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Who Gets It Wrong? Inflation Dynamics Following a Misperceived Energy Price Shock

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Who Gets It Wrong? Inflation Dynamics Following a Misperceived Energy Price Shock

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Abstract

This paper examines the role of misperception in shaping the inflation dynamics of Thailand following the 2022 energy price shock. For this purpose, I evaluate whether a New Keynesian model of a small open economy featuring a signal extraction problem can replicate the inflation and broader macroeconomic dynamics observed in Thailand during this episode. The signal extraction problem arises because agents observe the terms-of-trade shock but cannot distinguish its constituent components, transitory versus persistent, and must therefore infer the underlying state via the Kalman filter. Four information regimes are compared: full information, symmetric limited information in which both the central bank and the private sector misperceive, and two asymmetric cases in which only one agent misperceives while the other correctly identifies the shock. A simple distance-based comparison against Thai data indicates that the symmetric limited information regime most plausibly characterizes the prevailing dynamics of the 2022 Thai economy. The asymmetric cases further reveal that the consequences of misperception depend critically on who gets it wrong. Central bank misperception produces a prolonged inflation surge alongside a relatively muted output contraction, while private-sector misperception keeps inflation contained at the cost of a sharper and more persistent output decline – a stark illustration of the inflation–output trade-off in action.

Keywords: monetary policy, signal extraction, energy price shocks, small open economy, New Keynesian model, misperception, inflation dynamics, Bank of Thailand

JEL Classification: E31, E52, E58, F41, Q43, D84

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1 Introduction

A supply-driven inflation has long been a subject of interest in macroeconomics. The most recognized episode among them is, indisputably, the 1970s oil crises, which produced a prolonged period of high inflation and weak economic activity across advanced economies, a combination later labeled *stagflation*. The period is also remembered for another term, the Volcker tightening – the aggressive monetary tightening carried out under then-Federal Reserve Chair Paul Volcker, whose disinflation campaign has since served as a kind of textbook case for how central banks should react to an energy price shock.

The inflation surge of 2022 shared several features with the 1970s episode but differed from it in important respects. Energy prices – driven this time by shortages induced by the Russia–Ukraine conflict – again played a central role in driving inflation upward, yet the macroeconomic environment was markedly different. The economy had just been hit hard by the COVID-19 pandemic. Consequently, policy rates had been held at or near the effective lower bound for an extended period, a series of fiscal stimulus packages had been issued, and the subsequent recovery varied significantly across sectors.

Most importantly, a defining feature of the recent episode was the widespread view among policymakers and private forecasters that the inflationary effects of the energy price shock would prove temporary, expected to subside once the supply-side disruption itself subsided. As a result, many central banks adopted what has come to be known as a *look-through* approach, tolerating a temporary rise in inflation on the expectation that it would revert once the shock faded, so as to avoid imposing unnecessary costs on economic activity. Figure 1 illustrates this well: the federal funds rate remained essentially flat for almost a year before it began to rise in early 2022, well behind inflation.

Under normal circumstances, a conservative view would hold that this policy poses no harm to the economy so long as inflation expectations remain well anchored. Bernanke and Blanchard (2025) echo this view. They find that the second-round effects of the recent shocks on wages and prices were considerably weaker than in the 1970s because inflation expectations remained well anchored. Natal (2012) similarly argues that a strict Taylor rule is too costly a way to accommodate oil price shocks, and that policy should instead give more weight to long-run stability by targeting core inflation and output directly.

On the other hand, a later strand of the literature argues that a seemingly short-lived price shock can, under certain conditions, ignite an inflation spiral that proves far more persistent than initially thought. Gagliardone and Gertler (2023) show that a low elasticity of substitution between energy and labor can amplify what looks like a transitory shock into a sustained rise in marginal costs. Benigno and Eggertsson (2025) argue that a highly nonlinear, inv-L-shaped Phillips curve – flat when labor markets are slack but steep once the vacancy-to-unemployment ratio exceeds unity – can turn a shock that looks manageable in normal times into a prolonged inflationary episode simply because it arrives when the labor market is unusually tight. Merendino and Monacelli (2026) offer a complementary, information-based mechanism: they find that pass-through is state-dependent, rising with the degree of supply-chain uncertainty, notably when firms cannot fully distinguish the sources of an energy price shock and treat the observed price as a noisy signal of underlying supply-chain conditions. Erceg, Lindé, and Trabandt (2024) show, moreover, that once such nonlinearities are present, a look-through policy that is entirely appropriate for small shocks can become considerably riskier once a large shock has already pushed inflation above target. Which of these views better describes a given episode is ultimately an empirical question, and the answer plausibly varies across episodes and countries – a central motivation for the exercise undertaken here.

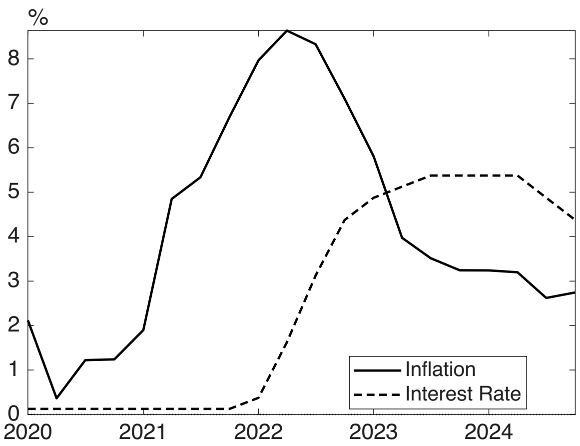

Figure 1: US inflation and policy rate.
Source: Bank for International Settlements

