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Taylor Principle under Inflation Targeting in Emerging ASEAN Economies: GMM and DSGE Approaches

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Abstract

This paper aims to reassess the performances of inflation targeting adopted by emerging ASEAN countries, Indonesia, the Philippines and Thailand, by examining their monetary policy rules, both through generalized-method-of-moments (GMM) estimations of policy reaction functions and through Bayesian estimations of the New Keynesian dynamic-stochastic-general-equilibrium (DSGE) model. The main findings are summarized as follows. First, the GMM estimations identified inflation-responsive rules fulfilling the Taylor principle, with a forward-looking manner in Indonesia and Thailand and with a contemporaneous way in the Philippines. Second, the Bayesian estimations of the New Keynesian DSGE could reassure the GMM estimation results, as the former estimations produced consistent outcomes with the latter ones on the policy rate reactions to inflation with the Taylor principle.

JEL classification numbers: E52, E58, O53
Keywords: Taylor principle; Inflation targeting; Emerging ASEAN; Generalized method of moments (GMM); New Keynesian dynamic stochastic general equilibrium (DSGE) model

1 Introduction

Inflation targeting (IT) has become a popular monetary policy among not only advanced countries but also among emerging market economies since the 1990s. The emerging ASEAN countries also have adopted the IT framework since the end of Asian currency crisis in the late 1990s: Indonesia in July 2005, the Philippines in January 2002 and Thailand in May 2000. Prior to the crisis, they had ever adopted a pegged exchange rate regime as an anchor to stabilize their inflation rates. In the crisis times, however, these economies had to switch their currency regimes to floating exchange rate regimes, and thus needed to search for an alternative anchor for price stability, that is the IT framework, as Mishkin (2000) argued.

While the IT performances in advanced countries are highly appreciated (e.g. (Mishkin and Posen, 1998; Mishkin and Schmidt-Hebbel, 2007), there have been rather less evidence to value the IT applications in emerging market economies due to their relatively shorter histories of its adoption and to some difficulties in its management. The one difficulty comes from the "fear of floating" suggested by Calvo and Reinhart (2002). The IT system could work well only if the independency of monetary policy is secured under floating exchange rate with capital mobility under the "impossible trinity" constraint. Emerging market economies are, however, afraid of their currency-value fluctuations, and their managing exchange rates might prevent their monetary policies from concentrating fully on the IT operation. Another possible difficulty might often be the lack of credibility of the central bank capacity in emerging

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market economies. It could come from arbitrary policy reactions accompanied with unreliable inflation forecasting by the central bank. The lack of credibility makes it difficult for the IT to have any significant impact on the expectations and behavior of the private sector with respect to wage and pricing contracts, thereby lessening its performances, as Eichengreen (2002) emphasized. Considering the difficulties inherent to emerging market economies, Ito and Hayashi (2004) presented the following two recommendations on the IT management: 1) emerging market countries should set an inflation with target central rate slightly higher and with a target range slightly wider than a typical advanced country; (2) small, open economies may pursue both an inflation target range and an implicit basket band in exchange rate regime, as both targets are expressed in a range (the targets work as the source of stability in expectations, while the ranges allow some flexibility).

Focusing on the IT adopters in emerging ASEAN, they have managed its system with the wider range around the central targeted inflation rate and by revising the targeted range in flexible manners. For assessing the IT performances, the limited literature examined inflation-responsive policy rules through policy reaction functions, and their transmission effect on inflation through impulse response functions under vector-autoregressive models: for instance, Taguchi and Kato (2011) for a group of ASEAN, Wimanda et al. (2011) for Indonesia, and Lueangwilai (2012) for Thailand.

This paper aims to reassess the IT performances on emerging ASEAN (Indonesia, the Philippines and Thailand) by examining their monetary policy rules, both through estimations of generalized method of moments (GMM) and through Bayesian estimations under the New Keynesian dynamic stochastic general equilibrium (DSGE) model. One of the crucial criteria for judging a monetary policy rule's relevance is the adaptability of the "Taylor principle": for inflation to be stable, the central bank must respond to an increase in inflation with an even greater increase in the nominal interest rate (Mankiw, 2016). Thus this study's contribution is that the inflation-responsiveness in ASEAN's monetary policy rules, GMM-estimated by single equation, are double-checked by the New Keynesian DSGE model, so that the adaptability of the "Taylor principle" could be reassured in a robust manner. The rest of the paper is structured as follows: Section 2 conducts the GMM estimation of monetary policy rules in the sample ASEAN countries; Section 3 turns to the DSGE model simulation to identify their monetary policy rules; Section 4 discusses the estimation outcomes in comparison with those of previous studies; and the last section summarizes and concludes.

