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Monetary Policy Analysis under Headline and Core Inflation Targeting in Thailand

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Abstract

This paper analyzes monetary policy in Thailand under core and headline inflation targeting regimes by using a small open economy DSGE model. The model, modified from Adolfson (2007), is based on the New Keynesian framework. We assume incomplete exchange rate pass-through. The results are estimated using Bayesian inference for 2001Q1 to 2015Q4. Our key finding is that the headline inflation targeting regime performs better than the core inflation targeting regime in terms of lower welfare losses. Intuitively, under the headline inflation targeting regime, the exchange rate channel will be more effective, which leads to a decrease in the degree of policy trade-off. In addition, we find no concrete conclusion regarding whether the Bank of Thailand can improve welfare by adjusting the policy rate in response to real exchange rate movements.

Keywords: Monetary policy, inflation targeting, Thailand
JEL Classifications: E37, E52, E58

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1. Introduction

On May 23, 2000, the Bank of Thailand (BOT) adopted a core inflation targeting regime (CITR) concentrating on core inflation as the monetary policy target. Since January 6, 2015, the BOT has switched to adopting a headline inflation targeting regime (HITR) focusing on headline inflation as the monetary policy target. For decades, many economists have debated whether central banks should conduct CITR or HITR initiatives. The evidence supporting CITR suggests that resource misallocation results from domestic price stickiness, which implies core inflation, under the New Keynesian (NK) model. Thus, optimal policy should fix domestic price stickiness (Aoki, 2001; Gali and Monacelli, 2005; Dhawan and Jeske, 2007; and Bodenstein et al., 2008). Intuitively, firms in a sticky price sector cannot freely adjust their prices. Hence, a firms' average price markup varies in response to shocks and may differ from representing an efficient level. As a result, central banks are inclined to stabilize sticky prices so that average price markups converge to efficient levels. The evidence supporting CITR also argues that, in practice, headline inflation often suffers from the effects of oil price shocks. Therefore, HITR has a higher risk of deviating way from its target rank. In such cases central banks implementing HITR face difficulties in achieving committed targets and lose credibility in anchoring the inflation expectations of households. As a result, price stability can be damaged in the long term (Mishkin, 2007).

However, the evidence supporting CITR is debatable and its findings rely on both underlying beliefs positing distortion arising from domestic price stickiness and some restricted assumptions. The assumption of a complete financial market is potentially contradictory and could mislead the decision makers within monetary policy authorities in emerging countries (Anand and Prasad, 2010). As a result, Anand and Prasad (2010) proposed an incomplete financial market assumption, which presents realistic features of emerging countries. Anand and Prasad (2010) found that stabilizing core inflation is no longer equivalent to stabilizing outputs. The logic is that, in the presence of financial friction, credit-constrained households cannot insure their future income against risks. Hence, their demand for goods does not depend on policy interest rates, but rather aggressively depends on their current real wages, which suffer from fluctuations in flexible prices. Stabilizing flexible prices is necessary to help monetary policy in stabilizing aggregate demand and outputs. Therefore, the implementation of HITR turns out to be the optimal policy. In an open economy, under complete degree of exchange rate pass-through (ERPT), imported goods prices are flexible. As a result, the law of one price of imported goods prices holds. Once this assumption is relaxed so that imported goods prices become sticky, stabilizing domestic goods prices would represent a sub-optimal policy (Monacelli, 2002). In detail, Monacelli (2002) found that the presence of an incomplete degree of ERPT likely changes the choice of the optimal monetary policy target because of a shift in the degree of the policy trade-off (PTF) between stabilizing inflation and stabilizing the output gap. Moreover, in practice, headline inflation is broadly supported to be used as the policy target in view of the following reasons. First, it is not appropriate to build a model simply assuming that agents use core inflation in forecasting headline inflation because the model should involve additional variables, such as expected inflation, development in a real economy, and the prevailing stance concerning monetary policy. Second, although headline inflation is volatile, central banks can decide how to respond to its fluctuations and its repercussions can be smoothed out (Bullard, 2011).

While many studies have examined the ongoing debate over the relative merits of CITR and HITR in conducting monetary policy, a consensus has yet to be reached. In Thailand, few theoretical studies have analyzed the performance of monetary policy under CITR and HITR. Therefore, in this study we aim to analyze the performance of monetary policy under both CITR and HITR using a theoretical approach which clearly captures economic frictions. Considering that Thailand is a small open nation and exchange rate movement represents an important issue, our model presents a small open-economy feature. Another interesting issue relates to real exchange rate (RER) responses in conducting monetary policy. As the degrees of ERPT of monetary policy under CITR and HITR are different, this study examines the different ways the BOT should respond to RER in the context of both regimes. Moreover, we also assume incomplete ERPT, based on empirical studies examining ERPT in Thailand (Jitpokkasame, 2007; Wattanakorn, 2013).

In considering parameter estimation, Bayesian inference represents a suitable estimation method for our dynamic stochastic general equilibrium (DSGE) model compared with alternative estimation methods, such as Ordinary Least Squares (OLS), Maximum Likelihood Estimation (MLE), and Generalized Method of Moment (GMM) for various reasons. First, OLS needs restricted conditions in order to ensure the unbiasedness and efficiency of parameters. Therefore, the estimated parameters from OLS may not conform to the pertinent economic theory. Second, in contrast to MLE, Bayesian inference allows us to specify the characteristics of parameters before estimation and, thus, to avoid outlying points at the peak of the likelihood function. Third, GMM is inappropriate for our DSGE model because it ignores the cross relationship of the estimated parameters in the general equilibrium (Pongsaparn, 2008). A compelling merit of employing Bayesian inference is that it allows us to use the observed data to update the prior-to-posterior distribution of parameters. Consequently, our study uses a small open-economy DSGE-based NK model with incomplete ERPT and estimates all relevant parameters using Bayesian inference. The remainder of this paper is organized as follows. Section 2 presents a literature review, while Section 3 outlines our model. Section 4 explains the methodology employed encompassing welfare loss function modification, policy rule modification, data description, parameter calibration and parameter estimation. In Section 5 we reveal the results of our policy performance, policy rate shock and sensitivity analyses on the degree of ERPT. Lastly, the major conclusions arising are discussed in Section 6.

2. Literature Review

Studies within the theoretical literature in this section adopted the same NK model and object to examine optimal monetary policy targets with alternative types of inflation and different definitions of core and headline inflation. Aoki (2001) analyzed how a central bank responds to sectorial supply shocks and examined the relationship between relative-price changes and inflation. They constructed a closed-economy NK model with a complete financial market which assumes no constraints to realizing smooth consumption for households. The model consists of both sticky-price and flexible-price sectors. In detail, the study defined sticky prices as core prices, with flexible prices representing food and energy prices, and the combination of both sticky and flexible comprising headline prices. Moreover, the study indicated that relative flexible prices behave like a shift parameter within the New Keynesian Phillips curve in the sticky-price sector. As a result, stabilizing headline prices would create a higher PTF. Therefore, the optimal monetary policy entails stabilizing core inflation because a central bank is able to firm up core inflation and the output gap with a lower PTF. Bodenstein et al. (2008) evaluated the efficiency of alternative monetary policy rules in response to an energy supply shock by setting up the optimal rule as a benchmark for analysis. They also used a closed-economy model with the complete financial market and explicitly introduced an energy sector and a sticky price sector. The findings revealed that a policy rate responding to headline inflation forecasts promotes fluctuations in core inflation and the output gap when a temporary energy shock occurs. Therefore, the policy rate responding to a core inflation forecast supports more effective stabilization within a macro-economy. By contrast, Anand and Prasad (2010) used a closed-economy model-based NK with an incomplete financial market. The model introduces non-food prices (sticky prices) defined as core prices, and a combination of food (flexible prices) and non-food values as headline prices. Anand and Prasad (2010) examined the performance between HITR and CITR through welfare comparison and modified the key characteristics of emerging countries which are a high share of expenditure on food in households'total expenditure, low price elasticity of demand for food items, and credit-constrained consumers. They found that, in the presence of credit-constrained consumers, central banks should implement flexible headline IT, especially in emerging countries. The logic is that, in the presence of financial frictions, credit-constrained households cannot efficiently insure their future income against risks. Hence, their demand for goods does not depend on policy interest rates, but categorically depends on their current real wages, which suffer from fluctuations in flexible prices. To determine the desirable outcome on aggregate demand, central banks should focus on prices in sectors with credit-constrained consumers, implying HITR implementation.

The following theoretical literature review regarding the open-economy model extends the scope of our discussion away from the closed-economy model in terms of encompassing the role exchange rates play within the interaction of the variables concerned. The effects of exchange rates variations are transmitted via: (i) the financial market channel depending on the uncovered interest rate parity (UIP) equation and (ii) the goods market channel depending on the degree of ERPT. Gali and Monacelli (2005), in terms of regarding an open-economy model with a complete degree of ERPT, analyzed the following alternative policy parameters: (i) the domestic inflation-based Taylor rule, (ii) the consumer price index (CPI)-based Taylor rule, and (iii) an exchange rate peg. Their findings revealed that domestic inflation-based Taylor rule represents the optimal policy because it allows the central bank to reduce distortions arising from price rigidity. In analyzing an open-economy model with an incomplete degree of ERPT, Corestti and Pesenti (2000) used a two-country model and introduced predetermined sectors reflecting local and foreign prices. In doing this they found that minimizing the expected value of a CPI overtime-average markup entails the optimal policy. They also mentioned that stabilizing core or domestic inflation no longer embodies an optimal policy when company markups vary according to currency volatility because firm decision makers are motivated to set higher prices to compensate against fluctuations in their profits. In addition, Corestti and Pesenti (2000) suggested that monetary policies ensuring low degrees of ERPT would present more constraints to rendering an economy flexible to price environments. Whereas in the context of a high degree of ERPT, an inward-looking policy, independent of world cyclical conditions, would represent an optimal strategy.

Adolfson (2001) also analyzed cases of both low and high degrees of ERPT and found that an economy with a low degree of ERPT can cause high fluctuations in exchange rates. This key finding implies that monetary policy stabilizing headline inflation reflects the optimal policy in cases of both low and high degrees of ERPT because it implicitly corresponds to exchange rate response. However, the monetary policy that directly stabilizes either nominal or real exchange rates does not represent the most desirable strategy. Similarly, Smets and Wouters (2002) also introduced an incomplete degree of ERPT by allowing the prices of imported goods to become rigid. Smets and Wouters (2002) suggested that central banks should reduce the resource cost of staggered price setting by stabilizing the combined prices of domestic and imported goods. In other words, HITR implementation represents the optimal policy.

3. Model

This study employs the open-economy DSGE-based NK model proposed by Adolfson et al. (2007). The model consists of households, domestic firms, importing firms, exporting firms, and a central bank. Key frictions within the model are as follows: (i) price and wage rigidities entailing that the law positing one price and wage does not hold, (ii) incomplete exchange rate pass-through implying that an import price cannot fully adjust to an exchange rate change, (iii) a risk premium for foreign bond holding implying that uncovered interest rate parity does not hold, (iv) costs of capital adjustment signifying a rigidity in physical capital stock prices, (v) habit formation entailing that consumption gradually responds to policy rates, (vi) the working capital channel signifying that an increase is the policy rate can create a cost-push shock and (vii) the complete financial market allowing households to borrow the money against future income risks.

