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IS MALAYSIA EXCHANGE RATE MISALIGNMENT BEFORE THE 1997 CRISIS?

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Abstract

This paper seeks to use the flexible-price monetary model in the cointegration and vector error correction model (VECM) contexts to determine whether there was misalignment in the Malaysian ringgit - U.S. dollar before the 1997 currency crisis. Unit roots, cointegration and weak exogeneity are tested to validate the monetary exchange rate model. Generally, it is found that all the series are I(1) process and there exists significant cointegrating vectors. Using the cointegrating vector and the final parsimonious VECM, out of sample predictions for Ringgit exchange rate are generated. The resulting residuals between the actual and the fitted values of exchange rate are the estimated misalignments. From cointegration, our results suggest that the Malaysian ringgit was overvalued from 1995Q2-1997Q2. Based on VECM, our results suggest that ringgit was overvalued from 1995Q2-1996Q2 and slightly undervalued from 1996Q3-1997Q2.

JEL Classifications: F31
Keywords: Monetary Model; Exchange Rate; Misalignment; Malaysia

1. Introduction

The most important event in the world economy in 1997 – perhaps in the decade – was financial crisis that besieged much of the Asian countries. The crisis began in Thailand in July 1997 and it quickly spilled over to engulf Indonesia, Korea and Malaysia by the end of 1997.

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The stock prices of these countries fall sharply together with the massive depreciation of their currencies. The outcome was that many Asian economies experienced drastic slowdown in their economic growth and a loss of confidence by foreign investors. The speed and severity of the crisis took everybody by surprise. One of the key questions surrounding the 1997 Asian crises is what caused the financial crisis? A number of papers have pointed to exchange rate overvaluation as a prominent determinant of currency crises (Frankel and Rose, 1996; Sachs *et al.,* 1996; Kaminsky and Reinhart, 1999; Goldfajn and Valdes, 1999; and Chinn, 2000). Hence, the presence of overvaluation is potentially important for policy purposes because of its role as a component of an early warning system (see e.g. Berg *et al*., 2000). This study examines the degree to which the Malaysian ringgit - U.S. dollar exchange rate is misaligned by using a theoretical baseline model. Firstly, we formulate and test the validity of the monetary exchange rate model for Malaysia using the cointegration and vector-error correction techniques. Then the models obtained are used to determine the exchange rate for the country before the currency crisis to see whether there is any currency misalignment.

This paper extends the existing literatures in three directions. First, this paper adds to the pool of very few studies that have investigated whether the ringgit is misalignment before the 1997 financial crisis. Those have came to our notice are Furman and Stigliz (1998), Sazanami and Yoshimura (1999), Chinn (2000), Kwek and Yoong (2002), Lee and Azali (2005) and Husted and MacDonald (1999). Second, we advance the above mentioned literatures in some ways. Compared to Furman and Stigliz (1998), Sazanami and Yoshimura (1999), and Chinn (2000) who used PPP to measure the exchange rate misalignment, we use a more structural model. The unrealistic assumption underlying the PPP based approach is that it assumes an unchanged equilibrium real exchange rate throughout the period. We employed a theoretical baseline model which incorporates the changes in economy fundamentals to estimate equilibrium exchange rate and to derive exchange rate misalignment. Although we employed the same monetary exchange rate model as Husted and MacDonald (1999) and Lee and Azali (2005), our study is different from theirs in the following aspects. Husted and MacDonald (1999) measured long-run exchange rate misalignment while Lee and Azali (2005) derived short-run misalignment from VECM monetary model, but we estimate both long-run and short-run misalignments. In addition, we had observed that most of the estimated coefficients of monetary model in the study of Lee and Azali (2005) carried an unexpected sign. This might due to the model is estimated under a restricted form; hence we relaxed the assumptions of equality in money and income elasticities across countries and tested the monetary model in an unrestricted form. Third, in the literature, the monetary model is widely used for testing the validity of the approach and its out-of-sample forecasting performance. However, this model is not widely used for assessment purposes. Notable exceptions are Husted and MacDonald (1999), Chinn (2000), Civcir (2004) and La Cour and MacDonald (2000).