2 GMM Estimations of Monetary Policy Rules in ASEAN

This section conducts the GMM estimations of monetary policy rules in the sample ASEAN countries. The section starts with the description of the sample data and methodology, and then moves onto the estimation outcomes and their discussion.

2.1 Sample Data and Methodology

The analysis here targets the IT adopters in ASEAN: Indonesia, The Philippines and Thailand, and samples the quarterly data during the periods with their IT operations and with the data availability: from 2005q3 (the third quarter of 2005) to 2019q3 in Indonesia, from 2002 q1 to 2018q4 in the Philippines, and from 2000q3 to 2019q3 in Thailand. The source of all the data is the International Financial Statistics (IFS) of the International Monetary Fund (IMF). The index needed for the monetary-policy-rule estimations are selected as follows: "Central Bank Policy Rate" for policy interest rate (denoted by *por*); "Consumer Prices Index (2010=100)" for price index, which is transformed into its year-on-year change rate as inflation rate (π); and "Gross Domestic Product (GDP), Volume, Seasonally Adjusted (2010=100)" for GDP, which is further processed into GDP gap (*gap*) by subtracting from the GDP a Hodrick-Prescott-filter of that series as a proxy of potential GDP level.

The monetary policy rules have been examined by so-called policy reaction function, namely, a more generalized form of the Taylor rule (see Taylor, 1993). Its standard specification is that a central bank adjusts the nominal policy interest rate in response to inflation and output gap. The function was initially put into empirics by Clarida and Gertler (1997) for the Bundesbank and Clarida et al. (1998a) for the US Federal Reserve System (US Fed). This study basically applies the methodology of these previous studies and modifies it for this study's analytical concern. The equation for an empirical estimation is specified as follows.

$$por_t = (1 - \rho) * (\alpha + \beta * \pi_{t+n} + \gamma * gap_t) + \rho * por_{t-1} + \varepsilon_t \quad (1)$$

where *por*, π, and *gap* are aforementioned variables; ρ is a degree of smoothing a change in policy rate in practice with $0<\rho<1$ (thereby α, β and γ being long-term coefficients for reactions); and ε is a linear combination of the forecast errors of inflation and real output.

The Taylor principle requires $\beta>1$: the policy rate reacts to more than inflation rate, otherwise the suppression in the real rate would accommodate inflation in a pro-cyclical manner. Clarida et al. (1998b), for instance, identified the Taylor principle for the Bundesbank (β=1.31), the Bank of Japan (β=2.04) and the US Federal Reserve System (β=1.79). The subscript n of π could take positive values: 1, 2, 3 and 4 as a forward-looking specification, and zero and negative values: 0, -1, -2 and -3 as a backward-looking one. Clarida et al. (1998b) verified forward-looking policy rules for the three (G3) central banks above, whereas Taguchi and Kato (2011) confirmed backward-looking ones for the bank of Indonesia and Thailand.

For the technique to estimate the parameters [α, β, γ, ρ], this section applies the generalized method of moments (GMM), since the equation above entails endogeneity problem in that the policy rate might also affect explanatory variables. The instrumental set includes one- and two-quarter lagged values of inflation rate π and GDP *gap*. The estimated J-statistic in Table 1 implies that these instrumental variables are valid in the sense that the over-identifying restrictions cannot be rejected except for the case of π_{t+4} in Thailand.

2.2 GMM Estimation Outcomes and Discussion

Table 1 and Table 2 reports the GMM estimation outcomes of policy reaction functions in Indonesia, the Philippines and Thailand by forward-looking and backward-looking specifications. In each category, based on the estimated short-term coefficients, the long-term coefficients are worked out, which are displayed in the lower part of each table. Focusing on the long-term coefficients, some of them are excluded from their calculations since the degree of smoothing ρ is unexpectedly beyond unity. In the summary Table 2, the Taylor principle with $\beta>1$ is significantly identified in all three countries regardless of their different specifications: the cases of π_{t+2} in Indonesia (β=1.843), π_t in the Philippines (β=1.445) and π_{t+1} in Thailand (β=1.333). The reaction to GDP gap γ is, on the other hand, not significant in majority cases except a few Thailand cases. All in all, the IT adopters' monetary policies in ASEAN are characterized by inflation-responsive rules fulfilling the Taylor principle, with a forward-looking manner in Indonesia and Thailand and with a contemporaneous way in the Philippines.