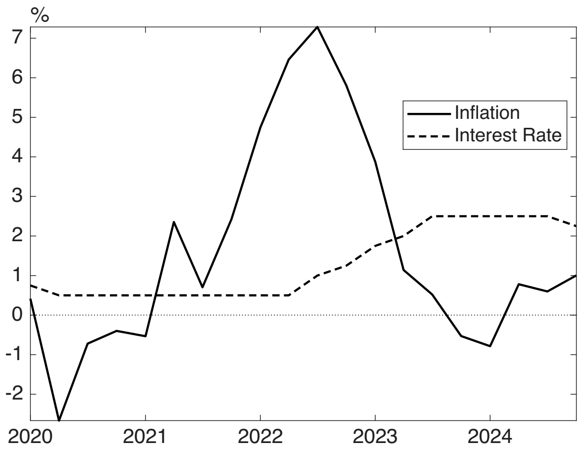

Figure 2: Thai inflation and policy rate.
Source: Bank for International Settlements

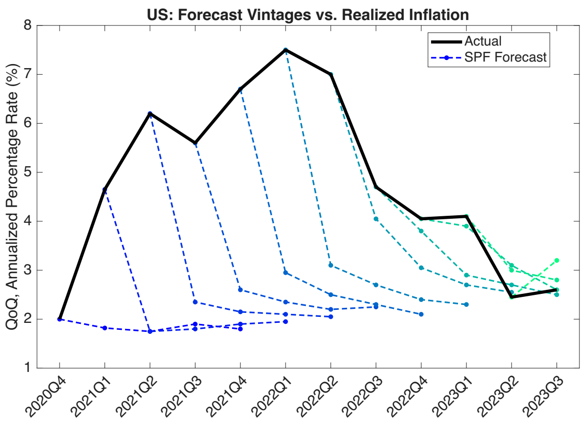

Figure 3: Realized inflation and SPF forecast vintages.
Source: Federal Reserve Bank of Philadelphia; author's calculations

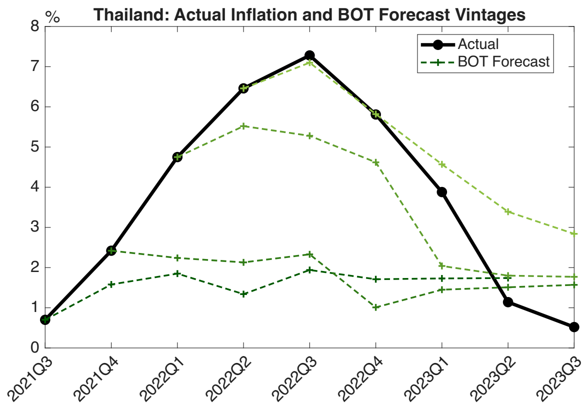

Figure 4: Realized inflation and BOT forecast vintages.
Source: Ministry of Commerce and Bank of Thailand; author's calculations

Apart from the US, Thailand too provides a useful illustration of this theme. Figure 2 shows that Thailand's own inflation and policy-rate paths tracked the US's (Figure 1) closely, though with some lag. Inflation picked up around 2021Q3 before peaking at 7.85 percent in August 2022, while the policy rate only began rising in 2022Q2, a hiking delay of roughly three quarters. Crucially, the Bank of Thailand (BOT) repeatedly forecast inflation lower than what subsequently materialized, as Figure 4 shows, which plots realized inflation against BOT forecast vintages – a feature it shares with the US's Survey of Professional Forecasters, depicted in Figure 3. These developments sparked public debate over the appropriateness of the look-through policy, and over whether delayed tightening contributed to the persistence of inflationary pressures.

While the existing literature has extensively examined whether central banks correctly assess a shock's persistence and its effects, considerably less attention has been devoted to the role of heterogeneous perceptions of shock characteristics. Asymmetric information has long been shown to matter for the monetary transmission mechanism and the broader economy: Mankiw and Reis (2002) show that gradual information diffusion across price-setters generates persistent real effects from nominal shocks, even though individual prices themselves remain fully flexible. Melosi (2017) shows that because a central bank's interest-rate decisions convey information about the state of the economy, a monetary tightening can raise rather than lower near-term private-sector inflation expectations, if it is read as a signal that the central bank possesses unfavorable information about future economic conditions. Han and Jia (2025) model a two-way version of this relationship – the central bank learns from lagged private-sector outcomes just as the private sector learns from the central bank's policy decisions – and find that this two-way information channel dampens the output costs of demand and noise shocks, but can generate a temporary rise in inflation following a contractionary monetary policy shock. Related to this backdrop, central banks and private agents may hold different beliefs regarding whether an observed increase in energy prices reflects a temporary disturbance or a more persistent structural change. Consequently, inflation dynamics may depend not only on whether agents misperceive a shock, but also on *who* misperceives it.

Motivated by these considerations, this paper studies how misperceptions regarding the persistence of energy price shocks affect inflation, output, and monetary policy transmission in Thailand during the recent inflation episode. To do so, I examine whether the widespread underestimation of inflation can be rationalized by agents initially interpreting a persistent energy-price shock as transitory. More importantly, this study further investigates whether inflation dynamics differ depending on whether this misperception originates from the private sector, the central bank, or both.

For this purpose, I develop a New Keynesian small open economy model featuring imported energy, Calvo price setting, wage rigidity, and imperfect information. Firms combine domestic labor and imported energy in production, while agents solve a signal-extraction problem using the Kalman filter to infer the persistence of observed shocks. I compare the effects of a terms-of-trade shock across four information regimes: full information, symmetric limited information in which all agents misperceive the shock, and two asymmetric-information cases in which either the private sector or the central bank alone misperceives the shock's persistence.

The results suggest that inflation and the other macroeconomic variables behave significantly differently across the four information regimes. Under full information, the model generates a front-loaded inflation response and an aggressive early rate hike. When agents instead have incomplete information and learn about shock persistence only gradually, the inflation spike is milder on impact yet becomes more persistent, monetary tightening is more muted, and the resulting output contraction is correspondingly smaller. The asymmetric-information cases further reveal that the identity of the misinformed agent matters substantially. Notably, when only the central bank underestimates shock persistence, inflation becomes markedly more persistent while output losses remain contained. However, when only the private sector misperceives the shock, inflation pressures are more muted but output costs are larger. Comparing all four regimes against Thailand's own experience, symmetric limited information delivers the closest match on inflation and on an overall weighted measure of fit, and so is the regime most plausibly consistent with the 2022 episode. These results point to a previously underexplored dimension of monetary transmission under supply shocks: not merely whether agents are mistaken about shock persistence, but *who gets it wrong*.

