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Short-Run Determinants of the USD/MYR Exchange Rate

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Abstract

This paper examines short-run determinants of the U.S. dollar/Malaysian ringgit (USD/MYR) exchange rate based on a simultaneous-equation model. Applying the EGARCH model, the paper finds that the USD/MYR exchange rate is positively associated with the Malaysian real government Treasury bill rate, U.S. real GDP, the Malaysian real stock index and the expected exchange rate and is negatively influenced by the U.S. real Treasury bill rate, Malaysian real GDP and the U.S. real stock index. The Asian financial crisis has shifted the exchange rate function downward.

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1. Introduction

During the Asian financial crisis, the Malaysian ringgit had depreciated as much as 43.87% from US$0.4035 per ringgit in 1997.M3 to US$0.2265 per ringgit in 1998.M1. Although by 1998.M10 the ringgit had recovered and appreciated 16.20% from US$0.2265 per ringgit to US$0.2632 per ringgit, the ringgit still depreciated 34.77% during the whole period of 1997.M3 - 1998.M10. To defend the ringgit, the Central Bank of Malaysia had raised the interbank overnight rate several times from a low of 6.4246% in 1997.M3 to a high of 11.4431% in 1997.M7. In addition, on August 4, 1997, the Central Bank of Malaysia limited outstanding noncommercial-related Ringgit offered side swap transactions to $2 million per foreign customer. By September 2, 1998, the Central Bank of Malaysia announced that the exchange rate would be pegged at US$0.2632 per ringgit. In the recent global financial crisis, the ringgit had depreciated as much as 13.88% from US$0.3162 per ringgit in 2008.M4 to US$0.2723 per ringgit in 2009.M3 but had recovered most of the losses and stood at US$0.3046 per ringgit as of 2014.M3. Although a depreciating ringgit is expected to help exports, it would raise import costs and domestic inflation, reduce international capital inflows, and increase the value of foreign debt measured in the ringgit.

This paper attempts to examine the USD/MYR exchange rate (units of the U.S. dollar per Malaysian ringgit) based on a simultaneous-equation model of demand and supply. Monetary models of exchange rates are based on the validity of purchasing power parity in the long run and may not apply in the short run. A study of the short-run determinants of the USD/MYR exchange rate would provide policymakers with more insights into the subject.

2. Literature Survey

There have been many studies examining the determinants of exchange rates for Malaysia or related countries. Chin, Azali and Matthews (2007) examine the ringgit exchange rate based on four monetary models. The ringgit exchange rate (units of the ringgit per U.S. dollar) is specified as a function of the money supply, income, interest rate and inflation rate differentials. The results for the money supply differential are in accord with the Frenkel (1976) and Frankel (1979) models. The results for the income differential are consistent with the Frenkel (1976) model. The coefficient of the inflation rate differential has a wrong sign in the Frenkel (1976) and Frankel (1979) models. The positive coefficient for the interest rate differential is in line with the Bilson (1978) model whereas the Dornbusch (1976) and Frankel (1979) models expect a negative sign.

Baharumshah, Aggarwal and Haw (2007) and Ho, Cheng and Hou (2009) find evidence of purchasing power parity (PPP) for Malaysia whereas Choudhry (2005) indicates that generalized purchasing power parity for Malaysia is not confirmed during the pre-crisis period and is confirmed during and after the crisis period.

Furman, Stiglitz, Bosworth and Radelet (1998) show that a higher interest rate leads to currency depreciation. Basurto and Ghosh (2001) find that a higher interest rate results in currency appreciation. Dekle, Hsiao and Wang (2002) reveal that a higher interest rate stabilizes depreciating currencies. Gould and Kamin (2000) and Hueng and Yau (2010) report that there is no significant evidence that a higher interest rate leads to currency appreciation during the Asian financial crisis.

Granger, Huang and Yang (2000), Hussain and Liew (2005), and Lee, Doong and Chou (2011) find a bilateral relationship between exchange rates and stock indexes or a significant link from stock markets to exchange rates in Malaysia. Tsai (2012) reports that exchange rates and stock prices in 6 Asian countries including Malaysia have a positive relationship (the international trading effect) during normal times and a negative relationship (the portfolio balance effect) during stock market bubbles or financial crises. Lin (2012) finds that comovements between stock indexes and exchange rates in Asian emerging markets are stronger during the crisis period, mostly running from stock index changes to exchange rate changes and are not strong for export-oriented sectors. These findings suggest that comovements are attributable to capital account balance instead of trade.