The structure of the paper is as follows: Section 2 discusses the concept of exchange rate misalignment, undervaluation and overvaluation. Section 3 reviews the empirical studies of estimating exchange rate misalignment. Section 4 outlines the monetary exchange rate model to estimate the exchange rate behavior and then to derive exchange rate misalignment. Section 5 describes the methodology and data set used. Section 6 presents the empirical results. Concluding remarks appear in section 7.

2. Misalignment, Undervaluation and Overvaluation

To understand the concept of exchange rate misalignment and the equilibrium exchange rate, one must begin with a simple definition of the equilibrium exchange rate. Conventionally, the long-run equilibrium exchange rate is defined as the exchange rate level that, for a given set of 'structural fundamentals' is compatible with simultaneous achievement of internal and external balances of economy[1]. And the exchange rate misalignment is defined as a "persistent departure of the exchange rate from its long-run equilibrium level"[2]. Hence, the literature on exchange rate misalignment has been mostly confined to estimation from long-run parameter. However, with the development of VECM, some recent studies had employed VECM to estimate exchange rate misalignment[3]. Regardless of the specific approach, to measure exchange rate misalignment, first, the equilibrium exchange rate must be ascertained. Then, the absolute difference between the actual spot exchange rate and the estimated equilibrium exchange rate is the estimated misalignment. For this study, we quantify equilibrium value using available time series data on the variables constituting the fundamentals that underpin the exchange rate. The equilibrium exchange rate is modelled as being dependent on these fundamentals and any deviation of the actual from the predicted value is interpreted as misalignment. If the value of actual spot exchange rate is above the value of equilibrium exchange rate, it's called exchange rate overvaluation. While exchange rate undervaluation describes the situation where the market value is below equilibrium rate.

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[1] See Edwards (2001).
[2] See Williamson (1985).
[3] For instance, Chinn (2000); Kemme and Teng (2000); and Chand (2001).

3. Empirical Studies on Exchange Rate Misalignment

A number of alternative methods have been used to calculate an equilibrium exchange rate. A comprehensive and detailed survey is offered in ÉGert *et al*. (2006)[4]. Nevertheless, two main approaches that are most popular found in the empirical literatures for measuring currency misalignment for developing countries are the price based purchasing power parity (PPP) approach and the model based approach[5].

The first approach is based on a simple no-arbitrage condition. This approach uses deviations of the actual real exchange rate from some base year in which the real exchange rate is believed to be in equilibrium to calculate misalignment. This approach is relatively easy to implement, but does not address the economically interesting question of whether a particular exchange rate is at an optimal level, besides that defined by a no-arbitrage condition (Chinn, 2000). In addition, inadequate consideration is given to changes in the equilibrium real exchange rate caused by fundamentals because this approach assumes an unchanged equilibrium real exchange rate throughout the period (Zhang, 2001) and issues on the choice of a relevant price index and a proper base year remain. On the other hand, the second approach uses a formal model for determining the equilibrium real exchange rate. Its principal advantage is the capability of incorporating changes in the equilibrium real exchange rate (Zhang, 2001). The main contribution of this approach is to capture explicitly economic factors in estimating equilibrium real exchange rate.

Price based PPP model have been employed by Furman and Stigliz (1998), Sazanami and Yoshimura (1999) and Chinn (2000) to estimate the ringgit exchange rate misalignment before the 1997 currency crisis. Employing monthly data from January 1989 to December 1991 in long-run averaging “stylized facts” base period (where average real exchange rate over 1989-1991 as the base year), Furman and Stigliz (1998) found that Malaysia ringgit were overvalued from January to June 1997. On

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[4] ÉGert, Halpern and MacDonald (2006) present a critical overview of the various methods available for calculating equilibrium exchange rates such as Purchasing Power Parity (PPP), its trend-adjusted variants, the internal–external approach and its variants [the Fundamental Equilibrium Exchange Rate (FEER), the Macroeconomic Balance Approach and the Natural Real Exchange Rate (NATREX)], the Behavioural Equilibrium Exchange Rate (BEER), the Permanent Equilibrium Exchange Rate (PEER), the Capital Enhanced Equilibrium Exchange Rate (CHEER) and the New Open Economy Macroeconomics (NOEM) approach to the determination of the equilibrium exchange rate.