The remainder of the paper proceeds as follows. Section 2 reviews the related literature. Section 3 presents the model. Section 4 describes the information structure and the signal-extraction problem. Section 5 discusses calibration. Section 6 presents the impulse response analysis. Section 7 evaluates which information regime best characterizes Thailand's 2022 episode. Section 8 concludes.

2 Related Literature

The theoretical backbone of this paper draws on the New Keynesian small open economy framework of Galí and Monacelli (2005) and Blanchard and Galí (2007), who show that introducing real wage rigidities into the standard New Keynesian model breaks the divine coincidence and generates a meaningful stabilization trade-off between inflation and the welfare-relevant output gap following supply shocks. This trade-off is the central tension this paper studies in the context of energy price disturbances.

Most directly related to this paper is Erceg, Lindé, and Trabandt (2024), who develop a nonlinear New Keynesian model in which agents solve a signal extraction problem to distinguish transitory from persistent cost-push shocks. Their central result—that a central bank operating under a forecast-based rule and misperceiving the shock as transitory can generate an initial output expansion alongside a hump-shaped inflation cycle—provides the primary intellectual motivation for the present exercise. Buss and Traficante (2025) complement this by characterizing the conditions under which a look-through policy is optimal as a function of the central bank's posterior beliefs about shock persistence. They show that while look-through dominates a Taylor rule under full information, the reverse is true under incomplete information, as agents' prior belief in transitory shocks induces policy inaction that simultaneously raises inflation and output.

This paper extends Erceg, Lindé, and Trabandt (2024) in three respects. First, this paper introduces a novelty to this strand of the literature by considering asymmetric information scenarios, distinguishing between cases in which only the central bank or only the private sector misperceives the shock, and characterizing the distinct macroeconomic dynamics that arise in each configuration. Second, it adapts the signal extraction framework to a small open economy in which terms-of-trade shocks are the source of misperception, so as to establish a setting more relevant to commodity-importing economies. Third, by disciplining the model directly to Thai data, this study also contributes to the Thai DSGE literature, which has received little attention despite a well-documented inflation episode in the micro-level literature such as Apaitan, Disyatat, and Manopimoke (2018) and Nookhwun and Manopimoke (2023).

3 Model

The model is a New Keynesian model of a small open economy with Calvo pricing and wage rigidity, Leontief production combining domestic labor and imported energy, and a signal extraction problem. Throughout, variables with a hat (e.g. $\hat{x}_t$) denote log-deviations from the non-stochastic steady state.

3.1 Households

There is a continuum of households indexed by $j \in [0,1]$. Households pool their income and hold identical portfolios of bonds, and consequently share the same consumption path, $C_t(j) = C_t$ for all j; however, each household supplies a differentiated variety of labor $L_t(j)$ over which it holds monopoly power, following Erceg, Henderson, and Levin (2000) and Blanchard and Galí (2007). Household preferences over consumption and its own labor variety exhibit internal habit formation and take the form:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t - hC_{t-1})^{1-1/\sigma}}{1-1/\sigma} - \frac{L_t(j)^{1+1/\psi}}{1+1/\psi} \right] \tag{1}$$

where C_t is aggregate consumption, $L_t(j)$ is household j's labor supply, $\beta \in (0,1)$ is the subjective discount factor, $\sigma > 0$ is the elasticity of intertemporal substitution, $\psi > 0$

is the Frisch elasticity of labor supply, and $h \in [0, 1)$ governs the degree of internal habit persistence. Each household holds one-period nominal bonds $B_t(j)$, supplies its differentiated labor at the household-specific nominal wage $W_t(j)$, and receives dividend income $D_t(j)$ from ownership of domestic firms. The nominal budget constraint is:

$$P_t C_t(j) + Q_t B_t(j) = B_{t-1}(j) + W_t(j) L_t(j) + D_t(j) \tag{2}$$

where P_t is the consumer price level and $Q_t = 1/(1+i_t)$ is the price of one-period nominal bonds.

A continuum of competitive labor packers combines the differentiated labor varieties into the homogeneous labor input L_t used by firms, via a CES aggregator:

$$L_t = \left[\int_0^1 L_t(j)^{\frac{\varepsilon_w - 1}{\varepsilon_w}} dj \right]^{\frac{\varepsilon_w}{\varepsilon_w - 1}}, \qquad \varepsilon_w > 1 \tag{3}$$

Cost minimization by the packers yields the demand curve facing household j,

$$L_t(j) = \left(\frac{W_t(j)}{W_t} \right)^{-\varepsilon_w} L_t, \qquad W_t = \left[\int_0^1 W_t(j)^{1-\varepsilon_w} dj \right]^{\frac{1}{1-\varepsilon_w}} \tag{4}$$

where W_t is the aggregate nominal wage index. Since there is no investment or government expenditure, goods-market clearing requires $Y_t = C_t$ in every period. Optimization over consumption and bond holdings yields the standard log-linearized Euler equation, unaffected by the introduction of monopolistic labor supply:

$$\hat{y}_t - h\hat{y}_{t-1} = \mathbb{E}_t \left(\hat{y}_{t+1} - h\hat{y}_t \right) - (1 - h)\, \sigma \left(\hat{i}_t - \mathbb{E}_t \hat{\pi}_{t+1} \right) \tag{5}$$

Households reset their wage, and the demand curve (4) that governs it, under the same Calvo friction as prices; this is taken up together with price-setting in Section 3.3.

