The Monetary Model of Exchange Rate: Evidence from The Philippines

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The monetary approach to exchange rate determination for Malaysia

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Abstract

This paper uses alternative versions of the monetary approach to exchange rate determination to explain the Malaysian-ringgit-USD exchange rate during the recent past. The result shows that in general the estimated coefficients of money and income differentials are consistent with all variants of monetary model. In particular, the evidence strongly supports the Bilson's version of the monetary approach.

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I. INTRODUCTION

Modelling exchange rate has been an important issue since the beginning of the flexible exchange rate regime three decades ago. A wide range of models arose to explain the experience of flexible exchange rates[1]. These models were mainly developed within the monetary approach to exchange rate (MAER) determination. The MAER has developed into two main types of models; the flexible-price monetary model due to Frenkel (1976) and Bilson (1978); and, the sticky-price monetary model of Dornbusch (1976) and with its modification as the real interest differential model of Frankel (1979).

A number of papers in the 1990s utilizing the Johansen's method have found new empirical evidence in favour of the long-run monetary model. This note seeks to use Johansen's method to investigate how well different versions of the MAER can explain the exchange rate of the ringgit-USD in recent years[2]. The MAER and the methodology are sketched in Section II. The data set is described and the empirical results are discussed in Section III. Section IV concludes.

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[1] For a comprehensive discussion on exchange rate models, see MacDonald and Taylor (1992); and Taylor (1995).

[2] For instance, MacDonald and Taylor (1991, 1993, 1994a, b), Kouretas (1997), Diamandis *et al.* (1998), Makrydakis (1998), Reinton and Ongena (1999), Miyakoshi (2000), Hwang (2001), Tawadros (2001) and Civcir (2003) had found evidence in favour of the monetary model for a number of currencies.

II. METHODOLOGY

This section briefly outlines the different testable hypotheses of the MAER. The reduced form of the MAER can be written in log-linear terms as follows:

$$e_t = c_0 + \beta_1(m_t - m_t^*) + \beta_2(y_t - y_t^*) + \beta_3(r_t - r_t^*) + \beta_4(\pi_t - \pi_t^*) + \varepsilon_t \quad (1)$$

where e_t is the spot exchange rate (defined as the price of a unit of foreign money in terms of domestic money), m_t is the domestic money supply, y_t is the domestic real income, r_t is the domestic interest rate, π_t is the domestic expected inflation rate, c_0 *is* a constant, ε_t is the error term, while an asterisk denotes the corresponding foreign variables, and all variables except for interest rate and expected inflation rate, are expressed in natural logarithms. On the basis of the four variants of the monetary model, four functional forms for the nominal exchange rate can be distinguished[3]. Table 1 summarizes the direction in which the different variables are expected to influence the exchange rate in these models.

Table 1: Alternative hypotheses on the coefficients of monetary models

Coefficients:	$(m - m^*)_t$	$(y - y^*)_t$	$(r - r^*)_t$	$E_t(\bar{\pi}_{t+1} - \bar{\pi}^*_{t+1})$
	β_1	β_2	β_3	β_4
Variants of the monetary model:				
Frenkel model:	+1	-	0	+
Bilson model:	+1	-	+	0
Dornbusch model:	+1	-	-	0
Frankel model:	+1	-	-	+

The empirical validity of the monetary model can be assessed by testing whether the exchange rate and the monetary fundamentals in Equation 1 are

[3] Refer Frenkel and Koske (2004) for more detail.

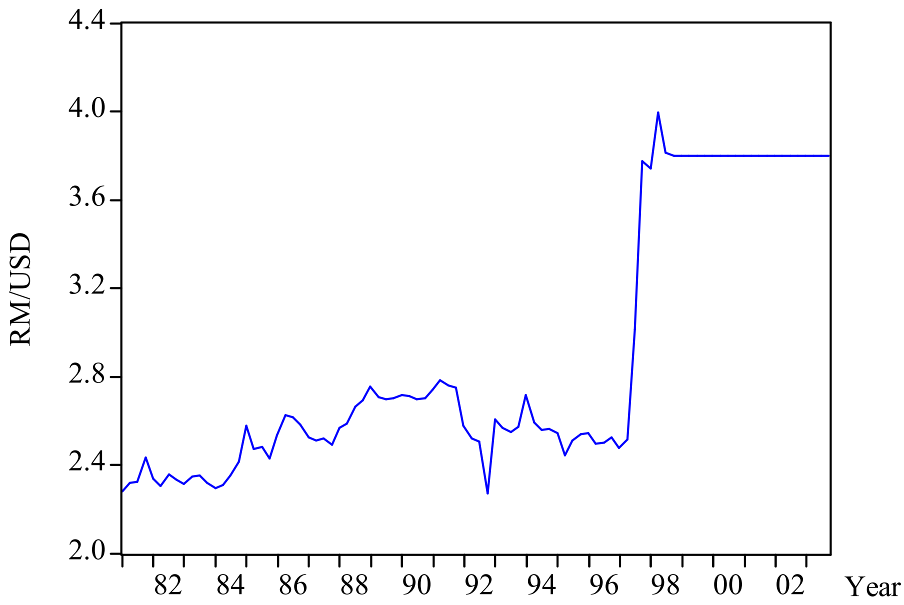
cointegrated using the Johansen method. If we are able to reject the null hypothesis of no cointegrating vector, this indicates that the exchange rate and its monetary fundamentals have a stable long-run relationship. Next, we test these cointegrating vectors by imposing relevant restrictions according to the four variants of the monetary model.