[5] For examples: Furman and Stigliz (1998); Sazanami and Yoshimura (1999); Baffes et. al. (1999); Husted and MacDonald (1999); Chinn and Dooley (1999); Chinn (2000); Lim (2000); Zhang (2001); Kakkar (2001); and Saxena (2002).

the other hand, Sazanami and Yoshimura (1999) used mean reverting as base period to measure currencies overvaluation. Using monthly data spanning from 1986 January to 1996 December, they found that RM/USD and RM/yen were overvalued on May 1997. Chinn (2000) estimated Malaysian currencies overvaluation respective to USD and yen using long-run averaging PPP model. They tested the model using deflated producer price indices (PPI) and deflated consumer price indices (CPI) over the data of January 1978 to December 1996. Both models provide consistent results of overvaluation for RM/USD and RM/yen at May 1997.

Lee and Azali (2005), Husted and MacDonald (1999) and Kwek and Yoong (2002) used a formal model to determine the equilibrium exchange rate for Malaysia before the currency crisis. Lee and Azali (2005) used a restricted version of sticky-price monetary model in the environment of vector error-correction to estimate the short run RM/USD exchange rate misalignment before the currency crisis. First, the authors formulated the exchange rate model for Malaysia by using quarterly data of 1980Q1 to 1995Q1. The model was checked for the diagnostics tests as well as in sample and out of sample forecasting performances. Next, using the model obtained, the equilibrium RM/USD exchange rates are generated. Finally, the exchange rate misalignments were derived from the residuals between the actual and the predicted equilibrium exchange rates. Their results showed that the Malaysian ringgit was slightly overvalued in the second quarter of 1997. However, it is statistically insignificant. Instead of RM/USD, Husted and MacDonald (1999) employed monetary model in panel OLS to examine the RM/yen exchange rates misalignments before the crises. The unrestricted version of flexible price monetary exchange rate model together with annual data ranging from 1974 – 1996 is used to produce estimates of equilibrium exchange rates and a plot of equilibrium or fitted values derived from the OLS fixed effects panel estimates of the monetary model was compared with the actual values. The results suggesting the RM/yen was overvalued at end of 1996. Kwek and Yoong (2002) assessed the RM/USD exchange rate valuation by employing an equilibrium exchange rate model. Quarterly data from 1991Q1 to 2001Q1 is used to estimate the equilibrium exchange rate model. Their results showed that the RM/USD was undervalued by 11% in 1997Q3. For the period just prior to 1998Q3, the real exchange rate is lower than the equilibrium real exchange rate, this suggests that ringgit Malaysia is pegged at an overvalued level as compared to equilibrium rate. However after 1999Q3, the ringgit Malaysia started to be undervalued after the pegging at RM3.80 to USD. Nevertheless, they concluded that the RM/USD exchange rate has not been misaligned with excessive overvaluation or undervaluation even after the government's policy on pegging of RM/USD. Except for Kwek and Yoong (2002), it had been observed that all of the above mention empirical studies both PPP and model based approach found that the ringgit was overvalued on the eve of the currency crisis.

4. Exchange Rate Model

The monetary model of exchange rate determination serves as the basic construct for equilibrium nominal exchange rate in variety of macroeconomic models[6]. All monetary models rely on the twin assumptions of purchasing power parity (PPP) holds continuously (Equation 1) and the existence of stable money demand functions for the domestic and foreign economies (Equations 2 and 3):

$$e_t = p_t - p_t^*, \tag{1}$$

$$m_t = \gamma_1 p_t + \gamma_2 y_t + \gamma_3 r_t, \tag{2}$$

$$m_t^* = \gamma_1 p_t^* + \gamma_2 y_t^* + \gamma_3 r_t^* \tag{3}$$

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, p_t pt is the domestic price level, y_t is the domestic real income, r_t is the domestic interest rate, while an asterisk denotes the corresponding foreign variables, and all variables except for interest rate, are expressed in natural logarithms[7].

