Jurnal Ekonomi Malaysia 44(2010) 51 - 60

Ringgit Malaysia Predictability: Do Currencies and Prediction Horizon Matters?

(Kebolehramalan Ringgit Malaysia: Adakah Mata Wang dan Perspektif Peramalan Penting?)

Tamat Sarmidi
Universiti Kebangsaan Malaysia

ABSTRACT

The main objective of this study is to investigate the predictability of Malaysian ringgit against currencies that are regarded as fundamentally unstable. The study is motivated by a hypothesis that postulates the performance of exchange rate predictability is better-off for currencies with weak macroeconomic fundamentals or monetary instability. We employ bootstrap technique as proposed by Mark (1995) and later improved by Kilian (1999) to alleviate statistical inference intricacies inherit in the long horizon forecasting to three different monetary models (flexible, sticky and relative price) for ringgit against selected developing economies' currencies. The empirical result shows the superiority of sticky price model for all prediction horizons along with the evidence of exchange rate predictability for ringgit against high inflation economies.

Keywords: foreign exchange; international finance; forecasting; simulation

ABSTRAK

Tujuan utama kajian ini ialah untuk menguji kebolehramalan kadar pertukaran ringgit Malaysia kepada matawang negara yang memiliki asas ekonomi yang tidak stabil. Kajian ini dimotivasikan oleh hipotesis yang mencadangkan kebolehramalan kadar pertukaran asing adalah lebih baik bagi matawang negara yang memiliki asas makroekonmi dan monetari yang lemah atau tidak stabil. Teknik bootstrap yang dibangunkan oleh Mark (1995) dan dimurnikan oleh Kilian (1999) bagi tujuan mengurangkan masalah peramalan menggunakan data jangkaan tempoh masa panjang telah diaplikasikan menggunakan tiga model monetari berbeza iaitu harga fleksibel, harga lekit dan harga relatif. Hasil kajian menunjukkan keutamaan model harga lekit untuk semua tempoh masa jangkaan dan wujudnya petunjuk statistik yang signifikan bagi kebolehramalan untuk kadar pertukaran ringgit kepada matawang negara berinflasi tinggi.

Keywords: tukaran asing; kewangan antarabangsa; peramalan; simulasi

INTRODUCTION

Exchange rate forecastability puzzle suggests that macroeconomic fundamentals contain a negligible predictive content about the movements of nominal exchange rates. Since the seminal papers by Meese and Rogoff (1983a, 1983b), a lot of works has been done to refine theoretical models or improve estimation techniques to explicate the puzzle. However, the empirical evidence from mature economies has consistently failed to overturn this paradox. Consequently, clarifying the exchange rate predictability puzzle remains a challenging area for the researchers. Therefore, this paper aims to investigate exchange rate predictability puzzle using monetary model for Malaysian ringgit against currency of an economy that considered fundamentally unstable.

In this paper we give monetary models another chance and investigate whether by using ringgit against developing economies currencies can improve forecasting performance. We expect to find significant exchange rate predictability with countries that have unstable macroeconomic fundamentals (see for example McNown & Wallace 1994; Rogoff 1996; Moosa 2000). The reason underlying this hypothesis is that countries with greater monetary instability or weak macroeconomic fundamentals are expected to show a stronger correlation between exchange rates movement and macroeconomic fundamentals. Rogoff (1999a) argues that economically stable countries like United States, Germany and Japan generally experience very modest inflation rates. In such circumstances, it is difficult to identify the effect of monetary shocks on exchange rates. On the other hand, developing economies experience high inflation rates, trade balance deficit, budget deficit and excess money supply. Table 1 shows comparison between income volatility and inflation rate between developing countries and the US. Countries Chile, Indonesia and Uruguay are categorised as high inflation countries. These relatively weak economic fundamentals, in addition to the poor management of the economy, are expected to be crucial in predicting exchange rates under the monetary approach. Furthermore, most of the literature in the area of exchange rate predictability deal with developed and industrialised economies. Until now not much work have been done to investigate the forecastability of exchange rates in developing economies despite their increasingly liberalised financial markets and their growing importance in the global financial system.

This study differs from most previous studies in few ways. First, our sample is limited to developing countries that satisfy two important assumptions of the exchange rate determination model: relatively floating exchange rate and considerably open economy for a long period to allow meaningful time series analysis. It does not mean that the developing countries that we choose are fully liberalised, rather that the markets are satisfactorily open with little market frictions and government interventions. The currencies we consider are Indonesia rupiah, Thai baht, Philippine peso, Chilean peso, Uruguayan peso, Moroccan dirham, South African rand and Tunisian dinar. According to Levy-Yeyati & Sturzeneggar (2003) these are countries that are adopting relatively floating exchange rate regime and in the process of liberalizing their capital account.

Second, motivated by Chinn & Meese (1995), we calculate the deviation from monetary fundamentals that suitable for the developing economies. In particular, we consider sticky and relative price of monetary models to account for developing country characteristics, as suggested by MacDonald & Ricci (2001). These models are expected to be superior to the standard flexible price monetary model especially for countries which are still in the process of liberalization period (see Crespo-Cuaresma et al. (2005); Candelon et al. 2007).

Third, we use an error-correction framework to investigate both in-sample predictive content and out-of-sample point forecast accuracy of the fundamental-based models by employing the bootstrap technique proposed by Kilian (1999). The technique is able to account for small sample biases and size distortion that arise in the inferences procedure. Furthermore, the methodology is designed to differentiate whether forecastability power (if any) is due to the contribution of the explanatory variables or simply due to the drift term in the model.

The plan of the paper is as follows. Section 2 delves with literature reviews. In Section 3, we describe the process of constructing the fundamental variables, the dataset and the econometric procedure for testing predictability of ringgit using the monetary models. Section 4 discusses the findings and the link between ringgit predictability and economic fundamentals of developing economies. Section 5 is the conclusion.

LITERATURE REVIEW

The study of exchange rates predictability was pioneered by Meese & Rogoff (1983a, 1983b). They suggest that none of the structural exchange rate models were able to forecast out-of-sample better than a naïve random walk model. Mark (1995) has given a new hope for exchange rate predictability by exploiting the assumed long-run linkages between exchange rates and monetary fundamentals. He finds significant evidence of forecastability at longer horizons (12 and 16 quarter). The same conclusion can also be found in Chinn & Meese (1995) who investigate the same issue using a larger set of explanatory variables. However, both the econometric techniques and the results of Mark (1995) and Chinn & Meese (1995) have not been free from criticism. Kilian (1999) finds that Mark's results suffer from inconsistencies in the testing procedure and small-sample bias. Correcting for these drawbacks, Kilian (1999) finds no support for long run predictability of exchange rate. Later, Berkowitz & Giorgianni (2001) argue that the results of Mark (1995) are not robust and heavily depend on the assumption of cointegration in the long run series. Berkowitz & Giorgianni (2001) show that using the same dataset as Mark (1995) but under the unrestricted VAR model has produced very little evidence of predictability. Therefore, unpredictability of exchange rates remains if no prior assumption is imposed.