3.1 Households

Each j[th] household maximizes the following utility function:

$$E_0^j \sum_{t=0}^{\infty} \beta^t \left[\zeta_t^c \ln\left(C_{j,t} - bC_{j,t-1}\right) - \zeta_t^h A_L \frac{\left(h_{j,t}\right)^{1+\sigma_L}}{1+\sigma_L} + A_q \frac{\left(\frac{Q_{j,t}}{z_t P_t^{core}}\right)^{1-\sigma_q}}{1-\sigma_q} \right] \tag{1}$$

subject to the following budget constraint:

$$\begin{aligned} &M_{j,t+1} + S_t B_{j,t+1}^* + P_t^{HL} C_{j,t}(1+\tau_t^c) + P_t^i I_{j,t} + P_t^{Core}\left(a\left(u_{j,t}\right)\bar{K}_{j,t} + P_{k',t}\Delta_t\right) \\ &= R_{t-1}\left(M_{j,t} - Q_{j,t}\right) + Q_{j,t} + \left(1-\tau_t^k\right)\prod_t + \left(1+\tau_t^y\right)\frac{W_{j,t}}{1+\tau_t^w} h_{j,t} + \left(1 - \right. \\ &\left. \tau_t^k\right) R_t^k u_{j,t} \bar{K}_{j,t} + R_{t-1}^* \Phi\left(\frac{A_{t-1}}{z_{t-1}}, \tilde{\Phi}_{t-1}\right) S_t B_{j,t}^* + TR_t + D_{j,t} - \tau_t^k \left[(R_{t-1}-1)\left(M_{j,t} - Q_{j,t}\right) + \right. \\ &\left. \left(R_{t-1}^* \Phi\left(\frac{A_{t-1}}{z_{t-1}}, \tilde{\Phi}_{t-1}\right) - 1\right) S_t B_{j,t}^* + B_{j,t}^*(S_t - S_{t-1})\right] \end{aligned} \tag{2}$$

and the following law of motion for the physical capital stock:

$$\bar{K}_{t+1} = (1-\delta)\bar{K}_t + \Upsilon_t F(I_t, I_{t-1}) + \Delta_t, \tag{3}$$

where $C_{j,t}$ is consumption, $h_{j,t}$ are working hours, $Q_{j,t}/P_t^{Core}$ is a real cash balance, ζ_t^c is a consumption preference shock, ζ_t^c is a labor supply shock, Υ_t is a stationary investment-specific technology shock, $I_{j,t}$ is investment, S_t is a nominal exchange rate (NER), $B^*_{j,t+1}$ is a foreign bond, P^i_t is a nominal investment goods price, $u_{j,t}$ is an utilization rate formulated by $u_t = K_t/\bar{K}_t$, $M_{j,t}$ is a money balance, Π_t is a profit, $W_{j,t}$ is a nominal wage, A_t is a real aggregate net foreign asset position, $\tilde{\Phi}_{t-1}$ is a time varying risk premium, $D_{j,t}$ is a net income by holding state contingent securities. Each household is a monopoly labor supplier and solves wage setting problem as follows:

$$\max_{W^{new}_{j,t}} E_t \sum_{s=0}^{\infty} (\beta\xi_w)^s \left[-\zeta^h_{t+s} A_L \frac{\left(h_{j,t+s}\right)^{1+\sigma_L}}{1+\sigma_L} v_{t+s} \frac{(1-\tau^y_{t+s})}{(1+\tau^w_{t+s})} \left((\pi^{HL}_t \dots \pi^{HL}_{t+s-1})^{\kappa_w} W^{new}_{j,t}\right) h_{j,t+s} \right]$$

The constant elasticity of substitution (CES) function of the aggregate consumption indexed by the domestic and imported consumption is given by

$$C_t = \left[(1-\omega_c)^{1/\eta_c} \left(C^d_t\right)^{(\eta_c-1)/\eta_c} + {\omega_c}^{1/\eta_c} (C^m_t)^{(\eta_c-1)/\eta_c}\right]^{\eta_c/(\eta_c-1)} \tag{4}$$

where C^d_t and C^m_t are the domestic and import consumption, respectively. An aggregate CPI is:

$$P^{HL}_t = [(1-\omega_c)(P^{Core}_t)^{1-\eta_c} + \omega_c (P^{m,c}_t)^{1-\eta_c}]^{1/(1-\eta_c)}. \tag{5}$$

3.2 Firms

3.2.1 A domestic sector

The final firm transforms intermediate goods into a homogenous product via the following CES equation:

$$Y_t = \left[\int_0^1 Y_{i,t}^{\frac{1}{\lambda_{d,t}}} di\right]^{\lambda_{d,t}}, 1 \leq \lambda_{d,t} < \infty, \tag{6}$$

and each intermediate firm i minimizes its costs subject to the following production function:

$$Y_{i,t} = z_t^{1-\alpha} \epsilon_t K^{\alpha}_{i,t} H^{1-\alpha}_{i,t} - z_t \phi, \tag{7}$$

where z_t is a permanent technology shock, ϵ_t is a covariance stationary technology shock, $K_{i,t}$ is a capital service stock, which can differ from the physical capital stock $(\bar{K}_t)$, $H_{i,t}$ is a homogeneous labour input and ϕ is a fixed cost. The cost minimization of each intermediate firm *i* gives the following marginal cost:

$$MC^d_t = \frac{1}{(1-\alpha)^{1-\alpha}} \frac{1}{\alpha^\alpha} \left(R^k_t\right)^\alpha \left[W_t\left(1+\nu(R_{t-1}-1)\right)\right]^{1-\alpha} \frac{1}{{z_t}^{1-\alpha}} \frac{1}{\epsilon_t}. \tag{8}$$

Because of the working capital cost, this marginal cost in eq. (8) can be affected by each intermediate firm, which is a monopolistic producer that can set its price incorporating the following price setting problem:

$$\max_{P^{core}_{new,t}} E_t \sum_{s=0}^{\infty}(\beta\xi_d)^s v_{t+s}\left[\left(\left(\pi^{Core}_t\pi^{Core}_{t+1}\dots\pi^{Core}_{t+s-1}\right)^{\kappa_d}P^{Core}_{new,t}\right)Y_{i,t+s}-MC_{i,t+s}\left(Y_{i,t+s}+z_{t+s}\phi\right)\right]$$

The log-linearized optimal condition of the price setting problem gives the Philips curve in the domestic sector as follows:

$$\hat{\pi}^{Core}_t=\frac{\beta}{1+\kappa_d\beta}E_t\hat{\pi}^{Core}_{t+1}+\frac{\kappa_d}{1+\kappa_d\beta}\hat{\pi}^{Core}_{t-1}+\frac{(1-\xi_d)(1-\beta\xi_d)}{\xi_d(1+\kappa_d\beta)}\left(\widehat{mc}_t+\hat{\lambda}_{d,t}\right). \tag{9}$$

3.2.2 An importing sector

Importing firms buy a homogenous good from an aboard market with a foreign price(P^*_t) and sell it as an imported consumption good (C^m_t) and an imported investment good (I^m_t). The monopolistic importing firms *i* can set imported consumption goods prices $(P^{m,c}_t)$ and imported investment goods prices $\left(P^{m,i}_t\right)$ as a result of incomplete exchange rate pass-through. The price setting problems of the importing firms are as follows:

$$\max_{P^{m,c}_{new,t}} E_t \sum_{s=0}^{\infty}\left(\beta\xi_{m,c}\right)^s v_{t+s}\left[\left(\left(\pi^{m,c}_t\pi^{m,c}_{t+1}\dots\pi^{m,c}_{t+s-1}\right)^{\kappa_{m,c}}P^{m,c}_{new,t}\right)C^m_{i,t+s}-S_{t+s}P^*_{t+s}\left(C^m_{i,t+s}+z_{t+s}\phi^{m,c}\right)\right],$$

$$\max_{P^{m,i}_{new,t}} E_t \sum_{s=0}^{\infty}\left(\beta\xi_{m,i}\right)^s v_{t+s}\left[\left(\left(\pi^{m,i}_t\pi^{m,i}_{t+1}\dots\pi^{m,i}_{t+s-1}\right)^{\kappa_{m,i}}P^{m,i}_{new,t}\right)I^m_{i,t+s}-S_{t+s}P^*_{t+s}\left(I^m_{i,t+s}+z_{t+s}\phi^{m,i}\right)\right].$$

The log-linearized optimal conditions of the price setting problems give the Philips curve in the importing sector are as follows:

$$\hat{\pi}^{m,j}_t=\frac{\beta}{1+\kappa_{m,j}\beta}E_t\hat{\pi}^{m,j}_{t+1}+\frac{\kappa_{m,j}}{1+\kappa_{m,j}\beta}\hat{\pi}^{m,j}_{t-1}+\frac{(1-\xi_{m,j})(1-\beta\xi_{m,j})}{\xi_{m,j}(1+\kappa_{m,j}\beta)}\left(\widehat{mc}^{m,j}_t+\hat{\lambda}^{m,j}_t\right) \tag{10}$$

where $\widehat{mc}^{m,j}_t=\hat{p}^*_t+\hat{s}_t-\hat{p}^{m,j}_t$ and for $j=\{c,i\}$.

3.2.3 An exporting sector

The exporting firms buy a homogenous good from the domestic market with a core price (P^{Core}_t) and sell it as an exported good $(\tilde{X}_t)$. The monopolistic exporting firms can set an exported good price (P^x_t). The price setting problem of exporting firms is:

$$\max_{P^x_{new,t}} E_t\sum_{s=0}^{\infty}(\beta\xi_x)^s v_{t+s}\left[\left(\left(\pi^x_t\pi^x_{t+1}\dots\pi^x_{t+s-1}\right)^{\kappa_x}P^x_{new,t}\right)\tilde{X}_{i,t+s}-\frac{P^{Core}_{t+s}}{S_{t+s}}\left(\tilde{X}_{i,t+s}+z_{t+s}\phi^{m,i}\right)\right]$$

The log-linearized optimal condition of the price setting problem gives the Philips curve in the exporting sector as follows:

$$\hat{\pi}_t^x = \frac{\beta}{1+\kappa_x\beta} E_t\hat{\pi}_{t+1}^x + \frac{\kappa_x}{1+\kappa_x\beta}\hat{\pi}_{t-1}^x + \frac{(1-\xi_x)(1-\beta\xi_x)}{\xi_x(1+\kappa_x\beta)}\left(\widehat{mc}_t^x + \hat{\lambda}_t^x\right) \tag{11}$$

where $\widehat{mc}_t^x = \hat{p}_t + \hat{s}_t - \hat{p}_t^x$.

3.3.4 Central Bank

To compare the performance of implementing core and headline inflation as the policy target, we then define the alternative Taylor rules as:

$$\hat{R}_t = \rho_R\hat{R}_{t-1} + (1-\rho_R)\left(r_\pi\hat{\pi}_{t-1}^{cpi} + r_y\hat{y}_{t-1} + r_{RER}\widehat{RER}_{t-1}\right) + \varepsilon_{R,t} \tag{12}$$

for *cpi = {HL, Core}* where $\hat{R}_t$ is a policy interest rate, $\hat{\pi}_{t-1}^{cpi}$ is an inflation target, $\hat{y}_{t-1}$ is an output gap and $\varepsilon_{R,t}$ is a policy interest rate shock.

4. Methodology

4.1 Welfare Loss Function Modification

We evaluate the performance of monetary policy under CITR and HITR using the welfare loss function proposed by Adolfson (2001). We further modify the welfare losses, which are a function of core and headline inflation as follows:

$$WFL^C = Var(\hat{\pi}_t^{Core}) + 0.5Var(\hat{y}_t), \tag{13}$$

$$WFL^H = Var(\hat{\pi}_t^{HL}) + 0.5Var(\hat{y}_t) \tag{14}$$

4.2 Policy Rule Modification

This section modifies the policy rules representing CITR and HITR. To modify the policy rule under CITR, we estimate a model wherein BOT targets core inflation during the time period from 2001Q1 to 2014Q4 to obtain the following policy rule:

$$\hat{R}_t = \rho_{R,C1}\hat{R}_{t-1} + \left(1-\rho_{R,C1}\right)\left[r_{\pi,C1}\hat{\pi}_{t-1}^{Core} + r_{y,C1}\hat{y}_{t-1} + r_{RER,C1}\widehat{RER}_{t-1}\right] + \varepsilon_{R,t}. \tag{C.1}$$

The problem with modifying the policy rule under HITR is that the time period concerned comprises only four observations because BOT switched implementing HITR on 6 January 2015. We then solve this problem by adopting the subsequent four approaches. The first concerns modifying the policy rule under HITR by using the same estimated parameter values as the policy rule (C.1) and assuming that BOT responds to all variables in Taylor rule under HITR with the same degree as under CITR. Therefore, we obtain the following policy rule:

$$\hat{R}_t = \rho_{R,C1}\hat{R}_{t-1} + \left(1-\rho_{R,C1}\right)\left[r_{\pi,C1}\hat{\pi}_{t-1}^{HL} + r_{y,C1}\hat{y}_{t-1} + r_{RER,C1}\widehat{RER}_{t-1}\right] + \varepsilon_{R,t}. \tag{H.1}$$

The second approach seeks to estimate the policy rule under HITR during the time period of 2001Q1 to 2015Q4 by assuming that BOT began implementing HITR since 2001Q1. Therefore, we obtain the following policy rule:

$$\hat{R}_t = \rho_{R,H2}\hat{R}_{t-1} + \left(1-\rho_{R,H2}\right)\left[r_{\pi,H2}\hat{\pi}_{t-1}^{HL} + r_{y,H2}\hat{y}_{t-1} + r_{RER,H2}\widehat{RER}_{t-1}\right] + \varepsilon_{R,t}. \tag{H.2}$$