Solving Equations (2) and (3) for the relative price level, and substituting into Equation (1) yields the basic flexible-price monetary model:

$$e_t = (m_t - m_t^*) - \beta(y_t - y_t^*) + \lambda(r_t - r_t^*) \tag{4}$$

Note that Equation (4) assumes the equality of identical demand for money coefficients across countries.

Relaxing these assumptions, gives Equation (4) in an unrestricted form as:

$$e_t = \alpha_0 m_t - \alpha_1 m_t^* - \beta_0 y_t - \beta_1 y_t^* + \lambda_0 r_t - \alpha_1 r_t^* + \varepsilon_t \tag{5}$$

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[6] See, for instance, Frenkel (1976), Bilson (1978), Hodrick (1978), Dornbusch (1976) and Frankel (1979).

[7] In this study, home country is Malaysia while foreign country is the United States.

Theoretically, α_0 and α_1 should equal 1 and –1 respectively, β_0 and β_1 should be negative and positive, respectively, with values equal to income elasticities from domestic and foreign money demand functions, and λ_0 and λ_1 should be positive and negative with values similar to those of semi-interest rate elasticities in money demand functions.

5. Methodology and Data

As an initial step in our analysis, the order of integration for the time series were determined using the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. If the series are of same order, then we may proceed to test the existence of cointegrating relations among the exchange rate and its fundamentals using Johansen multivariate cointegration techniques. The test used is the trace statistic, which tests for at most r cointegrating vectors among a system of n time series (where r = 0, 1, 2, . . . , n – 2, n – 1) (Johansen, 1988). If we are able to reject the null hypothesis of no cointegrating vectors based on the trace statistic, this indicates the monetary model have some long-run validity (Enders, 2004).

According to the Granger Representation Theorem, if a cointegrating relationship exists between a series of I(1) variables, then an error-correction model (ECM) also exists. An ECM is a model, which uses the lagged residual from the cointegrating regression in combination with short-run dynamics to adjust the model towards long-run equilibrium (Tawadros, 2001). This suggests that there should exist an exchange rate equation of the form:

$$\Delta e_t = C + \sum_{i=0}^{n} \Gamma_{1i} \Delta e_{t-i-1} + \sum_{i=0}^{n} \Gamma_{2i} \Delta m_{t-i} + \sum_{i=0}^{n} \Gamma_{3i} \Delta m^*_{t-i} + \sum_{i=0}^{n} \Gamma_{4i} \Delta y_{t-i} + \sum_{i=0}^{n} \Gamma_{5i} \Delta y^*_{t-i} + \sum_{i=0}^{n} \Gamma_{6i} \Delta r_{t-i} + \sum_{i=0}^{n} \Gamma_{7i} \Delta r^*_{t-i} + \Pi Z_{t-1} + \mu_t \quad (6)$$

where C denotes a constant, μ_t denotes a error term, Z_t represents the cointegrating vector normalized on e_t and Π-matrix captures the adjustment of the exchange rate towards its long-run equilibrium value. $\Pi = \alpha\beta'$, where α represents the speed of adjustment to disequilibrium while β is a matrix of long-run coefficients such that the term $\beta' Z_t$ embedded in Equation (6) represents up to (n – 1) cointegration relationships in the multivariate model which ensure that the Z_t converges to their long-run steady-state solutions.

Equation (6) can be used to test the Granger causality for weakly exogeneity. The Granger causality test must be conducted in the environment of vector error-correction model (VECM) where the relevant error-correction terms (ECTs) were included in the model to avoid misspecification and omission of the important variables. Granger causality is testing the null hypothesis that the lagged values of the independent variables are jointly significant in the equation of the dependent variable. This can be done by running a VECM on the system of equations and testing for zero restrictions on the lagged values of the independent variables' coefficients.