3 The New Keynesian DSGE Estimations

This section turns to the New Keynesian DSGE estimations for re-checking the ASEAN samples' inflation-responsive rules with the Taylor principle, verified by the GMM estimations in the previous section. The section first specifies the model structure and then presents the estimations result and their interpretations.

3.1 Specification of New Keynesian DSGE Model

The DSGE literature originated from the Real Business Cycle (RBC) model proposed initially by Kydland and Prescott (1982), which provided a reference framework for the macroeconomic analysis of economic fluctuations with technology shocks. As a next stage of the literature, the New Keynesian

DSGE model has been developed by combining the DSGE micro-founded characteristic of the RBC model with the following assumptions: monopolistic competition, nominal rigidities and short run non-neutrality of monetary policy (see Gali, 2008). Since Christiano et al. (2005) and Smets and Wouters (2003, 2007) estimated the New Keynesian model, it has been widely used for empirical studies including monetary policy analyses during the recent decade.

This study applies the simplest form of the New Keynesian DSGE model to examine the monetary policy rules of the same ASEAN sample countries in Section 2. The estimable model consists of the following six equations based on Gali (2008).

$$\tilde{y}_t = -(i_t - \pi_{t+1}) + Et[\tilde{y}_{t+1}] - (1 - \rho_a) * a_t \quad (2)$$
$$\pi_t = \beta * Et[\pi_{t+1}] + \kappa * \tilde{y}_t + e_t \quad (3)$$
$$i_t = \phi_i * i_{t-1} + (1 - \phi_i) * (\phi_\pi * Et[\pi_{t+n}] + \phi_y * \tilde{y}_t) + \varepsilon_{it} \quad (4)$$
$$\kappa = [(1 - \theta) * (1 - \beta * \theta)] / \theta \quad (5)$$
$$a_t = \rho_a * a_{t-1} + \varepsilon_{at} \quad (6)$$
$$e_t = \rho_e * e_{t-1} + \varepsilon_{et} \quad (7)$$

where the endogenous variables [$\tilde{y}$, i, π] denote output gap, nominal interest rate, and inflation rate; the exogenous variables [a, e] represents productivity shock and cost-push shock that follow first-order autoregressive process with i.i.d. shocks [ε_a, ε_e]; [ε_i] shows an i.i.d. monetary policy shock; the parameters [β, θ, κ] are discount factor for households, probability a firm does not change its price (price stickiness) and κ defined in the equation (5); the parameters [ϕ_i, ϕ_π, ϕ_y] govern monetary policy behaviors: smoothing degree of policy rate and policy reactions to inflation rate and output gap; and the parameters [ρ_a, ρ_e] are the ones for AR(1) process of productivity and cost-push factors. The variables in the log-linearized version are expressed by the percentage deviation from the zero-inflation steady-state level. Note that the model structure is common to the countries.

The first three equations constitute the major structure of the New Keynesian model characterizing the dynamic behavior of three key macroeconomic indicators: output, inflation and nominal interest rate. The equation (2), called the "expectational IS curve", corresponds to the log-linearization of an optimizing household's Euler equation, linking consumption and output to the real interest rate. The equation (3), called the New- Keynesian Phillips curve, describes the optimizing behavior of monopolistically competitive firms that set their prices in a randomly staggered fashion, as suggested by Calve (1983). The equation (4) represents the monetary policy rule, corresponding to the equation (1) shown in Section 2. The subscript n of π depends on the specifications identified empirically for each sample economy in Section 2. This specification of the policy rule would be different from the standard three-equations New Keynesian model.