The third approach is to estimate the policy rule under HITR during the time period of 2015Q1 to 2015Q4, which are the actual periods of the monetary policy under HITR. In view of the fact that four observations probably provide inaccurate estimation results, we set up the new prior information of the Bayesian estimation by using the posterior information from the policy rule (C.1). This approach of modification can reflect BOT implementing the monetary under CITR from 2001Q1 to 2014Q4 and then switching to implementing the monetary policy under HITR from 2015Q1 to 2015Q4, the same as the actual economy envelopment. Therefore, we obtain the following policy rule:

$$\hat{R}_t = \rho_{R,H3}\hat{R}_{t-1} + (1-\rho_{R,H3})\left[r_{\pi,H3}\hat{\pi}^{HL}_{t-1} + r_{y,H3}\hat{y}_{t-1} + r_{RER,H3}\widehat{RER}_{t-1}\right] + \varepsilon_{R,t}. \quad \text{(H.3)}$$

The fourth approach comprises estimating the policy rule under HITR during the time period of 2015Q1 to 2015Q4, which is the actual period of the monetary policy under HITR. As four observations may well lead to inaccurate estimation results, we establish the new prior information inherent in the Bayesian estimation. This fourth approach is similar to the third, but we are able to find an alternative way to set up the new prior information. We use the posterior information from the policy rule under HITR estimated with the time period of 2001Q1 to 2014Q4 to be the alternative prior information for the fourth approach of the policy rule modification. Therefore, we obtain the following policy rule:

$$\hat{R}_t = \rho_{R,H4}\hat{R}_{t-1} + (1-\rho_{R,H4})\left[r_{\pi,H4}\hat{\pi}^{HL}_{t-1} + r_{y,H4}\hat{y}_{t-1} + r_{RER,H4}\widehat{RER}_{t-1}\right] + \varepsilon_{R,t}. \quad \text{(H.4)}$$

To analyze the policy rules with and without RER responses, we further modify the policy rules without RER as follows:

$$\hat{R}_t = \rho_{R,C1Nx}\hat{R}_{t-1} + (1-\rho_{R,C1Nx})\left[r_{\pi,C1Nx}\hat{\pi}^{Core}_{t-1} + r_{y,C1Nx}\hat{y}_{t-1}\right] + \varepsilon_{R,t}, \quad \text{(C.1.Nx)}$$

$$\hat{R}_t = \rho_{R,C1Nx}\hat{R}_{t-1} + (1-\rho_{R,C1Nx})\left[r_{\pi,C1Nx}\hat{\pi}^{HL}_{t-1} + r_{y,C1Nx}\hat{y}_{t-1}\right] + \varepsilon_{R,t}, \quad \text{(H.1.Nx)}$$

$$\hat{R}_t = \rho_{R,H2Nx}\hat{R}_{t-1} + (1-\rho_{R,H2Nx})\left[r_{\pi,H2Nx}\hat{\pi}^{HL}_{t-1} + r_{y,H2Nx}\hat{y}_{t-1}\right] + \varepsilon_{R,t}, \quad \text{(H.2.Nx)}$$

$$\hat{R}_t = \rho_{R,H3Nx}\hat{R}_{t-1} + (1-\rho_{R,H3Nx})\left[r_{\pi,H3Nx}\hat{\pi}^{HL}_{t-1} + r_{y,H3Nx}\hat{y}_{t-1}\right] + \varepsilon_{R,t}, \quad \text{(H.3.Nx)}$$

$$\hat{R}_t = \rho_{R,H4Nx}\hat{R}_{t-1} + (1-\rho_{R,H4Nx})\left[r_{\pi,H4Nx}\hat{\pi}^{HL}_{t-1} + r_{y,H4Nx}\hat{y}_{t-1}\right] + \varepsilon_{R,t}. \quad \text{(H.4.Nx)}$$

This model assumes that the BOT response to inflation deviated from its steady state, which reflects optimal inflation, rather than its target in order to avoid any target change problem. Moreover, this study has used other types of the Taylor rule, which are Forward-looking, Backward-looking and Real-time. However, the conclusions concerning all types of Taylor rule are the same. For simplification, this paper presents only findings concerning the case of the Backward-looking Taylor rule.

4.3 Data Description

This study uses Thai quarterly data between 2001Q1 and 2015Q4, which reflect the periods of implementing inflation targeting. We choose a set of fifteen observable variables as follows: real wages, consumption, investment, RER, policy interest rate (RP1), working hours, GDP, exports, imports, headline inflation rate, core inflation rate, an investment deflator, foreign output, foreign inflation rate and foreign interest rate. All data is seasonally adjusted using the X-12-ARIMA method. The sources of data shown in Table 1 are from National Economic and Social Development Board (NESDB), National Statistical Office (NSO), the Bank of Thailand (BOT), Minister of Commerce (MOC), U.S. Bureau of Economic Analysis (BEA), and U.S. Federal Reserve System (FED). This study also tests the stationarity of data shown in Table 2 in order to match with the measurement equations.

Table1: Data Description

Name	Variable	Proxy	Unit	Source
Real GDP	Y_t	Thai real GDP *(Reference year = 2002)*	Baht mn.	NESDB
Real GDP	$\tilde{C}_t$	Thai real consumption expenditure *(Reference year = 2002)*	Baht mn.	NESDB
Real investment	$\tilde{I}_t$	Thai total investment expenditure *(Reference year = 2002)*	Baht mn.	NESDB
Real export	$\tilde{X}_t$	Thai exports of goods and services *(Reference year = 2002)*	Baht mn.	NESDB
Real import	$\tilde{M}_t$	Thai imports of goods and services *(Reference year = 2002)*	Baht mn.	NESDB
Hours worked	H_t	Thai average hours worked per week	Thousand hours	NSO
Real exchange rate	RER_t	$\text{NER}\times\frac{\text{(Thai headline CPI)}}{\text{(U.S.headline CPI)}}$	Bath per U.S. dollar	Author's Calculation
Policy interest rate	R_t	BOT policy rate: RP1 day	% per annum	BOT
Nominal wages	W_t	Thai average monthly wages	Bath	BOT
Core CPI	P_t^{Core}	Thai core CPI *(Based year 2011=100)*	Index	MOC
Headline CPI	P_t^{HL}	Thai headline CPI *(Based year 2011=100)*	Index	MOC
Investment deflator	$P_t^{def,i}$	$\frac{\text{Thai nominal investment x 100}}{\text{Thai real invest. (Reference year = 2002)}}$	Index	Author's Calculation
Foreign GDP	Y_t^*	U.S. real GDP *(Reference year = 2009)*	USD bn.	BEA
Foreign inflation	P_t^*	U.S. headline CPI *(Based year 2010=100)*	Index	BEA
Foreign interest rate	R_t^*	U.S. Fed funds rate	% per annum	FED

Source: Adopted from Adolfson et al. (2007)

Table 2: Transformed Data and Unit Root Tests

Name	Variable	ADF Test			Phillips-Perron Test		
		None	Cons.	Status	None	Cons.	Status
Real GDP growth	$Y_t^{obs} = \%\Delta lnY_t$	-7.15*	-9.16*	I(0)	-7.33*	-9.18*	I(0)
Real consumption growth	$C_t^{obs} = \%\Delta lnC_t$	-3.11*	-7.35*	I(0)	-6.00*	-7.38*	I(0)
Real investment growth	$I_t^{obs} = \%\Delta lnI_t$	-11.80*	-11.81*	I(0)	-13.84*	-14.93*	I(0)
Real export growth	$\tilde{X}_t^{obs} = \%\Delta ln\tilde{X}_t$	-7.48*	-7.92*	I(0)	-7.47*	-8.37*	I(0)
Real import growth	$\widetilde{M}_t^{obs} = \%\Delta ln\widetilde{M}_t$	-6.81*	-7.01*	I(0)	-6.78*	-7.04*	I(0)
De-mean Hours worked growth	$\widehat{H}_t^{obs} = \%\Delta\frac{(H_t - H)}{\overline{H}}$	-2.62*	-2.96*	I(0)	-2.38*	-3.31*	I(0)
De-mean Real exchange rate growth	$\widehat{RER}_t^{obs} = \%\Delta\frac{(RER_t - \overline{RER})}{\overline{RER}}$	-5.56*	-5.53*	I(0)	-5.48*	-5.45*	I(0)
Policy interest rate	$R_t^{obs} = R_t$	-4.49*	-4.46*	I(1)	-4.49*	-4.46*	I(0)
Real wage growth	$w_t^{obs} = \%\Delta ln(W_t/P_t^{HL})$	-8.33*	-9.94*	I(0)	-8.40*	-10.03*	I(0)
Core inflation	$\pi_t^{core,obs} = \%\Delta lnP_t^{Core}$	-2.98*	-4.41*	I(0)	-2.95*	-4.46*	I(0)
Headline inflation	$\pi_t^{HL,obs} = \%\Delta lnP_t^{HL}$	-3.44*	-4.45*	I(0)	-3.24*	-4.10*	I(0)
Invest. deflator inflation	$\pi_t^{i,obs} = \%\Delta lnP_t^{def,i}$	-7.31*	-7.25*	I(0)	-7.32*	-7.25*	I(0)
Foreign GDP growth	$Y_t^{*,obs} = \%\Delta lnY_t^*$	-3.64*	-4.68*	I(0)	-3.54*	-4.68*	I(0)
Foreign inflation	$\pi_t^{*,obs} = \%\Delta lnP_t^*$	-3.96*	-5.91	I(0)	-3.85*	-5.86*	I(0)
Foreign interest rate	$R_t^{*,obs} = R_t^*$	-3.31*	-3.22*	I(1)	-4.19	-4.15	I(1)

Note: ***, ** and * is significant at 10%, 5% and 1% level, respectively
Source: Calculated by author

4.4 Measurement Issues

This section explains the method of measuring consumption, investment, export, import and output into the model by using observed data.

$$Y_t = \tilde{C}_t + \tilde{I}_t + G_t + \tilde{X}_t - \widetilde{M}_t \quad (15)$$

where

$$\tilde{C}_t = C_t^d + C_t^m, \quad (16)$$

$$\tilde{I}_t = I_t^d + I_t^m, \quad (17)$$

$$\tilde{X}_t = C_t^x + I_t^x, \tag{18}$$

$$\widetilde{M}_t = C_t^m + I_t^m \tag{19}$$

According to the theoretical model, the aggregate production resource constraint is given by:

$$C_t^d + I_t^d + G_t + C_t^x + I_t^x \leq \epsilon_t z_t^{1-\alpha} K_t^\alpha H_t^{1-\alpha} - z_t\phi - a(u_t)\bar{K}_t, \tag{20}$$

which is rewritten as

$$\left(C_t^d + C_t^m\right) + \left(I_t^d + I_t^m\right) + G_t + C_t^x + I_t^x - C_t^m + I_t^m \leq \epsilon_t z_t^{1-\alpha} K_t^\alpha H_t^{1-\alpha} - z_t\phi - a(u_t)\bar{K}_t \tag{21}$$

This study measures the resource constraint in eq. (20) with the aggregate demand in eq. (15). We observe that $\tilde{C}_t = C_t^d + C_t^m$ which is the aggregate of C_t, and C_t^d , by using the CES function. As a result, we match the consumption from the model, C_t^m, with the consumption from observable data, C_t, by using the following equation:

$$\tilde{C}_t = C_t^d + C_t^m = \left((1-\omega_c)\left[\frac{P_t^{Core}}{P_t^{HL}}\right]^{-\eta_c} + \omega_c\left[\frac{P_t^{m,c}}{P_t^{HL}}\right]^{-\eta_c}\right) C_t\,. \tag{22}$$

Using the same method as with consumption, the investment is conducted by:

$$\tilde{I}_t = I_t^d + I_t^m = \left((1-\omega_i)\left[\frac{P_t^{Core}}{P_t^i}\right]^{-\eta_i} + \omega_i\left[\frac{P_t^{m,i}}{P_t^i}\right]^{-\eta_i}\right) I_t\,. \tag{23}$$

The exports depend on the foreign output as per the following equation:

$$\tilde{X}_t = C_t^x + I_t^x = \left[\frac{P_t^x}{P_t^*}\right]^{-\eta_f} Y_t^*. \tag{24}$$