Finally, following the Hendry's general-to-specific methodology, the final parsimonious specification of Equation (6) is used to forecast the exchange rate before the currency crisis. This final parsimonious specification can be achieved by sequentially removing the insignificant regressors from the general model if the t-statistic of the coefficient is less that one in absolute terms.

The data for this study are collected from various issues of the International Monetary Fund's International Financial Statistics yearbook spanning from 1973Q2 to 2003Q1. Data during the flexible exchange rate period and before any evidence of currency misalignment i.e. 1973Q2 to 1995Q1 were used to formulate the model, while the data from 1995Q2 onwards were set aside for comparison and for out-sample forecasting exercises[8]. Exchange rates are quarterly averages in terms of RM/USD. The chosen monetary aggregates are broad money stock (M2)[9]. The industrial product indices (IPI) were utilized as proxies for domestic income. The interest rates are the quarterly averages of three-month treasury bill rates.

6. Empirical Results

The order of integration of the series was determined using the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Table 1 reports that all of the series are $I(1)$ processes[10].

The Johansen-Juselius likelihood cointegration test was reported in Table 2. The result indicates that the null hypothesis of one cointegrating vector is rejected using 5% critical value. This implies that

[8] Sazanami and Yoshimura (1999) found that the misalignment of the East Asian currencies started since April 1995.

[9] Data for monetary aggregates are seasonally adjusted.

[10] Except for two cases, i.e. constant with trend PP test shows that the exchange rate is level stationary and constant with trend ADF test shows that the foreign interest rate is nonstationary at both levels. We treat them as $I(1)$ process since the other three tests show that they are $I(1)$.

the variables in this model are cointegrated with two cointegrating vectors. Our finding of at least one cointegrating vector indicates that the monetary model would seem to have some long-run validity.

Table 1
Unit Root Tests

	Augmented Dickey-Fuller				**Phillips-Perron**			
	Constant without Trend		Constant with Trend		Constant without Trend		Constant with Trend	
	Level	First Difference	Level	First Difference	Level	First Difference	Level	First Difference
e	-1.90	-4.73***	-2.78	-4.70***	-2.52	-13.95***	-3.51**	-13.86***
m	-1.66	-3.16**	-2.09	-3.45*	-2.02	-10.20***	-2.17	-10.50***
*m**	-1.90	-3.52***	-0.32	-4.04**	-1.95	-9.05***	-0.38	-9.39***
y	-0.79	-4.39***	-2.99	-4.37***	-0.86	-8.97***	-3.09	-8.91***
*y**	-0.35	-4.54***	-3.38	-4.56***	-0.33	-5.37***	-2.85	-5.35***
r	-2.22	-3.69***	-2.56	-3.67**	-2.29	-7.23***	-2.51	-7.18***
*r**	-1.79	-2.80*	-1.96	-2.72	-1.90	-7.77***	-2.21	-7.72***

Notes: Figures are the *t*-statistics for testing the null hypothesis of ADF (PP) that the series is nonstationary (stationary). ***, ** and * denotes significance at 1 , 5 and 10% level, respectively. For constant without trend, the critical values for rejection are -3.50, -2.89 and -2.58 at 1, 5 and 10%, respectively. For constant with trend, the critical values for rejection are –4.07, -3.46 and –3.16 at 1, 5 and 10%, respectively. Lag length used in all series is 4.

Table 2
Johansen-Juselius Likelihood Cointegration Test

Null Hypotheses	**Maximum Eigenvalue**	**Trace**	**Critical Value (5%)**	**Critical Value (1%)**
(r = 0)***	0.390041	136.6072	124.24	133.57
($r \leq 1$)**	0.334013	5.08061	94.15	103.18
($r \leq 2$)	0.238750	0.93581	68.52	76.07
($r \leq 3$)	0.190153	38.02121	47.21	54.46
($r \leq 4$)	0.154598	20.30475	29.68	35.65
($r \leq 5$)	0.070959	6.197579	15.41	20.04
($r \leq 6$)	0.000178	0.014995	3.76	6.65

Notes: *r* indicates the number of cointegrating vectors. *** and ** denotes rejection of the hypothesis at 1% and 5% critical value. Seasonal dummies are not included in this test since they had been dropped in the parsimonious model although they had been considered in the preliminary analyses.