3.2 DSGE Model Estimations and Outcomes

The DSGE model had ever worked with the "calibration" that depends solely on inference from external sources to assign values for the model's parameters. The "Bayesian estimation" has, however, gained popularity in recent times for estimating the parameters. The Bayesian approach combines observable data with assumptions on "prior" distributions to determine "posterior" distributions for the parameters, so that the possibility of misspecification from imposing strong restrictions could be lessened (for more details, see An and Schorfheside, 2007). Thus this study applies the Bayesian method for the New Keynesian DSGE model estimation.[3]

Regarding the observed data, this DSGE estimations also applies the data of GDP gap (*gap*), policy rate (*por*) and the change rate in consumer prices (π) in Section 2 to the endogenous variables in the New Keynesian model: output gap ($\tilde{y}$), nominal interest rate (i), and inflation rate (π), respectively. The data of policy rate is processed into a detrended series by subtracting a Hodrick-Prescott-filter of that data, since

[3] This study uses "Dynare (4.6.1 version)".

the New Keynesian model is expressed by the deviation from the steady-state level.[4] The sample periods are just the same as those in each sample country in Section 2.

As for the prior values for estimated parameters, this study focuses on those of the monetary policy rule in the equation (4), namely, [ϕ_i, ϕ_π, ϕ_y]. The study uses the parameters estimated by the GMM in Section 2 as the values of prior means. The Table 3 reports the prior-value settings in the left side of the column, and shows that the prior means of parameters on the reaction to inflation ϕ_π and the smoothing degree ϕ_i correspond to those of the cases of π_{t+2} in Indonesia (β=1.843, ρ=0.912), π_t in the Philippines (β=1.445, ρ=0.953) and π_{t+1} in Thailand (β=1.333, ρ=0.891), all of which fulfils the Taylor principle in Section 2 (as for the parameter on the reaction to output gap ϕ_y, the prior-mean-values are set to zero, since all the coefficients obtained by the GMM estimations were insignificant). The other parameters are treated as fixed ones following plausible settings as in various type of DSGE literatures, Smets and Wouters (2003, 2007), Gali (2008) among others: β=0.99, θ=0.75 and ρ_a=ρ_e=0.90.

The outcomes of the Bayesian estimations are exhibited in terms of the posterior distributions in Table 3 and the impulse response functions to monetary policy shock in Figure 1. Regarding the posterior distributions, it is worth noting that the posterior means of parameters on the reaction to inflation ϕ_π and the smoothing degree ϕ_i have almost the same values as their prior means: in the reaction to inflation, 1.814 (posterior) vs. 1.843 (prior) in Indonesia, 1.421 vs. 1.445 in the Philippines, and 1.336 vs. 1.333 in Thailand; and in the smoothing degree, 0.866 vs. 0.912 in Indonesia, 0.914 vs. 0.953 in the Philippines, and 0.869 vs. 0.891 in Thailand. With regard to the reaction to output gap, the posterior means turn out to have significantly positive values in all sample countries. It implies that there is still room to investigate the cause of discrepancy in estimation results between the GMM the Bayesian approaches. As for the impulse response functions, Figure 1 demonstrates expectedly that inflation rate and output gap respond negatively to monetary policy shock (one percent point of policy rate shock) during ten quarters in all the sample countries.

In sum, the Bayesian estimations of the New Keynesian DSGE model could reassure the GMM estimations of policy reaction functions on the monetary policy rules in the ASEAN IT-adopters, in the sense that the former estimations in this section produce consistent outcomes with the latter ones in the previous section on the policy rate reactions to inflation fulfilling the Taylor principle.

4 Discussions on Estimation Outcomes

This section discusses the estimation outcomes presented Section 2 and 3 in comparison with those of previous studies. This study could, through the GMM and DSGE approaches, identify inflation-responsive rules fulfilling the Taylor principle, with a forward-looking manner in Indonesia and Thailand and with a contemporaneous way in the Philippines.

The previous studies targeting the ASEAN IT adopters, such as Taguchi and Kato (2011), Wimanda et al. (2011) and Lueangwilai (2012), showed the results common to this study, in the sense that the Taylor principle has held in their policy rule analyses. In terms of expectational manners in inflation responsiveness, however, there are some differences: Taguchi and Kato (2011), Wimanda et al. (2011) and Lueangwilai (2012) verified backward-looking or contemporaneous policy rules in Indonesia and Thailand respectively, whereas this study revealed forward-looking rules in these two countries. Their upgrading toward forward-looking rules might reflect the recent improvements of their forecasting and managing capacities as they have accumulated experiences of operating their IT systems.