Recent studies that use different information set and econometrics approaches (mostly depart from the traditional linear time series) to analyse the association of exchange rates and economic fundamentals do find encouraging support. For example, Kilian & Taylor (2003) use an Exponential Smoothing Threshold Autoregressive (ESTAR) model for seven OECD countries. They show the (in-sample) relevance of nonlinearities in exchange rate dynamics at the one- and two-year horizons. However, they still could not find support for out-of-sample predictability. Manzan & Westerhoff (2007) propose a chartist-fundamentalist model which allows for nonlinear time variation in chartists' extrapolation rate that provide support for the long-term predictability for five major currencies (German mark, Japanese yen, British pound, French franc and Canadian dollar) against the US dollar. Their study shows that the fundamentalist, together with the chartist, are correcting the deviation of exchange rate from its long run equilibrium path. A comprehensive review of the empirical literature on the exchange rate unpredictability for industrialised nations over the last few decades can be found in Neely & Sarno (2002).

However, literature that investigates the predictability of exchange rate movements using exchange rate determination model in developing economies is inconclusive. Empirical attempts are hampered by the difficulty to find an appropriate market that satisfies the assumption of free floating regime, free capital mobility and stable monetary regime. Chinn (1998) stresses the importance of capital imperfect mobility and substitutability, and instability of money demand that are widespread in developing countries in monetary modelling in developing countries.

Ferreira (2006) extensively investigates the significance effect of monetary fundamentals on the exchange rates for Chile, South Korea, Malaysia, Mexico, South Africa, Thailand and Turkey from 1992 to 2002 using panel cointegration techniques. He considers the sticky price model to account for the price rigidities effect between developed and developing countries. The empirical evidence does not show any significant support to reject the hypothesis of no long run co-movement between exchange rates and monetary fundamentals across time and models. Therefore the finding casts doubt on the validity of the hypothesis introduced by McNown & Wallace (1994) who find significant co-movement between exchange rate and monetary fundamentals in some developing countries (Argentina, Chile and Indonesia). On the other hand, Wang & Wong (1997) use Kalman filtering techniques and ARCH models to address the issues of parameter instability and conditional variances to predict Japanese yen, Singapore dollar and Malaysian ringgit from 1973 to 1995. They find that the predictive power improves over 6 to 12 months forecasting horizons. The out-of-sample forecast errors are significantly lower compared to the naïve random walk model. Baharumshah & Masih (2005) further confirm this finding using cointegration techniques. They find substantial evidence of strong predictive power of the monetary model, both for in-sample and out-of-sample forecast accuracy. Based on the standard root mean square error (RMSE) and the Theil's *U* statistics, their findings suggest that the structural model performs better than the random walk only when the current account is included into the VAR system. They also find the error-correction term in the exchange rate equation enters with a significantly negative coefficient. This could suggest that exchange rates converge to the equilibrium path over longer period.

MONETARY MODELS AND ESTIMATION PROCEDURE

Theoretically, exchange rate should not deviate significantly from its "fundamental value". In other words, the exchange rate and the fundamental value are supposed to be cointegrated and one of the two variables will pull the other toward the equilibrium path. Therefore temporary deviations of the exchange rate from its fundamental value should help predict future exchange rate movements. As such, the relationship may be represented in a typical dynamic error-correction framework:

$$\Delta s_{t+k} = s_{t+k} - s_t = \alpha_k + \lambda_k (s_t - f_t) + \upsilon_{t+k} \qquad (1)$$
$$k = 1, 8, 12 \text{ and } 16$$

where s_t is logarithm of the nominal Malaysian ringgit price of one unit of foreign exchange at time t. f_t represents the fundamental value of the exchange rate. α_k is a constant and λ_k is the predictability parameter to be estimated. k is the forecast horizon (3 months or quarter of a year) and $\upsilon_k$is an *iid* disturbance term. If λ_k is smaller than 0, Equation 1 predict that the exchange rate should depreciate when $s_t > f_t$ in order to revert toward the equilibrium path. A statistical test of predictability of exchange rate at horizon k is thus carried out based on the null hypothesis of no predictability, H_0: $\lambda_k = 0$, against the alternative hypothesis of predictability, H_1: $\lambda_k < 0$.

The estimation of Equation 1 is implemented in 2 steps. First step consists of obtaining the fundamental value f_t and the second is to estimate the forecasting regression. Specifically, first, we use Mark (1995) methodology to construct the fundamental value but with few alteration to suite developing market characteristics. Instead of imposing theoretical value to the elasticity of money stock and income elasticity of money demand to [1, –1] respectively, the fundamental value f_t will be constructed using the estimated elasticity of money stock and income elasticity of money demand from the estimated cointegrating coefficient of the Dynamic Ordinary Least Squares (DOLS) method. After constructing the fundamental values then the forecasting estimation will be carried out employing bootstrap procedure proposed by Mark (1995) and improved by Kilian (1999) under a constrained error-correction specification.

CONSTRUCTION OF THE FUNDAMENTAL VALUES

The fundamental values f_t is constructed using cointegrating coefficients estimated by DOLS regression using the following specification:

$$s_t = \alpha + \beta f_t + \sum_{j=-q}^{q} \delta j \Delta f_{t-j} + \varepsilon_t \qquad (2)$$

where f_t is a vector of fundamental variables obtained from either one of the following three monetary models; flexible price model

$$f_t = [(m_t - m_t^*), (y_t - y_t^*)] \qquad (3)$$

sticky price model

$$f_t = [(m_t - m_t^*), (y_t - y_t^*), (i_t - i_t^*), (\pi_t - \pi_t^*)] \qquad (4)$$

and relative price model

$$f_t = [(m_t - m_t^*), (y_t - y_t^*), (i_t - i_t^*), (\pi_t - \pi_t^*), \qquad (5)$$
$$(p_t^T - p_t^N) - (p_t^{T*} - p_t^{N*})]$$

where *m, y, i,* π and *p* in Equation 3, 4 and 5 represent the logarithm of money stock, the logarithm of real income, nominal interest rate, the CPI inflation rate and overall prices which include *T*, tradable, and *N*, non-tradable goods, respectively. An asterisk indicates foreign markets. β in Equation 2 is a vector of parameters of the corresponding monetary models (flexible price, [β_m, β_y]; sticky price, [β_m, β_y, β_i, β_π]; and relative price, [β_m, β_y, β_i,

β_π, β_p]). The β_m represents the elasticity of money stock, β_y is the income elasticity of money demand, β_p is the relative price elasticity, β_i and β_π are the interest and inflation semi-elasticity, respectively. The anticipated sign for the estimated coefficients are β_m, β_p and $\beta_\pi > 0$, while β_y and $\beta_i < 0$. Δ is difference operator. Following Stock and Watson (1993) we set the number of leads and lags of the regressor (q) in the DOLS estimator of Equation 2 equal to three ($q = 3$). We use Newey-West procedure to compute robust standard errors.