III. EMPIRICAL FINDINGS

The data are compiled from various issues of the International Monetary Fund’s International Financial Statistics yearbook. The data are of quarterly frequency spanning from 1981Q1 to 2003Q1. Exchange rates are quarterly averages in terms of ringgit/USD. Chart 1 shows the exchange rate for the full sample period, which includes the period of the East Asian financial crisis of 1997/8.

The chosen monetary aggregates are broad money stock (M2). Quarterly industrial production indices are used as proxies for real domestic income. Interest rates are quarterly averages of the short-term market rates. Preceding 4 quarters growth in consumer price indices is used as a measure of the unobservable expected inflation rate.

Chart 1: Exchange Rate for Malaysia (1981Q1 - 2003 Q1)



In order to implement the Johansen cointegration test, one has to determine the order of integration. The Augmented Dickey-Fuller (ADF) unit root test result (Table 2) clearly show that all variables are integrated of order one, $I(1)$.

Table 2: Augmented Dickey-Fuller unit root tests

Series	constant without trend		constant with trend	
	Level	First Difference	Level	First Difference
e	-0.98 (1)	-5.92 (1) [a]	-2.11 (1)	-5.88 (1)[a]
m-m*	-0.375 (3)	-3.41 (2) [b]	-1.67 (3)	-4.63 (1)[a]
y-y*	-0.71 (8)	-3.47 (7) [b]	-3.02 (8)	-4.88 (6)[a]
r-r*	-2.88 (5)	-4.47 (2) [a]	-3.21 (4)	-4.52 (2)[a]
π-π*	-2.34 (8)	-6.16 (7) [a]	-3.25 (9)	-6.52 (7)[a]

Notes: Figures are the t-statistics for testing the null hypothesis that the series is nonstationary. a and b denotes significance at 1% and 5% levels. For constant with trend, the critical values for rejection are –4.06, and -3.46 at 1% and 5%. For constant without trend, the critical values for rejection are -3.51 and -2.90 at 1% and 5%. Figures in parenthesis are lag length.

Since the series are of same order, we proceed to test the existence of cointegrating between the exchange rate and its fundamentals using

Johansen test. The result (Table 3) indicates that the model is cointegrated with one cointegrating vector.

Table 3: Johansen cointegration test

Null Hypotheses	Eigenvalue	Trace	Critical Value (1%)	Critical Value (5%)	Max-Eigen	Critical Value (1%)	Critical Value (5%)
(r = 0)	0.352717	80.75671[a]	76.07	68.52	36.97253[b]	38.77	33.46
(r ≤ 1)	0.227292	43.78418	54.46	47.21	21.91762	32.24	27.07
(r ≤ 2)	0.124478	21.86655	35.65	29.68	11.29950	25.52	20.97
(r ≤ 3)	0.109364	10.56705	20.04	15.41	9.844621	18.63	14.07
(r ≤ 4)	0.008463	0.722430	6.65	3.76	0.722430	6.65	3.76

Notes: r indicates the number of cointegrating vectors. a and b denote rejection of the hypothesis at 1% and 5% critical values. Model included 4 lags on each variable.

In order to investigate whether any of the variants of the monetary approach really applies to Malaysia, the normalized cointegrating vector is examined. The summary of the restrictions on the cointegrating vector along with the results are shown in Table 4.

The results show that the estimated coefficients of money and income differentials are in accord with all variants of monetary model. The Bilson (1978) model perfectly describes the cointegrating relationship in which all the estimated coefficients of money, income and interest rate differentials carry the anticipated sign. However, only the interest rate differential is statistically significant. The similar results only explain money and income differentials for Dornbusch (1976) model. Positive interest rate differential is contradicts to Dornbusch’s expectation. In the case of the Frenkel (1976) model, the estimated coefficients of money and income differentials are correctly signed and strongly significant. However, the expected inflation rate differential is not consistent with the theory. For the Frankel (1979) model, both the money and income differentials are correctly signed. The money differential is statistically significant, however the income differential is insignificant. The signs of the estimated coefficients on interest rate and inflation rate differentials do not conform to the model.

Table 4: Normalized cointegrating vector

Model	**Restrictions**	$(m-m^*)_t$	$(y-y^*)_t$	$(r-r^*)_t$	$(\pi-\pi^*)_t$
			Estimated coefficient		
Frenkel	[-1, • , • , 0 , •]	0.82[a]	-0.86[a]	**0.00**	-0.23[a]
Bilson	[-1, • , • , • , 0]	0.85	-2.60	55.56[a]	**0.00**
Dornbusch	[-1, • , • , • , 0]	0.85	-2.60	55.56[a]	**0.00**
Frankel	[-1, • , • , • , •]	0.84[a]	-0.95	2.07	-0.24[a]
			Expected sign		
Frenkel		+1	-	0	+
Bilson		+1	-	+	0
Dornbusch		+1	-	-	0
Frankel		+1	-	-	+

Notes: Coefficient is the β coefficient from monetary cointegrating vector normalized on the exchange rate. • denotes an unspecified column of β, to be estimated from data. Coefficient in shade indicates correctly signed. a and b denotes significance at 1% and 5% levels.

IV. CONCLUSIONS

This paper uses different versions of the MAER to investigate how well this approach can explain the exchange rate of the ringgit-USD during the recent past. The cointegration result shows that a long-run relationship exists between the variables of the monetary model for the ringgit-USD exchange rate. This is supportive of the long-run properties of the monetary approach. The estimated coefficients are broadly in line with the monetary model, in particular the estimated coefficients of money and income differentials are consistent with all variants of monetary model. Importantly, all the estimated coefficients of money, income and interest rate differentials support the Bilson (1978) version of the MAER model.

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