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ANALYSIS OF EXCHANGE RATE FLUCTUATIONS FOR THAILAND: TEST OF UNCOVERED INTEREST-RATE PARITY

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ABSTRACT

Applying an open macroeconomic model, this study finds that the nominal exchange rate in Thailand is negatively associated with real quantity of M2 money, the expected inflation rate and the relative price, is positively influenced by financial stock assets, the U.S. Treasury bill rate and the expected exchange rate, and is not affected by real government deficit spending. Thus, the expected negative relationship between the exchange rate and the foreign interest rate characterized by UIRP may be offset by the potential positive impact of the foreign interest rate on real demand for money.

Key words: UIRP, monetary policy, fiscal policy, foreign interest rate.

JEL Classification: F31, F41, G15.

INTRODUCTION

During November 1984–June1997, Thailand adopted the pegged exchange rate regime and relied on the Exchange Equalization Fund to defend the Thai baht against the U.S. dollar. Monetary and financial measures were undertaken to pursue the goal of pegging the U.S. dollar. In July 1997, Thailand switched to the floating exchange rate regime. During July 1997–May 2000, the central bank set monetary targeting to pursue economic growth and price stability and avoid excessive liquidity in the financial system and volatility in the interest rate level.

The 1997-98 Asian financial crisis began in Thailand and spread to Indonesia, Korea and several other countries in the region. The Baht/U.S. dollar exchange rate depreciated by 83.2% from 25.79 in 1997.Q2 to 47.25 in 1997.Q4 and gradually recovered and appreciated to 39.06 in 2004.Q4. To defend the baht, the authorities raised the domestic money market rate from 11.99% in 1997.Q2 to a high of 19.32% in 1997.Q3 and engaged in expansionary fiscal policy by increasing deficit spending. The substantial depreciation of the baht caused capital outflows, increased import costs, made Thai products cheaper, and increased the cost of foreign debt service.

There are several recent studies on exchange rates and related subjects for Thailand or other countries in the region. The IMF (1999) made efforts to advise and help affected countries including Thailand to pursue (1) a temporary contractionary monetary policy, (2) a sound fiscal policy to protect the social safety net and seek continual economic growth, (3) reform in the financial sector by closing unhealthy firms, increasing the capitalization of week firms, having closer supervision of poor-performing firms, and encouraging foreign investment in the domestic financial institution, (4) structural reforms to tackle trade barriers, monopolies and questionable corporate practices, and (5) maintain and secure external financing sources.

Berg (1999) attributed the financial crisis to overvalued baht, current account deficits, slow growth of exports, high short-term external debt/reserve ratios, undercapitalized and poorly regulated banks, large non-performing loans, etc. Gould and Kamin (2000) indicated that during the Asian financial crisis, stock values and international credit spreads had significant effects on the exchange rate and that the interest rate level reflecting a tight or expansionary monetary policy did not have a statistically significant impact. Bahmani-Oskooee and Techaratanachai (2001) revealed that real demand for M2 responded negatively to baht depreciation. Dekle, Hsiao and Wang (2002) investigated the relationship between exchange rates and interest rates for three countries including Thailand during and after the Asian financial crisis. They found evidence that during the crisis, a higher interest rate caused a small appreciation of nominal exchange rates. Fujii (2002) investigated whether the Asian financial crisis has changed the behavior of real exchange rates for five countries. For Thailand, the purchasing power parity is still valid in the long run, and there were structural changes in the short-run dynamic relationship. He concluded that the Asian financial crisis caused a transitory variation and not a fundamental change in real exchange rates. Huang and Suchada (2003) showed that most of the variation in Thai baht exchange rates can be attributable to demand shocks and that country risk also explained part of exchange rate volatility of the baht after the Asian financial crisis. Pruettiangkura (2004) assessed the IMF prescription of high interest rates and tight fiscal policy for Thailand to stabilize exchange rates and reduce capital outflows during the Asian financial crisis and found that a high interest rate policy would lead to more capital outflows. *Sharma, Kandil*, and *Chaisrisawatsuk* (2005) found that money demand in Thailand responded more to the baht/dollar exchange rate than the domestic interest rate and that the extent of currency substitution is rising.

This paper attempts to examine exchange rate fluctuations for Thailand with several focuses. The paper applies an extended open macroeconomic model and includes three equations for the goods market, the money market, and uncovered interest-rate parity, respectively (Romer, 2001; D'Amato and Pistoresi, 2001; Romer, 2001; Schroder and Dornau, 2002). Potential impacts of a change in real quantity of money, government deficit spending, financial stock assets, the foreign interest rate, the expected inflation rate, the expected exchange rate, and the relative price are examined based on comparative-static analysis. For example, higher financial stock

values are expected to increase household consumption spending via the wealth effect and investment spending through the balance-sheet effect (Mishkin, 1995; Kuttner and Mosser, 2002). Higher stock prices may reduce real demand for money due to the substitution effect or increase real demand for money because of the wealth effect (Friedman, 1988; Choudhry, 1996). A higher foreign interest rate may reduce real demand for money due to the capital mobility effect or increase real demand for money due to the cost of borrowing effect (Marquez, 1987; Bahmani-Oskooee and Ng, 2002). Therefore, their impacts on real demand for money and the exchange rate may be unclear and depends on empirical results. The Newey-West (1987) method is employed in empirical work to yield heteroskedasticity autocorrelation consistent estimates for standard errors and covariance.

