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Monetary Policy Rules and Exchange Rate Uncertainty: A Structural Investigation in Thailand

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Abstract

This paper analyzes monetary policy implementation under an Inflation Targeting (IT) regime in Thailand. The paper applies the Bayesian Maximum Likelihood estimation to a small open economy model, proposed by Lubik and Schorfheide (2007). The study examines whether or not the Bank of Thailand (BOT) considers exchange rate movement, which is uncertain, in setting the policy rate. The paper considers various types of the Taylor rule: contemporaneous, backward-looking and forward-looking. The main finding is that the BOT responds to the exchange rate movement. The contemporaneous rule responding to the nominal exchange rate movement well characterizes the policy rate set by the BOT. The BOT focuses more on the contemporaneous economic condition than the lag of interest rate. Specifically, the rule illustrates that the BOT follows the Taylor principle, with on average the inflation-response coefficient is 1.515. Also, the BOT puts more weight on exchange rate stabilization relative to the output stabilization. Thus, the BOT has implemented flexible IT policy with exchange rate concern.

Keywords: Monetary policy rule; Taylor rule; Exchange rate uncertainty

1. Introduction

Inflation Targeting (IT) is the monetary policy that the central banks try to stabilize inflation in order to provide a good sentiment for the economy by using the short-term interest rate as the policy instrument. However, most IT central banks have adopted flexible IT, in which the central banks respond to other variables such as output in addition to inflation. Especially, IT in the emerging market economies (EMEs) would also have the objective of exchange rate stabilization because the exchange rate has many impacts on the domestic economy: exchange rate pass-through and expenditure switching effect. These effects impact relative prices and demand of the domestic goods and then the domestic output and domestic inflation for the

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EMEs: hence the central banks may need to be concerned about it. This case might be true for the Thailand, which is a small open economy in EMEs.

The literatures, which have studied about the monetary policy in the IT countries, especially in EMEs, consider the exchange rate movement in the policy decision. Most studies assume that the central banks follow the Taylor rule, which is a function of the short-term interest rate responding to a deviation of inflation from an inflation targeting rate, an output gap, and an the exchange rate movement. Ball (1999) states that, under the open economy model, central banks who do not consider the exchange rate in the policy decision create a large variation in the exchange rate and the output, which is too dangerous for the economy. Cavoli (2008) finds that responding to the exchange rate in the policy function assists the policymakers in achieving the domestic objectives; inflation objective and the output objective.

The subsequent literatures have extended the study by relaxing the complete financial market assumption which generates the exchange rate uncertainty resulting from the validity of the Uncovered Interest Parity (UIP). The results of empirical studies state that the UIP validity is rejected in the short run, even in the weak form (Chai-anat, Pongsaporn and Tansuwanrat (2008)). Wollmershäuser (2006) examines the policy rule when the exchange rate uncertainty, which results from the UIP, is high. The results show that the Taylor rule augmented with the exchange rate movement delivers a lower welfare loss than the simple Taylor rule. It implies that responding to the exchange rate movement help the policymakers to achieve the monetary policy's objectives, inflation and the output stabilization. This finding is also supported by Pavasuthipaisit (2010). However, the idea that includes the exchange rate in the policy function is argued by Taylor (2001). This paper analyzes this issue by adopting the structural estimation. The model is adopted from the study of Lubik and Schorfheide (2007). The paper also proposes other types of policy rule in order that the result of the model would be robust.

The mentioned above literatures show that the literatures have discussed the role of the exchange rate in the policy rule. The results of the empirical studies are not clear-cut whether the policymakers are concerned about the exchange rate or the exchange rate movement in their consideration or not. The results are divided into two groups. The literatures findings are that the central banks do not take the exchange rate or the exchange rate movement into the decision (e.g. Clarida, Gali and Gertler (1998) in case E3, Osawa (2006), LS07 in Australia and New Zealand). On the other hand, the findings show that the central banks consider the exchange rate or the exchange rate movement in (e.g. Ball (1999), Clarida, Gali and Gertler (1998) in the case of G3, Mohanty and Klau (2004)). Thus, this paper aims to investigate the policy decision of the Bank of Thailand (BOT) when the exchange rate uncertainty exists in the economy.