Having determined how many cointegrating vectors there are, it is necessary to consider whether these are unique and consequently whether they tell us anything about the structural economic relationships underlying the long run model. The estimated cointegrating vectors are given economic meaning by means of normalizing. The vector that makes economic sense is that the estimated coefficients are close to and have the same signs as those predicted by economic theory. The values of the coefficients in these two cointegrating vectors are reported in Table 3. The upper panel shows the coefficients in the estimated cointegrating vectors, which normalized on the exchange rate and the lower panel shows the results of some popular homogeneity restrictions on the monetary model. The cointegrating vectors seem represent the monetary model where eight out of twelve coefficients carried the expected signs. In particular, the long-run parameters for domestic money and income, as well as foreign interest rate are correctly signed and consistent in both vectors. These suggested that an increase in Malaysian money supply induces a depreciation to the ringgit; rapid domestic growth will strengthen the ringgit; and a rise in US interest rate leads to depreciation of ringgit. Our finding of cointegration allows us to proceed to test some of the popular imposed monetary restrictions. The estimated values of the χ^2 statistics, which test the equality in money, income and interest rate elasticities across countries, are reported in the lower panel of Table 3. The statistics results rejected the homogeneity in money and interest rate elasticities across countries. Only the restriction of identical income elasticity cannot be rejected. These suggested that we should proceed with unrestricted version of monetary exchange rate model since most of the restrictions do not hold.

Table 3
Normalized Cointegrating Vectors and Restrictions Test

Normalized Cointegrating Vectors:						
	m	m^*	y	y^*	r	r^*
(Predicted Sign)	(+)	(-)	(-)	(+)	(+)	(-)
	0.140	0.358	-0.657	-0.201	-3.720	-3.430
	0.033	-0.044	-0.324	1.075	-1.911	-0.522
Test of Homogeneity Restrictions:						
	$m = -m^* = 1$		$y = -y^*$		$r = -r^*$	
χ^2 (p-value)	9.686 (0.008)		0.006 (0.936)		3.791 (0.052)	

Notes: The upper panel shows the coefficients in the estimated cointegrating vectors, which normalized on the exchange rate. Coefficients in shade indicate correctly signed. The lower panel shows the results of impositions of various homogeneity restrictions on the monetary model.

After obtaining the long-run cointegration relations using the Johansen approach, we can estimate the short-run behaviour in error correction form with the cointegration relationships being included. Table 4 reports the summary results of Granger-causality test in the environment of VECM[11]. The results clearly indicate that the domestic money stock, domestic income and domestic interest rate are weakly exogenous. The results also show that the foreign money stock, foreign income and foreign interest rate granger cause the Malaysian exchange rate. This is reasonable since Malaysian's external sector is closely related to the US.

Table 4
Summary of the of Granger Causality Results based on VECM

From Variable	Direction of Causality	To Variable	Remarks
m	≠>	*e*	No causal relationship
y	≠>	*e*	No causal relationship
r	≠>	*e*	No causal relationship
*m**	=>	*e*	The presence of causal relationship
*y**	=>	*e*	The presence of causal relationship
*r**	=>	*e*	The presence of causal relationship