The total imports depend on the domestic demand as in the following equation:

$$\widetilde{M}_t = C_t^m + I_t^m = \omega_c\left[\frac{P_t^{m,c}}{P_t^{HL}}\right]^{-\eta_c} C_t + \omega_i\left[\frac{P_t^{m,i}}{P_t^i}\right]^{-\eta_i} I_t\,. \tag{25}$$

Since we introduce the capital utilization cost as the adjustment cost, the GDP in the model and real data are not explicitly comparable. As the adjustment costs are equivalent to cyclical components, we then introduce those adjustment costs to investment, instead of explaining them as a residual in the real GDP data. As a result, output is as follows:

$$Y_t = \epsilon_t z_t^{1-\alpha} K_t^\alpha H_t^{1-\alpha} - z_t\phi. \tag{26}$$

The headline CPI and the price deflators of investment are measured using the following nominal GDP data, which is as follows:

$$P_t^{HL} Y_t = (1+\tau_t^c)\left(P_t^{Core} C_t^d + P_t^{m,c} C_t^m\right) + \left(P_t^{Core} I_t^d + P_t^{m,i} I_t^m\right) + P_t^{Core} G_t + \left(P_t^x C_t^x + P_t^x I_t^x\right) - \left(P_t^{m,c} C_t^m + P_t^{m,i} I_t^m\right).$$

Therefore, the headline CPI is measured as:

$$P_t^{HL} \equiv \frac{(1+\tau_t^c)(P_t^{Core} C_t^d + P_t^{m,c} C_t^m)}{C_t^d + C_t^m} \tag{27}$$

and the price deflators of investment are measured as:

$$P_t^{def,i} \equiv \frac{P_t^{Core} I_t^d + P_t^{m,i} I_t^m}{I_t^d + I_t^m}. \tag{28}$$

In addition, we measure the growth rate in foreign output as $\mu_z + \Delta\hat{y}_t^* + \Delta\hat{z}_t^*$, which is the first-different measurement equation.

4.5 Measurement Equation

Bearing in mind the measurement issues in Section 4.4, we build up measurement equations using the transformed data shown in Table 2 in order to estimate the parameters. Additionally, we apply a differential Kalman filter to construct the measurement equations as follows:

$$Y_t^{obs} = 100\ln(\mu_z^{ss}) + \Delta\hat{y}_t + \mu_{z,t}, \tag{29}$$

From eq. (22), we obtain the measurement equation for consumption as follows:

$$C_t^{obs} = 100\ln(\mu_z^{ss}) + \Delta\hat{c}_t + \left[\left(\frac{c_{ss}}{c_{ss}^d + c_{ss}^m}\right)\left(\frac{c_{ss}^d c_{ss}^m}{c_{ss} c_{ss}}\right)\frac{\eta^c}{\gamma_{ss}^{c,d}} - \frac{1}{\gamma_{ss}^{c,d}}\right]\Delta\gamma_t^{mc,d} + \mu_{z,t} \tag{30}$$

From eq. (23), we obtain the measurement equation for investment as follows:

$$I_t^{obs} = 100\ln(\mu_z^{ss}) + \Delta\hat{\imath}_t + \left[\left(\frac{i_{ss}}{i_{ss}^d + i_{ss}^m}\right)\left(\frac{i_{ss}^d i_{ss}^m}{i_{ss} i_{ss}}\right)\frac{\eta^i}{\gamma_{ss}^{i,d}} - \frac{1}{\gamma_{ss}^{i,d}}\right]\Delta\gamma_t^{mi,d} + \left(\frac{(1-\tau_{ss}^k) r_{ss}^k k_{ss}}{\mu_{ss}^z}\right)(k_t - \bar{k}_t - u_t) + \mu_{z,t} \tag{31}$$

From eq. (24), we can derive the measurement equation for total exports as follows:

$$\tilde{X}_t^{obs} = 100\ln(\mu_z^{ss}) + \Delta\tilde{y}_t^* + \left[\left(\frac{c_{ss}}{c_{ss}^d + c_{ss}^m}\right)\left(\frac{c_{ss}^d c_{ss}^m}{c_{ss} c_{ss}}\right)\frac{\eta^c}{\gamma_{ss}^{c,d}} - \frac{1}{\gamma_{ss}^{c,d}}\right]\Delta\gamma_t^{mc,d} + \Delta\tilde{z}_t^* + \mu_{z,t} \tag{32}$$

From eq. (25), we are able to detail the measurement equation for total imports as follows:

$$\widetilde{M}_t^{obs} = 100\ln(\mu_z^{ss}) + \left(\frac{c_{ss}^m}{c_{ss}^m + i_{ss}^m}\right)\Delta c_t + \left(\frac{i_{ss}^m}{c_{ss}^m + i_{ss}^m}\right)\Delta i_t$$
$$-\left(\left(\frac{c_{ss}^m}{c_{ss}^m + i_{ss}^m}\right)(1-\omega^c)\gamma_{ss}^{c,d}\right)^{-(1-\eta^c)}\Delta\gamma_t^{mc,d} - \left(\left(\frac{i_{ss}^m}{c_{ss}^m + i_{ss}^m}\right)(1-\omega^i)\gamma_{ss}^{i,d}\right)^{-(1-\eta^i)}\Delta\gamma_t^{mi,d} + \mu_{z,t} \quad 33)$$

We conduct the following measurement equation for working hours, real exchange rate, policy rate, real wages and core inflation, respectively.

$$H_t^{obs} = \Delta\widehat{H}_t \tag{34}$$

$$RER_t^{obs} = \Delta\widehat{RER}_t \tag{35}$$

$$R_t^{obs} = 100(R_{ss} - 1)R_{ss} + 4R_{ss}\hat{R}_t \quad 36)$$

$$w_t^{obs} = 100\ln(\mu_z^{ss}) + \Delta\widehat{w}_t + \mu_{z,t} \quad (37)$$

$$\pi_t^{core,obs} = 100(\pi_{ss} - 1)\pi_{ss} + \pi_{ss}\hat{\pi}_t^{core} \quad (38)$$

From eq. (27), we obtain the measurement equation for headline inflation as follows:

$$\pi_t^{HL,obs} = 100(\pi_{ss} - 1)\pi_{ss} + \pi_{ss}\left(\frac{c_{ss}^d}{c_{ss}^d + \left(\frac{\eta^{m,c}}{\eta^{m,c}-1}\right)c_{ss}^m} - \lambda^{m,c}\right)\hat{\pi}_t^{core} + \pi_{ss}\left(\frac{c_{ss}^{m,c}}{c_{ss}^d + \left(\frac{\eta^{m,c}}{\eta^{m,c}-1}\right)c_{ss}^m} - \lambda^{m,c}\right)\hat{\pi}_t^{m,c} + \pi_{ss}\left(\frac{\tau_{ss}^c}{1+\tau_{ss}^c}\right)\Delta\tau_t^c \quad (39)$$

Where

$$\lambda^{m,c} = \eta^c\omega^c\left(\frac{1}{\gamma_{c,mc_{ss}}{}^{(1-\eta^c)}}\right)\left(\frac{c_{ss}^d}{c_{ss}^d + \left(\frac{\eta^{m,c}}{\eta^{m,c}-1}\right)c_{ss}^m} - \frac{c_{ss}^d}{c_{ss}^d + c_{ss}^m}\right) - \eta^c(1-\omega^c)\left(\frac{1}{\gamma_{c,d_{ss}}{}^{(1-\eta^c)}}\right)\left(\frac{\left(\frac{\eta^{mc}}{\eta^{mc}-1}\right)c_{ss}^m}{c_{ss}^d + \left(\frac{\eta^{mc}}{\eta^{mc}-1}\right)c_{ss}^m}\right)$$

From eq. (28), we derive the measurement equation for the inflation deflator of investment as follows:

$$\pi_t^{i,obs} = 100(\pi_{ss} - 1)\pi_{ss} + \pi_{ss}\left(\frac{i_{ss}^d}{i_{ss}^d + \left(\frac{\eta^{m,i}}{\eta^{m,i}-1}\right)i_{ss}^m} - \lambda^{m,i}\right)\hat{\pi}_t^{core} + \pi_{ss}\left(\frac{i_{ss}^{m,c}}{i_{ss}^d + \left(\frac{\eta^{m,i}}{\eta^{m,i}-1}\right)i_{ss}^m} - \lambda^{m,i}\right)\hat{\pi}_t^{m,i} \quad (40)$$

Where:

$$\lambda^{m,i} = \eta^i\omega^i\left(\frac{1}{\gamma_{i,mi_{ss}}{}^{(1-\eta^i)}}\right)\left(\frac{i_{ss}^d}{i_{ss}^d + \left(\frac{\eta^{m,i}}{\eta^{m,i}-1}\right)i_{ss}^m} - \frac{i_{ss}^d}{i_{ss}^d + i_{ss}^m}\right) - \eta^i(1-\omega^i)\left(\frac{1}{\gamma_{i,d_{ss}}{}^{(1-\eta^i)}}\right)\left(\frac{\left(\frac{\eta^{m,i}}{\eta^{mc}-1}\right)i_{ss}^m}{i_{ss}^d + \left(\frac{\eta^{m,i}}{\eta^{m,i}-1}\right)i_{ss}^m}\right)$$

Furthermore, we conduct the measurement equations for foreign output, inflation and interest rate as follows:

$$Y_t^{*,obs} = 100\ln(\mu_z^{ss}) + \Delta\hat{y}_t^* + \Delta\hat{z}_t^* + \mu_{z,t} \quad (41)$$

$$\pi_t^{*,obs} = 100(\pi_{ss} - 1)\pi_{ss} + \pi_{ss}\hat{\pi}_t^* \quad (42)$$

$$R_t^{*,obs} = 100(R_{ss} - 1)R_{ss} + 4R_{ss}\hat{R}^*{}_t \quad (43)$$

4.6 Parameter Calibration

This study obtains some calibrated parameters following Adolfson et al. (2007) and Tanboon (2007). Note that we use the same value of calibrated parameters under both CITR and HITR. These calibrated parameters relate to the steady state value of the observed variables. Table 3 shows calibrated parameters.

Table 3: Calibrated Parameters

Description	Parameter	Value	Source
A constant in the labor disutility function	A_L	7.5	Adolfson et al. (2007)
A steady state fraction of firms' wage bill	v	0.95	Adolfson et al. (2007)
A substitute elasticity consumption	η_c	5	Adolfson et al. (2007)
A varying cost of a capital utilization rate	σ_a	0.49	Adolfson et al. (2007)
Capital income tax persistence	ρ_{τ^k}	0.9	Adolfson et al. (2007)
Pay-roll tax persistence	ρ_{τ^w}	0.9	Adolfson et al. (2007)
A steady state markup in wage setting	λ_W	1.05	Adolfson et al. (2007)
A curvature parameter in money demand	σ_q	10.62	Adolfson et al. (2007)
A discount factor coefficient	β	0.9926	Tanboon (2007)
A share of capital in the production	α	0.3	Tanboon (2007)
A labor supply elasticity	σ_L	1	Tanboon (2007)
A steady state money growth rate	μ	1.0179	An average growth rate of M3
A steady state technology growth rate	μ_z	1.01	An average HP-trend real GDP growth rate
A steady state value of inflation	π	1.0078	$\pi = \mu/\mu_z$
A steady state gross nominal interest rate	R	1.0283	$R = (\pi\mu_z - \tau^k\beta)/(1-\tau^k)\beta$
A steady state consumption-income tax	τ^c	0.07	Value added tax 7%
A steady state capital income tax rate	τ^k	0.2	Capital income tax 20%

Source: Adopted from Adolfson et al. (2007) and Tanboon (2007)

4.7 Parameter Estimation

Bayesian inference allows us to specify the characteristics of parameters before estimation. The study uses the observed data to update the prior distribution to be the posterior distribution of the parameter by applying Bayes theorems. The prior distributions of the 48 parameters are specified by adopting the findings of Cooley and Hansen (1995), Chari et al. (2002), Altig et al. (2003), Linde et al. (2003), Smets et al. (2003) and Adolfson et al. (2007). Estimated parameters are shown in Tables 4, 5, 6, 7, 8 and 9.

