor of the future spot exchange rate (Frenkel, 1980; Levich 1979). The efficiency of the foreign exchange market for different currencies against the US dollar was examined using ordinary least squares (OLS); these studies rejected the EMH because of a deviation from unity in both forward and level specifications. The deviation was a result of the risk premium factor involved in the forward exchange rate market (Fama, 1984).

The EMH became the hypothetical basis for most subsequent research during the 1980s, and was used to forecast the forward rate from historical data and stock variables such as P/E ratios, term structure variables, and dividends yield (Campbell & Shiller, 1987). The EMH can also be applied to the foreign exchange market to determine whether prices are independent of each other or if they follow a random walk. The weak form of efficiency exists because of the random walk but the random walk does not determine weak efficiency (Cuthbertson & Nitzsche, 2005). Time series financial market data can also be used to examine the relative efficiency of foreign exchange markets. Furthermore, an approximate entropy method can be applied to quantify foreign exchange market efficiency (Oh, Kim, & Eom, 2007).

In Pakistan, the empirical research shows that stock market prices are manipulated by market players, which increases the volatility of the financial market (Khawaja and & Mian, 2005). In India, which follows a

floating exchange rate, the intervention of the Reserve Bank of India does not affect the determination of the forward exchange rate. The main determinant is the interest rate differential of the two countries in the inter-bank market (Sharma & Mitra, 2006). Another study shows that the foreign exchange market for the Indian rupee against the US dollar is efficient as the current forward rate predicts the future spot rate (Kumar & Mukherjee, 2007). The foreign exchange market in Sri Lanka shows weak efficiency, i.e., the forward rate reflects only the history of prices or returns (Wickremasinghe, 2004).

The markets for the euro, Japanese yen, and pound sterling are volatile as market players obtain higher returns through buying and selling without considering the transaction costs involved—although this would be more efficient (Lee & Khatanbaatar, 2012). Conjectures regarding volatility, speculation, and predictability also relate to the efficiency of foreign exchange markets; these are all interdependent issues (Cuthbertson, 1996). Various empirical models have been used to determine volatility, speculation, and certainty in foreign exchange markets, which either support or reject the market's efficiency (Bollerslev & Hodrick, 1992).

Empirical studies show that, in competitive markets, rational investors, returns, and prices are interdependent and follow a sequence of random variables (Mandelbrot, 1963). Due to volatility, speculation, and uncertainty in the financial market following the Asian economic crisis, the Thai baht was devalued and most currency markets in Southeast Asia suffered depreciating exchange rates with respect to their most important foreign currencies (Titman & Wei, 1999).

3. An Overview of Pakistan's Foreign Exchange Market

Pakistan's foreign exchange market is smaller than those of other emerging economies. The exchange rate policy is, by definition and in practice, part of the monetary policy and has undergone several changes since 1949. The country's exchange rate was originally pegged to the pound sterling up to September 1971 and subsequently to the US dollar. Since January 1982, the exchange rate regime has followed a managed float system pegged to a basket of currencies. Under the financial reforms initiated in 1991, a free float was proposed and finally achieved in 2000/01. Pakistan uses the US dollar as its reserve currency.

The Pakistani rupee has undergone various changes in nominal value. In September 1949, the government decided not to devalue the rupee (48 other currencies in the sterling area had been devalued) in spite of the fact that the current account deficit in 1948/49 was around 2.5 percent of GDP. The Korean War, however, helped Pakistan emerge from the crisis and in 1950/51 the country recorded a surplus in its current account. Once the Korean boom ended, the current account fell into deficit once again. On 31 July 1955, the Pakistan rupee was devalued for the first time.

By 1956/57, the balance of payments position had worsened to such an extent that the SBP governor singled out the balance of payments and inflation as the two main culprits in the economy. Since then, Pakistan has experienced a similar pattern. The nominal exchange rate had been fixed at PRs 4.76 per US dollar in 1955, but since the export bonus scheme was in vogue at the time, it was effectively a multiple exchange rate. In 1971, it depreciated to PRs 7.76 for exports. However, in 1972 it was unified at PRs 11 per US dollar.

Another issue confronting Pakistan at the time was the significant overvaluation of the real effective exchange rate (REER), which appreciated by 56 percent in 1972 and 25 percent in 1973. To adjust this and in order to make exports more competitive, the rupee was devalued by 56.73 percent. The main feature of adjustment in feeding current account deficits has been the external aid received from donor agencies (mainly from the US). This feature has continued to hold back the economy.