Following the general to specific approach to modelling, parsimonious error-correction regression is obtained by removing the insignificant regressors[12]. The final parsimonious estimated error-correction regression for flexible price monetary model is:

$$\Delta e_t = -\underset{(1.989)}{0.009} - \underset{(-2.520)}{0.187}\,ECT_1 + \underset{(2.222)}{0.015}\,ECT_2 - \underset{(-2.575)}{0.245}\,\Delta m_t^* - \underset{(-2.884)}{0.659}\,\Delta y_{t-2}^* + \underset{(2.111)}{1.155}\,\Delta r_{t-2}^*, \qquad (7)$$

where ECT_i is normalized cointegrating equation being included in error-correction form. All the variables (except for interest rate) are expressed in natural logarithms and the values in parentheses below the coefficients are the *t*-values. It shows that all the coefficients are statistically significant. Equation (7) shows the error-correction terms are statistically significant and negative, except the second vector[13]. The speed of adjustment coefficient suggests that approximately 18% of the change in the exchange rate per quarter can be attributed to the disequilibrium between actual and equilibrium levels. It also shows that changes in some of the lagged variables have significant short-run effects on exchange rate. The foreign money enters in with a negative

[11] The result of *F*-statistics for the Granger-causality test is reported in Appendix 1.
[12] The full estimates of the regressors are available upon request from the authors.
[13] ECT_2 is positive, however, its magnitude is relatively small.

sign, indicating that an increase in the US money supply lead to an appreciation to the ringgit. Significant negative foreign income variable implies that the US economic growth tends to strengthen the RM/USD rate. And positive foreign interest rate coefficient suggests that US interest rate rise induces ringgit to depreciate.

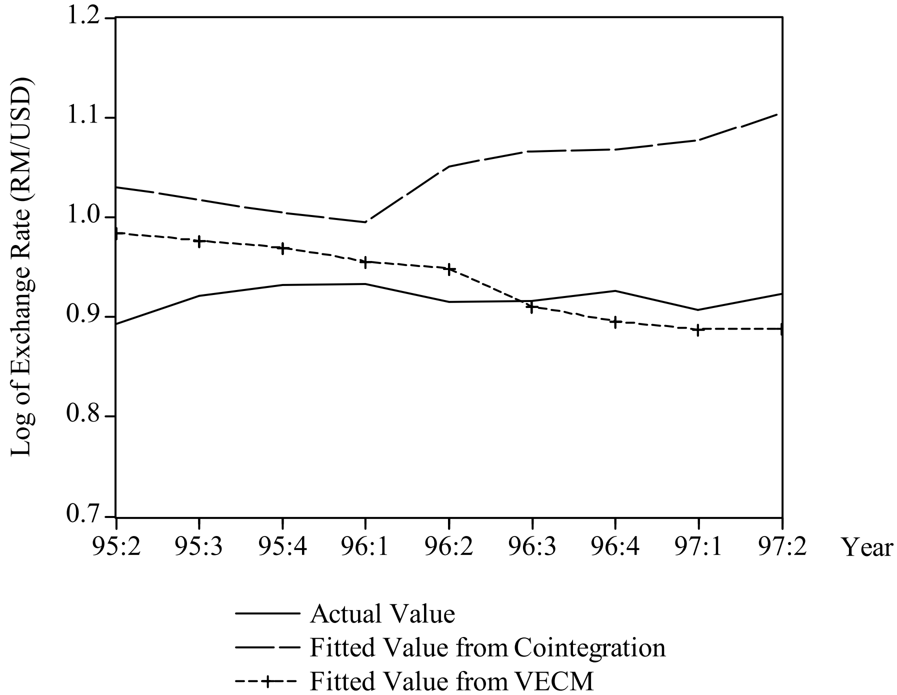
Using the cointegrating vector and Equation (7), out of sample predictions of ringgit exchange rate for the period of 1995Q2 to 1997Q2 are generated. The resulting residuals between the actual and the fitted values of exchange rate are the estimated misalignment (Table 5 and Figure 1). The residuals represent the deviations from short-run and long-run equilibrium. The short-run misalignments are expected to be smaller than the long-run misalignments since there are opportunities for adjustments in exchange rate through short-run dynamics. From cointegration, our results suggest that the RM/USD was overvalued from 1995Q2-1997Q2, in particular the overvaluation was persistently high at 13% – 18% over the period 1996Q2-1997Q2. Based on VECM, our results suggest that RM/USD was overvalued since 1995Q2, however, it turns to become slightly undervalued after 1996Q3. The turning sign in short-run misalignment might due to overshooting of self-correction mechanism. As expeceted the short-run misalignments derived from VECM are smaller than the long-run misalignments of cointegration.