The estimated cointegrating coefficients, $\hat{\beta}$ s in Equation 2 are then used to construct the fundamental values based on the following models;

flexible price

$$\hat{f}_t = \hat{\beta}_m(m_t - m_t^*) = \hat{\beta}_y(y_t - y_t^*) \tag{6}$$

sticky price

$$\hat{f}_t = \hat{\beta}_m(m_t - m_t^*) = \hat{\beta}_y(y_t - y_t^*) - \hat{\beta}_i(i_t - i_t^*) = \hat{\beta}_\pi(\pi_t - \pi_t^*) \tag{7}$$

and relative price

$$\hat{f}_t = \hat{\beta}_m(m_t - m_t^*) = \hat{\beta}_y(y_t - y_t^*) - \hat{\beta}_i(i_t - i_t^*) + \hat{\beta}_\pi(\pi_t - \pi_t^*) + \hat{\beta}_m(p_t^T - p_t^N) - (p_t^{T*} - p_t^{N*}) \tag{8}$$

Deriving fundamental values using the standard flexible price monetary model (Equation 6) is the most common procedure that has been extensively used by most of the researchers in the area, Mark (1995) and Kilian (1999) among others. However, it is less appropriate in the case of developing countries since it requires domestic and foreign asset to be perfect substitutes and uncovered interest parity (UIP) condition to hold in the markets.

In this paper, we consider also two extension of the basic monetary model as suggested by Chinn (1998). First, following the work of Dornbusch (1976) and Frankel (1976), we consider a monetary model that incorporates short-term price rigidities (Equation 7). This model incorporates variables that allow for short run price stickiness that violates the Purchasing Power Parity (PPP) hypothesis. In addition, the relationship includes interest rates in order to capture the short term liquidity effect of the monetary policy. Second, we consider relative price movements by including the tradable and non-tradable goods within and across countries. Following Balassa (1964) and Samuelson (1964), the relative prices model is driven by relative differentials in productivity in the tradable and non-tradable sectors as presented in Equation 8. These two approaches are expected to represent better the fundamental values of developing economies and could be crucial to find cointegration evidence in developing countries.

Equation 1, combined with the structural models discussed above, result in the following predictability equations:

Model 1:

$$\Delta s_{t+k} = \alpha + \lambda_k[s_t - (\hat{\beta}_m(m_t - m_t^*) - \hat{\beta}_y(y_t - y_t^*))] + \varepsilon_{t+k} \tag{9}$$

Model 2:

$$\Delta s_{t+k} = \alpha + \lambda_k[s_t - (\hat{\beta}_m(m_t - m_t^*) - \hat{\beta}_y(y_t - y_t^*) - \hat{\beta}_y(i_t - i_t^*) + \hat{\beta}_\pi(\pi_t - \pi_t^*))] + \varepsilon_{t+k} \tag{10}$$

Model 3:

$$\Delta s_{t+k} = \alpha + \lambda_k[s_t - (\hat{\beta}_m(m_t - m_t^*) - \hat{\beta}_y(y_t - y_t^*) - \hat{\beta}_y(i_t - i_t^*) + \hat{\beta}_\pi(\pi_t - \pi_t^*) + \hat{\beta}_p(p_t^T - p_t^N) - (p_t^{T*} - p_t^{N*})))] + \varepsilon_{t+k} \tag{11}$$

FORECASTING REGRESSION

We consider in-sample and out-of-sample forecast to evaluate the accuracy of monetary model in predicting exchange rate movements. Analysis of in-sample forecast (base on full sample from 1984Q1 to 2005Q4) of the monetary models (Model 1, 2 and 3) has been compared to random walk model [$s_{t+k} - s_t = d_k + \varepsilon_{t+k}$ for $k = 1, 8, 12$ and 16] of the corresponding k and tested for H_0: $\lambda_k = 0$ against H_1: $\lambda_k < 0$ or based on joint test of all forecast horizon as H_0: $\lambda_k = 0$ $\forall$k against H_1: $\lambda_k < 0$ for some k. For out-of-sample forecast, we use prediction mean-squared error of Equation 9, 10, 11 and 12 from the sequence of recursive forecasts to evaluate the Theil's U-statistic and DM statistic of Diebold and Mariano (1995) with and without drift. Specifically, the estimation starts from 1984Q1 to 1995Q4. To generate the next forecast k, the estimation sample is updated by one period 1996Q1 for $k = 1$, 1997Q4 for $k = 8$, 1998Q4 for $k = 12$ and 1999Q4 for $k = 16$. The procedure is repeated until we reach the end of the sample in 2005Q4.

However, forecasting exercise based on Model 1, 2 and 3 involves some econometric difficulties. First, the error-correction representation is only appropriate under the assumption of stationarity of the error correction term ($s_t - f_t$). This is because the asymptotic null distribution of test statistics for λ_k depends on whether the error-correction term is stationary or not, as discussed in Cavanagh et al (1995) and Valkanov (2003).

Another econometric problem is that forecasting involves future horizons k; when $k > 1$, the dependent variable ($s_{t+k} - s_t$) represents overlapping sums of the original series that may result in high persistency of the error correction term. In this case, statistical inference should be handled with care since the in-sample R^2 and the t-statistics do not converge to a well-defined asymptotic distribution and the estimated coefficient, $\hat{\lambda}_k$, is biased away from zero due to size distortions. This bias is in favour of finding predictability as the forecast horizon (k) increases (see Mark and Sul, (2001), and Berkowitz and Giorgianni, (2001) among others, for detail discussions on the subject matter).

To mitigate the above discussed problems we consider bootstrap technique proposed by Kilian (1999) to approximate the finite sample distribution of the test statistic under the null hypothesis of no exchange rate predictability. This approach consist of first, estimating the Data-Generating Process (DGP) under the null of no predictability for the Constrained Vector Error Correction Model (VECM)

$$\Delta s_t = \alpha_s + u_{1,t} \tag{13}$$

and

$$\Delta f_t = \alpha_f - h_2(f_{t-1} - s_{t-1}) + \sum_{j=1}^{q-1} \xi_j^{21} \Delta s_{t-j} + \sum_{j=1}^{q-1} \xi_j^{22} \Delta f_{t-j} + u_{2,t} \tag{14}$$

using constrained Estimated Generalised Least Squares (EGLS) technique with all coefficient but α_s set equal to zero. The system also requires the restriction of $h_2 < 0$ to be satisfied to ensure estimation stability. The lag order q has been determined under H_o using AIC criterion. Further details explanation on the estimation procedures please refer to Appendix in Kilian (1999).