3.2 Production

Consider a small open economy that can import a quantity Z_t of energy products from the rest of the world. There are two goods in this economy: a domestic good Y_t, consumed solely by households, and a homogeneous tradeable good E_t, traded in a perfectly competitive international market.

3.2.1 Tradeable good market

The tradeable good is produced by competitive firms with a linear production function in labor. Specifically, E_t units of the good are produced using E_t units of domestic labor. Labor is freely mobile between the tradeable and domestic-good sectors and earns the same wage W_t in either, so households are indifferent between the two markets in equilibrium, and total labor demand is $L_t = N_t + E_t$, where N_t denotes labor employed in the domestic-good sector. Ultimately, the unit labor coefficient implies that the nominal marginal cost of the tradeable good is W_t, and perfect competition drives its price to equal W_t as well.

In turn, the price of energy imports in units of domestic currency is S_t. The terms of trade, defined as the relative price of imports to exports, is therefore $s_t \equiv S_t/W_t$. The terms of trade s_t is assumed to follow an exogenous stochastic process, capturing a world-determined relative price that the small open economy takes as given. A shock to s_t thus represents an energy-price shock in the model. Real allocations in the model depend only on this real relative price s_t, while the nominal price of energy imports, $S_t = s_t W_t$, follows from s_t and the equilibrium nominal wage W_t, and is not separately specified.

3.2.2 Domestic goods market

The domestic good is produced by a continuum of monopolistically competitive firms $i \in [0, 1]$, each producing a differentiated good using a Leontief technology in domestic labor $N_t(i)$ and imported energy $Z_t(i)$:

$$Y_t(i) = \min\left\{\frac{Z_t(i)}{\alpha},\ \frac{N_t(i)}{1-\alpha}\right\} \tag{6}$$

where $\alpha \in (0, 1)$ is the steady-state energy share of total production costs. The Leontief technology implies labor and energy are perfect complements, so cost minimization yields fixed input proportions:

$$Z_t(i) = \alpha Y_t(i) \quad \text{and} \quad N_t(i) = (1-\alpha) Y_t(i). \tag{7}$$

The nominal marginal cost of producing one unit of output is therefore:

$$X_t = \alpha S_t + (1-\alpha)\, W_t \tag{8}$$

Dividing nominal marginal cost by the price level P_t, and defining the real wage as $w_t \equiv W_t/P_t$, real marginal cost can be written as:

$$x_t = (1 - \alpha + \alpha s_t)\, w_t \tag{9}$$

Crucially, because households have no access to international borrowing or lending, imposing a financial autarky condition implies that the balance of payments coincides with the trade balance. The value of energy imports hence must equal the value of exports every period, $S_t Z_t = W_t E_t$, giving the balanced-trade condition:

$$E_t = s_t Z_t \tag{10}$$

Aggregating firm-level input demands and substituting the balanced-trade condition into the total labor demand equation delivers the aggregate production function:

$$Y_t = \frac{L_t}{(1 - \alpha + \alpha s_t)\,\Delta_t}, \qquad \text{where } \Delta_t \equiv \int_0^1 \left(\frac{P_t(i)}{P_t}\right)^{-\varepsilon} di \tag{11}$$

is the usual index of relative-price distortions.

Essentially, equations (9) and (11) show that the terms of trade s_t enters directly and positively into firms' real marginal cost, and negatively into aggregate production. The balanced-trade condition (10) further implies that the quantity variables E_t and Z_t must adjust following a terms-of-trade shock. Taken together, a terms-of-trade depreciation – an increase in the price of imports relative to exports – behaves similarly to a negative productivity shock. Specifically, when s_t rises, a given volume of energy imports becomes more expensive, so under financial autarky more domestic labor must be devoted to exports E_t to finance it, leaving less labor for domestic-good production and reducing Y_t proportionately. The Leontief specification isolates this mechanism transparently, without loss of generality. Finally, log-linearizing around the zero-distortion steady state ($\Delta = 1$, $\bar{s} = 1$) yields:

$$\hat{y}_t = \hat{l}_t - \alpha \hat{s}_t \tag{12}$$

3.3 Price and Wage Setting

Nominal rigidities enter through both goods and labor markets via Calvo (1983) staggered contracts. Each period, a fraction θ of firms and a fraction θ of households cannot re-optimize their price or wage, respectively, whereas the remainder re-optimize freely. The choice of Calvo pricing follows from Apaitan, Disyatat, and Manopimoke (2018), whose rich analysis of Thai disaggregated CPI data finds that price adjustment in Thailand is dominated by the intensive margin rather than extensive margin.

3.3.1 Goods Market

Log-linearizing the Calvo price-setting conditions around the zero-inflation steady state, the aggregate price level and reset price evolve as:

$$\hat{p}_t = \theta\,\hat{p}_{t-1} + (1-\theta)\,\hat{p}_t^* \tag{13}$$

$$\hat{p}_t^* = \beta\theta\,\mathbb{E}_t \hat{p}_{t+1}^* + (1-\beta\theta)\,\hat{x}_t^n \tag{14}$$

where $\hat{x}_t^n$ denotes log nominal marginal cost. Combining (13)–(14) with inflation definition $\hat{\pi}_t \equiv \hat{p}_t - \hat{p}_{t-1}$ yields the New Keynesian Phillips Curve (NKPC):

$$\hat{\pi}_t = \beta\,\mathbb{E}_t\hat{\pi}_{t+1} + \kappa\,\hat{x}_t, \qquad \kappa \equiv \frac{(1-\theta)(1-\beta\theta)}{\theta} \tag{15}$$

where $\hat{x}_t = \hat{w}_t + \alpha\hat{s}_t$ is the log-linearized real marginal cost implied by equation (9). A deterioration in the terms of trade raises firms' energy costs and feeds directly into inflation, with a magnitude proportional to energy dependence, α.