The foreign exchange market in Pakistan receives inflows through export proceeds, remittances, and foreign direct investment. The amount received from the IMF is to meet the current account deficit and does not translate into forex market activities. The SBP occasionally intervenes to smooth out the market, which can come under pressure on account of lumpy payments or plunge on receipt of a large amount. Under the financial reforms that started in 1991, the current account was made completely convertible in 1993 such that any foreign account holder (FE-25) could send money abroad unrestricted. Likewise, the account could receive amounts in cash or from abroad without any restrictions. In capital market investments, amounts could be sent in or out through special convertible rupee accounts that banks maintained on behalf of their investors. Capital account convertibility is not yet allowed in Pakistan.

FY2008 was a volatile year for the forex market: net foreign assets contracted by around PRs 375 billion, coinciding with an equivalent depletion in bank deposits. The outflow went mainly to the Gulf states, which offered better investment opportunities. This trend has now been reversed on account of the recessionary mood in these countries. At the time, the rupee had depreciated by more than 18 percent, although the situation improved with the receipt of IMF aid. These are, however, short-term arrangements. Opportunities exist to encash them on the back of declining inflation and a world emerging from the recession.

Forward points, an indicator of future trends in the forex market, had risen as high as PRs 3.72 per US dollar in June 2008. These are now softening out and forex reserves have also improved. This is needed mainly to meet import obligations and to help the forex market avoid dire undue fluctuations in the nominal exchange rate. In the wake of these changes, the SBP has succeeded in shifting oil payments to the interbank market. Furthermore, the kerb market is also showing some degree of discipline, resulting in a smaller spread between the interbank and kerb markets.

Another corrective measure is the foreign exchange exposure limit (FEEL) implemented by the SBP after replacing NOSTRO[1] limits had made the market more flexible and disciplined enough to move within some range of banks' paid-up capital. Previously, this range was 10 percent and recently, it has been relaxed to 20 percent. This has helped the forex market arrange its funds in a wider space.

Other factors that dictate exchange rate parity include (i) the difference in the interest rate on other currencies, specifically the US Dollar, with respect to the rupee; (ii) the difference between the forward exchange rate and the spot rate; (iii) how expected spot rates for the US dollar and rupee might be determined the following year; and (iv) the relationship foreseen between inflation in Pakistan with respect to other countries. The paramount factor is the demand and supply position of the US dollar with respect to the rupee, which can alter as a result of government and central bank policies. The kerb market plays a role here as well as in shifting market flows and creating market sentiments.

At present, the most important step in developing the forex market will be the introduction of hedging products. The SBP initiated a

[1] A bank account held in a foreign country by a domestic bank, denominated in the currency of that country. It is commonly used for currency settlement, where a bank or other financial institution needs to hold balances in a currency other than its home accounting unit.

derivatives market in 2004 with the introduction of forex options and other interest rate derivatives. Forwards and currency swaps already existed. Sensing the huge differential between the LIBOR and KIBOR, the market opted for cross-currency swaps in FY2007 and FY2008. However, a significant depreciation of the rupee affected corporate investors negatively. Since most of them had naturally hedged against their export proceeds, they were left where they started. This experience and others in the use of forwards reveals that most corporate players are not aware of the risks involved in cross-currency swaps and other derivatives. Forwards are mostly demand-driven and operate in an environment where no price discovery mechanism exists; ultimately, they also fail to provide prudent future prices.

These constraints to the forex market in Pakistan can be streamlined with the SBP's initiatives in collaboration with market players. However, the market side lacks capable staff, which places an extra burden on banks and other financial or corporate institutions in building the capacity of their treasury staff.

4. Methodology

As mentioned earlier, our methodology is based on the regression analyses conducted by Frenkel (1980) and Levich (1979), who take the logs of the future spot exchange rate and current forward exchange rate. Their results suggest that the forward exchange rate is an unbiased predictor of the future spot exchange rate. We establish the following relationship between the logs of the actual spot exchange rate and forward exchange rate at time *t*.