Regarding the studies on the Taylor rules of advanced economies, there has been relatively a larger volume of recent literature since the initially seminal works of Clarida and Gertler (1997) and Clarida et al. (1998a and 1998b), such as Belke and Polleit (2007), Belke and Cui (2010), Botzen and Marey (2010), Heimonen et al. (2017) and Papadamou et al. (2018). Among these studies, Belke and Cui (2010), Botzen

[4] The data of inflation rate and GDP gap have no need for being processed under the assumption of zero-inflation steady-state.

and Marey (2010) and Papadamou et al. (2018) prioritized their analyses on the policy rule governed by European Central Bank in Euro area, which were different from individual countries' policy rules. Botzen and Marey (2010) and Heimonen et al. (2017) targeted their Taylor-rule analyses on the responses to stock market, which had rather different scope from this study's target. Thus this section focuses on the comparison in estimated policy rules between ASEAN IT adopters in this study and the US Fed based on Belke and Polleit (2007).[5] This study obtained the inflation-responsive coefficients fulfilling the Taylor principle by 1.3 in Thailand, 1.4 in the Philippines and 1.8 in Indonesia, and the smoothing degree toward targeted policy by around 0.9 common to all three countries. Belke and Polleit (2007), on the other hand, exhibited the US Fed policy rule by 2.27-2.57 as the reaction degree to inflation and 0.84-0.91 as the smoothing degree for the quarterly sample period from the first quarter of 1999 to the second quarter of 2005. The comparison of both studies suggests that there is a difference in the strength of policy rate reaction to inflation between ASEAN and US monetary policy rules, although they have similar degrees of smoothing degrees: the policy rate reactions to inflation in ASEAN IT adopters are more moderate that of US Fed.

5 Concluding Remarks

This paper reassessed the IT performances on emerging ASEAN (Indonesia, the Philippines and Thailand) by examining their monetary policy rules, both through GMM estimations of policy reaction functions and through Bayesian estimations of the New Keynesian DSGE model. This study's contribution was that the adaptability of the Taylor principle could be verified both by the partial estimations of policy reaction functions and by the New Keynesian macroeconomic model with micro-foundations.

The main findings are summarized as follows. First, the GMM estimations identified inflation-responsive rules fulfilling the Taylor principle, with a forward-looking manner in Indonesia and Thailand and with a contemporaneous way in the Philippines. Second, the Bayesian estimations of the New Keynesian DSGE could reassure the GMM estimation results, as the former estimations produced consistent outcomes with the latter ones on the policy rate reactions to inflation with the Taylor principle.

The policy implications from this study' findings could be highlighted as follows. First, it should be further investigated from macroeconomic perspectives whether the policy rate reactions to inflation in ASEAN IT adopters have been powerful enough to control inflation, since their reactions, although fulfilling the Taylor principle, have been far weaker than that of US Fed. Second, there is still room for the Philippines's policy rule (as estimated to be a contemporaneous responsive rule to inflation) to be upgraded to a forward-looking responsive rule to inflation. For investors in ASEAN economies, their expectations on inflation are expected to converge into targeted inflation rates regardless of external temporary shocks, since the performance of the central bank's policy rate depends highly on their formation of inflationary expectations.

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Table 1: GMM Estimation Results of Policy Reaction Functions

[Indonesia]

Forward-looking	π_{t+1}	π_{t+2}	π_{t+3}	π_{t+4}
(1-ρ)*α	1.134 *** (2.894)	-0.359 (-0.838)	-1.284 * (-1.941)	-1.422 (-1.239)
(1-ρ)*β	0.294 *** (6.839)	0.160 ** (2.533)	0.026 (0.307)	-0.014 (-0.109)
(1-ρ)*γ	-0.181 (-0.748)	0.254 (1.078)	0.625 * (1.812)	0.727 * (1.702)
ρ	0.590 *** (7.815)	0.912 *** (11.022)	1.145 *** (14.858)	1.196 *** (13.540)
J-statistics	0.033 (0.855)	0.162 (0.687)	0.469 (0.493)	0.520 (0.470)
Long-term Coefficients				
α	2.771 ***	-4.124	-	-
β	0.719 ***	1.843 **	-	-
γ	-0.443	2.913	-	-