Second, after estimating Equations 13 and 14, a sequence of $\{s_t^*, f_t^*\}$, pseudo observations can be generated under the assumption of i.i.d. innovations using cumulative sums of the realizations of the bootstrap data-generating process. The process has been initialized by specifying $\left(f_{t-1}^* - s_{t-1}^*\right) = 0$ and $\Delta s_{t-j}^* = 0$ and $\Delta f_{t-j}^* = 0$ for $j = q - 1, \ldots, 1$ and discard the first 500 observations. The pseudo innovation term $u_t^* = (u_{1t}^*, u_{2t}^*)'$ is random and drawn with replacement from the set of observed residuals $\hat{u}_t = (\hat{u}_{1t}, \hat{u}_{2t})'$. The process has been repeated for 2000 times. Third, use these $\{s_t^*, f_t^*\}$ of 2000 bootstrap replication to estimate the following long-horizon regression;

$$s_{t+k}^* - s_t^* = \alpha_k^* + \lambda_k^*(s_t^* - f_t^*) + \upsilon_{t+k}^* \tag{15}$$
$$k = 1, 4, 8, 12, 16$$

Finally, use the empirical distribution of these 2000 replication of the bootstrap test statistics to determine the p-value of the $t(20)$, $t(A)$, U, $DM(20)$, and $DM(A)$ of Equation 9, 10 and 11.

Regarding the potential problem of the serial correlation of the error term due to $k > 1$, we adopt two approaches. First we use Newey-West corrected t-statistics by setting the truncation lags to 20 since the longest forecast horizon is 16. Second, we use a data-dependent formula provided by Andrews (1991) under a univariate AR(1) as an approximating model. As a result, the statistical inference is robust to highly persistent or near-spurious regression problems because it has the ability to automatically adjust the critical values to the increase in dispersion of the finite sample distribution of the test statistic for different lag structures and estimation procedures.

DATA

In the present case, which is limited by the availability of fully liberalized developing economies, we constrain ourselves to markets that satisfy the assumptions of the monetary model i.e. floating exchange rate regime and relatively open capital markets for long period. Based on Levy-Yeyati and Sturzeneggar (2003, 2005), and supplemented with ratios of total external trade to GDP (see Table 1), we choose the following 8 developing economies: Chile, Indonesia, Morocco, Philippines, South

TABLE 1. Economic Fundamentals for Selected Developing Countries from 1984Q1 to 2005Q4

Country	Exchange Rate Regime Lowest	Highest	Income Volatility	Inflation	Total Trade (% GDP)
Chile	1	2	2.75	11.63	60.32
Indonesia	1	3	2.27	12.42	83.41
Morocco	1	1	4.84	4.11	60.84
Philippines	1	3	3.89	9.91	79.11
South Africa	1	3	2.59	9.99	48.50
Thailand	1	2	4.78	3.61	90.73
Tunisia	1	2	2.60	5.00	87.36
Uruguay	1	2	5.08	43.41	42.22
United States	1	1	1.53	3.11	21.64

Note: Classification of exchange rate regime is base on Levy-Yeyati and Sturzenegger (2003 and 2005). The index ranges from 1 = float; 2 = intermediate; and 3 = fixed. Income volatility is the standard deviation of the growth rate of GDP per capita. Inflation is a measure of mean inflation over the sample period. Total trade is an average of total import and export per GDP.

Africa, Thailand, Tunisia and Uruguay. The definition of developing market is based on the International Financial Cooperation (IFC). Levy-Yeyati and Sturzeneggar (2003) classify 3 *de-facto* exchange rate regimes: float, intermediate and fixed. We choose only markets that are under float or intermediate regimes for the whole sample periods. Float and intermediate regimes also indirectly indicate that the markets are not only open but characterised by little market frictions and government intervention. As defined by Levy-Yeyati and Sturzeneggar (2003), float and intermediate regimes are characterized by indices of low reserve volatility together with high exchange rate volatility. Low volatility of reserves is considered an indicator of less government intervention in the monetary policy. Therefore countries that have adopted a hard peg exchange regime, like China, or excessive capital control, like Korea, are excluded from the analysis.

The variables considered in our monetary model are end of period quarterly nominal exchange rates expressed as the Malaysian ringgit per developing countries currency to proxy the nominal exchange rate (s_t), the money stock M2 to measure money supply (m_t), the Gross Domestic Product (GDP) is used to proxy real output (y_t), the Consumer Price Index (CPI) is used as broad deflator (π_t), short term interest rate is proxied by inter-bank deposit interest rates (i_t), and the relative price of tradable and non tradable price deflator (p_t) is proxied by the ratio of CPI and Producers Prices Index (PPI) or Wholesale Price Index (WPI). The sample period considered in the analysis is from 1984Q1 to 2005Q4 and retrieved from either Datastream® or the IMF's International Financial Statistics. All variables except interest rates are converted to natural logarithms.

RESULTS

Unlike to the earlier studies (for instance Mark 1995 and Kilian 1999), this paper does not impose theoretical value for the cointegrating coefficients in constructing the fundamental values (f_t). Instead, we use the estimated parameters obtained from DOLS regressions of Equation 2. Table 2 shows the estimated cointegrating coefficients that are used in constructing the fundamental values for all models and markets.

We compute the Theil's *U*-statistics (the ratio of RMSE from two competing models-monetary versus random walk), the *t*-statistics and the Diebold-Mariano, (*DM*) statistics to assess the performance of exchange rate forecast using Model 1, 2, and 3. The estimation results are presented in Table 3a and 3b for the drift-less random walk benchmark model while Table 3c and 3d for the random walk with a drift term. All the test results are presented in the form of bootstrap *p*-values based on 2000 replications. We are particularly interested in testing (in-sample) the hypothesis that $\lambda_k < 0$, and the out-of-sample performance based on one-step ahead the Diebold-Mariano *DM* test statistics and Theil's *U*-statistics. Long horizon predictability arises if the *p* values indicate increasing significance as the horizon *k* becomes larger. We are also interested in testing the joint significant of $\lambda_k = 0$ for all *k* at 10% level.

Based on these criteria, the results show that only ringgit against two currencies (Indonesian rupiah and Uruguayan peso) provides strong support for long horizon out-of-sample predictability. For ringgit-rupiah, the forecast accuracy is improving for longer horizons. This is evident from the *U*-statistics that are significant at k = 12 and 16 under the no drift sticky price model. In

TABLE 2. Cointegrating Coefficient Estimates Based on Dynamic OLS (DOLS), for 1984Q1 to 1995Q4