$$SR_{t+1} = ER_{t+1} + U_t \tag{1}$$

where SR_{t+1} is the log of the actual spot exchange rate in terms of the domestic currency unit per unit of foreign currency in $t + 1$ period, ER_{t+1} is the log of the expected exchange rate in $t + 1$ period, and U_t is the normally distributed random error term with mean equal to 0. Investors are assumed to be risk neutral and can set the forward exchange rate at a point that matches the expected future spot exchange rate. The forward exchange rate at time t is thus equal to the expected exchange rate in $t + 1$. Therefore,

$$f_t = ER_{t+1} \tag{2}$$

Putting this value in the above equation, we get

$$SR_{t+1} = f_t + U_t \quad (3)$$

Equation (3) constitutes a dual test of foreign exchange market efficiency and no risk premium. In other words, the forward exchange rate is, on average, an unbiased predictor of future spot exchange rates. The estimated equation used for empirical analysis is

$$SR_{t+1} = \alpha_1 + \alpha_2 f_t + U_t \quad (4)$$

where SR_{t+1} and f_{t+1} are stationary time series and the level of significance is 5 percent (see Levich, 1979, and Frenkel, 1980, who test the hypothesis based on this equation). The purpose of the empirical analysis is to examine the efficiency of the market. In order to obtain unbiased regression results, it is necessary to de-trend the data, for which purpose we re-estimate the results using the following regression equation:

$$(SR_{t+1} - S_t) = \alpha_1 + \alpha_2 (f_t - S_t) + U_{t+1} \quad (5)$$

where S_t is the log of the spot exchange rate. This is the more significant test of the EMH, according to which a currency that is at a forward discount rate $(f_t - S_t)$ of x percent should, on average, depreciate by x percent, whereas a currency that is at a forward rate premium $(SR_{t+1} - S_t)$ of x percent should, on average, appreciate by x percent.

5. Data and Estimation

We have used monthly data compiled from the State Bank of Pakistan and KIBOR rates. These include the spot exchange rate and one-month forward rates of the Australian dollar (AUD) to the rupee, Swiss franc (CHF) to the rupee, euro (EUR) to the rupee, yen (JPY) to the rupee, and US dollar (USD) to the rupee. The data span the period 3 July 2006 to 2 December 2013. The sample comprises a total of 90 observations.

The OLS regression we have carried out uses the log of the actual spot rate as the dependent variable and the log of the forward rate at time t as the independent variable. Durban Watson d statistics are used to detect the presence of autocorrelation in the residuals from the analysis. The model is then de-trended in order to obtain unbiased regression estimates.

According to this test, the foreign exchange market is deemed efficient if the forward exchange rate incorporates all currently accessible information without any risk premium. The estimation is based on the following assumptions:

- α_1 should be 0. The forward exchange rate may over- or under-predict the future spot exchange rate and rational market players will use this information to make a profit.
- α_2 should be equal to unity, indicating that, on average, the forward exchange rate exactly predicts the future spot exchange rate.
- The error term U_t should possess OLS properties.

If all three conditions are met, we can conclude that the foreign exchange market is efficient.

6. Empirical Analysis

All tests are conducted over the full sample of 90 observations. Both the actual spot rates and one-month forward rates are taken as units of the domestic currency per unit of foreign currency. The data refer to the end of every month. For dates for which both the spot and forward exchange rates were not available, we have taken the data available for the nearest date of the same month.

Tables 1 to 5 give the currency-wise summary statistics of the data, which are also illustrated in Figures 1 to 5.

Table 1: Summary statistics for AUD–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	74.74304	75.0088
Median	76.27265	76.71795
Maximum	102.5093	102.9738
Minimum	44.8437	44.9201
SD	19.24307	19.3462
Skewness	-0.09345	-0.0975
Kurtosis	1.514534	1.515461
Jarque-Bera	8.405787	8.407049
Probability	0.014952	0.014943
Sum	6726.874	6750.792
Sum sq. dev.	32956.33	33310.51

Source: Authors' calculations.

Table 2: Summary statistics for CHF–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	80.52053	81.09155
Median	80.58735	81.2523
Maximum	119.4341	119.529
Minimum	48.6839	48.9594
SD	21.21715	21.37859
Skewness	-0.08412	-0.09846
Kurtosis	1.770334	1.758107
Jarque-Bera	5.776448	5.929014
Probability	0.055675	0.051586
Sum	7246.848	7298.239
Sum sq. dev.	40064.92	40676.92

Source: Authors' calculations.