Table 5
Malaysian Exchange Rate Misalignment

Period	Actual Values	Fitted Values		Misalignment (%)	
		COINT	VECM	COINT	VECM
1995:2	0.893	1.030	0.984	-13.7	-9.1
1995:3	0.921	1.017	0.976	-9.6	-5.5
1995:4	0.932	1.003	0.969	-7.1	-3.7
1996:1	0.933	0.994	0.955	-6.1	-2.2
1996:2	0.915	1.051	0.948	-13.6	-3.3
1996:3	0.916	1.065	0.910	-14.9	0.7
1996:4	0.926	1.068	0.895	-14.2	3.1
1997:1	0.907	1.077	0.887	-17.0	2.0
1997:2	0.923	1.103	0.888	-18.1	3.5

Notes: Figures are in log. Fitted values are estimated from cointegrating vector (COINT) and VECM. Misalignment is the residual between actual and fitted values of exchange rate. Positive (negative) value for residual denotes an undervaluation (overvaluation) of the RM/USD.

Figure 1: Actual and Fitted Values of Malaysian Exchange Rate



7. Concluding Remarks

Although there has been much empirical work on the validity of the monetary model, there have been only a few that utilized this model for other purposes. This paper is sought to use the flexible-price monetary model in the cointegration and VECM contexts to determine whether the Malaysian ringgit - U.S. dollar exchange rate was misaligned before the currency crisis. The estimates from cointegrating vector suggest that the Malaysian ringgit was substantially overvalued on the eve of the financial crisis. And the results of VECM indicate that the Malaysian ringgit was overvalued from 1995Q2 – 1996Q2. Thus, evidence do support that the exchange rate overvaluation might be one of the causes contributed to the 1997 financial crisis. The relationships among exchange rate and the economic fundamentals as depicted in our model may provide some insights to the depreciation of ringgit. The estimated long-run parameters of monetary exchange rate model indicated that an increase in Malaysian money supply and a reduction in domestic income lead to a depreciation of ringgit. Malaysian expansionary monetary policy during the 1990s may contribute to the weakening of ringgit. Malaysia has been maintaining high monetary growth in response to a decade of rapid economic growth and to minimise the disruptions of capital inflows in 1992-1994. Although Malaysia had expereince rapid economic growth before the currency crisis, the export growth was decline sharply in 1996. After recording strong export growth of 26% in 1995, Malaysian export growth falls to 7% in 1996 due to the downturn in the global electronic industry, rising wage costs and competition posed by the low-wage countries. Hence, the demand for ringgit in international market may tampered by the sharp decline in exports. In addition, the Granger-causality tests also show that foreign money stock, income and interest rate granger cause Malaysian exchange rate in the short-run. This is reasonable since Malaysian's external sector is closely related to the US.

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Appendix 1
Granger Causality Results based on VECM

Dependent Variable	Independent Variable						
	e	*m*	*m**	*y*	*y**	*r*	*r**
e	-	0.417	2.950**	1.486	6.029***	1.340	2.333*
m	1.109	-	1.291	1.175	0.784	0.323	1.510
*m**	4.115**	0.110	-	0.834	1.487	1.294	2.609*
y	1.346	0.750	2.094	-	1.048	1.322	0.323
*y**	1.065	0.498	4.531***	1.342	-	0.488	0.496
r	0.364	1.906	0.178	0.964	0.432	-	0.407
*r**	1.478	0.241	9.572***	0.440	0.319	0.249	-

Notes: Figures are the *F*-statistics for testing the null hypothesis that the joint significance of the lagged values of the independent variables in the equation of the dependent variable. ***, ** and * denotes significance at 1 , 5 and 10% level, respectively. All variables are in their first-differences.