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PREDICTABILITY OF TRENDS IN FOREIGN EXCHANGE MARKET: THE CASE OF ASEAN CURRENCIES

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ABSTRACT

This paper explores the possibility of using past foreign exchange spot rates at different lags to predict future spot rates. Correlation coefficients were used to determine whether there is a significant relationship between past and future rates. In addition, runs test was also performed to find out whether or not the exchange rates are in fact move in a random fashion. Overall, this study indicates that trends in the foreign exchange rates for Asean currencies are not predictable. In other words, the Asean currencies follow a random walk (or the weak form of the efficient market hypothesis).

ABSTRAK

Kertas ini menyelidiki kemungkinan penggunaan kadar pertukaran wang masa lampau pada lat yang berbeza untuk meramalkan kadar pertukaran akan datang. Koefisi korelasi digunakan untuk menentukan sama ada terdapatnya satu perhubungan yang ketara di antara kadar pertukaran masa lepas dan kadar pertukaran masa hadapan. Tambahan itu, ujian larian juga dilakukan untuk mengetahui sama ada kadar-kadar pertukaran bergerak secara rambang. Secara keseluruhannya, kajian ini mendapati bahawa arah aliran kadar pertukaran bagi matawang negara-negara Asean adalah tidak tertelah. Dengan lain-lain perkataan, matawang-matawang Asean mengikuti model perjalanan rawak (ataupun hipotesis pasaran cekap bentuk lemah).

INTRODUCTION

The United States abandoned its policy of fixed exchange rate (with the abandonment of gold as the backing for her currency) in March 1973, and the world since then has been struggling with the problem of "instability" of the floating exchange rate. Speculators, however, are attracted to the market because of the belief that there is "money" to be made due to the volatility of the exchange rates. In addition, assertions are also made that currencies are under or overvalued because of the interventions by the central banks of respective countries to "stabilize" or to push the currency in their favor. The most recent example is in the case of U.S. dollar and Japanese Yen. Efforts are made by the Japanese Central Bank to push the dollar higher, even without much success. Such systematic deviations of a currency from the equilibrium exchange rate is, of course, inconsistent with the notion of an efficient market, at least in the weak sense. Fama

(1970) stated that the weak form of the efficient market hypothesis (also known as random walk model) implies that the information on the past history of price movements (in this case, past exchange rates) does not allow an investor to make a more accurate predictions of future prices. This means that past exchange rates are not predictive of future exchange rates. They are independent of each other, or in other words, they move in a random fashion.

A study by Cornell and Dietrich (1978) in 1976 on the spot markets for the Canadian dollar, the Swiss franc, the Dutch guilder, the German mark, the British pound, and the Japanese yen concluded that the market for foreign exchange behaves (in the weak sense) surprisingly like the market for common stock, despite the dominance of large transactors (international banks, multinational corporations, and governments) in the exchange markets. That is, the markets for the currencies under study conform to the weak form of the efficient market hypothesis.

Levich (1978) suggested the use of a time-series analysis of weekly spot exchange rates to test the efficiency of the market for exchange rates, in which he found that over the period 1973-1975, the strict random walk model for the weak form of the efficient market hypothesis is valid only for the Italian lira and the Swiss franc. In addition, he found that for the 1967-1975 period, the lagged spot rate did better than the one-month forward rate in predicting future spot rates for seven of the nine currencies studied.

London (1978) found that for the Canadian-U.S. exchange market, the 30-day forward rate is an unbiased predictor of the 30-day future spot rate using the end of the month data. Longworth (1981), in his study of the efficiency of the Canadian-U.S. exchange market, indicated that the current spot rate was found to provide a better forecast of the future spot rate (in terms of root mean square error) than the current forward rate. Cornell (1977), before that, found that, for the sample period April 1973 through January 1977, the lagged spot rate was a better forecaster than the forward rate for five of seven currencies (relative to the U.S. dollar). For the Canadian dollar the lagged spot and forward rates did equally well over the period.