Table 4: Non-Policy Estimated Parameters in All Policy Rules

Description	Para-meter	Prior Information			Posterior Means								
		Distri-bution	S.D.	Mean	C.1 &H.1	C.1.Nx &H.1.Nx	H.2	H.2.Nx	H.3	H.3.Nx	H.4	H.4.Nx
Calvo wages	ξ_w	Beta	0.050	0.675	0.660	0.751	0.679	0.647	0.718	0.631	0.705	0.633
Calvo core prices	ξ_d	Beta	0.050	0.675	0.778	0.720	0.890	0.678	0.687	0.653	0.657	0.599
Calvo import consumption prices	$\xi_{m,c}$	Beta	0.100	0.500	0.472	0.310	0.498	0.434	0.708	0.581	0.647	0.498
Calvo import investment prices	$\xi_{m,i}$	Beta	0.100	0.500	0.202	0.164	0.187	0.466	0.473	0.297	0.455	0.343
Calvo export prices	ξ_x	Beta	0.100	0.675	0.526	0.354	0.487	0.492	0.611	0.629	0.551	0.588
Indexation wages	κ_w	Beta	0.150	0.500	0.366	0.516	0.775	0.551	0.715	0.338	0.271	0.072
Indexation core prices	κ_d	Beta	0.150	0.500	0.498	0.508	0.259	0.434	0.345	0.582	0.385	0.622
Index. import consumption prices	$\kappa_{m,c}$	Beta	0.150	0.500	0.389	0.368	0.398	0.445	0.500	0.450	0.558	0.464
Index. import investment prices	$\kappa_{m,i}$	Beta	0.150	0.500	0.257	0.245	0.835	0.555	0.545	0.462	0.592	0.465
Indexation export prices	κ_x	Beta	0.150	0.500	0.430	0.423	0.535	0.459	0.400	0.468	0.575	0.437
Markup core prices	λ_d	IG.	2.000	1.200	3.553	7.239	3.967	1.430	0.962	0.361	0.916	0.303
Markup import consump. prices	$\lambda_{m,c}$	IG.	2.000	1.200	1.320	1.195	1.442	0.755	0.777	0.768	0.784	0.806
Markup import investment prices	$\lambda_{m,i}$	IG.	2.000	1.200	1.402	1.672	3.520	1.792	1.850	2.980	2.109	6.559
Investment adjustment costs	ξ^I	Normal	1.500	7.694	0.506	0.181	1.951	7.347	9.709	5.359	7.162	9.048
Habit formation	b	Beta	0.100	0.650	0.721	0.769	0.877	0.630	0.748	0.808	0.737	0.622
Elasticity of substitution investment	η_i	IG.	4.000	1.500	0.393	0.476	0.559	0.195	0.529	1.460	0.545	1.238
Elasticity of substitution foreign	η_f	IG.	4.000	1.500	2.874	1.535	3.032	1.772	0.841	0.799	0.820	0.699
Technology growth	μ_z	Normal	0.0005	1.006	1.011	1.011	1.011	1.011	1.008	1.008	1.008	1.009
A labour pay-roll tax	τ_w	Beta	0.050	0.120	0.236	0.124	0.214	0.140	0.188	0.182	0.212	0.203
A labour-income tax	τ_y	Beta	0.050	0.180	0.254	0.188	0.076	0.195	0.147	0.174	0.178	0.158
Risk premium	$\tilde{\phi}$	Beta	0.100	0.010	0.269	0.663	0.341	0.001	0.024	0.015	0.017	0.066
Unit root tech. shock persistence	ρ_{μ_z}	Beta	0.100	0.850	0.365	0.360	0.156	0.786	0.623	0.741	0.606	0.823
Investment tech. shock persistence	ρ_{Υ}	Beta	0.100	0.850	0.787	0.825	0.657	0.951	0.872	0.830	0.912	0.831
Asymmetric tech. shock persistence	ρ_{z^*}	Beta	0.100	0.850	0.998	0.987	0.992	0.809	0.927	0.838	0.881	0.852
Consump. pref. shock persistence	ρ_{ζ_c}	Beta	0.100	0.850	0.698	0.889	0.569	0.781	0.938	0.871	0.913	0.856
Leisure pref. shock persistence	ρ_{ζ_h}	Beta	0.100	0.850	0.962	0.968	0.928	0.876	0.826	0.866	0.873	0.924
Risk premium shock persistence	$\rho_{\tilde{\phi}}$	Beta	0.100	0.850	0.962	0.956	0.978	0.889	0.746	0.880	0.928	0.774
Core price shock persistence	ρ_{λ_d}	Beta	0.100	0.850								

Description	Para-meter	Prior Information			Posterior Means							
		Distri-bution	S.D.	Mean	C.1 &H.1	C.1.Nx &H.1.Nx	H.2	H.2.Nx	H.3	H.3.Nx	H.4	H.4.Nx
Imported cons. shock persistence	$\rho_{\lambda_{m,c}}$	Beta	0.100	0.850	0.912	0.989	0.505	0.880	0.844	0.819	0.812	0.925
Imported invest. shock persistence	$\rho_{\lambda_{m,i}}$	Beta	0.100	0.850	0.819	0.996	0.950	0.856	0.844	0.819	0.812	0.925
Export price shock persistence	ρ_{λ_x}	Beta	0.100	0.850	0.941	0.970	0.938	0.760	0.891	0.679	0.861	0.841
S.D. of a unit root tech. shock	σ_{μ_z}	IG.	2.000	0.200	2.551	2.754	2.385	0.672	0.582	0.217	0.445	0.136
S.D. of a stationary tech. shock	σ_{ε}	IG.	2.000	0.700	0.663	0.658	0.904	0.512	0.936	2.641	0.686	2.877
S.D. of an invest. tech. shock	σ_{Υ}	IG.	2.000	0.200	13.659	3.467	23.538	1.928	14.061	6.193	10.604	0.182
S.D. of an asymmetric tech. shock	$\sigma_{\tilde{z}^*}$	IG.	2.000	0.400	2.783	2.741	2.591	0.559	0.300	0.278	0.269	0.295
S.D. of a consump. pref. shock	σ_{ξ_c}	IG.	2.000	0.200	13.236	9.070	13.698	1.378	0.290	0.184	0.162	0.216
S.D. of a leisure preferences shock	σ_{ξ_h}	IG.	2.000	0.200	2.527	3.848	10.848	0.548	0.164	0.158	0.129	0.145
S.D. of a risk premium shock	$\sigma_{\tilde{\phi}}$	IG.	2.000	0.050	0.773	0.538	0.596	0.200	0.050	0.042	0.036	0.035
S.D. of a core price markup shock	σ_{λ_d}	IG.	2.000	0.300	3.702	3.495	12.690	0.803	1.329	0.298	1.839	0.261
S.D. of an import cons. price shock	$\sigma_{\lambda_{m,c}}$	IG.	2.000	0.300	8.227	2.677	5.516	2.355	1.495	1.432	2.447	2.458
S.D. of an import investment shock	$\sigma_{\lambda_{m,i}}$	IG.	2.000	0.300	9.674	10.641	14.960	1.276	14.712	10.642	14.043	11.904
S.D. of an export price shock	σ_{λ_x}	IG.	2.000	0.300	10.251	7.892	6.005	1.176	2.120	3.901	2.005	2.743
S.D. of a monetary policy shock	σ_R	IG.	2.000	0.150	0.092	0.080	0.089	0.080	0.095	0.100	0.086	0.096

Note: IG. denotes Inverse Gamma.
Source: Author's estimation based on Bayesian Inference

Table 5: Policy Estimated Parameters in the Policy Rules (C.1), (H.1), (C.1.Nx), (H.1.Nx), (H.2) and (H.2.Nx)

Description	Para-meter	Prior Information			Posterior Mean			
		Distribution	S.D.	Mean	C.1 &H.1	C.1.Nx &H.1.Nx	H.2	H.2.Nx
Interest rate smoothing	ρ_R	Beta	0.050	0.800	0.890	0.901	0.901	0.835
Inflation response	r_π	Normal	0.050	1.700	1.751	1.668	1.681	1.682
Output gap response	r_y	Normal	0.050	0.125	0.062	0.072	0.042	0.075
RER response	r_{RER}	Normal	0.050	0.000	-0.003	-	0.039	-

Source: Author's estimation based on Bayesian Inference

Table 6: Policy Estimated Parameters in the Policy Rule (H.3)

Description	Para-meter	Prior Information			Posterior Mean
		Distribu-tion	S.D.	Mean	
Interest rate smoothing	ρ_R	Beta	0.009	0.890	0.926
Inflation response	r_π	Normal	0.012	1.751	1.740
Output gap response	r_y	Normal	0.005	0.062	-0.001
RER response	r_{RER}	Normal	0.005	-0.003	0.007

Source: Author's estimation based on Bayesian Inference

Table 7: Policy Estimated Parameters in the Policy Rule (H.3.Nx)

Description	Para-meter	Prior Information			Posterior Mean
		Distribu-tion	S.D.	Mean	
Interest rate smoothing	ρ_R	Beta	0.001	0.901	0.911
Inflation response	r_π	Normal	0.010	1.668	1.740
Output gap response	r_y	Normal	0.006	0.072	-0.001
RER response	r_{RER}	Normal	-	-	-

Source: Author's estimation based on Bayesian Inference

Table 8: Policy Estimated Parameters in the Policy Rule (H.4)

Description	Para-meter	Prior Information			Posterior Mean
		Distribution	S.D.	Mean	
Interest rate smoothing	ρ_R	Beta	0.013	0.886	0.926
Inflation response	r_π	Normal	0.024	1.460	1.451
Output gap response	r_y	Normal	0.006	0.051	0.066
RER response	r_{RER}	Normal	0.005	0.002	-0.052

Source: Author's estimation based on Bayesian Inference

Table 9: Policy Estimated Parameters in the Policy Rule (H.4.Nx)

Description	Para-meter	Prior Information			Posterior Mean
		Distribu-tion	S.D.	Mean	
Interest rate smoothing	ρ_R	Beta	0.023	0.791	0.780
Inflation response	r_π	Normal	0.017	1.693	1.653
Output gap response	r_y	Normal	0.008	0.103	0.000
RER response	r_{RER}	Normal	-	-	-

Source: Author's estimation based on Bayesian Inference

5. Results

5.1 Policy Performance Analysis

5.1.1 Analysis of the Monetary Policy Performance under CITR and HITR

This section analyzes the monetary policy performance under CITR and HITR within the policy rules with RER responses by comparing the WFLs of the policy rule (C.1) with those of policy rules (H.1), (H.2), (H.3), and (H.4). Table 10 shows that the WFL, which is a function of the core inflation (WFLC) of (C.1), is 25.497, which is higher than 22.612, 20.242, 23.814, and 12.882 of (H.1), (H.2), (H.3), and (H.4), respectively. Moreover, we analyze the monetary policy performance under CITR and HITR under the policy rules without RER response by comparing the WFLs of the policy rule (C.1.Nx) with those of policy rules (H.1.Nx), (H.2.Nx), (H.3.Nx), and (H.4.Nx). Table 11 shows that the WFL^C of (C.1.Nx) is 53.438, which is greater than 22.612, 10.588, 27.335, and 38.019 of (H.1.Nx), (H.2.Nx), (H.3.Nx), and (H.4.Nx), respectively. Both Table 10 and 11 show that considering WFLC and WFLH leads to the same interpretation; thus, the WFLs do not differ in terms of the type of inflation. In addition, both Table 10 and 11 reveal that y ̂_t plays an important role in determining WFLs, as well as the result of interpretation. In summary, the monetary policy generates WFLs higher under CITR than under HITR in both groups of policy rules, with and without considering RER response because the latter generates a lower variance of $\hat{y}_t$

5.1.2 Analysis of the Monetary Policy Performance with and without RER Response

In this section we analyze the monetary policy performance with and without incorporating RER responses from Table 10 and 11 by comparing the WFLs of (C.1) with (C.1.Nx), (H.1) with (H.1.Nx), (H.2) with (H.2.Nx), (H.3) with (H.3.Nx), and (H.4) with (H.4.Nx). Table 10 and 11 illustrate that the WFLC of (C.1) is 25.497, which is lower than the 53.438 of (C.1.Nx). The WFLC of (H.1) is 22.612, which is less than the 51.735 of (H.1.Nx). The WFLC of (H.2) is 20.424, higher than the 10.588 of (H.2.Nx). The WFLC of (H.3) is 23.814, lower than the 27.335 of (H.3.Nx). While the WFLC of (H.4) is 12.882, which is lower than the 38.019 of (H.4.Nx). In summary, no consensus exists regarding whether the monetary policy with or without RER response can improve welfare because the results indicate unclear signs concerning RER response.