3.3.2 Labor Market

Households supply differentiated labor varieties and set wages subject to the same Calvo friction, taking the demand curve (4) as given. Each period, a household may reset its wage with probability $1-\theta$, and otherwise leaves it unchanged. A household that reoptimizes at t chooses its reset wage to equate the present discounted value of its marginal rate of substitution, marked up by its monopoly power over its own labor variety, to its wage over the expected duration of the contract. The log-linearized wage-setting equations mirror the price block derived above:

$$\hat{w}_t^n = \theta\,\hat{w}_{t-1}^n + (1-\theta)\,\hat{w}_t^* \tag{16}$$

$$\hat{w}_t^* = \beta\theta\mathbb{E}_t\hat{w}_{t+1}^* + (1-\beta\theta)\left[\hat{p}_t + \frac{1}{\sigma(1-h)}(\hat{y}_t - h\hat{y}_{t-1}) + \frac{1}{\psi}\hat{l}_t\right] \tag{17}$$

where $\hat{w}_t^n$ is the log nominal wage and the term in brackets is the household's log marginal rate of substitution between consumption and its own labor supply, expressed in nominal terms. The real wage follows as $\hat{w}_t = \hat{w}_t^n - \hat{p}_t$.

3.4 Monetary Policy

To close the model, the forward-looking interest rate rule follows:

$$\hat{i}_t = \phi\hat{i}_{t-1} + (1-\phi)\left[\chi_\pi\mathbb{E}_t(\hat{\pi}_{t+1Q}) + \chi_y\hat{\Upsilon}_t\right] \tag{18}$$

where ϕ is the policy inertia, $\chi_\pi > 1$ ensures the Taylor principle holds, and $\chi_y \geq 0$ captures the response to annual output growth, $\hat{\Upsilon}_t$. As the model is simulated at monthly frequency, the central bank responds to one-quarter-ahead expected inflation, $\mathbb{E}_t\hat{\pi}_{t+1Q}$, defined as the average of the three monthly inflation rates over the coming quarter. This near horizon preemptive rule aligns with contemporary central banks' communication and serves as a core feature generating asymmetric responses elaborated in Section 6. Under the limited and asymmetric information regimes, the central bank's inflation forecast is formed using its own Kalman filter beliefs about the shock composition, so the rule embeds the same misperception that governs private-sector pricing.

4 Terms-of-Trade and Signal Extraction

Let $\hat{s}_t$ denote the log deviation of s_t from its steady-state value $\bar{s} = 1$. The observed terms of trade can be decomposed into unobserved permanent and transitory components:

$$\hat{s}_t = a_t^P + a_t^T \tag{19}$$

The individual components are then assumed to follow exogenous stochastic processes:

$$a_t^i = \rho_i a_{t-1}^i + \sigma_i \varepsilon_t^i, \qquad \varepsilon_t^i \sim \text{i.i.d. } \mathcal{N}(0,1) \tag{20}$$

where $i \in \{P, T\}$, $\rho_i \in (0,1)$ represents the persistence of the processes, and σ_P/σ_T is the signal-to-noise ratio. Typically, $\rho_P > \rho_T$ and $\sigma_T \gg \sigma_P$, meaning the permanent component is more persistent and agents initially attribute most of the observed shock to the transitory component.

This section follows Erceg, Lindé, and Trabandt (2024) closely. Agents observe the total terms-of-trade shock $a_t = a_t^P + a_t^T$ each period but cannot distinguish the two components. They estimate the underlying state using the optimal linear filter. Define the state vector $\mathbf{a}_t = (a_t^P,\, a_t^T)'$ and write the state-space system:

$$a_t = \underbrace{\begin{bmatrix} 1 & 1 \end{bmatrix}}_{H'} \mathbf{a}_t \tag{21a}$$

$$\mathbf{a}_{t+1} = \underbrace{\begin{bmatrix} \rho_P & 0 \\ 0 & \rho_T \end{bmatrix}}_{F} \mathbf{a}_t + \underbrace{\begin{bmatrix} \sigma_P & 0 \\ 0 & \sigma_T \end{bmatrix}}_{Q} \begin{bmatrix} \varepsilon_{t+1}^P \\ \varepsilon_{t+1}^T \end{bmatrix} \tag{21b}$$

Using the Kalman filter, the state updating equation can be written as:

$$\begin{bmatrix} \hat{a}_{t|t}^P \\ \hat{a}_{t|t}^T \end{bmatrix} = \begin{bmatrix} \hat{a}_{t|t-1}^P \\ \hat{a}_{t|t-1}^T \end{bmatrix} + L_t \left(a_t - H' \begin{bmatrix} \hat{a}_{t|t-1}^P \\ \hat{a}_{t|t-1}^T \end{bmatrix} \right) \tag{22}$$

where

$$L_t = P_{t|t-1} H (H' P_{t|t-1} H)^{-1} \tag{23}$$

$$P_{t|t} = P_{t|t-1} - L_t H' P_{t|t-1} \tag{24}$$

The one-step-ahead forecast equation is:

$$\begin{bmatrix} \hat{a}^P_{t+1|t} \\ \hat{a}^T_{t+1|t} \end{bmatrix} = F \begin{bmatrix} \hat{a}^P_{t|t-1} \\ \hat{a}^T_{t|t-1} \end{bmatrix} + K_t \left(a_t - H' \begin{bmatrix} \hat{a}^P_{t|t-1} \\ \hat{a}^T_{t|t-1} \end{bmatrix} \right) \tag{25}$$

where

$$K_t = F P_{t|t-1} H (H' P_{t|t-1} H)^{-1} \tag{26}$$

$$P_{t+1|t} = (F - K_t H') P_{t|t-1} (F - K_t H')' + QQ'. \tag{27}$$

It follows that for $j > 1$, the forecast obeys:

$$\begin{bmatrix} \hat{a}^P_{t+j|t} \\ \hat{a}^T_{t+j|t} \end{bmatrix} = F^j \begin{bmatrix} \hat{a}^P_{t|t} \\ \hat{a}^T_{t|t} \end{bmatrix}, \quad j = 1, 2, \ldots \tag{28}$$

It is important to note that at time t, when new information arrives, agents update their forecasts following (25). Nevertheless, in subsequent periods, their forecasts follow a simple AR(1) decay because no new information arrives, as shown in (28).