Backward-looking	π_{t}	π_{t-1}	π_{t-2}	π_{t-3}
(1-ρ)*α	1.278 *** (3.520)	1.915 ** (2.336)	2.136 (1.371)	-0.127 (-0.094)
(1-ρ)*β	0.187 *** (4.776)	0.200 ** (2.206)	0.141 (0.837)	-0.132 (-0.984)
(1-ρ)*γ	0.180 (0.779)	0.327 (1.072)	0.576 (1.376)	0.227 (0.609)
ρ	0.650 *** (8.978)	0.548 *** (2.952)	0.566 (1.616)	1.125 *** (3.672)
J-statistics	0.328 (0.566)	0.140 (0.707)	0.006 (0.937)	0.151 (0.696)
Long-term Coefficients				
α	3.660 ***	4.243 **	4.928	-
β	0.536 ***	0.445 **	0.325	-
γ	0.516	0.725	1.330	-

[The Philippines]

Forward-looking	π_{t+1}	π_{t+2}	π_{t+3}	π_{t+4}
(1-ρ)*α	-0.265 (-0.408)	-1.077 (-1.056)	-2.356 (-0.853)	-1.911 (-0.497)
(1-ρ)*β	0.083 ** (2.348)	0.000 (0.015)	-0.141 (-0.994)	-0.242 (-0.762)
(1-ρ)*γ	-0.083 (-0.877)	0.006 (0.044)	0.095 (0.400)	0.270 (0.978)
ρ	0.988 *** (6.527)	1.212 *** (5.809)	1.572 ** (2.528)	1.560 (1.583)
J-statistics	1.513 (0.218)	0.312 (0.576)	0.003 (0.951)	0.257 (0.611)
Long-term Coefficients				
α	-	-	-	-
β	-	-	-	-
γ	-	-	-	-

Backward-looking	π_{t}	π_{t-1}	π_{t-2}	π_{t-3}
(1-ρ)*α	-0.032 (-0.055)	0.271 (0.545)	0.394 (0.798)	0.213 (0.340)
(1-ρ)*β	0.066 ** (2.188)	0.045 (0.953)	0.023 (0.325)	-0.015 (-0.181)
(1-ρ)*γ	-0.036 (-0.407)	-0.006 (-0.072)	0.019 (0.249)	0.015 (0.159)
ρ	0.953 *** (7.389)	0.908 *** (8.327)	0.899 *** (6.813)	0.964 *** (5.531)
J-statistics	1.539 (0.214)	1.099 (0.294)	0.870 (0.350)	0.432 (0.510)
Long-term Coefficients				
α	-0,708	2.965	3.939	6.072
β	1.445 **	0.496	0.240	-0.432
γ	-0.785	-0.066	0.195	0.441

[Thailand]

Forward-looking	π_{t+1}	π_{t+2}	π_{t+3}	π_{t+4}
(1-ρ)*α	-0.049 (-0.312)	-0.305 (-1.321)	-0.284 (-0.861)	0.372 (0.946)
(1-ρ)*β	0.144 *** (3.569)	0.063 (1.553)	0.049 (1.246)	-0.024 (-0.890)
(1-ρ)*γ	-0.033 (-0.759)	0.006 (0.065)	0.045 (0.424)	0.133 ** (2.014)
ρ	0.891 *** (11.351)	1.100 *** (11.206)	1.112 *** (7.955)	0.833 *** (4.845)
J-statistics	0.107 (0.743)	1.769 (0.183)	1.770 (0.183)	5.506 ** (0.018)
Long-term Coefficients				
α	-0.461	-	-	2.232
β	1.333 ***	-	-	-0.144
γ	-0.313	-	-	0.797 **

Backward-looking	π_{t}	π_{t-1}	π_{t-2}	π_{t-3}
(1-ρ)*α	0.109 (0.508)	0.132 (0.992)	0.298 ** (2.157)	0.575 ** (2.450)
(1-ρ)*β	0.098 ** (2.316)	0.033 (0.850)	0.054 (1.016)	0.085 (1.662)
(1-ρ)*γ	-0.013 (-0.375)	0.040 (0.790)	0.079 ** (2.104)	0.152 ** (2.618)
ρ	0.861 *** (6.979)	0.912 *** (13.357)	0.816 *** (8.537)	0.669 *** (4.583)
J-statistics	1.302 (0.253)	2.025 (0.154)	2.041 (0.153)	0.076 (0.781)
Long-term Coefficients				
α	0.788	1.510	1.629 **	1.739 **
β	0.713 **	0.376	0.300	0.260
γ	-0.100	0.464	0.434 **	0.462 **