Table 10: Welfare Losses of the Monetary Policy in Policy Rules with RER Responses

The Rule	Estimated Policy Parameter				Variance			WFL	
	ρ_R	r_π	r_y	r_{RER}	$\hat{\pi}_t^{Core}$	$\hat{\pi}_t^{HL}$	$\hat{y}_t$	WFL^C	WFL^H
C.1	0.890	1.751	0.062	-0.003	0.378	0.462	50.203	25.497	25.563
H.1	0.890	1.751	0.062	-0.003	0.367	0.437	44.490	22.612	22.682
H.2	0.901	1.681	0.042	0.039	0.195	0.301	40.457	20.424	20.529
H.3	0.926	1.740	-0.001	0.007	0.746	1.592	46.139	23.814	24.661
H.4	0.926	1.451	0.066	-0.052	1.912	2.787	21.939	12.882	13.757

Note: 1) Variance of each variable is calculated from the 200-period simulated series.
2) WFLC = $\text{Var}(\hat{\pi}_t^{Core}) + 0.5\text{Var}(\hat{y}_t)$ and WFLH = $\text{Var}(\hat{\pi}_t^{HL}) + 0.5\text{Var}(\hat{y}_t)$.
Source: Author's calculations

Table 11: Welfare Losses of the Monetary Policy in Policy Rules without RER Responses

The Rule	Estimated Policy Parameter				Variance			WFL	
	ρ_R	r_π	r_y	r_{RER}	$\hat{\pi}_t^{Core}$	$\hat{\pi}_t^{HL}$	$\hat{y}_t$	WFL^C	WFL^H
C.1.Nx	0.901	1.669	0.072	-	0.849	1.005	105.179	53.438	53.594
H.1.Nx	0.901	1.669	0.072	-	0.888	0.998	105.179	51.735	51.845
H.2.Nx	0.835	1.682	0.075	-	0.467	1.091	20.242	10.588	11.212
H.2.Nx	0.911	1.537	-0.001	-	0.829	0.842	53.013	27.336	27.349
H.2.Nx	0.780	1.653	0.000	-	0.680	0.607	74.678	38.019	37.946

Note: 1) Variance of each variable is calculated from the 200-period simulated series.
2) WFLC = $\text{Var}(\hat{\pi}_t^{Core}) + 0.5\text{Var}(\hat{y}_t)$ and WFLH = $\text{Var}(\hat{\pi}_t^{HL}) + 0.5\text{Var}(\hat{y}_t)$.
Source: Author's calculations

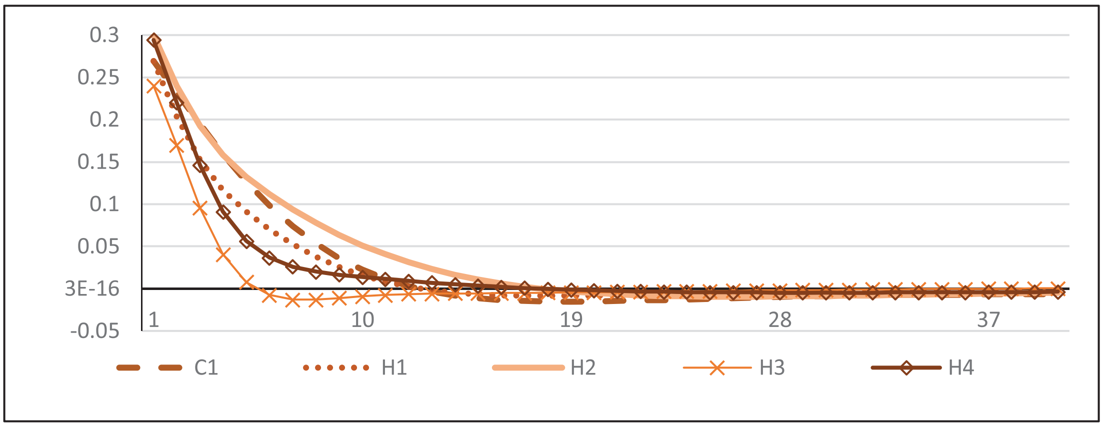
5.2 Policy Rate Shock Analysis

In this section we focus on the responses of an economy to one S.D of a positive policy rate shock ($\varepsilon_{R,t}$). In addition, it examines the effectiveness of monetary policy transmission (MPT). The responses of $\hat{R}_t$to $\varepsilon_{R,t}$ in Figure 2a indicate that when $\hat{R}_t$ increases, $\varepsilon_{R,t}$ will also rise. Figure 2a shows that the effects of $\varepsilon_{R,t}$ to $\hat{R}_t$ within monetary policies under CITR and HITR are similar. However, the persistence of $\varepsilon_{R,t}$ to $\hat{R}_t$ in monetary policy under HITR is higher than under CITR. Responses $\hat{y}_t$ of $\varepsilon_{R,t}$ to in Figure 2b show that when $\varepsilon_{R,t}$ increases, $\hat{y}_t$ will decrease because a higher policy rate causes lower aggregate demand and eventually a lower output gap. Figure 2b shows that the effects of $\varepsilon_{R,t}$ to $\hat{y}_t$ within monetary policy under HITR are stronger and more persistent than under CITR. The responses of $\hat{\pi}_t^{Core}$ to $\varepsilon_{R,t}$ in Figure 2c reveal that when $\varepsilon_{R,t}$ increases $\hat{\pi}_t^{Core}$, will decrease because a higher policy rate causes lower aggregate demand and eventually diminished core inflation. Figure 2c shows that the effects of $\varepsilon_{R,t}$ to $\hat{\pi}_t^{Core}$ in monetary policy under HITR are stronger than under CITR, but both regimes achieve roughly the same persistence. The responses of $\hat{\pi}_t^{HL}$ to $\varepsilon_{R,t}$ in Figure 2d indicate that when $\varepsilon_{R,t}$ increases, $\hat{\pi}_t^{HL}$ will decrease because a higher policy rate causes lower aggregate demand and eventually lower headline inflation. Figure 2d shows that the effects of $\varepsilon_{R,t}$ to $\hat{\pi}_t^{HL}$ in monetary policy under HITR are stronger than under CITR, but both regimes achieve approximately the same persistence. The responses of $\widehat{RER}_t$ to $\varepsilon_{R,t}$ in Figure 2e display that when $\varepsilon_{R,t}$ increases, $\widehat{RER}_t$ will decrease because a higher policy rate causes capital inflow and eventually currency appreciation. Figure 2e shows that the effects of $\varepsilon_{R,t}$ to $\widehat{RER}_t$ in monetary policy under HITR are stronger than under CITR. However, no clear finding exists about the persistence of monetary policy under CITR and HITR.

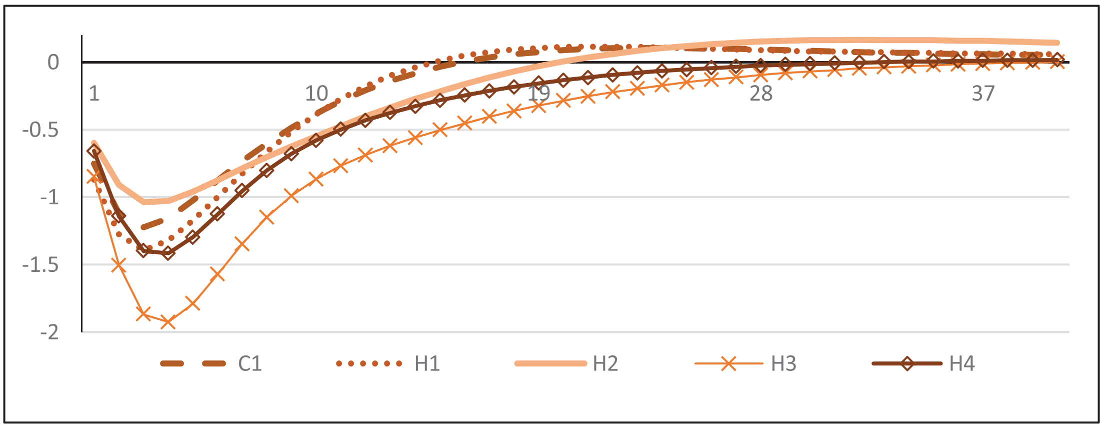
Overall, the key finding is that MPT under HITR exerts a greater influence than under CITR because of the following considerations. First, in empirical terms, the expectation channel of MPT under HITR is stronger than under CITR. This is because of the fact that headline inflation provides a clearer definition than core inflation. Headline inflation provides greater understanding of the public. Second, the theory supports the proposition that the exchange rate channel of the MPT under HITR is potentially more effective than under CITR, given the direct effects of exchange rates via the prices of imported goods. Hence, the results from the policy rate shock analysis support the previous findings from policy performance analysis that monetary policy under HITR performs better than under CITR because of the greater effectiveness of MPT under HITR.

Figure 2: The Impulse Response of the Policy Rate Shock ($\varepsilon_{R,t}$)

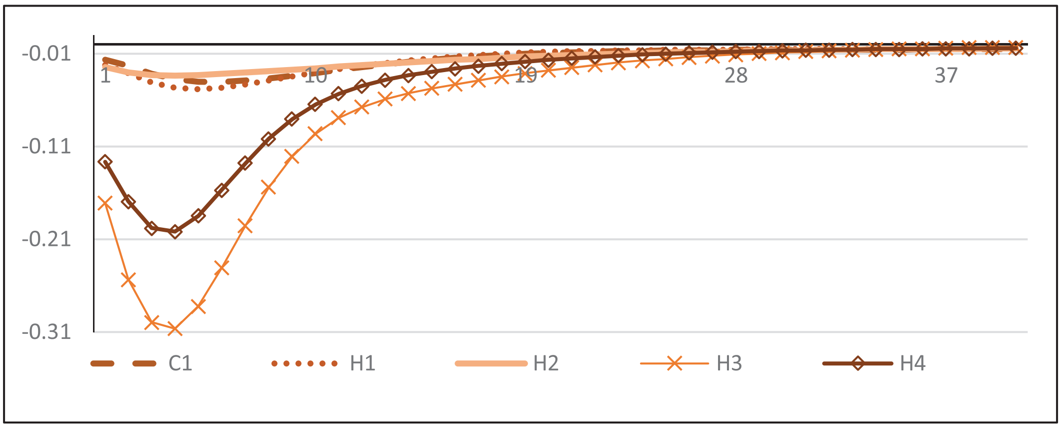
a) Response of $\hat{R}_t$ to $\varepsilon_{R,t}$ in the policy rules (C.1), (H.1), (H2), (H3) and (H.4)



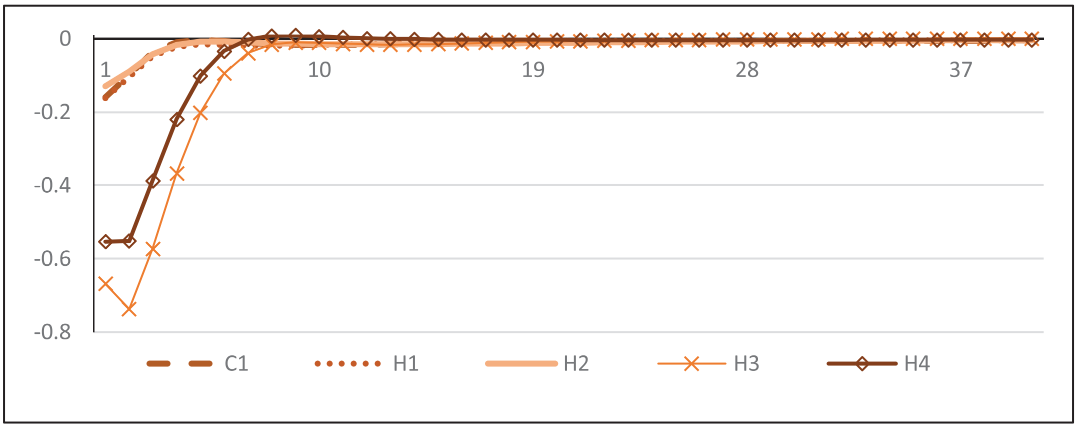
b) Response of $\hat{y}_t$ to $\varepsilon_{R,t}$ in the policy rules (C.1), (H.1), (H2), (H3) and (H.4)