Agents are assumed to have access to an infinite history of past observations, so the Kalman gain and error covariance are solved at their fixed points: $P_{t+1|t} = P_{t|t-1} = P^*$, where P^* satisfies the discrete algebraic Riccati equation. This implies time-invariant gain matrices L and K.

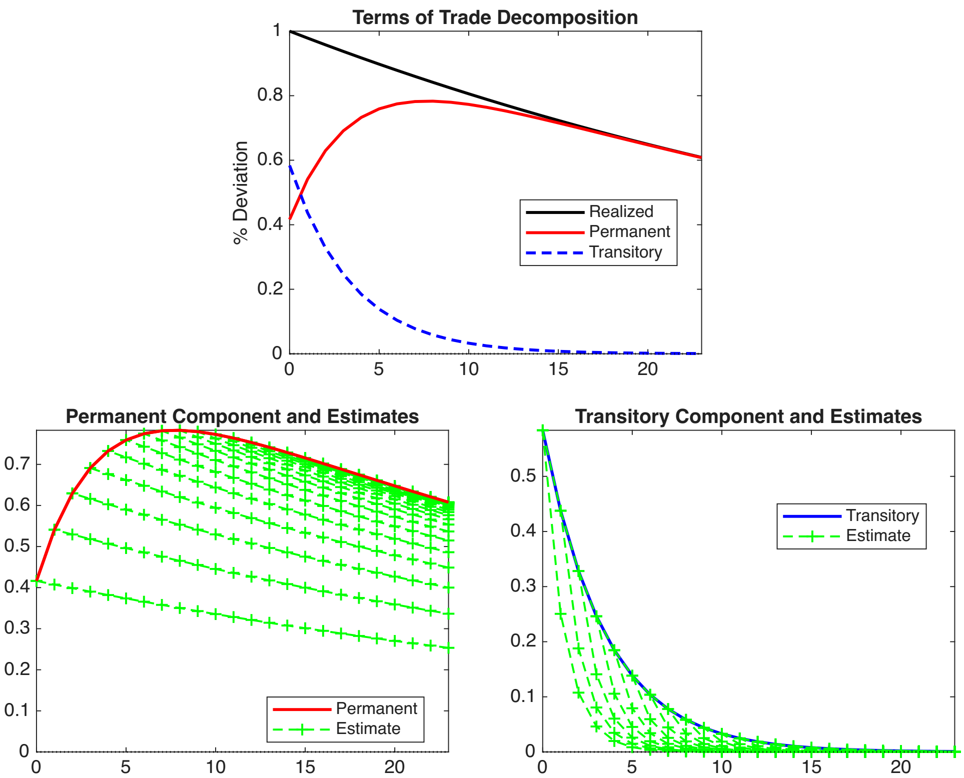

Figure 5: Terms-of-trade decomposition and Kalman filter estimates.

Figure 5 depicts how the dynamics of the unobserved components develop following a unit percentage shock to the terms of trade. The parameters are set to $\rho_P = 0.979$, $\rho_T = 0.429$, $\sigma_P = 1$, and $\sigma_T = 1.89$; justification for these values is provided in Section 5. As can be seen, the green lines lying below the red and blue lines throughout indicate that agents consistently underestimated the shock, expecting it to decay faster than it did. However, as the observed value exceeds the forecast, they revise their estimates upward, as depicted by the shifting green lines each period, until approximately period 10, when the permanent component and the observed value converge, implying that agents eventually correctly perceive the persistence of the shock.

5 Calibration

Table 1 presents the full set of monthly calibrated parameters. Each is discussed in turn.

Table 1: Calibrated Parameter Values

Parameter	Value	Description	Source
β	0.9975	Discount factor	Standard
σ	1.0	Elasticity of intertemporal substitution	Standard
ψ	1.0	Frisch elasticity of labor supply	Standard
α	0.0696	Energy cost share	NESDC IO Table 2021
h	0.70	Habit persistence	ECM regression
θ	0.818	Calvo pricing probability	Apaitan et al. (2018)
ϕ	0.901	Taylor rule: policy inertia	Phrommin (2018)
χ_π	1.681	Taylor rule: inflation response	Phrommin (2018)
χ_Y	0.042	Taylor rule: output response	Phrommin (2018)
ρ_P	0.979	AR(1), STL trend (first difference)	STL + AR(1)
ρ_T	0.429	ARMA(1,1), STL residual	STL + ARMA(1,1)
σ_P/σ_T	1/1.89	Signal-to-noise ratio	GMM

The discount factor $\beta = 0.9975$ is standard in the New Keynesian literature, consistent with an annualized steady-state real interest rate of approximately 3 percent. As there is no settled consensus on the elasticities of intertemporal substitution and labor supply for Thailand specifically, both parameters are set $\sigma = \psi = 1$ following the standard value in the NK literature. The energy cost share $\alpha = 0.0696$ is derived from the NESDC Input–Output Table for 2021, the most recent available at the time of writing, computed as the share of total imported energy in intermediate inputs, amounting to approximately 7 percent. Habit persistence $h = 0.7$ is obtained from an error correction model regressing aggregate consumption on income, consumer confidence, credit conditions, and the CPI, instrumenting the lagged CPI to address simultaneity; the estimated coefficient on lagged consumption is 0.7.