The main investigation is that whether or not the BOT takes the exchange rate movement in policy setting. The study considers the exchange rate uncertainty arising from the deviation of UIP. The analysis focuses on the structural estimation since it considers the interaction between the variables unlike to the single equation estimation. Bayesian estimation is adopted since it treats the structural parameters as the random variables given the observed data, and does not assume the fixed distribution of the parameters. The estimation combines the prior knowledge on the parameters and the observing data together to compute the posterior distributions. Thus, the parameters are estimated under the distribution, which well explains the Thai economy. The paper also computes the posterior odds to analyze whether the BOT is concerned about the exchange rate movement or not.

The estimation illustrates that the BOT considers the exchange rate movement and adopts the contemporaneous rule as the guideline. The BOT focuses more on the current economic conditions than the lag of policy rate. Moreover, the coefficient of inflation response is greater than one meaning that the BOT adjusts the interest rate more than one percent when the inflation changes by one percent. It implies that the BOT follows the Taylor principle against the inflation. The BOT is more concerned about the output objective than the exchange rate objective. The estimation shows that the BOT adopts the flexible IT regime.

2. Monetary Policy of the BOT

The BOT formally adopted the IT in May 2000 alongside with the managed float exchange rate regime. The Monetary Policy Board (MPB), which have a responsibility on the policy rate decision, targets on the core inflation, which is the headline inflation excluding fresh food and energy prices, between 0.5 – 3.0 percent of quarterly average inflation. The MPB has a meeting approximately every six weeks to access the domestic and international economic conditions and financial conditions including the risk factors that may affect the current and future inflation. The MPB makes the decision on the policy rate under the information that MPB access against the expected future inflation. After the meeting, the MPB announces the decision to the public with the minute of the meeting for explaining decision making factors. The MPB also publics the economic conditions about which MPB concerns to make the public understand the decision.

3. The Small Open Economy Model

3.1. A Model

The model, which is adopted from LS07, belongs to the class of the dynamic and stochastic general equilibrium model. The model is a simplified model of Gali and Monacelli (2005). The system of equations consists of the dynamic IS equation (DIS), which is derived from the consumption Euler equations, the dynamic NKPC (DNKPC), which is derived from the optimal price setting of the producers, and the policy rule.

The DIS explains the path of the output, which can be written as:

$$\begin{aligned} y_t = E_t y_{t+1} - \left[\tau+\alpha\ \ 2-\alpha\ \ 1-\tau\right] R_t - E_t\pi_{t+1} + \rho_z z_t \\ -\alpha\left[\tau+\alpha\ \ 2-\alpha\ \ 1-\tau\right] E_t\Delta q_t + \alpha\ \ 2-\alpha\ \ \frac{1-\tau}{\tau} E_t\Delta y^*_{t+1}. \end{aligned} \tag{1}$$

where $0<\alpha<1$ is the share of import, and $0<\tau$ is the intertemporal substitution elasticity. y_t and π_t are the output and CPI inflation, respectively. q_t is the terms of trade defined as the relative price of export in terms of import. The terms of trade are expressed as the first different form in (1) in order to capture an impact of its change to the output. The terms of trade can be interpreted as the real exchange rate as well. z_t is a technology growth, in which its process is assumed to follow AR(1) process. An exogenous world output is Δy^*_t, which is assumed to follow AR(1), too. Equation (1) can be reduced to the close economy IS by setting $\alpha=0$.