Table 3: Summary statistics for EUR–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	109.9209	110.6129
Median	115.2609	116.2247
Maximum	147.0172	147.0811
Minimum	51.7029	51.8355
SD	18.65862	18.85561
Skewness	-0.63731	-0.65589
Kurtosis	2.97792	2.945412
Jarque-Bera	6.094346	6.464133
Probability	0.047493	0.039476
Sum	9892.883	9955.16
Sum sq. dev.	30984.84	31642.51

Source: Authors' calculations.

Table 4: Summary statistics for JPY–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	0.8792	0.885709
Median	0.93605	0.9436
Maximum	1.2173	1.226
Minimum	0.4932	0.4968
SD	0.238556	0.240442
Skewness	-0.40491	-0.40747
Kurtosis	1.7363	1.739174
Jarque-Bera	8.447777	8.451761
Probability	0.014642	0.014612
Sum	79.128	79.7138
Sum sq. dev.	5.064878	5.14529

Source: Authors' calculations.

Table 5: Summary statistics for USD–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	81.14992	81.58305
Median	84.5132	84.92615
Maximum	108.5238	108.5718
Minimum	60.2455	60.374
SD	13.86169	14.01576
Skewness	-0.22449	-0.24049
Kurtosis	2.030534	2.011453
Jarque-Bera	4.280435	4.5321
Probability	0.117629	0.103721
Sum	7303.493	7342.475
Sum sq. dev.	17101.04	17483.3

Source: Authors' calculations.