The Calvo pricing parameter $\theta = 0.818$ follows Apaitan, Disyatat, and Manopimoke (2018), who document average price adjustment durations of 4–7 months for Thai firms. Adopting the midpoint of $d = 5.5$ months and applying $\theta = 1 - 1/d$ yields $\theta \approx 0.818$. The Calvo wage parameter is set equal to θ, as direct evidence on wage adjustment frequency is unavailable for Thailand. The Taylor rule coefficients ϕ, χ_π, and χ_Y are taken from Phrommin (2018).[1]

The persistence parameters of the unobserved-components representation, ρ_P and ρ_T, are estimated directly from Thailand's terms-of-trade data spanning 2001–2025 – the longest span available – mirroring the assumption that agents know the shock's true data-generating process and could, in principle, estimate it themselves.[2] The two unobserved components are extracted using an STL (seasonal-trend decomposition via Loess) filter, with the estimated trend and residual mapped to the permanent and transitory components, respectively. Because the estimated trend is non-stationary, ρ_P is instead obtained as the AR(1) coefficient of its first difference; the stationary residual component is modeled directly as an ARMA(1,1) process, from which ρ_T is recovered.

The signal-to-noise ratio σ_P/σ_T – with σ_P normalized to unity – is disciplined more formally than the persistence parameters above, via an equally-weighted GMM estimator that matches the model's implied inflation forecast-error profile to the Bank of Thailand's actual real-time forecast errors shown in Figure 4. Critically, quarterly real-time forecast errors are available only for the central bank, not for private forecasters. Therefore, the estimation is carried out under the assumption that both agents share a common forecast when they misperceive the shock. The moment conditions compare the model-implied forecast-error profile to the BOT's real-time forecast errors across four forecast vintages (2021Q3–2022Q2) and four quarterly horizons, for sixteen moments in total. Restricting attention to a one-year horizon, rather than the longer sample available, places weight on the more reliable near-horizon forecast errors rather than on longer-horizon errors that tend to mean-revert, as Figure 4 illustrates. Both the model-implied and actual forecast errors are normalized by their own one-quarter-ahead value within each vintage, so that the estimator targets the shape of forecast-error persistence rather than its absolute scale. The estimator solves

$$\hat{\sigma}_T = \arg\min_{\sigma_T} \; g(\sigma_T)' g(\sigma_T) \tag{29}$$

where $g(\sigma_T)$ stacks the sixteen normalized differences between the model-implied and the BOT's actual forecast errors, and the weighting matrix is set to the identity rather than an estimated inverse-covariance matrix, since the small number of vintage clusters does

[1] Phrommin (2018) estimates Thailand's interest rate rule under headline inflation targeting via DSGE model. Given that the Bank of Thailand adopted headline targeting only in January 2015, he proposes four alternative specifications to address the resulting short-sample problem. The coefficients adopted here are the posterior means from the specification estimated over the full 2001–2015 sample under the assumption of headline targeting throughout, the H2 case, which is the most data-rich of the four.

[2] Source: Bank of Thailand, EC_EI_019 Trade Indices and Terms of Trade.

not support a reliable estimate of the moments' covariance structure. The objective is minimized via a two-stage grid search. A coarse grid with a step size of 0.1 locates the optimum in the neighborhood of $\sigma_T \approx 1.9$, after which a finer grid with a step size of 0.01 is used in that neighborhood to refine the estimate, for computational efficiency. This procedure yields $\hat{\sigma}_T = 1.89$.

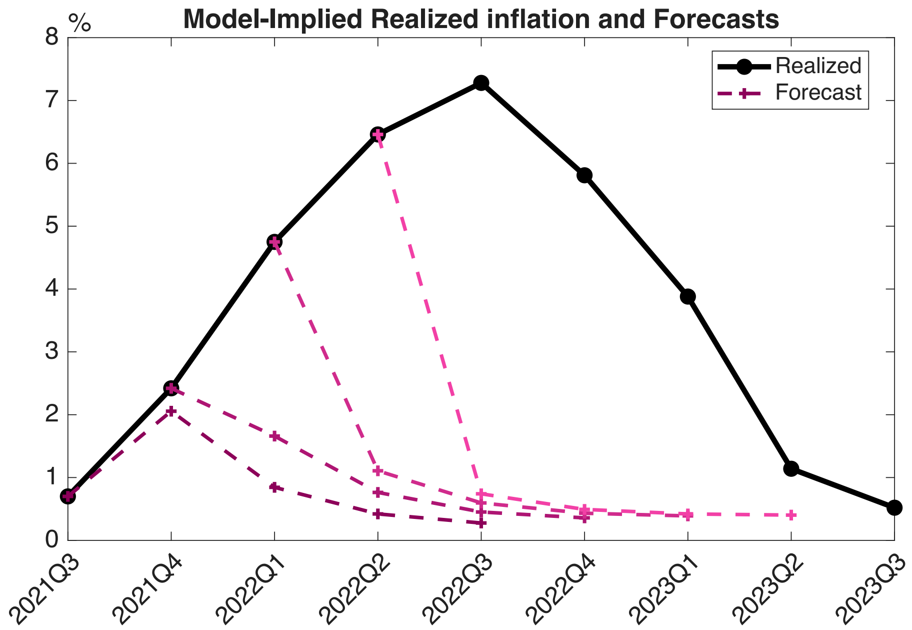

Figure 6: Model-implied versus actual forecast-error vintages, GMM fit.

Figure 6 plots the resulting model-implied forecast-error vintages against the actual data. The fit deteriorates somewhat in the later vintages. This is because the model, by construction, does not allow for inconsistent expectations, whereas Figure 4 suggests that the BOT's own assessment shifted over the episode, from underestimating to overestimating the shock's persistence. Despite this limitation, the calibrated ratio delivers an accurate match to the convergence of terms-of-trade perceptions shown in Figure 5, where the permanent component converges to the realized series within approximately 10 months.

This timing can be loosely compared to the BOT's communication. In its December 2021 Press Release, the BOT stated that "the likelihood of second-round effects remained low,"[3] before revising its inflation forecast upward in its June 2022 release, citing "increasing domestic energy prices and higher cost passthrough that have broadened into wider ranges of product."[4] Figure 4 reflects this shift well.