The DNKPC describes the path of headline inflation as follows:

$$\pi_t = \beta E_t\pi_{t+1} + \alpha\beta E_t\Delta q_{t+1} - \alpha\Delta q_t + \frac{\kappa}{\tau+\alpha\ \ 2-\alpha\ \ 1-\tau}\ \ y_t - \bar{y}_t\ . \tag{2}$$

where $0<\beta<1$ is the household discount factor and $\kappa>0$ is the function of the structural parameters such as the elasticity of demand for labor and supply of labor. The paper treats κ as the structural parameters because the study does not consider the information of the parameters. The DNKPC can be reduced to the close economy NKPC as the DIS by setting $\alpha=0$. The potential output, $\bar{y}_t$, is calculated from $\bar{y}_t = -\alpha\ \ 2-\alpha\ \ 1-\tau\ / \tau\ \ y^*_t$.

The relationship of CPI inflation and domestic inflation is displayed as the following equation. $\pi_{H,t}$ is domestic inflation.

$$\pi_t = \pi_{H,t} + \alpha \Delta q_t . \quad (3)$$

The nominal exchange rate, e_t, is introduced via the definition of CPI inflation. By assuming the PPP holds, the headline inflation can be written as:

$$\pi_t = \Delta e_t + (1-\alpha)\Delta q_t + \pi_t^* . \quad (4)$$

where π_t^* is the world inflation, which is an unobservable variable. Its process is assumed to follow AR(1).

Instead of endogenously solving for the terms of trade, the paper assumes that the terms of trade change's process is AR(1), which determines the exchange rate uncertainty as Wollmershäuser (2006). This process implies that the real exchange rate is a purely random variable.

$$\Delta q_t = \rho_q \Delta q_{t-1} + \varepsilon_{q,t} . \quad (5)$$

The monetary policy is assumed to follow the Taylor rule, augmented with the nominal exchange rate change, as their policy guideline. The policy rule is assumed to respond to the lag of the interest rate so as to smooth the interest rate. The interest rate smoothing decision implies as a fear of disrupting the capital market, loss of credibility from sudden large policy reversal, etc. Therefore, the policy rule is expressed as the following equation. This rule is called a baseline policy rule.

$$R_t = \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 \pi_{H,t} + \psi_2 y_t + \psi_3 \Delta e_t\right] + \varepsilon_{R,t} . \quad (6)$$

where ψ_1, ψ_2 and $\psi_3 \geq 0$ are the policy coefficients, which determine how much the central banks adjust the policy rate when the relevant variables change. The policymakers raise the policy rate against the inflation, the output growth, and the exchange rate depreciation. $0 < \rho_R < 1$ is the degree of interest rate smoothing that captures the persistence in the policy rate. $\varepsilon_{R,t}$ is an exogenous component, which can be interpreted as a non systematic component of the monetary policy.

3.2. Alternative Rules

The baseline rule, (6), is the behavior of the policymakers who are concerned about the contemporaneous information provided at period t. However, the central banks may not necessarily concern the current information. Thus, the paper proposes an alternative type of the policy rule, a backward-looking type and a forward-looking type of policy rule. Additionally, (6) also assumes that the central banks consider the nominal exchange rate movement. Thus, the paper modifies the baseline rule by changing the nominal exchange rate change to the terms of trade change, which refers to the real exchange rate.

The first specification is the contemporaneous rule, which is modified by changing the nominal exchange rate. The improvement of the terms of trade induces the nominal exchange rate appreciation, which influences the fall in the inflation: hence the policymakers decrease the policy rate.

$$R_t = \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 \pi_{H,t} + \psi_2 y_t - \psi_3 \Delta q_t\right] + \varepsilon_{R,t}. \quad (7)$$

The second one is the backward-looking rule. McCallum (1999) states that the contemporaneous policy rule is not realistic since the central banks do not have complete information on the variables at the current period. He suggests that the policy rule, which reacts to the last period of relevant variable, is more realistic than the contemporaneous one. The alternative rules for the backward-looking type of policy rules can be expressed as follows:

$$R_t = \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 \pi_{H,t-1} + \psi_2 y_{t-1} + \psi_3 \Delta e_{t-1}\right] + \varepsilon_{R,t}. \quad (8)$$

$$R_t = \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 \pi_{H,t-1} + \psi_2 y_{t-1} - \psi_3 \Delta q_{t-1}\right] + \varepsilon_{R,t}. \quad (9)$$