This paper will attempt to explore the possibility of predicting future spot exchange rates using the information on past spot exchange rates. In other words, this paper explores the possibility of exchange rates having significant trends that can be exploited for the purpose of building a model, based on the past spot rates, to predict their future movements. If the trend is not predictable, then it can be concluded that the market for Asean currencies is efficient in the weak sense of the efficient market hypothesis. Asean currencies were chosen because they are accessible to most Malaysians for the purpose of constructing a currency portfolio based on these currencies.

METHODOLOGY

The data base consists of weekly spot rates of five Asean currencies as quoted by Asian Wall Street Journal. Spot rates as quoted on Fridays were used, and in the case of Friday being a holiday, the most recent available rates were used . The time period covered is November 1983 through October 1985. The data are in the form of U.S. equivalent dollar of a unit of Asean currency.

Two hypotheses wil be tested:

1. Exchange rates at any lag k are independent of each other; and,
2. Exchange rates move in a random fashion.

Conformity to these two hypothesis indicate an efficient market (in the weak sense) for the Asean currencies.

The statistical measure called autocorrelation was used to determine the direction and strength of the relationship between lagged spot rates. A statistically significant relationship would mean that a given lagged spot rate could in fact contribute to the prediction of the future spot rate.

The autocorrelation coefficient (Pankratz 1983) at lag k is given by the formula

$$r_k = \frac{\sum_{t=1}^{n-k} (Z_t - \bar{Z})(Z_{t+k} - \bar{Z})}{\sum_{t=1}^{n} (Z_t - \bar{Z})^2}$$

where,

$$Z_{t+k} = \log_e P_{t+k} - \log_e P_t ,$$

$$\bar{Z} = \left(\sum_{t=1}^{n} Z_t\right)/n,$$

n = number of observation (log changes)
and P_t = actual spot rate at time t.

Fama (1965) in his study of the U.S. stock's behaviour explained that there are three main reasons for using changes in log prices rather than simple price changes. First, the change in log price is the yield, with continuous compounding, from holding the security for that day. Second, it has been shown by Moore (1962) that the variability of simple changes for a stock is an increasing function of the price level of the stock. His work indicate that taking logarithms seems to neutralize most of this price level effect. Third, for changes within plus or minus 15 per cent, the change in log price is very

close to the percentage price change, and for many purposes it is convenience to look at the data in terms of percentage changes. In addition, Hong (1978) indicated that the variance of log changes is constant (better known as homoscedasticity) whereas the variance of a simple changes increases with the price level. Homoscedasticity is important for the validity of the serial correlation test. In this study, log spot rate changes are used in accordance with the above explanation. Following Hong (1978) and Fama (1965), the standard error of autocorrelation at lag k is calculated as $S_{r_k} = 1/(N-K)^{1/2}$

The relationship between spot rate changes at lag k is statistically significant if r_k is within plus or minus $1.96S_{rk}$ at the 5 percent level or if r_k is within plus or minus $2.575Sr_k$ at the 1 percent level. In this study, autocorrelations were reported only for lags 1 through 4 because of the fact that autocorrelations were not that significant after lag 4.

A run is defined as an exchange rate change sequence of the same sign. For example, "+ + + − − − ooo + +" would constitute four runs, where "+" represents an increase in the exchange rate, "o" represents no change, and "−" represents a decrease.

Wallis and Roberts (1952) introduced the runs test in 1952 which was since then has been used by many researchers studying the weak form of the efficient market hypothesis. The expected number of runs, E(R), was calculated as follows:

$$E(R) = [N(N+1) - \sum_{i=1}^{3} n_i^2)]/N$$

where, n_i = number change for each sign,
and N = total number of changes.

The standard error of runs, S(r), was computed as follows:

$$S(r) = \left\{ \frac{\sum_{i=1}^{3} n_i^2 [\sum_{i=1}^{3} n_i^2 + N(N+1)] - 2N \sum_{i=1}^{3} n_i^3 - N^3}{N^2 (N-1)} \right\}^{1/2}$$

where, N and n_i are as defined above. Studies on the efficiency of the stock markets also used this approach regarding runs tests.

The null hypothesis which states that the exchange rates' changes are random was tested using the formula.

$$Z-(\text{observed}) = [R - E(R) \pm 1/2]/S(r)$$

where, R = actual number of runs,
E(R) = expected number of runs,
S(r) = sample standard error for number of runs,
and 1/2 is the correction factor for continuity adjustment, in which the sign of the continuity adjustment is plus if $R \leqslant E(R)$ and minus otherwise.