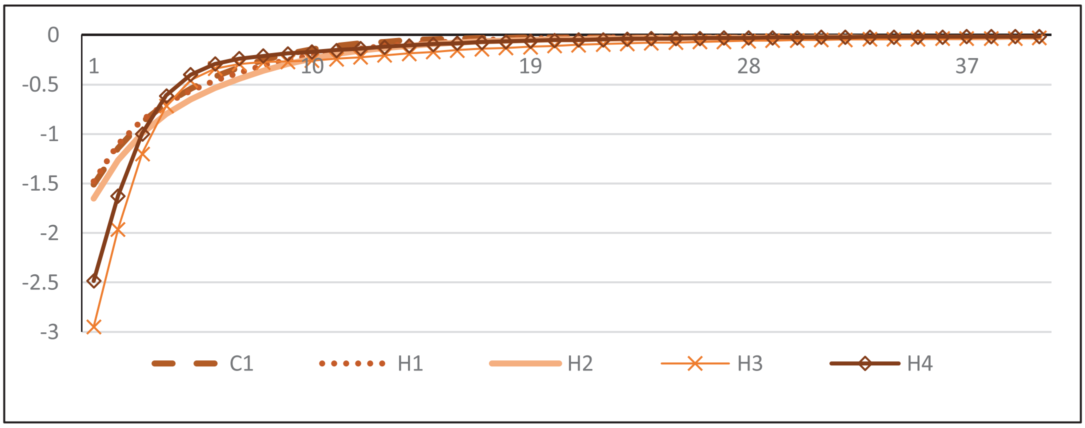
c) Response of $\hat{\pi}_t^{Core}$ to $\varepsilon_{R,t}$ in the policy rules (C.1), (H.1), (H2), (H3) and (H.4)



d) Response of $\hat{\pi}_t^{HL}$ to $\varepsilon_{R,t}$ in the policy rules (C.1), (H.1), (H2), (H3) and (H.4)



e) Response of (RER) $\widehat{RER}_t$ to $\varepsilon_{R,t}$ in the policy rules (C.1), (H.1), (H2), (H3) and (H.4)



Note: This study does not conduct only the IRF of the policy rate shock, but also the technology shock, inflation shock, exchange rate shock, etc. To see concerning the further IRF data, my thesis is available on: http://ethesisarchive.library.tu.ac.th/thesis/2015/TU_2015_5604040062_3866_2918.pdf.

Source: Impulse Response Function (IRF) based on Bayesian Inference

5.3 Sensitivity Analysis on the Degree of Exchange Rate Pass-Through

In this section we present a sensitivity analysis on the degree of ERPT to WFLs under both CITR and HITR. Furthermore, policy performance is examined under both CITR and HITR with varying impacts of the exchange rate channel revealed. The degree of ERPT refers to how much the price of imported goods change according to changes in an exchange rate. The degree of ERPT plays an important role in determining the degree of distortion in the prices of imported goods, or the degree of price stickiness in these prices. Given that the prices of imported goods represent the components in headline consumer prices, the optimal choice for inflation targets can vary according to the different degrees of ERPT (Corestti and Pesenti, 2000; Adolfson, 2001; Monacelli, 2002; Smets and Wouters, 2002; and Gali and Monacelli, 2005). In this study, the degree of ERPT is measured in terms of the degree of the price flexibility on imported consumption goods $(1-\xi_{m,c})$. We vary the degrees of ERPT to be 0.001, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 0.999, with the results listed in Tables 12, 13, and 14. For simplification, we use the results from those tables to draw Figures 3 and 4.

Figure 3a shows that the WFL^C of (C.1) is lower than that of (H.1) and (H.2) when the degrees of ERPT are between 0.001 and 0.2. In addition, the WFL^C of (C.1) is higher than (H.1) and (H.2) when the degrees of ERPT are between 0.2 and 0.999. Similarly, Figure 3b shows that the WFL^H of (C.1) is lower than (H.1) and (H.2) when the degrees of ERPT are between 0.001 and 0.2. The WFL^H of (C.1) is higher than that of (H.1) and (H.2) when the degrees of ERPT are between 0.2 and 0.999. Note that Figures 2a and 2b provide the same results. Therefore, the degree of ERPT at 0.2 represents the turning point at which WFLs in monetary policies under CITR and HITR are different. Moreover, Figure 3 details the relationship between the degree of ERPT and the degree of policy trade-off (PTF). Notably, for monetary policy under CITR in (C.1), its degree of PTF refers to PTFC. In terms of monetary policies under HITR in (H.1) and (H.2), their degree of PTF refers to PTFH. Figure 3 illustrates that at low degrees of ERPT, monetary policy under CITR involves a low degree of PTF between stabilizing core inflation and the output gap, whereas the variable under HITR exhibits a high degree of PTF between stabilizing headline inflation and the output gap. In total, Figure 3 reveals that a higher degree of ERPT leads to decreases in the degree of PTF in monetary policy under HITR. Notably, our results support the findings of Monacelli (2002).

In considering the findings from Figure 3 and Figure 4, it can be concluded that, at the low degree of ERPT within 0.001 to 0.2, monetary policy under CITR generates lower WFLs than under HITR. This is because, at the low degree of ERPT, monetary policy under CITR presents a low degree of PTF between stabilizing core inflation and the output gap, whereas that under HITR demonstrates a high degree of PTF between stabilizing headline inflation and the output gap. Intuitively, at a low degree of ERPT, the prices of imported goods suffer less from foreign shocks. Hence, ignoring movements in the prices of imported goods would comprise the optimal monetary policy. However, at medium and high degrees of ERPT within 0.2 to 0.999, WFLs of monetary policy under CITR turn out to be higher than under HITR because the higher degree of ERPT leads to a decrease in the degree of PTF between stabilizing headline inflation and the output gap. The logic is that, at medium and high degrees of ERPT, MPT under the exchange rate channel of HITR is increasingly effective, given the direct effects of the exchange rate via the prices of imported goods. From the Bayesian estimation in our model, the degrees of Thai ERPT from the policy rules (C.1), (H.1), (H2), (H.3), (H.4), (C.1.Nx), (H.1.Nx), (H.2.Nx), (H.3.Nx), and (H.4.Nx) are 0.528, 0.528, 0.292, 0.353, 0.690, 0.690, 0.502, 0.511, 0.412, and 0.515, respectively, which are at the medium level. Hence, monetary policy under HITR is more appropriate than under CITR in the context of Thailand thanks to the greater effectiveness of the exchange rate channel.

Figure 3: Sensitivity Analysis on the Degree of ERPT

a) Sensitivity on the degree of ERPT to WFL^C Sensitivity on the degree of ERPT to WFL^H

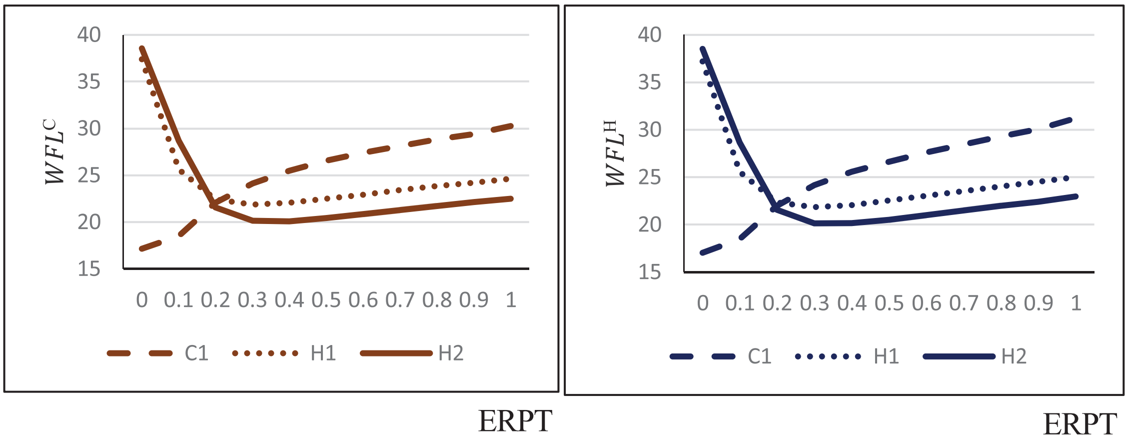
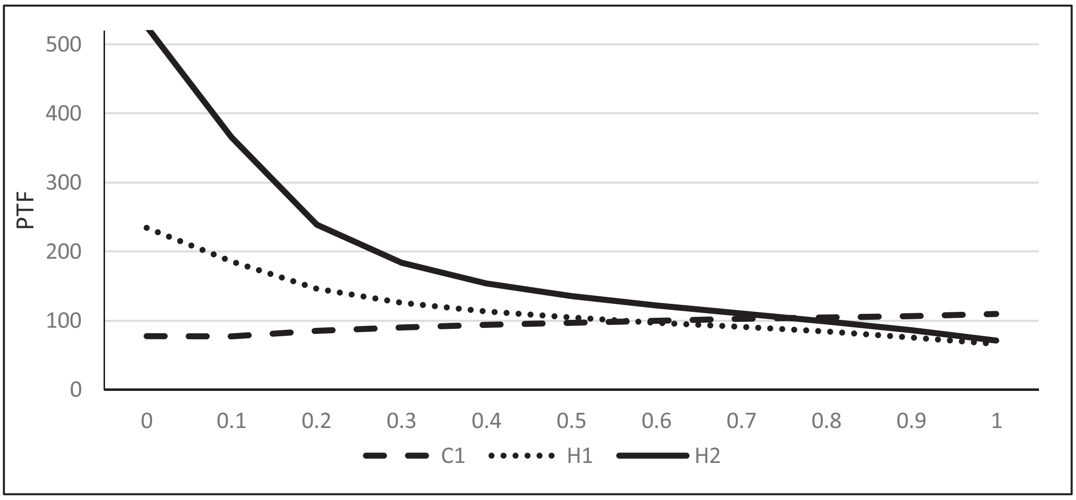


Figure 4: The Relationship between the Degree of ERPT and the Degree of PTF



Source: Author’s calculations

Table 12: Sensitivity Analysis on the Degree of ERPT in the Policy Rule (C.1)

The Rule	ERPT $(1-\xi_{m,c})$	Variance			WFL		PTF	
		$\hat{\pi}_t^{Core}$	$\hat{\pi}_t^{HL}$	$\hat{y}_t$	WFL^C	WFL^H	PTF^C	PTF^H
C.1	0.001	0.434	0.316	33.438	17.152	17.034	77.046	105.816
	0.1	0.469	0.390	36.108	18.522	18.444	76.989	92.585
	0.2	0.507	0.474	43.073	22.044	22.010	84.957	90.871
	0.3	0.524	0.525	47.262	24.154	24.156	90.195	90.023
	0.4	0.532	0.577	49.979	25.521	25.566	93.945	86.619
	0.5	0.536	0.643	52.025	26.548	26.655	97.062	80.910
	0.6	0.538	0.730	53.711	27.394	27.586	99.835	73.577
	0.7	0.540	0.844	55.190	28.135	28.439	102.204	65.391
	0.8	0.541	0.993	56.568	28.825	29.277	104.562	56.967
	0.9	0.542	1.194	57.779	29.432	30.083	106.603	48.391
	0.999	0.543	1.494	59.443	30.264	31.215	109.471	39.788

Note: 1) The Degree of ERPT is measured by the price flexibility on imported consumption goods $(1-\xi_{m,c})$.
2) PTFC = $Var(\hat{y}_t) / Var(\hat{\pi}_t^{Core})$ and PTFH = $Var(\hat{y}_t) / Var(\hat{\pi}_t^{HL})$.
Source: Author's calculations

Table 13: Sensitivity Analysis on the Degree of ERPT in the Policy Rule (H.1)

The Rule	ERPT $(1-\xi_{m,c})$	Variance			WFL		PTF	
		$\hat{\pi}_t^{Core}$	$\hat{\pi}_t^{HL}$	$\hat{y}_t$	WFL^C	WFL^H	PTF^C	PTF^H
H.1	0.001	0.507	0.315	73.780	37.397	37.205	145.523	234.222
	0.1	0.366	0.273	50.587	25.660	25.567	138.216	185.300
	0.2	0.365	0.302	44.134	22.432	22.369	120.915	146.139
	0.3	0.365	0.342	43.012	21.871	21.848	117.841	125.766
	0.4	0.366	0.384	43.410	22.071	22.089	118.607	113.047
	0.5	0.366	0.425	44.236	22.484	22.543	120.863	104.085
	0.6	0.367	0.466	45.148	22.941	23.040	123.019	96.884
	0.7	0.368	0.508	46.042	23.389	23.529	125.114	90.634
	0.8	0.369	0.560	46.894	23.816	24.007	127.084	83.739
	0.9	0.369	0.629	47.714	24.226	24.486	129.306	75.857
	0.999	0.370	0.735	48.529	24.634	25.000	131.159	66.026