The last specification is the forward-looking rule, which considers the expectation of relevant variables. Clarida, Gali and Gertler (1998) find that the forward-looking rule well captures the actual behavior of the short term interest rate. The alternative forward-looking rules can be express as follows:

$$R_t = \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 E_t \pi_{H,t+1} + \psi_2 E_t y_{t+1} + \psi_3 E_t \Delta e_{t+1}\right] + \varepsilon_{R,t}. \quad (10)$$

$$R_t = \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 E_t \pi_{H,t+1} + \psi_2 E_t y_{t+1} + \psi_3 E_t \Delta q_{t+1}\right] + \varepsilon_{R,t}. \quad (11)$$

4. Methodology and Data Description

In this section, the paper constructs the data set for the empirical investigation, discusses on the economic methodology, and presents the data description and the choice of prior.

4.1. A Bayesian Estimation

The main focus of the paper is about the monetary policy rules: (6) for the baseline rule and (7) – (11) for the alterative rules estimation. For the consistent estimation, the paper needs to correct the endogeneity problem. This problem can be corrected by adjusting the non-zero condition expectation of the policy shock: hence the baseline policy rule (6) is replaced by follows:

$$\begin{aligned} R_t = {} & \mathrm{E}\left[\varepsilon_t^R \middle| \pi_t, y_y, \Delta e_t\right] + \rho_R R_{t-1} + (1-\rho_R)\left[\psi_1 \pi_t + \psi_2 y_t + \psi_3 \Delta e_t\right] \\ & + \left[\varepsilon_t^R - \mathrm{E}\left[\varepsilon_t^R \middle| \pi_t, y_y, \Delta e_t\right]\right] \end{aligned} \quad (12)$$

The parameters of the model can be divided into two types, policy parameters and non policy parameters. The policy parameters are collected into $\psi = [\psi_1, \psi_2, \psi_3, \rho_R]'$ while the non policy parameters are collected into $\theta = [\alpha, \kappa, r, \tau, \rho_q, \rho_{\pi^*}, \rho_{y^*}, \rho_z, \sigma_R, \sigma_q, \sigma_{\pi^*}, \sigma_{y^*}, \sigma_z]'$. All structural shocks are assumed as the normal distribution and do not correlate with each other at all leads and lags.

For the observable variables, the study observes the Manufacturing Production Index (MPI), the annualized core inflation, the change in the nominal exchange rate, the change in the terms of trade, and the annualized interest rate as the vector $I_t = \left[\Delta y_t + z_t, 4\pi_{H,t}, \Delta e_t, \Delta q_t, 4R_t \right]$.

The paper estimates the structural model by adopting the Bayesian estimation. The Bayesian approach is based on the prior knowledge of the parameters that contains the signal and the distribution combining with the observed data in order to generate the posterior distribution of the parameter through the Bayes' Theorem. The prior distribution of the structural parameters is placed by the density function, $p\ \psi,\theta|\mathrm{M}_i = p\ \psi|\mathrm{M}_i\ \ p\ \theta|\mathrm{M}_i$ here $i = 0,1$. M_0 stands for the model that is restricted on the policy coefficient of the exchange rate equaling to zero while M_1 stands for the unrestricted model. The observed data are used to update the priors expressed as the likelihood function, $\mathrm{L}_D\ \psi,\theta|I^T,\mathrm{M}_i$, where $I^T = I_1, I_2, I_3, ..., I_T$ is a set of data provided at time *t*. The posterior distribution is calculated as follows:

$$p_D\ \psi,\theta|I^T,\mathrm{M}_i = \frac{\mathrm{L}_D\ \psi,\theta|I^T,\mathrm{M}_i\ \ p\ \psi|\mathrm{M}_i\ \ p\ \theta|\mathrm{M}_i}{\int \mathrm{L}_D\ \psi,\theta|I^T,\mathrm{M}_i\ \ p\ \psi|\mathrm{M}_i\ \ p\ \theta|\mathrm{M}_i\ \ d\ \psi,\theta}. \tag{13}$$