THE MODEL

Suppose that aggregate expenditures are determined by real output, government spending, government tax revenues, the real interest rate, financial stock assets, and the real exchange rate, that real demand for money is a function of the nominal interest rate, real output, financial stock values, and the nominal exchange rate, and that the interest rate differential is offset by the currency appreciation or depreciation. The open macroeconomic model and uncovered interest-rate parity for Thailand can be expressed as:

$$Y = E[Y, G, T, R - \pi^e, A, \varepsilon(P / P^f)] \tag{1}$$

$$M = L(R, Y, A, R^f, \varepsilon) \tag{2}$$

$$\varepsilon = \varepsilon^e / (-R + R^f + 1) \tag{3}$$

where

- Y = real GDP for Thailand,
- E = aggregate expenditures,
- G = real government spending,
- T = real government tax revenues,
- R = the nominal interest rate,
- π^e = the expected inflation rate,
- A = financial stock assets,
- ε = the nominal exchange rate (U.S. dollar per Thai baht),
- P = the domestic price level,
- P^f = the foreign price level,

M = real supply of money,

L = real demand for money,

R^f = the foreign interest rate, and

ε^e = the expected exchange rate.

In the money demand function in equation (2), the signs for financial stock assets, the foreign interest rate, and the nominal exchange rate may be positive or negative. If L_A is positive, the wealth effect is greater than the substitution effect; and if L_A is negative, the substitution effect dominates the wealth effect. If L_{R^f} is negative, the capital mobility effect dominates the cost of borrowing effect; and if L_{R^f} is positive, the capital mobility effect dominates the cost of borrowing effect. If L_ε is positive, the substitution effect dominates; and if L_ε is negative, the wealth effect dominates (Arango and Nadiri, 1981; Bahmani-Oskooee and Ng, 2002).

Uncovered interest-rate parity in equation (3) shows that the nominal exchange rate has a positive relationship with the expected exchange rate and the domestic interest rate and a negative relationship with the foreign interest rate. If the domestic interest rate is greater than the foreign interest rate, the baht is expected to depreciate by the same percentage of the interest rate differential. If the domestic interest rate is less than the foreign interest rate, the baht would appreciate by the same percentage of the interest rate differential.

Suppose that these equations have continuous partial derivatives. Let

$$\begin{aligned} &E_Y > 0, E_G > 0, E_T < 0, E_{R-\pi^e} < 0, E_A > 0, E_{\varepsilon(P/P^f)} < 0, \\ &L_R < 0, L_Y > 0, L_A > or < 0, L_{R^f} > or < 0, L_\varepsilon > or < 0. \end{aligned} \tag{4}$$

Solving simultaneously for the nominal exchange rate, real output, and the nominal interest rate, we can express the implicit function of the equilibrium nominal exchange rate as

$$\bar{\varepsilon} = \bar{\varepsilon}(M, G, T, A, R^f, \pi^e, \varepsilon^e, P/P^f) \tag{5}$$

The Jacobian can be written as

$$|J| = (1 - E_Y)L_R\varepsilon^e\varepsilon^{-2} + E_R L_Y \varepsilon^e \varepsilon^{-2} + E_\varepsilon L_Y + (1 - E_Y)L_\varepsilon < 0. \tag{6}$$

The respective impacts of a change in real quantity of money, real government spending, and real government taxes on the equilibrium nominal exchange rate can be written as

$$\partial\bar{\varepsilon}/\partial M = (1 - E_Y)/|J| < 0. \tag{7}$$

$$\partial\bar{\varepsilon} / \partial G = -L_Y E_G / |J| > 0. \quad (8)$$

$$\partial\bar{\varepsilon} / \partial T = -L_Y E_T / |J| < 0. \quad (9)$$

A higher financial stock value may increase or reduce the equilibrium exchange rate because of its positive impacts on aggregate expenditures and its negative or positive effect on real demand for money due to the substitution effect and the wealth effect (Friedman, 1988; Choudhry, 1996):

$$\partial\bar{\varepsilon} / \partial A = [-(1 - E_Y)L_A - E_A L_Y] / |J| > or < 0. \quad (10)$$

The impact of a higher world interest rate on the equilibrium exchange rate is unclear mainly because real demand for money may respond to a higher world interest rate positively or negatively due to the capital mobility effect or the cost of borrowing effect (Marquez, 1987; Bahmani-Oskooee and Ng, 2002):

$$\partial\bar{\varepsilon} / \partial R^f = [-(1 - E_Y)L_R - E_R L_Y - (1 - E_Y)L_{R^f}] / |J| > or < 0. \quad (11)$$