3. The Model

Extending previous studies, we can express the demand for and supply of the Malaysian ringgit versus the U.S. dollar in the foreign exchange market as:

$$MYR^d = U(\varepsilon, Y^{US}, R^{MY}, S^{MY}, \varepsilon^e) \qquad (1)$$

$$\quad - \quad + \quad ? \quad + \quad +$$

$$MYR^s = V(\varepsilon, Y^{MY}, R^{US}, S^{US}) \qquad (2)$$

$$\quad + \quad + \quad ? \quad +$$

where

MYR^d = demand for the Malaysian ringgit,
MYR^s = supply of the Malaysian ringgit,
ε = the USD/MYR exchange rate (units of the U.S. dollar per Malaysian ringgit),
Y^{MY} = real GDP or income in Malaysia,
R^{US} = the real interest rate in the U.S.,
S^{US} = the real stock index in the U.S.,
ε^e = the expected USD/MYR exchange rate,
Y^{US} = real GDP or income in the U.S.,
R^{MY} = the real interest rate in Malaysia, and
S^{MY} = the real stock index in Malaysia.

We expect that the demand for the Malaysian ringgit has a negative relationship with the USD/MYR exchange rate, a positive relationship with real GDP or income in the U.S., the real stock index in Malaysia, and the expected USD/MYR exchange rate (Mishkin, 2012, p. 436), and an unclear relationship with the Malaysian real interest rate. The supply of the Malaysian ringgit is expected to be positively associated with the USD/MYR exchange rate, real GDP or income in Malaysia, and the real stock index in the U.S., and an unclear relationship with the U.S. real interest rate

As real GDP or income in the U.S. rises, Americans tend to import more goods and services from Malaysia and increase the demand for the Malaysian ringgit. When real GDP or income in Malaysia rises, Malaysians tend to import more goods and services from the U.S. and increase the supply of the Malaysian ringgit in exchange for the U.S. dollar.

The impact of a change in the interest rate on the exchange rate depends on whether the traditional or revisionist view would prevail (Dekle, Hsiao and Wang, 2002). According to the traditional view, a higher real interest rate in Malaysia tends to attract Americans investors to purchase Malaysian financial assets, increase the demand for the Malaysian ringgit, and cause the Malaysian ringgit to appreciate. On the other hand, the revisionist view argues that a higher Malaysian real interest rate may reduce the demand for the Malaysian ringgit and cause the Malaysian ringgit to depreciate due to a higher default probability, a weaker financial position and a higher exchange rate risk premium. The above analyses apply to the impact of a change in the U.S. real interest rate on the exchange rate.

Solving for the equilibrium values of the two endogenous variables simultaneously, we can express the equilibrium exchange rate as a function of all the exogenous variables in a reduced form in (3) (Driskill, 1981). According to comparative static analysis, the sign beneath each of the variables shows the impact of a change in any one of the exogenous variables on the equilibrium USD/MYR exchange rate.

$$\bar{\varepsilon} = X(R^{US}, R^{MY}, Y^{US}, Y^{MY}, S^{US}, S^{MY}, \varepsilon^{e}) \tag{3}$$

$$\quad ? \quad ? \quad + \quad - \quad - \quad + \quad +$$

4. Empirical Results

The data were collected from the *International Financial Statistics* published by the International Monetary Fund. The USD/MYR exchange rate measures units of the U.S. dollar per Malaysian ringgit. Hence, an increase means an appreciation of the Malaysian ringgit and a depreciation of the U.S. dollar. The real interest rate in the U.S. is represented by the Treasury bill rate minus the inflation rate in the U.S. The real interest rate in Malaysia is represented by the Treasury bill rate minus the inflation rate in Malaysia. Real GDP in the U.S. is measured in billions at the 2005 price. The data for real GDP at the 2005 price for Malaysia do not cover earlier years and begin in 2005.Q1. Hence, an index real GDP in Malaysia with 2005 as the base year is chosen. The expected exchange rate is unobservable and needs to be estimated. Following Clifton, Leon and Wong (2001) who suggest that the expected value may be represented by a weighted average of past values, I estimate the expected USD/MYR exchange rate as a weighted average exchange rate over the past four quarters with weights assigned as 0.4, 0.3, 0.2 and 0.1. The stock index in the U.S. or Malaysia is represented by the share price index with 2005 as the base year and divided by the consumer price index to derive the real value. The sample consists of quarterly data ranging from 1988.Q1 to 2013.Q1 and has a total of 101 observations. An analysis of the data indicates that the USD/MYR exchange rate has decreased sharply due to the Asian financial crisis since 1997.Q4. Hence, a binary variable beginning in 1997.Q4 is added to (3) to account for a potential structural break.

The ADF test on the regression residuals is employed to determine whether these time series variables are cointegrated. The value of the test statistic is estimated to be -4.5824, which is greater than the critical value of -3.4970 in absolute values at the 1% level. Therefore, these variables have a long-term stable relationship.