In order to examine whether the BOT takes the exchange rate movement into the consideration or not, the paper estimates the unrestricted model, M_1, and restricted model, M_0, and computes the posterior odds in favor of model M_0 against model M_1, which is illustrated as the ratio of the posterior probabilities between the models. The posterior probability is the probability, in which the model well explains the given data. The posterior odds are expressed as follows:

$$\frac{\pi_{0,T}}{\pi_{1,T}} = \frac{\pi_{0,0}}{\pi_{1,0}} \cdot \frac{p\ \ I^T|\psi,\theta,\mathrm{M}_o}{p\ \ I^T|\psi,\theta,\mathrm{M}_1}. \tag{14}$$

The first factor is the prior odds in favor of M_0. The second term is called the Bayesian factor. $p\ \ I^T|\psi,\theta,\mathrm{M}_i$ is called the marginal data density.

4.2. Data Description

The paper estimates the unrestricted model and restricted model of each rule by using the observation on the MPI growth, the core inflation, the policy rate, the nominal exchange rate of Bath per US dollar change, and the terms of trade change. The observed data fits the output growth, domestic inflation, the nominal interest rate, the nominal exchange rate change, and the terms of trade change, respectively. All data is monthly data expressed in logarithm form from June 2000 until June 2011, which is the period that the BOT implemented the IT. The MPI and core inflation are taken from the Office of Industrial Economics and the Bureau of Trade and Economic Indices, respectively. The rest of data series is taken from the Bank of Thailand.

4.3. Choice of Prior

Table 1 presents the prior mean and standard deviation of the structural parameters. The priors of the structural parameters, excepting the import share and the terms of trade, are obtained from LS07. Rather than consider the discount factor, β, the model is parameterized in terms of steady state real interest rate, *r*. β is

calculated from $\beta = \exp[\frac{-r}{400}]$. In order to capture the Thai economy, the paper estimates the priors of the import share, the terms of trade, and the technology growth obtained from (4), (5), and AR(1) process of technology growth, respectively, by using the OLS estimation. The data is the monthly data from June 2000 to May 2004.

Table 1. A prior specification.

Name	Domain	Density	Mean	Standard deviation
α	[0,1)	Beta	0.21	0.27
κ	$\mathbb{R}^+$	Gamma	0.50	0.05
r	$\mathbb{R}^+$	Gamma	2.50	1.00
τ	[0,1)	Beta	0.50	0.20
ψ_1	$\mathbb{R}^+$	Gamma	1.50	0.50
ψ_2	$\mathbb{R}^+$	Gamma	0.25	0.13
ψ_3	$\mathbb{R}^+$	Gamma	0.25	0.13
ρ_r	[0,1)	Beta	0.80	0.20
ρ_q	[0,1)	Beta	0.18	0.15
ρ_z	[0,1)	Beta	0.05	0.21
ρ_{π^*}	[0,1)	Beta	0.98	0.19
ρ_{y^*}	[0,1)	Beta	0.99	0.01
σ_r	$\mathbb{R}^+$	InvGamma	0.50	4.00
σ_q	$\mathbb{R}^+$	InvGamma	0.01	4.00
σ_z	$\mathbb{R}^+$	InvGamma	3.78	4.00
σ_{π^*}	$\mathbb{R}^+$	InvGamma	0.57	4.00
σ_{y^*}	$\mathbb{R}^+$	InvGamma	0.56	4.00

5. Estimation Result

In this section, the paper discusses the posterior probability comparing for the baseline rule in order to examine whether the BOT takes the exchange rate change into the decision or not. Then the paper also analyzes the alternative rules by considering the log marginal data density. The study reconsiders the log marginal data density between the policy rules to conclude the rule that well describe the policy rate of Thailand.