Figure 1: AUD–PKR

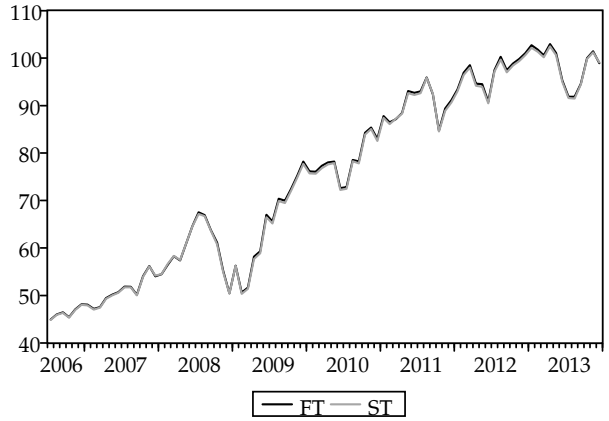


Figure 2: CHF–PKR

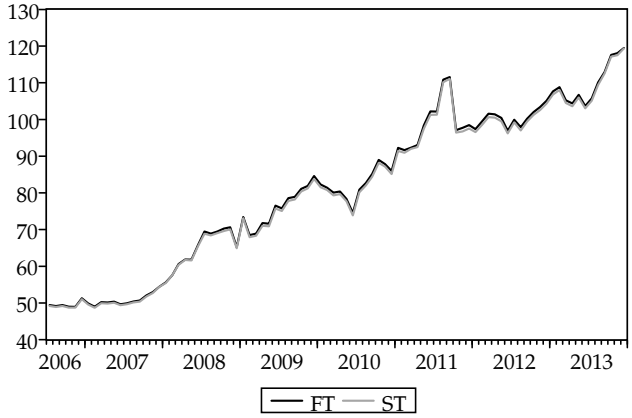


Figure 3: EUR–PKR

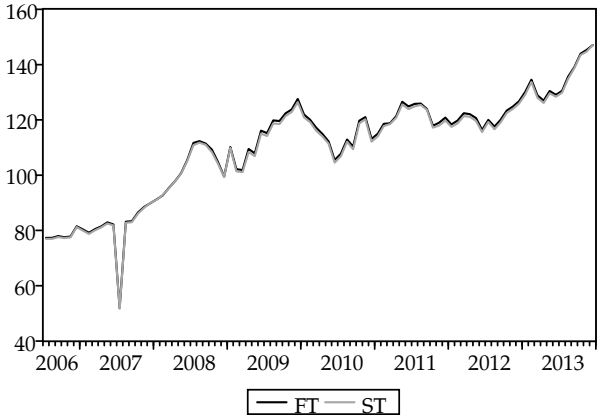


Figure 4: JPY–PKR

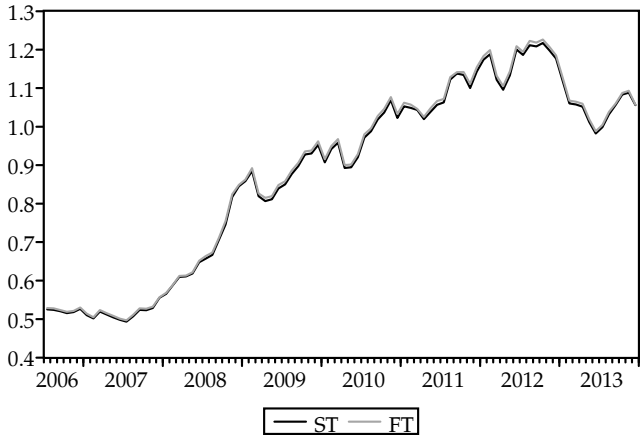
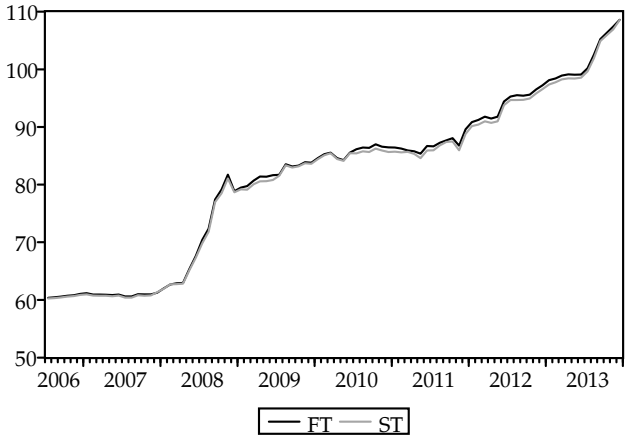


Figure 5: USD–PKR



Tables 6 and 7 give the country-wise regression statistics for the models. Overall, the model is found to be significant because α_1 and α_2 do not differ significantly from their hypothesized values at a 5 percent significance level. R^2 also indicates that the regression results are significant. The results suggest, therefore, that the market is efficient without a risk premium. However, the Durbin-Watson statistics show that there is serial positive correlation between the error terms. Since this renders the values of the t-statistics and R^2 less reliable, it becomes necessary to run the regression after correcting for serial correlation.

Table 6: Market efficiency test (A)

Estimated equation $SR_{t+1} = \alpha_1 + \alpha_2 f_t + U_t$					
Currency rate	**Period**	**α_1**	**α_2**	**DW**	**R^2**
Australian dollar (AUD)	06M7-10M6	0.475*	0.989*	0.54	0.99
		(2.731)	(637.83)		
Swiss franc (CHF)	06M7-10M6	0.001	0.997*	0.58	0.99
		(0.800)	(1185.99)		
Euro (EUR)	06M7-10M6	0.009*	0.994*	0.55	0.99
		(3.39)	(727.59)		
Japanese yen (JPY)	06M7-10M6	-0.003*	0.99*	0.74	1.00
		(-29.73)	(1361.34)		
US dollar (USD)	06M7-10M6	0.012*	0.992*	0.64	0.99
		(4.027)	(646.09)		

* Reject the null hypothesis at 5 percent significance level; t-statistics given in parentheses.
Source: Authors' calculations.

Table 7: Market efficiency test (B)

Estimated equation: $(SR_{t+1} - S_t) = \alpha_1 + \alpha_2 (f_t - S_t) + U_{t+1}$			
Currency rate	**Period**	**α_1**	**α_2**
Australian dollar (AUD)	06M7-10M6	-0.0014*	0.993*
		(-12.44)	(167.30)
Swiss franc (CHF)	06M7-10M6	-0.0030*	1.001*
		(-25.41)	(140.65)
Euro (EUR)	06M7-10M6	-0.0026*	0.999*
		(-21.20)	(269.04)
Japanese yen (JPY)	06M7-10M6	-0.0031*	0.99*
		(-28.80)	(134.78)
US dollar (USD)	06M7-10M6	-0.002*	0.942*
		(-11.296)	(42.606)

* Reject the null hypothesis at 5 percent significance level; t-statistics given in parentheses.
Source: Authors' calculations.

The purpose of the empirical analysis is to examine the efficiency of the market. To obtain unbiased regression results for this purpose, we re-estimate equation (5). The results indicate that the estimated coefficient of the one-period lagged forward rate does not differ significantly from 1, which is the condition for the EMH to hold true. However, α_1 differs

significantly from 0 even after correcting for serial correlation, indicating that α_1 incorporates information that is not absorbed fully in the forward rate. In other words, the forward exchange rate does not fully reflect all the information available.