Table 1 presents the estimated regression and related statistics. The EGARCH method is applied in order not to place any restriction on the parameters and to yield a positive conditional variance. As shown, approximately 95.27% of the change in the equilibrium USD/MYR exchange rate can be explained by the eight right-hand side variables. The mean absolute percent error of 2.3985% suggests that the forecast error is relatively small. All the coefficients are significant at the 1% level. The equilibrium USD/MYR exchange rate is positively associated with the Malaysian real Treasury bill rate, U.S. real GDP, the Malaysian real stock index, and the expected exchange rate. It is negatively affected by the U.S. real Treasury bill rate, Malaysian real GDP, the U.S. real stock index and the binary variable

Table I. Estimated Regression of the USD/MYR Exchange Rate

Dependent variable: USD/MYR exchange rate	Coefficient	z-Statistic
U.S. real Treasury bill rate	-0.0017	-3.8912
Malaysian real Treasury bill rate	0.0010	3.4639
Log(U.S. real GDP)	0.0861	34.7226
Log(Malaysian real GDP)	-0.0472	-11.1808
Log(U.S. real stock index)	-0.0158	-5.6089
Log(Malaysia real stock index)	0.0456	18.1051
Expected USD/MYR exchange rate	0.6947	18.1093
Binary variable	-0.0158	-2.5428
Constant	-0.6317	-23.3646
R^2	0.9527	
Mean absolute percent error	2.3985%	
Sample period	1988.Q1-2013.Q1	
Number of observations	101	
Methodology	EGARCH	

Notes: All the coefficients are significant at the 1% level.
The USD/MYR exchange rate refers to units of the U.S. dollar per Malaysian ringgit.
Binary variable = 1 since 1997.Q4, and = 0 otherwise.

Specifically, a 1 percentage-point increase in the U.S. real Treasury bill rate would reduce the USD/MYR exchange rate by 0.0017 whereas a 1 percentage-point increase in the Malaysian real Treasury bill rate would raise the USD/MYR exchange rate by 0.0010. A 1 unit increase in the log of U.S. real GDP would raise the USD/MYR exchange rate by 0.0861 whereas a 1 unit increase in the log of the Malaysian real GDP would reduce the USD/MYR exchange rate by 0.0472. A one unit increase in the log of the U.S. real stock index would reduce the USD/MYR exchange rate by 0.0158 whereas a one unit increase in the log of the Malaysian real stock index would raise

the USD/MYR exchange rate by 0.0456. If the expected exchange rate rises by 1, the actual exchange rate would increase 0.6947. The Asian financial crisis has shifted the exchange rate function downward by 0.0158, suggesting that there was a structural break since 1997.Q4. In comparison, the results for the interest rates in this study are in contrast with the finding of Chin, Azali and Matthews (2007) and are consistent with the Dornbusch (1976) and Frankel (1979) models in that a higher interest rate in Malaysia causes the ringgit to appreciate.

Several other versions are tested to determine whether the results may change. If U.S. exports to Malaysia and U.S. imports from Malaysia measured in real terms replace real GDP in the U.S. and Malaysia, the coefficient of U.S. real exports to Malaysia is negative and significant at the 1% level, and the coefficient of U.S. real imports from Malaysia is positive and significant at the 1% level. However, the coefficient of real U.S. share price is insignificant at the 10% level. The R^2 value of 0.9640 is very similar to the R^2 value of 0.9527 as reported in Table 1. When the simple lagged exchange rate replaces the weighted exchange rate, its positive coefficient is significant at the 1% level, but the coefficients of the U.S. real Treasury bill rate and the real stock index become insignificant at the 10% level. If the expected exchange rate is represented by the average exchange rate over the past four quarters, the value of R^2 is slightly lower, the mean absolute percent error is slightly higher, and the coefficient of the U.S. real Treasury bill rate has a weak significance at the 10% level. Other results are similar.

5. Summary and Conclusions

This paper has examined the determinants of the USD/MYR exchange rate in the short run based on a simultaneous-equation model consisting of the demand for and supply of the Malaysian ringgit. A reduced-form equation is estimated by the EGARCH method. The paper finds that a higher Malaysian real Treasury bill rate, a higher U.S. real GDP, a higher Malaysian real stock index, and a higher expected exchange rate would raise the USD/MYR exchange rate whereas a higher U.S. real Treasury bill rate, a higher Malaysian real GDP, and a higher U.S. real stock index would reduce the USD/MYR exchange rate.

There are several policy implications. It seems that demand and supply analysis of exchange rates in the short run works reasonably well because it can explain approximately 95.27% of exchange rate movements and the forecast error is relatively small. Interest rates, real GDP, stock indexes and the expected exchange rate in the U.S. and Malaysia play significant roles in exchange rate movements in the short run. Holding other factors constant, the declining trend of the U.S. 3-month Treasury bill rate from a pre-crisis high of 5.1128% in 2007.Q1 to 0.0495% in 2014.Q1 would

raise the USD/MYR exchange rate whereas the rising trend of U.S. stock market indexes since March 2009 would cause the USD/MYR exchange rate to decline. The slow growth of U.S. real GDP may put a relatively small upward pressure on the USD/MYR exchange rate. The rising trends of the Malaysian real GDP and stock market index are expected to cause the Malaysian ringgit to appreciate.

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