5.1. Model Estimation

The estimated parameter of the model that the BOT takes the exchange rate change in the consideration is shown in Table 2, showing the posterior mean as the point estimation, and the 90% posterior interval of the parameters. The BOT focuses less on the previous decision of the policy rate than the current economic conditions since the coefficient of the interest rate smoothing is 0.306, indicating the low degree of the policy rate persistence. The coefficient of the inflation response is 1.515, which illustrates that the BOT follows the Taylor principle. The BOT strongly adjusts the short term interest rate more than the change of the core CPI. The BOT raises the policy rate about 0.197 and 0.125 in order to slow down the economy growth and reduce the impact of exchange rate depreciation, respectively. Under this rule, the BOT implements the flexible Inflation Targeting regime since the BOT stabilize inflation, the output growth and the exchange rate movement. The policy parameters can be written in the form of policy rule (6) as following:

$$R_t = 0.306R_{t-1} + \ 1-0.306\ \left[1.515\pi_{H,t} + 0.197y_t + 0.125\Delta e_t\right]$$

The discount factor, β, is 0.99. The value of discount factor illustrates a belief of the household, in which the value of the future utility is almost the same as the present utility. The intertemporal substitution elasticity illustrates the willingness of the household to substitute the consumption between two periods. The posterior mean of the intertemporal substitution elasticity is 0.317, which implies that the household is not willing to postpone the current consumption to the next period consumption.

Table 2. Parameter estimation results, Baseline Rule.

Name	Prior Mean	Posterior Mean	90% Posterior Interval
α	0.21	0.030	[0.013, 0.047]
κ	0.50	0.683	[0.680, 0.685]
r	2.50	2.555	[2.549, 2.561]
τ	0.50	0.317	[0.313, 0.321]
ψ_1	1.50	1.515	[1.511, 1.518]
ψ_2	0.25	0.197	[0.196, 0.198]
ψ_3	0.25	0.125	[0.122, 0.127]
ρ_r	0..80	0.306	[0.295, 0.317]
ρ_q	0.18	0.046	[0.044, 0.047]
ρ_z	0.05	0.002	[0.000, 0.003]
ρ_{π^*}	0.98	0.970	[0.970, 0.971]
ρ_{y^*}	0.99	0.989	[0.989, 0.989]
σ_r	0.50	0.069	[0.068, 0.069]
σ_q	0.01	0.010	[0.010, 0.010]
σ_z	3.78	0.703	[0.606, 0.799]
σ_{π^*}	0.57	0.068	[0.068, 0.069]
σ_{y^*}	0.56	0.480	[0.412, 0.549]

Given the data and the prior distribution, the study estimates model M_1, and the model M_0, by unrestricting the coefficient of the exchange rate change, $\psi_3 > 0$, and restricting the coefficient of the exchange rate change, $\psi_3 = 0$, respectively. The posterior odds of the baseline rule equal to 2.004×10^{-175}, which implies for the decisive evidence against the null hypothesis M_0. The ratio can be concluded that the MPB is concerned about the nominal exchange rate movement in the policy decision when there is the exchange rate uncertainty existing in the economy, and the policymakers follow (6) as the policy rule.

Table 3. Variance decomposition of the model with policy rule (6).

	Monetary policy shock	Terms of trade shock	Technology growth shock	World inflation shock	World output shock
Output	1.460	0.000	0.000	0.010	98.530
Potential Output	0.000	0.000	0.000	0.000	100.000
Core CPI inflation	27.580	0.000	0.000	36.600	35.810
Policy rate	3.320	0.000	0.000	48.280	48.400
Exchange rate movement	3.660	0.140	0.000	91.440	4.750

The study computes the variance decomposition of the exogenous shocks to the endogenous variables to measure the importance of the shocks, which is reported in Table 3. The terms of trade movement does not play a significant role in determining the domestic variables. On the other hand, the foreign shocks, world inflation and the world output shocks, play a substantial role in the model because of the persistence of the shocks, ρ_{π^*} and ρ_{y^*}.