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance. The numbers in parentheses are t-values, except that those in J-statistics are their probabilities.
Sources: IFS of IMF

Table 2: Summary of GMM Estimation Results

		Coefficient of Inflation β			Coefficient of GDP Gap γ		
		Indonesia	**Philippines**	**Thailand**	**Indonesia**	**Philippines**	**Thailand**
Forward-looking	π_{t+4}	-	-	not sig.	-	-	***
	π_{t+3}	-	-	-	-	-	-
	π_{t+2}	** >1	-	-	not sig.	-	-
	π_{t+1}	*** <1	-	*** >1	not sig.	-	not sig.
Backward-looking	π_{t}	*** <1	*** >1	** <1	not sig.	not sig.	not sig.
	π_{t-1}	*** <1	not sig.	not sig.	not sig.	not sig.	not sig.
	π_{t-2}	not sig.	not sig.	not sig.	not sig.	not sig.	**
	π_{t-3}	-	not sig.	not sig.	-	not sig.	**

Note: ***, ** denote the rejection of null hypothesis at the 99% and 95% level of significance in the coefficients, and "not sig." means that the coefficients are not significant. ">1" and "<1" mean that the coefficients' magnitudes are more or less than unity, implying whether the Taylor principle is fulfilled or not.

Sources: Author's estimation

Table 3: DSGE Bayesian Estimation Results

[Indonesia]

Parameters		Priors			Posterior	
		Dist.	Mean	Stdev.	Mean	90% HPD interval
Monetary policy rule						
Inflation	ϕ_π	norm	1.843	0.050	1.814	1.734 - 1.893
GDP gap	ϕ_y	norm	0.000	0.050	0.169	0.124 - 0.213
Smoothing	ϕ_i	norm	0.912	0.050	0.866	0.826 - 0.898
Shocks						
Monetary Policy	$\varepsilon_{i\,t}$	invg	1.000	1.000	1.030	0.785 - 1.267
Productivity	$\varepsilon_{a\,t}$	invg	1.000	1.000	3.884	3.133 - 4.623
Cost-push	$\varepsilon_{e\,t}$	invg	1.000	1.000	0.544	0.459 - 0.627

[The Philippines]

Parameters		Priors			Posterior	
		Dist.	Mean	Stdev.	Mean	90% HPD interval
Monetary policy rule						
Inflation	ϕ_π	norm	1.445	0.050	1.421	1.341 - 1.502
GDP gap	ϕ_y	norm	0.000	0.050	0.150	0.099 - 0.199
Smoothing	ϕ_i	norm	0.953	0.050	0.914	0.894 - 0.935
Shocks						
Monetary Policy	$\varepsilon_{i\,t}$	invg	1.000	1.000	0.572	0.443 - 0.694
Productivity	$\varepsilon_{a\,t}$	invg	1.000	1.000	3.567	2.876 - 4.240
Cost-push	$\varepsilon_{e\,t}$	invg	1.000	1.000	0.310	0.267 - 0.355

[Thailand]