Country	Flexible Price		Sticky Price				Balassa-Samuelson Effect				
	β_m	β_y	β_m	β_y	β_p	β_π	β_y	β_m	β_i	β_p	β_π
Chile	0.654	-0.322	0.806	-0.531	-0.073	0.014	-0.423	1.12	-0.085	-4.179	-0.081
	(0.27)	(0.31)	(0.31)	(0.36)	(0.10)	(0.15)	(0.57)	(0.72)	(0.10)	(1.76)	(0.14)
Uruguay	-3.061	4.007	-2.886	3.789	-0.105	-0.114	-3.581	4.739	-0.135	-2.345	-0.095
	(0.14)	(0.16)	(0.33)	(0.38)	(0.13)	(0.10)	(0.61)	(0.75)	(0.15)	(1.14)	(0.11)
Philippines	0.589	-0.404	0.548	-0.367	-0.078	-0.098	0.414	-0.117	-0.101	-1.238	-0.164
	(0.12)	(0.13)	(0.16)	(0.17)	(0.10)	(0.12)	(0.17)	(0.20)	(0.10)	(0.39)	(0.12)
Thailand	1.34	-1.584	1.498	-1.785	-0.106	-0.095	1.456	-1.689	-0.116	-1.697	-0.152
	(0.11)	(0.12)	(0.14)	(0.17)	(0.09)	(0.12)	(0.16)	(0.20)	(0.10)	(0.80)	(0.13)
Indonesia	-0.903	1.059	-0.967	1.139	-0.082	-0.089	-0.097	0.042	-0.086	2.5	-0.087
	(0.16)	(0.17)	(0.18)	(0.20)	(0.09)	(0.11)	(0.37)	(0.44)	(0.10)	(0.90)	(0.11)
Morocco	-1.115	0.582	-1.1	0.559	-0.069	-0.12	-0.985	0.534	-0.113	-1.298	-0.123
	(0.25)	(0.17)	(0.45)	(0.28)	(0.12)	(0.11)	(0.54)	(0.35)	(0.19)	(2.25)	(0.12)
S. Africa	-1.2	1.3	0.164	-0.162	-0.101	-0.106	0.761	-0.905	-0.087	2.616	-0.106
	(0.22)	(0.23)	(0.47)	(0.50)	(0.10)	(0.11)	(0.59)	(0.66)	(0.10)	(1.41)	(0.11)
Tunisia	0.018	-0.13	-0.438	0.282	-0.172	-0.067	0.577	-0.615	-0.11	2.118	-0.061
	(0.34)	(0.31)	(0.24)	(0.22)	(0.10)	(0.12)	(0.35)	(0.32)	(0.11)	(0.67)	(0.12)

Number in the parenthesis is robust standard errors. Sample from 1984Q1 to 1995Q4. q = 3. β_m is the elasticity of money stock, β_y is the income elasticity of money demand, β_p is the relative price elasticity, β_i and β_π are the interest and inflation semi-elasticity, respectively.

TABLE 3a: Results of the VEC Bootstrap Model with No-Drift

		Flexible Price Model					*Sticky Price Model*					*Relative Price Model*				
Currency	Horizon	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*
Chile	1	**0.051**	**0.009**	**0.063**	**0.073**	**0.066**	**0.021**	**0.002**	0.141	0.125	0.132	**0.035**	**0.005**	**0.056**	**0.068**	**0.059**
	8	0.149	**0.065**	0.287	0.258	0.300	**0.063**	**0.019**	0.222	0.196	0.217	0.115	**0.047**	0.214	0.199	0.229
	12	0.190	0.129	0.243	0.275	0.274	**0.072**	**0.038**	0.170	0.170	0.170	0.141	0.103	0.188	0.189	0.188
	16	0.233	0.208	0.279	0.617	0.381	**0.073**	**0.063**	0.166	0.127	0.130	0.138	0.120	0.199	0.221	0.210
	Joint	0.277	0.182	0.311	0.288	0.285	0.112	**0.069**	0.240	0.202	0.203	0.192	0.145	0.286	0.258	0.253
Uruguay	1	0.345	0.157	0.982	0.534	0.418	0.345	0.155	0.982	0.531	0.411	0.365	0.175	0.962	0.530	0.408
	8	0.332	0.322	0.972	0.660	0.712	0.328	0.319	0.982	0.655	0.714	0.351	0.341	0.982	0.652	0.716
	12	0.277	0.293	0.972	0.631	0.666	0.282	0.295	0.972	0.640	0.680	0.311	0.332	0.972	0.650	0.681
	16	0.202	0.213	0.972	0.630	0.667	0.208	0.224	0.972	0.631	0.665	0.231	0.259	0.972	0.623	0.652
	Joint	0.275	0.292	0.972	0.724	0.604	0.280	0.292	0.982	0.730	0.608	0.302	0.322	0.972	0.723	0.610
Philippines	1	0.569	0.605	0.479	0.559	0.415	0.742	0.747	0.376	0.388	0.308	0.653	0.662	0.383	0.441	0.325
	8	0.781	0.779	0.137	0.116	0.126	0.797	0.799	0.204	0.218	0.218	0.787	0.785	0.197	0.208	0.204
	12	0.803	0.804	0.200	0.225	0.212	0.830	0.831	0.317	0.536	0.440	0.808	0.805	0.273	0.466	0.378
	16	0.875	0.879	0.203	0.175	0.185	0.866	0.871	0.352	0.537	0.585	0.859	0.860	0.312	0.474	0.464
	Joint	0.765	0.801	0.281	0.258	0.270	0.843	0.844	0.467	0.416	0.409	0.806	0.811	0.505	0.402	0.398
Thailand	1	0.633	0.492	0.980	0.594	0.498	0.628	0.573	0.543	0.727	0.620	0.587	0.492	0.624	0.681	0.641
	8	0.740	0.743	0.257	0.668	0.542	0.714	0.712	0.319	0.757	0.598	0.744	0.739	0.448	0.960	0.888
	12	0.787	0.789	0.317	0.880	0.768	0.804	0.804	0.608	0.610	0.650	0.795	0.794	0.648	0.630	0.656
	16	0.821	0.819	0.452	0.628	0.665	0.834	0.836	0.646	0.521	0.565	0.844	0.844	0.696	0.509	0.546
	Joint	0.835	0.829	0.676	0.787	0.680	0.805	0.793	0.615	0.855	0.813	0.793	0.786	0.690	0.811	0.820

Note: The figure under t(20), t(A), U, DM(20) and DM(A) headings are bootstrap p-values for the VEC model with or without drift (Kilian 1999). Flexible price model, sticky price model and relative price model have been considered to construct the fundamental variables. t(20) refers to t-statistic for the slope coefficient in the long-horizon regression with robust standard errors calculated based on a fixed truncation lag of 20. t(A) refers to the case of standard errors using Andrew (1991) rule. DM and U refer to the corresponding Diebold-Mariano and Theil's U-statistics (ratio of out-of-sample and random walk model) respectively. Results are shown for alternative forecast horizons k = 1-, 8-, 12- and 16-quarter. Joint refers to the p-value for the joint test statistics for all horizons. Boldface p values denote significance at the 10 percent level.