7. Conclusion

The forex market is clearly important to any economy. Pakistan's foreign exchange market is still small compared to those of other emerging economies, implying that substantial policy work is required to expand it.

We have empirically investigated the efficiency of the market for the Pakistani rupee against the US dollar-rupee, Swiss franc-rupee, Australian dollar-rupee, yen-rupee, and euro-rupee, using monthly data on spot and forward rates for the period July 2006 to December 2013. Our results indicate that, on average, the forward exchange rate closely predicts the future spot exchange rate. After correcting for serial correlation, the estimated coefficient of the one-period lagged forward rate does not differ significantly from 1. However, α_1 differs significantly from 0, indicating that it incorporates information that is not absorbed fully by the forward rate, i.e., the forward exchange rate does not fully reflect all information available. We can thus conclude that the EMH does not hold completely in the case of Pakistan's foreign exchange market, where market players can still benefit from speculation due to market inefficiency.

8. Research Limitations

We have not made any assumptions about the source of the variation between the forward rate and future spot rate, or taken into account structural changes over time in Pakistan's foreign exchange market. This provides further scope for analysis in this area. Moreover, for exchange rate market efficiency, the one-period lagged forward rate should reflect all the available information. This is not the case in our study, which implies that other hidden factors may be at play. Future research could follow the factors that determine the future spot rate in Pakistan.

References

Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy Modeling*, *26*, 627–639.

Bollerslev, T., & Hodrick, R. J. (1992). *Financial market efficiency tests* (Working Paper No. 4108). Cambridge, MA: National Bureau of Economic Research.

Campbell, J. Y., & Shiller, R. J. (1987). Cointegration and tests of present value models. *Journal of Political Economy*, *95*, 1062–1088.

Cuthbertson, K. (1996). *Quantitative financial economics: Stocks, bonds, and foreign exchange*. Chichester, UK: John Wiley.

Cuthbertson, K., & Nitzsche, D. (2005). *Quantitative financial economics: Stocks, bonds and foreign exchange* (3rd ed.; chaps. 2 and 8). Chichester, UK: John Wiley.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance*, *25*(2), 387–417.

Fama, E. F. (1984). Forward and spot exchange rates. *Journal of Monetary Economics*, *14*, 319–338.

Fama, E. F. (1991). Efficient capital markets: II. *Journal of Finance*, *46*(5), 1575–1617.

Frenkel, J. A. (1980). Exchange rates, prices and money: Lessons from the 1920s. *American Economic Review*, *70*, 235–242.

Khwaja, A. I., & Mian, A. (2005). Unchecked intermediaries: Price manipulation in an emerging stock market. *Journal of Financial Economics*, *78*(1), 203–241.

Kumar, R. V., & Mukherjee, S. (2007). Testing forward rate unbiasedness in India: An econometric analysis of Indo-US forex market. *International Research Journal of Finance and Economics*, *12*, 56–66.

Lee, Y.-H., & Khatanbaatar, S. (2012). Efficiency tests in foreign exchange market. *International Journal of Economics and Financial Issues*, *2*(2), 216–224.

Levich, R. M. (1979). On the efficiency of markets for foreign exchange. In R. Dornbusch & J. Frenkel (Eds.), *International economic policy: An assessment of theory and evidence*. Baltimore, MD: Johns Hopkins University Press.

Mandelbrot, B. (1963). The variation of certain speculative prices. *Journal of Business*, *36*(4), 394–419.

Oh, G., Kim, S., & Eom, C. (2007). Market efficiency in foreign exchange markets. *Physica A: Statistical Mechanics and its Applications*, *382*(1), 209–212.

Roberts, H. (1967). *Statistical versus clinical prediction of the stock market*. Unpublished manuscript, Center for Research in Security Prices, University of Chicago, IL.

Sharma, A. K., & Mitra, A. (2006). What drives forward premia in Indian forex market? *Reserve Bank of India Occasional Papers*, *27*(1–2), 119–139.

Titman, S., & Wei, K. C. J. (1999). Understanding stock market volatility: The case of Korea and Taiwan. *Pacific-Basin Finance Journal*, *7*, 41–66.

Wickremasinghe, G. B. (2004). *Efficiency of foreign exchange markets: A developing country perspective* (Discussion Paper No. 3). Melbourne, Australia: Monash University, Asian Business and Economics Research Unit.