Source: Author's calculations

Table 14: Sensitivity Analysis on the Degree of ERPT in the Policy Rule (H.2)

The Rule	ERPT $(1-\xi_{m,c})$	Variance			WFL		PTF	
		$\hat{\pi}_t^{Core}$	$\hat{\pi}_t^{HL}$	$\hat{y}_t$	WFL^C	WFL^H	PTF^C	PTF^H
H.2	0.001	0.183	0.146	76.759	38.562	38.526	419.448	525.747
	0.1	0.190	0.156	57.058	28.719	28.685	300.305	365.756
	0.2	0.192	0.179	42.709	21.547	21.533	222.443	238.598
	0.3	0.193	0.217	39.838	20.112	20.135	206.415	183.585
	0.4	0.194	0.259	39.768	20.078	20.143	204.990	153.544
	0.5	0.195	0.300	40.462	20.426	20.531	207.497	134.873
	0.6	0.196	0.340	41.337	20.865	21.009	210.903	121.579
	0.7	0.197	0.384	42.215	21.304	21.491	214.289	109.935
	0.8	0.197	0.437	43.051	21.723	21.963	218.533	98.515
	0.9	0.197	0.512	43.852	22.123	22.438	222.599	85.648
	0.999	0.198	0.629	44.640	22.518	22.949	225.455	70.970

Note: 1) The Degree of ERPT is measured by the price flexibility on imported consumption goods $(1-\xi_{m,c})$.
2) PTFC = $\text{Var}(\hat{y}_t)/\text{Var}(\hat{\pi}_t^{Core})$ and PTFH = $\text{Var}(\hat{y}_t)/\text{Var}(\hat{\pi}_t^{HL})$.
Source: Author's calculations

6. Conclusions

This main aim of this study is to analyze the performance of monetary policies under CITR and HITR, as well as to evaluate the importance of RER response within the Taylor rule. This study uses a small open-economy, DSGE-based NK model with incomplete ERPT, as proposed by Adolfson et al. (2007). We estimate all relevant parameters employing Bayesian inference. All of the variables involve Thai quarterly data between 2001Q1 and 2015Q4, which comprises the period when inflation targeting was implemented by the BOT. In particular, we construct monetary policy rules under both CITR and HITR, and analyze them adopting the WFLs proposed by Adolfson (2001).The estimated policy parameters indicate that the Taylor principle holds under both CITR and HITR for Thailand. Analysis of monetary policy performance under CITR and HITR indicates that monetary policy under CITR generates higher WFLs than under HITR because of the higher volatility in the output gap. On the other hand, analysis of RER responses reveal no concrete conclusions concerning whether the BOT is able to improve welfare by adjusting policy rates in response to RER movements. Moreover, the policy rate shock analysis supports the rationale that monetary policy under HITR performs better than under CITR because of the enhanced effectiveness of MPT under HITR. The sensitivity analysis of the degree of ERPT indicates that the level of ERPT plays an important role in determining the optimal choice of inflation target. The finding shows that when the degree of ERPT is quite low, monetary policy under CITR generates lower WFLs than under HITR. Intuitively, at the low degree of ERPT, monetary policy under CITR indicates a low degree of PTF between stabilizing core inflation and stabilizing the output gap, whereas that under HITR demonstrates the high degree of PTF between stabilizing headline inflation and stabilizing the output gap. Moreover, at the low degree of ERPT, the prices of imported goods suffer less from foreign shocks. As a result, inward-looking monetary policy, which emphasizes ignoring movements in the prices of imported goods, would represent the optimal monetary policy, whereas, at medium and high degrees of ERPT, the WFLs of monetary policy under CITR turn out to be higher than under HITR because the higher degree of ERPT leads to a decrease in the degree of PTF between stabilizing headline inflation and stabilizing the output gap. The logic is that, at medium and high degrees of ERPT, MPT under the exchange rate channel of HITR is increasingly effective, given the direct effects of exchange rates via the prices of imported goods. The Bayesian estimation shows that the degrees of ERPT in Thailand are at the medium level. As a result, the exchange rate channel under HITR is effective and as a consequence the degree of PTF decreases. In summary, monetary policy under HITR in Thailand performs better than under CITR thanks to the increased effectiveness of MPT via the exchange rate channel and a decrease in the degree of PTF.

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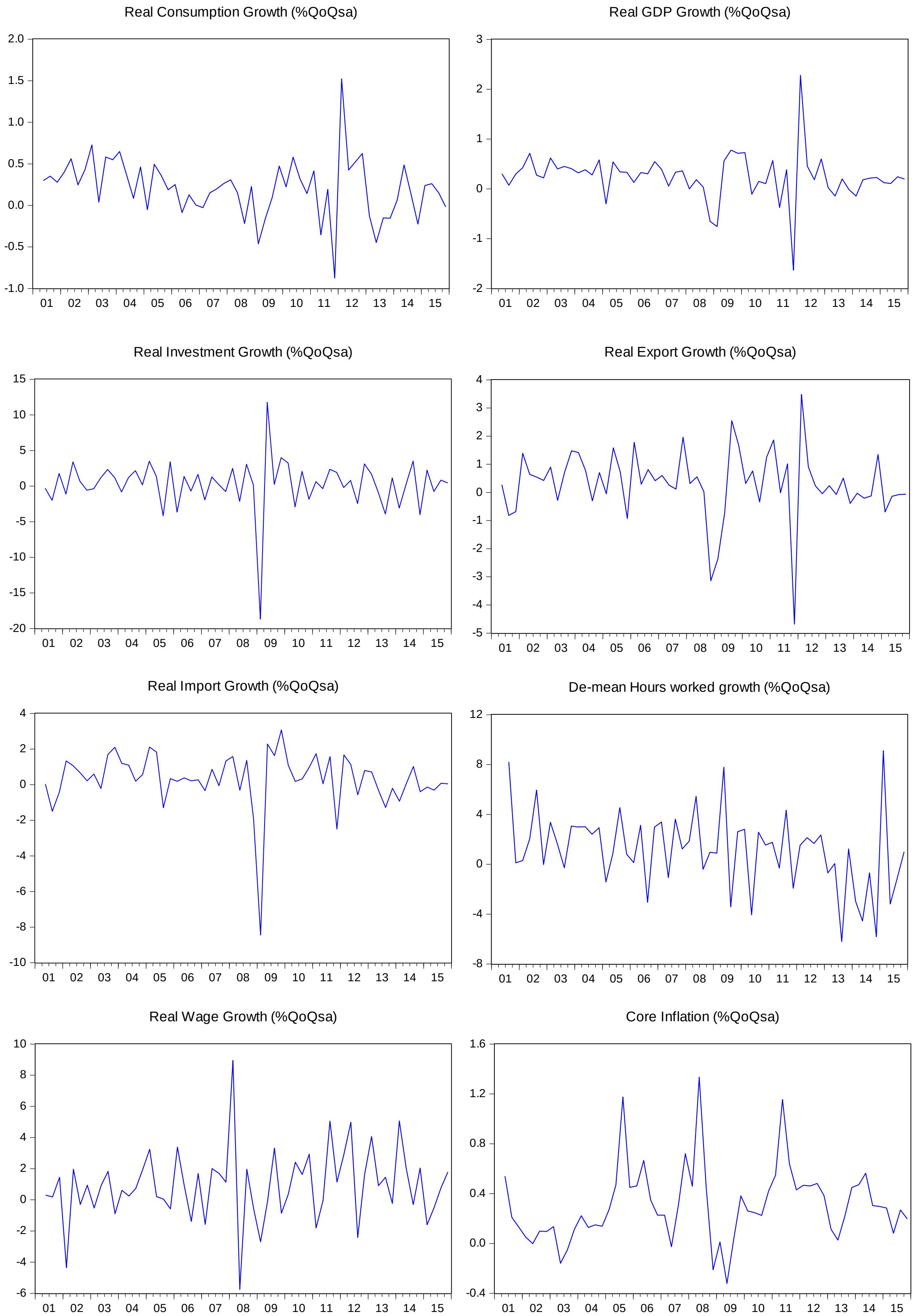
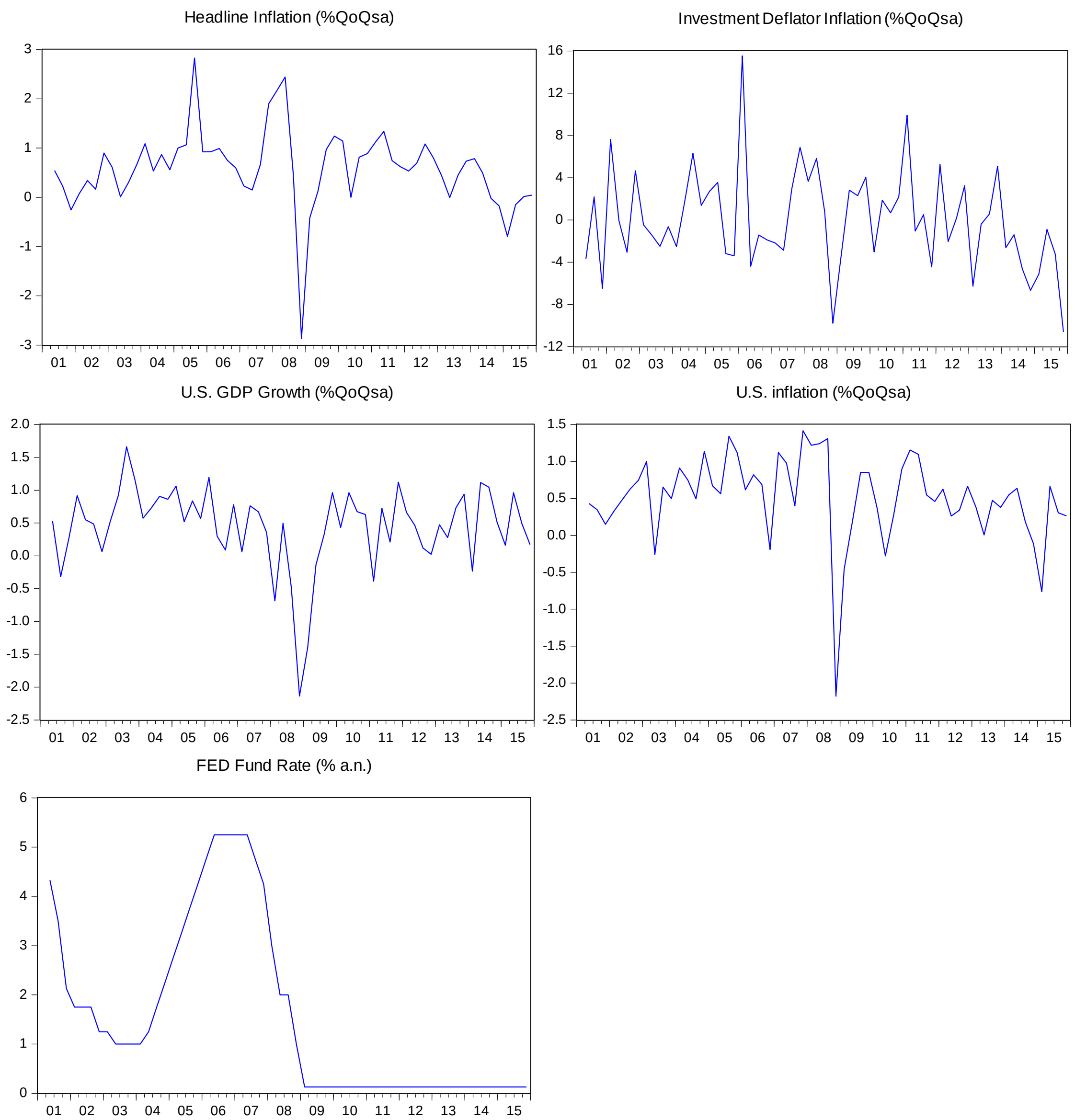
Appendix

Figure 1: Data Figures




Headline Inflation (%QoQsa)
3
2
1
0
-1
-2
-3
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
Investment Deflator Inflation (%QoQsa)
16
12
8
4
0
-4
-8
-12
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
U.S. GDP Growth (%QoQsa)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
U.S. inflation (%QoQsa)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
FED Fund Rate (% a.n.)
6
5
4
3
2
1
0
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15