TABLE 3b. Results of the VEC Bootstrap Model with No-Drift

		Flexible Price Model					*Sticky Price Model*					*Relative Price Model*				
Currency	Horizon	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*
Indonesia	1	0.540	0.486	0.127	0.142	0.143	0.139	0.115	0.170	0.122	0.119	0.417	0.352	0.095	0.114	0.117
	8	0.473	0.457	0.177	0.192	0.191	0.128	0.119	0.197	0.167	0.166	0.384	0.362	0.223	0.197	0.197
	12	0.314	0.312	**0.044**	0.115	0.117	**0.059**	**0.059**	**0.040**	**0.079**	**0.083**	0.249	0.239	**0.057**	0.116	0.117
	16	0.235	0.277	**0.074**	0.126	0.134	**0.053**	**0.066**	**0.078**	**0.097**	0.107	0.179	0.218	**0.073**	0.102	0.109
	Joint	0.306	0.351	**0.090**	0.198	0.204	**0.079**	**0.085**	**0.079**	0.144	0.145	0.238	0.272	**0.087**	0.160	0.170
Morocco	1	0.135	0.161	0.329	0.350	0.353	0.135	0.180	0.304	0.395	0.346	**0.051**	**0.051**	**0.089**	**0.087**	**0.079**
	8	0.065	0.066	0.139	0.136	0.138	0.148	0.144	0.254	0.812	0.799	0.097	0.113	0.207	0.233	0.223
	12	0.176	0.179	0.188	0.159	0.158	0.255	0.241	0.203	0.551	0.677	0.174	0.178	0.198	0.173	0.173
	16	0.190	0.196	0.306	0.369	0.400	0.277	0.261	0.325	0.404	0.501	0.169	0.178	0.328	0.373	0.415
	Joint	0.183	0.189	0.268	0.284	0.280	0.287	0.300	0.446	0.656	0.551	0.250	0.241	0.286	0.284	0.275
S. Africa	1	0.600	0.587	0.453	0.181	0.195	0.717	0.715	0.375	0.183	0.190	0.604	0.605	0.407	0.176	0.185
	8	0.489	0.460	0.529	0.264	0.283	0.576	0.549	0.407	0.248	0.266	0.482	0.457	0.499	0.248	0.271
	12	0.562	0.537	0.348	0.231	0.243	0.644	0.630	0.259	0.211	0.217	0.559	0.531	0.333	0.233	0.238
	16	0.682	0.676	0.205	0.208	0.208	0.744	0.742	0.127	0.168	0.163	0.672	0.668	0.181	0.197	0.195
	Joint	0.669	0.637	0.322	0.337	0.336	0.743	0.718	0.162	0.272	0.256	0.655	0.627	0.252	0.313	0.306
Tunisia	1	0.518	0.574	0.773	0.932	0.760	0.180	0.232	0.114	0.114	0.114	0.408	0.444	0.601	0.319	0.348
	8	0.501	0.512	0.652	0.514	0.559	0.261	0.253	0.309	0.224	0.229	0.298	0.318	0.689	0.557	0.619
	12	0.560	0.531	0.579	0.585	0.626	0.331	0.323	0.185	0.182	0.183	0.391	0.353	0.696	0.880	0.893
	16	0.698	0.696	0.288	0.288	0.299	0.490	0.490	**0.088**	0.128	0.114	0.580	0.584	0.324	0.306	0.321
	Joint	0.531	0.619	0.808	0.467	0.503	0.388	0.394	0.112	0.189	0.164	0.375	0.431	0.664	0.531	0.558

Note: Refer to note in Table 3a

TABLE 3c. Results of the VEC Bootstrap Model with Drift

		Flexible Price Model					*Sticky Price Model*					*Relative Price Model*				
Currency	Horizon	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*
Chile	1	**0.022**	**0.002**	**0.016**	**0.035**	**0.018**	**0.036**	**0.005**	**0.005**	**0.032**	**0.016**	**0.046**	**0.008**	**0.004**	**0.051**	**0.029**
	8	**0.062**	**0.018**	0.229	0.213	0.214	0.114	**0.043**	0.244	0.217	0.220	0.141	**0.059**	0.341	0.258	0.263
	12	**0.072**	**0.039**	0.574	0.365	0.425	0.139	0.103	0.588	0.375	0.400	0.192	0.128	0.686	0.414	0.446
	16	**0.072**	**0.061**	0.763	0.476	0.487	0.136	0.118	0.790	0.507	0.499	0.229	0.199	0.851	0.564	0.547
	Joint	0.112	**0.069**	0.251	0.273	0.251	0.189	0.143	0.238	0.254	0.225	0.272	0.185	0.273	0.312	0.281
Uruguay	1	**0.090**	**0.021**	**0.005**	**0.017**	**0.010**	**0.091**	**0.019**	**-0.005**	**0.017**	**0.009**	**0.094**	**0.020**	**0.004**	**0.019**	**0.009**
	8	**0.061**	**0.048**	0.118	0.112	0.113	**0.060**	**0.049**	0.118	0.111	0.114	**0.063**	**0.050**	0.117	0.112	0.114
	12	**0.048**	**0.036**	0.116	0.114	0.115	**0.047**	**0.037**	0.112	0.110	0.113	**0.049**	**0.042**	0.113	0.112	0.113
	16	**0.035**	**0.031**	0.145	0.142	0.142	**0.035**	**0.031**	0.144	0.143	0.145	**0.039**	**0.032**	0.143	0.140	0.143
	Joint	**0.037**	**0.032**	0.113	**0.094**	**0.090**	**0.037**	**0.032**	0.112	**0.091**	**0.087**	**0.041**	**0.033**	0.114	**0.092**	**0.087**
Philippines	1	0.738	0.744	0.770	0.835	0.781	0.620	0.642	0.692	0.580	0.736	0.302	0.336	0.222	0.404	0.575
	8	0.795	0.795	0.713	0.764	0.751	0.770	0.766	0.456	0.646	0.591	0.612	0.609	0.163	0.904	0.735
	12	0.825	0.828	0.805	0.902	0.912	0.825	0.825	0.584	0.871	0.910	0.594	0.592	0.189	0.914	0.922
	16	0.862	0.869	0.866	0.845	0.888	0.869	0.871	0.623	0.820	0.856	0.531	0.534	0.236	0.897	0.846
	Joint	0.843	0.841	0.826	0.934	0.895	0.731	0.756	0.718	0.764	0.727	0.458	0.523	0.312	0.625	0.749
Thailand	1	0.628	0.573	0.585	0.703	0.712	0.712	0.576	0.934	0.704	0.616	0.577	0.437	0.985	0.667	0.578
	8	0.714	0.711	0.382	0.890	0.859	0.790	0.796	0.421	0.940	0.869	0.669	0.672	0.283	0.251	0.264
	12	0.803	0.803	0.711	0.677	0.720	0.850	0.850	0.805	0.773	0.761	0.717	0.719	0.346	0.814	0.543
	16	0.835	0.835	0.784	0.618	0.662	0.883	0.883	0.911	0.636	0.663	0.746	0.751	0.503	0.637	0.659
	Joint	0.805	0.793	0.713	0.903	0.895	0.857	0.842	0.909	0.840	0.749	0.771	0.760	0.477	0.449	0.463