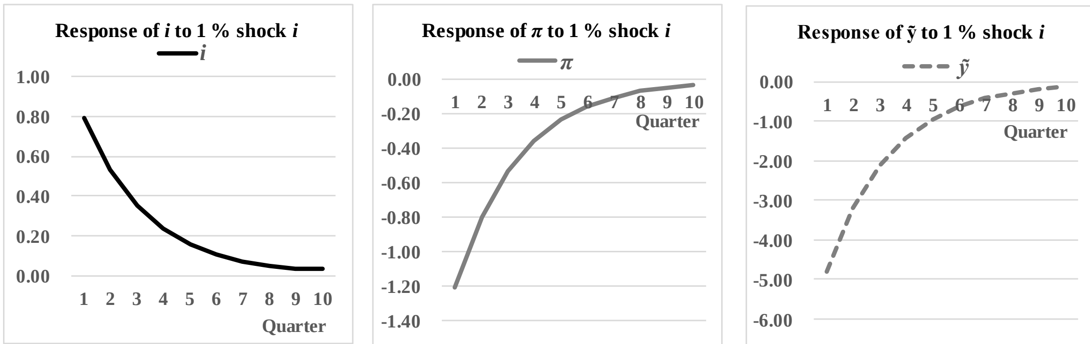
Parameters		Priors			Posterior	
		Dist.	Mean	Stdev.	Mean	90% HPD interval
Monetary policy rule						
Inflation	ϕ_π	norm	1.333	0.050	1.336	1.258 - 1.416
GDP gap	ϕ_y	norm	0.000	0.050	0.071	0.026 - 0.116
Smoothing	ϕ_i	norm	0.891	0.050	0.869	0.845 - 0.893
Shocks						
Monetary Policy	$\varepsilon_{i\,t}$	invg	1.000	1.000	0.409	0.345 - 0.473
Productivity	$\varepsilon_{a\,t}$	invg	1.000	1.000	3.446	2.845 - 4.044
Cost-push	$\varepsilon_{e\,t}$	invg	1.000	1.000	0.322	0.278 - 0.365

[Fixed Parameters]

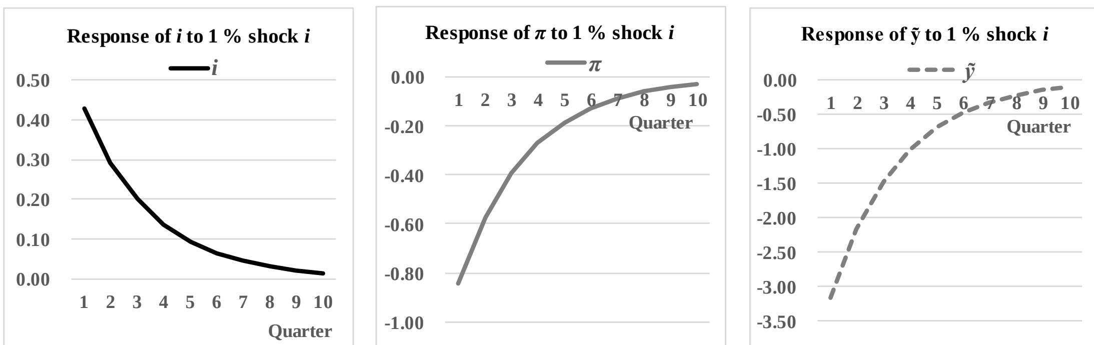
Discount factor for households	β	0.99
Probability a firm does not change its price	θ	0.75
Autoregressive parameter for productivity shock	ρ_a	0.90
Autoregressive parameter for cost-push shock	ρ_e	0.90
$\kappa = [(1 - \theta) * (1 - \beta * \theta)] / \theta$		

Note: "invg" represents the inverted Gamma distribution.
Sources: Author's estimation

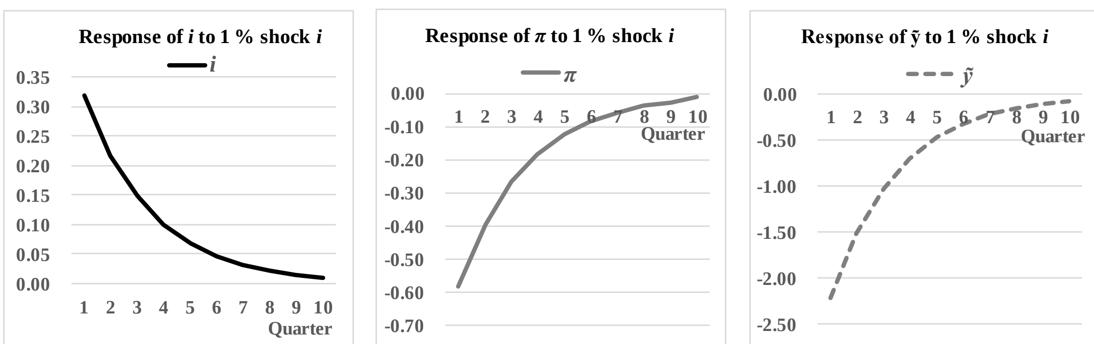
[Indonesia]



[The Philippines]



[Thailand]



Sources: Author's estimation

Figure 1: Impulse Responses to Monetary Policy Shock under DSGE Model