5.2. Alternative Rules Estimation

The posterior odds are presented in Table 4. The table also displays the log marginal data density of each model. The results illustrate that the log marginal data density of all alternative rules that the BOT is not concerned about the exchange rate change in the consideration is lower than the model that the BOT is concerned about its change. These generate that the posterior odds are less than zero, which can be interpret that the evidence is decisive evidence against the null hypothesis M_0. As the estimation results, the estimation express approval that the BOT considers the nominal exchange rate movement or the terms of trade movement in the decision for all cases of policy rule under the model.

Table 4. Posterior odds, alternatives rules.

Rule	Log marginal data density		Posterior odds
	$\psi_3 = 0$	$\psi_3 > 0$	
(6)	92.398	494.655	2.004×10^{-175}
(7)	92.398	420.424	3.467×10^{-143}
(8)	19.644	385.061	2.002×10^{-159}
(9)	19.644	340.476	4.619×10^{-140}
(10)	220.851	401.222	4.634×10^{-79}
(11)	220.851	338.536	7.764×10^{-52}

Notes: the table reposts posterior odds of the hypothesis $\psi_3 = 0$ versus $\psi_3 > 0$, *assuming that the prior odds are one.*

The study analyzes policy rules using the log marginal data densities between the policy rules for each type of policy rule; the contemporaneous rule, the backward-looking rule, the forward-looking rule in order to examine either the MPB considers the nominal exchange rate change or the terms of trade change in the policy decision. The posterior odd of the model that the BOT considers the nominal exchange rate movement in the decision, (6), (8), and (10) against the model that the BOT considers the terms of trade movement, (7), (9), and (11), in the decision are 1.730×10^{32}, 2.307×10^{19}, and 1.675×10^{27}. For all types of policy rule, the posterior odds illustrate that the evidence support the null hypothesis, in which the BOT is concerned about the nominal exchange rate movement than the terms of trade movement.

Table 5. policy parameter estimation, alternative rule.

Rule	ρ_r	ψ_1	ψ_2	ψ_3
(6)	0.306	1.515	0.197	0.125
(8)	0.778	1.637	0.237	0.285
(10)	0.749	1.917	0.212	0.241

Notes: the table reposts posterior odds of the hypothesis $\psi_3 = 0$ versus $\psi_3 > 0$, *assuming that the prior odds are one.*

The policy parameters of the policy rule (6), (8) and (10) are presented in Table 5. The coefficients on the interest rate smoothing is ambiguous since, for the case of contemporaneous rule, the BOT is focusing on the relevant economic condition, while, for the others, the BOT is focusing on the previous decision. All the inflation coefficients of the rules are greater than one, which implies that the BOT follows the Taylor principle. The BOT changes the policy rate more than one percent when the inflation is one. The estimations obviously confirm that the policymakers consider the inflation more than others variables. For the coefficients of the output growth and the exchange rate change, the BOT is more concerned about the output growth than the exchange rate movement for the case of contemporaneous rule, (6). On the other hand, the MPB are more

concerned about the exchange rate movement than the output for the case of backward-looking rule, (8), and forward-looking rule, (10).

The last policy rule analysis in this section considers the log marginal data densities between the policy rule (6), (8) and (10). The analysis examines which model delivers the highest probability given the Thai data. The log marginal data densities showed in Table 5 illustrate that the contemporaneous rule, which incorporates the nominal exchange rate movement, (6), delivers a highest log marginal data density which dominates other rules. There the MPB is concerned about the data that available at time t in order to set the policy rate.

6. Conclusion

The paper estimates a small open economy model, proposed by Lubik and Schorfheide (2007) by using Bayesian Maximum Likelihood estimation. The paper considers various types of the Taylor rule: contemporaneous, backward-looking, and forward-looking specification. The main finding is that the BOT also responds to the exchange rate movements. The BOT follows the contemporaneous rule with the nominal exchange rate movement response, which can well explain the policy rate set by the BOT. The BOT focuses more in the relevant economic conditions that available at time t than the lag of interest rate. Also, the result indicates that the BOT follows the Taylor principle and put more weight on the output stabilization relative to the exchange rate stabilization. Therefore, the MPB has adopted the flexible Inflation Targeting policy.

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