Note: Refer to note in Table 3a

TABLE 3d. Results of the VEC Bootstrap Model with Drift

		Flexible Price Model					*Sticky Price Model*					*Relative Price Model*				
Currency	Horizon	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*	*t(20)*	*t(A)*	*U*	*DM(20)*	*DM(A)*
Indonesia	1	0.141	0.107	0.428	0.260	0.448	0.391	0.306	0.210	0.210	0.217	0.525	0.469	0.285	0.282	0.306
	8	0.133	0.121	0.495	0.277	0.295	0.356	0.328	0.434	0.313	0.322	0.457	0.443	0.371	0.330	0.337
	12	**0.061**	**0.062**	0.204	0.216	0.216	0.221	0.217	0.275	0.270	0.270	0.295	0.299	0.268	0.307	0.305
	16	**0.056**	**0.063**	0.382	0.277	0.281	0.163	0.196	0.286	0.294	0.294	0.227	0.265	0.350	0.363	0.363
	Joint	**0.082**	**0.083**	0.376	0.420	0.419	0.213	0.243	0.406	0.431	0.431	0.293	0.324	0.397	0.473	0.470
Morocco	1	0.135	0.182	0.310	0.310	0.275	**0.051**	**0.051**	**0.053**	**0.068**	**0.054**	0.135	0.162	0.311	0.263	0.280
	8	0.146	0.144	0.229	0.225	0.227	0.097	0.113	0.128	0.170	0.178	**0.065**	**0.066**	**0.071**	0.139	0.140
	12	0.254	0.240	0.200	0.191	0.187	0.174	0.178	0.136	0.194	0.178	0.176	0.179	0.132	0.189	0.171
	16	0.275	0.259	0.490	0.384	0.417	0.168	0.177	0.536	0.394	0.428	0.190	0.196	0.485	0.363	0.378
	Joint	0.288	0.300	0.333	0.351	0.340	0.249	0.240	0.244	0.331	0.324	0.183	0.189	0.190	0.366	0.347
S. Africa	1	0.716	0.714	0.669	0.474	0.409	0.579	0.535	0.483	0.396	0.318	0.579	0.535	0.483	0.396	0.318
	8	0.577	0.548	0.648	0.494	0.525	0.536	0.515	0.522	0.369	0.388	0.536	0.515	0.522	0.369	0.388
	12	0.644	0.628	0.657	0.448	0.488	0.608	0.584	0.422	0.351	0.365	0.608	0.584	0.422	0.351	0.365
	16	0.743	0.743	0.677	0.538	0.582	0.740	0.740	0.407	0.349	0.360	0.740	0.740	0.407	0.349	0.360
	Joint	0.741	0.715	0.775	0.741	0.667	0.658	0.623	0.521	0.539	0.434	0.658	0.623	0.521	0.539	0.434
Tunisia	1	0.179	0.233	0.127	0.123	0.122	0.408	0.444	0.789	0.764	0.664	0.517	0.572	0.861	0.746	0.780
	8	0.258	0.254	0.555	0.611	0.686	0.298	0.320	0.845	0.961	0.982	0.499	0.513	0.792	0.936	0.970
	12	0.332	0.323	0.477	0.416	0.454	0.390	0.355	0.901	0.987	0.992	0.558	0.533	0.819	0.976	0.984
	16	0.493	0.493	0.375	0.352	0.365	0.581	0.585	0.768	0.966	0.980	0.699	0.697	0.705	0.975	0.985
	Joint	0.390	0.394	0.462	0.450	0.448	0.374	0.432	0.856	0.953	0.894	0.532	0.620	0.901	0.880	0.920

Note: Refer to note in Table 3a

addition, the p value of the joint test of the *Theil's U*-statistics is also significant. However none of the test statistics for ringgit-rupiah are significant when a drift term is considered in the models. In the case of ringgit-Uruguayan peso, the monetary models with a drift predict better the exchange rate movements. The joint test of *DM(20)* and *DM(A)* statistics for all three models with a drift are significant compared to none for the driftless case.

The result shows that there is evidence of the short horizon ($k = 1$ and 8) predictability of ringgit-Chilean peso, ringgit-Uruguayan peso and ringgit-Moroccan dirham under the monetary models with a drift term. The out-of-sample test statistics (for $k = 1$) of all models are significant for ringgit-Chilean peso and ringgit-Uruguayan peso. At the same time, for ringgit-Moroccan dinar, there is a statistical evidence of short horizon ($k = 1$) predictability for relative price model with no drift and sticky price for model with drift. Another obvious finding from the analysis is that the ringgit-Chilean peso, ringgit-Indonesian rupiah and ringgit-Uruguayan peso also provide significant support for in-sample predictability. The p values of *t(A)* and *t(20)* for some of the λ_k are significant (in the case of Uruguayan peso, the in-sample predictability test statistics are significant for all models with drift term). For the remaining currencies (ringgit-Philippine peso, ringgit-Thai baht, ringgit-South African rand and ringgit-Tunisian dirham), no predictability has been detected in the analysis.

A number of interesting observations can be drawn from the results discussed above. First, the two currencies (Indonesian rupiah and Uruguayan peso) for which we find support of long-horizon predictability are characterized by high inflation (see for instance Braumann 2000 for high inflation countries classification and Table 1 for comparison between markets under study). The results confirm the earlier proposition made by McNown and Wallace (1994) and Rogoff (1999a) who argued that forecast accuracy using monetary models should be higher in countries with unstable macroeconomic fundamentals.

Second, inclusion of a drift term in the estimation has eliminated predictability from the ringgit-Indonesian rupiah. The opposite holds for ringgit-Uruguayan peso where predictability arises when we use random walk with drift as a benchmark. This shows the importance of considering drift or no drift in the estimation, as argued by Kilian (1999). Third, considering alternatives monetary models (sticky price and relative price models) has proved to be useful in the process of predicting exchange rates movements in developing countries. At least the sticky price model seems to be superior to the standard flexible price and the relative price model. This finding is similar to Chinn (1998) where he suggested the superiority of the sticky price model over relative price for Philippines peso and Thailand bath.

Finally, the finding of short-term predictability ($k = 1$ and 8) for Chilean peso, Uruguayan peso and Moroccan dirham is relatively surprising. This could be presumably a result of the instantaneous exchange market reaction to the instability of economic fundamental. The evidence is in favour to the growing literature on the integration of currency market (Francis et al. (2002) and equity market (Frankel and Poonawala, 2004, and Golstein et al. 2000) in developing economies.

CONCLUSION

We consider ringgit exchange rate against developing countries' currencies that are open and adopt relatively floating exchange rate regimes to investigate the exchange rate forecastability puzzle using three monetary models. The motivation for this study is based on the hypothesis proposed by McNown and Wallace (1994) and Rogoff (1999a). The hypothesis states that exchange rate predictability should be better off in countries with unstable monetary fundamentals. In addition to the standard flexible price model, we consider two alternatives approaches that account for sticky and relative prices. The method of Kilian (1999) has been employed to reduce problems in the long horizon finite sample forecasting estimations.

Based on Levy-Yeyati and Sturzeneggar (2003 and 2005), eight currencies from developing countries have been chosen in the analysis to gain insight on the ringgit forecastability. The results suggest that the inclusion of fundamental values derived from the sticky price monetary model appears to improve the out-of-sample forecast accuracy of the exchange rate determination models for ringgit against four currencies, Chilen peso, Indonesian rupiah, Moroccan dirham and Uruguayan peso. Empirical evidences are in favour of the hypothesis that markets with unstable monetary fundamentals such as high inflation have higher forecast accuracy compared to the random walk model.