Empirical Results

The data were obtained from the *International Financial Statistics* published by the International Monetary Fund. The sample ranges from 1997.Q1 to 2004.Q3. Earlier data for the share price index is not available. The nominal exchange rate is expressed as U.S. dollar per Thai baht. An increase in the nominal exchange rate means an appreciation. Real M2 is chosen to represent the real quantity of money and is measured in billion bahts. Real government deficit spending measured in million baths and defined as D = (G – T)/CPIx100 is employed to reduce multicollinearity among variables. The 3-month U.S. Treasury bill rate is chosen to represent the foreign interest rate. The inflation rate is derived from the CPI. The lagged inflation rate is employed to represent the expected inflation rate. The forward exchange rate ε_{t+1} is selected to represent the expected exchange rate. The relative price is equal to the CPI in Thailand divided by the CPI in the U.S.

The unit root test shows that in levels, log(ε), log(A), log(R^f), log(ε_{t+1}) and log (P / P^f) have unit roots and other variables are stationary and that in first difference, all the variables are stationary at the 1% or 5% level. The ADF cointegration test with p = 2 indicates that all the variables are cointegrated because the test statistic of 6.48 is greater than the critical value of 3.77 at the 1% level.

Table 1 presents the estimated regression and related statistics. As shown, 87.5% of the variation in the real exchange rate can be explained by the seven right-hand side

Table 1
Estimated Regression of the Nominal Exchange Rate for Thailand

Dependent Variable: $LOG(\overline{\varepsilon})$
Method: Least Squares
Sample (adjusted): 1997.Q1–2004.Q3
Included observations: 31 after adjustments
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	3.931129	1.818067	2.162257	0.0412
LOG(M)	-0.725179	0.250641	-2.893296	0.0082
D	-1.72E-07	2.43E-07	-0.708412	0.4858
LOG(A)	0.115181	0.044769	2.572786	0.0170
LOG (R^f)	0.037698	0.013358	2.822039	0.0097
π^e	-0.031620	0.012432	-2.543434	0.0182
LOG (ε_{t+1})	0.543004	0.166109	3.268960	0.0034
LOG (P / P^f)	-1.360064	0.636503	-2.136776	0.0435
R-squared	0.874589	Mean dependent var	-3.679726	
Adjusted R-squared	0.836420	S.D. dependent var	0.135354	
S.E. of regression	0.054744	Akaike info criterion	-2.754668	
Sum squared resid	0.068928	Schwarz criterion	-2.384607	
Log likelihood	50.69735	F-statistic	22.91376	
Durbin-Watson stat	2.122083	Prob (F-statistic)	0.000000	

variables. The estimated coefficients are significant at the 1% or 5% level except that the coefficient of real government deficits is insignificant even at the 10% level. Several comments can be made. An expansionary monetary policy to increase real quantity of money would shift LM^* to the right and lower the nominal exchange rate. A higher stock value would increase consumption and investment expenditures, and its impact on real demand for money would not cancel out the positive effects on consumption and investment expenditures. It appears that the expected exchange rate should be included in the model to reflect anticipated currency appreciation or depreciation due to the interest rate differential. It is surprised to note that a higher foreign interest rate would cause the exchange rate to rise. One possible reason is that real demand for money may respond positively to a change in the foreign interest rate. In other words, the cost of borrowing effect probably dominates the capital mobility effect in the money demand function. The insignificance of real government deficit spending may suggest that as long as government deficit is relatively small, its impact on exchange rates would not be a concern.

SUMMARY AND CONCLUSIONS

This paper has examined fluctuations in the nominal exchange rate for Thailand based on an open macroeconomic model and uncovered interest-rate parity. Monetary policy, fiscal policy, stock market performance, the foreign interest rate, the expected inflation rate, the expected exchange rate, and the relative price are considered to

estimate their potential impacts on the equilibrium nominal exchange rate. The results show that the nominal exchange rate has a negative relationship with real M2, the expected inflation rate and the relative price and a positive relationship with financial stock assets, the foreign interest rate and the expected exchange rate. Therefore, empirical results confirm that expansionary monetary policy, a lower stock price, a lower foreign interest rate, a higher inflation rate and a higher relative price would lead to currency depreciation but do not validate the hypothesis that government deficit spending would raise the exchange rate. Because the result does not support uncovered interest-rate parity, it implies that the perfect capital mobility assumption may not apply to Thailand.

There are areas for potential future research. Monetary models for the exchange rate may be considered (Taylor, 1995; Cheung, Chinn and Pascual, 2002; Sarno and Taylor, 2002; Neely and Sarno, 2002). The expected inflation rate and the expected exchange rate may be estimated using more advanced methodologies. Different estimation techniques (Laopodis, 2003; Suliman, 2005) such as the ARCH or GARCH process may be considered in order to deal with different assumptions on regression errors and the error variance. The results should be regarded as preliminary and need to be re-estimated once more sample observations become available.

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