The null hypothesis is accepted if Z – (observed) is within plus or minus 1.96 at the 5 per cent level of significance, or within plus or minus 2.576 at the 1 per cent level of signifinance.

FINDINGS

Table 1 shows the autocorrelation coefficients at lags 1 through 4 for each of the 5 Asean currencies. The P-Prob values (level of significance values) were also presented in the parentheses for the corresponding correlation coefficients.

As we can see from Table 1, only two currencies show significant relationship between spot rates at lag 1, namely the Philippines peso and the Singaporean dollar. The relationships are not significant for all Asean currencies at lags 2 through 4. The correlation coefficients of −0 495 and −0.344 for the Philippines peso and the Singaporean dollar respectively, are quite high. This means that spot rates at time period t contribute quite significantly to the movement of the spot rates at time t + 1 for these two currencies. Correlation coefficients of −0.495 and −0.344 can be translated as R^2 (coefficient of determination) of 0.245 and 0.118, respectively The low values of R^2 indicated that past spot rates at lag 1 alone are not adequate in

TABLE 1. Correlation Coefficients and the Corresponding P-Prob Values for Lags 1 through 4

Country	Currency	Lag 1	Lag 2	Lag 3	Lag 4
Indonesia	Rupiah	−0.035	−0.015	0.005	−0.030
		(0.662)	(0.853)	(0.952)	(0.711)
Malaysia	Ringgit	0.057	−0.084	0.132	−0.027
		(0.476)	(0.300	(0.104)	(0.740)
The Phillippines	Peso	−0.495**	−0.001	0.006	−0.012
		(0.000)	(0.990)	(0.940)	(0.881)
Singapore	Dollar	−0.344**	−0.017	0.031	0.032
		(0.000)	(0.757)	(0.702)	(0.693)
Thailand	Baht	−0.003	−0.007	0.013	−0.016
		(0.970)	(0.933)	(0.873)	(0.843)

Notes: 1) P-Prob refers to the level of significance. The P-Prob values are in the parentheses.
2) ** Autocorrelation at the corresponding lag is significantly non-zero at the 1 per cent level of significance.

describing the future movements of spot rates; other variables should also be included, which is beyond the scope of this paper. In other words, a forecasting model which uses spot rates at time period t to predict spot rates at time t+1 would not be that meaningful from an investor's point of view

Negative autocorrelation values indicate movements in the opposite direction. That is, if this week's spot rate exhibits an increase from last week's rate, then we can expect next week's rate to fall, or vice-versa.

Table 2 show the results of the runs test for each of the Asean currencies used in this study All Asean currencies show a conformity to the random walk at the 5 per cent level of significance. This proves conclusively that spot exchange rates for Asean currencies do move in a random fashion.

TABLE 2. Result of Runs Test

Country	Currency	Actual	Expected	Standard Errors of Runs	Z-(observed)
Indonesia	Rupiah	100	95.79	5.77	0.64*
Malaysia	Ringgit	77	83.74	5.87	−1.06*
The Philippines	Peso	89	100.59	5.77	−1.92*
Singapore	Dollar	84	84.56	5.94	−0.01*
Thailand	Baht	85	93.53	5.38	−1.49*

Note: Accept the null hypothesis which states that the spot exchange rate changes are random, at the 5 per cent level of signifinance.

CONCLUSION

This paper explores the possibility of using past spot rates at different lags in building a model for forecasting the future spot rates. Overall, with the exception of the Philippiness peso and the Singaporean dollar at lag 1, the results indicated that spot rates at different lags are not good indicators of the future spot rates. Strong correlations found in peso and Singapore dollar are not adequate in building a "good" model that can be used to predict future spot rates based on past spot rates at lag 1, due to their relatively low R^2 values. In other words, spot rates of Asean currencies are not quite predictable in terms of their trends. This statement is further supported by the results of the runs test. Therefore, we can safely conclude that the markets for Asean currencies are quite efficient in the weak sense of the efficient market hypothesis, just like the markets for currencies of the developed countries.

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