Overall, predictability of ringgit Malaysia is very sensitive to the selection of appropriate currencies, prediction horizons and monetary models. Furthermore the forecastability results are country specific in nature. For future research in developing countries under the same issue, it may be fruitful to explore on the potential of short- or long-term forecast accuracy using non-linear specification.

REFERENCES

Andrews, Donald W.K. 1991. Heteroskedasticity and autocorrelation consistent covariance matrix estimation. *Econometrica* 59(3): 817-58.

Baharumshah, Ahmad Zubaidi and Masih, A. Mansur M. 2005. Current account, exchange rate dynamics and the predictability: the experience of Malaysia and Singapore. *Journal of International Financial Markets, Institutions and money* 15(3): 255-70.

Balassa, Bela. 1964. The purchasing power parity doctrine: A repraisal. *Journal of Political Economy* 72(6): 584-96.

Berkowitz, Jeremy and Giorgianni, Lorenzo. 2001. Long-horizon exchange rate predictability? *The Review of Economics and Statistics* 83(1): 81-91.

Braumann, B. 2000. Real effects of high inflation. *IMF Working Paper* No. 00/85. Washington, DC. IMF.

Candelon, B., Kool, C., Raabe, K., and Veen, T. 2007. Long-run real exchange rate determinants: Evidence from eight new EU member states, 1993–2003. *Journal of Comparative Economics* 35(1): 87-107.

Cavanagh, Christopher L., Elliott, Graham, and Stock, James H. 1995. Inference in models with nearly integrated regressors. *Econometric Theory* 11(5): 1131-47.

Chinn, Menzie D. 1998. Before the fall: were East Asian currencies overvalued? *NBER Working Paper* No 6491.

Massachusetts: National Bureau of Economic Research.

Chinn, Menzie D. and Meese, Richard A. 1995. Banking on currency forecasts: How predictable is change in money? *Journal of International Economics* 38(1-2): 161-78.

Crespo-Cuaresma, Jesus, Fidrmuc, Jarko, and MacDonald, Ronald. 2005. The monetary approach to exchange rates in the CEECs. *The Economics of Transition* 13(2): 395-416.

Diebold, Francis X. and Roberto S. Mariano. 1995. Comparing pedictive accuracy. *Journal of Business and Economic Statistics* 13: 253-263.

Dornbusch, Rudiger. 1976. Expectations and exchange rate dynamics. *The Journal of Political Economy* 84(6): 1161-76.

Ferreira, Jose Eduardo de A. 2006. Effects of fundamentals on the exchange rate: A panel analysis for a sample of industrialised and emerging economies. *University of Kent, Department of Economics Discussion Paper* 06/03. Kent: University of Kent.

Francis, Bill, Hasan, Iftekar, and Hunter, Delroy. 2002. Emerging market liberalization and the impact on uncovered interest rate parity. *Journal of International Money and Finance* 21(6): 931-56.

Frankel, J. 1976. A monetary approach to the exchange rate: Doctrinal aspects and empirical evidence. *The Scandinavian Journal of Economics* 78(2): 200-24.

Frankel, Jeffery A and Poonawala, Jumana. 2004. The forward market in emerging currencies: Less biased than in major currencies. *Mimeo,* Massachusetts: Kennedy School of Government, Cambridge.

Goldstein, Morris, Kaminsky, Graciela, and Reinhart, Carmen. 2000. *Assessing financial vulnerability: An early warning system for emerging markets.* Washington, DC: Institute for International Economics.

Kilian, Lutz. 1999. Exchange rates and monetary fundamentals: What do we learn from long-horizon regressions? *Journal of Applied Econometrics* 14(5): 491-510.

Kilian, Lutz and Taylor, Mark P. 2003. Why is it so difficult to beat the random walk forecast of exchange rates? *Journal of International Economics* 60(1): 85-107.

Levy-Yeyati, Eduardo and Sturzenegger, Federico. 2003. To float or to fix: Evidence on the impact of exchange rate regimes on growth. *The American Economic Review* 93(4): 1173-93.

Levy-Yeyati, Eduardo and Sturzenegger, Federico. 2005. Classifying exchange rate regimes: Deeds vs. words, *European Economic Review* 49(6): 1603-35.

MacDonald, R. and Ricci, L. A. 2001. PPP and the Balassa Samuelson effect - The role of the distribution sector. *IMF Working Paper* 01/38, Washington, DC. IMF.

Manzan, Sebastiano and Westerhoff, Frank. 2007. Heterogeneous expectations, exchange rate dynamics and predictability. *Journal of Economic Behavior and Organization* 64: 111-218.

Mark, Nelson C. 1995. Exchange rates and fundamentals: Evidence on long-horizon predictability, *The American Economic Review* 85(1): 201-18.

Mark, Nelson C. and Sul, Donggyu. 2001. Nominal exchange rates and monetary fundamentals: Evidence from a small post-Bretton woods panel. *Journal of International Economics* 53(1): 29-52.

McNown, Robert and Wallace, Myles S. 1994. Cointegration tests of the monetary exchange rate model for three high-inflation economies. *Journal of Money, Credit and Banking* 26(3): 396-411.

Meese, Richard A. and Rogoff, Kenneth. 1983a. Empirical exchange rate models of the seventies: Do they fit out of sample? *Journal of International Economics* 14(1-2): 3-24.

Meese, R. and Rogoff, K. 1983b. The out-of-sample failure of empirical exchange rate models: Sampling error or misspecification? In J. Frankel (ed.), *Exchange rates and international macroeconomics*. Chicago: University of Chicago Press.

Moosa, Imad A. 2000. A structural time series test of the monetary model of exchange rates under the German hyperinflation. *Journal of International Financial Markets, Institutions and Money* 10(2): 213-23.

Neely, Christopher J. and Sarno, Lucio. 2002. How well do monetary fundamentals forecast exchange rates? *The Federal Reserve Bank of St. Louis* 02/09/51: 21-74.

Rogoff, Kenneth. 1996. The purchasing power parity puzzle. *Journal of Economic Literature* 34(2): 647-68.

Rogoff, Kenneth. 1999a. Monetary models of Dollar/Yen/Euro nominal exchange rates: Dead or undead? *The Economic Journal* 109(459): 655-59.

Rogoff, Kenneth. 1999b. International institutions for reducing global financial instability. *The Journal of Economic Perspectives* 13(4): 21-42.

Samuelson, Paul A. 1964: Theoretical notes on trade problems. *The Review of Economics and Statistics* 46(2): 145-54.

Stock, James H. and Watson, Mark W. 1993. A Simple estimator of co-integrating vectors in higher order integrated systems. *Econometrica* 61(4): 783-820.

Valkanov, Rossen. 2003. Long-horizon regressions: theoretical results and applications. *Journal of Financial Economics.* 68(2): 201-32.

Wang, Jian-Xin and Wong, Hoi-In. 1997. The predictability of Asian exchange rates: evidence from Kalman filter and ARCH estimations. *Journal of Multinational Financial Management* 7(3): 231-52.

School of Economics
Faculty of Economics and Management
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor D.E.
tamat@ukm.my