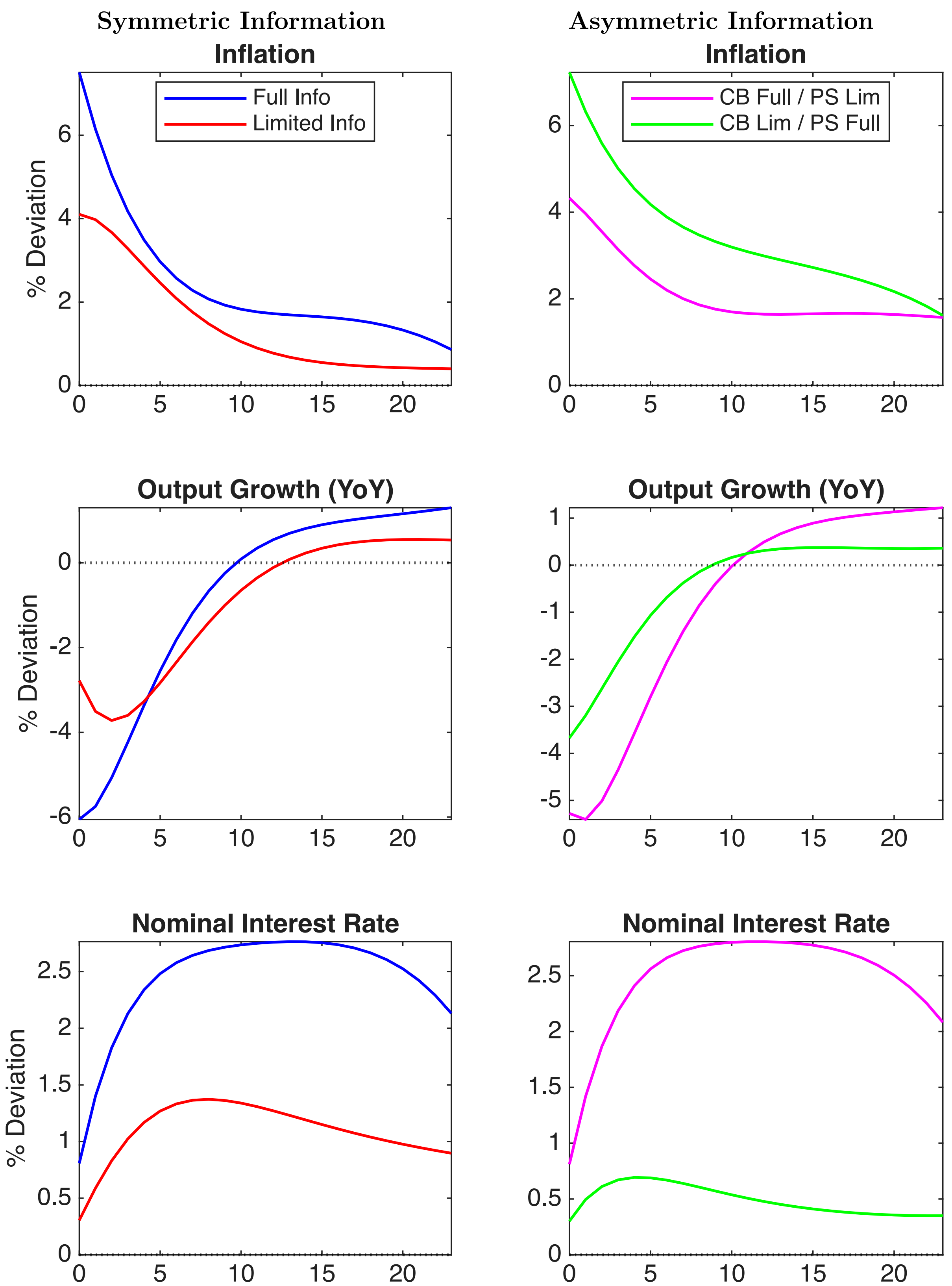

Figure 7: Impulse responses of inflation, output growth, and nominal interest rate to a terms-of-trade shock.

Notes: Left column compares full information (blue) against limited information (red). Right column compares asymmetric information cases: CB full / PS limited (pink) and CB limited / PS full (green). All responses are deviations from steady state in percentage points over a 24-month horizon.

6 Impulse Response Analysis

Figure 7 presents the impulse responses of inflation, output, and the nominal interest rate to a terms-of-trade shock across all four information regimes. The size of the shock is disciplined such that the on-impact inflation response under full information peaks exactly at the realized pinnacle of 7.85 percent recorded in August 2022.[5]

6.1 Symmetric Information

Under this assumption (left column of Figure 7), both agents—the private sector (PS) and the central bank (CB)—either correctly or incorrectly perceive the composition of the observed shock symmetrically; that is, they either both know or both do not know a_t^P and a_t^T.

Under full information (blue), agents correctly identify the shock as driven predominantly by its persistent component on impact. Forward-looking price-setters embed the full future cost-push path into reset prices, generating a front-loaded inflation response peaking at 7.85 percent on impact. Output growth drops simultaneously to -6 percent, as the terms-of-trade shock enters the production function directly, immediately compressing output. The nominal rate follows a hump-shaped path, rising steeply to over 2.5 percent within five months and lingering there for a while before declining, reflecting the Taylor rule's simultaneous response to the high initial inflation forecast and the sharp output growth decline, with the subsequent fall driven by the faster moderation of both. Output growth turns positive after approximately three quarters as the direct supply-side shock fades, though the recovery is tempered by high interest rate inertia relative to the declining inflation path. The result is the canonical stabilization trade-off: a front-loaded contraction accompanied by rapid inflation reversion.

Under limited information (red), this mechanism is compressed at every stage relative to the full information case. Agents initially attribute most of the observed shock to the transitory component, incorporating less cost-push pressure into reset prices and wages, generating an inflation response of roughly 4 percent on impact—substantially below the full information peak of 7.85 percent. The central bank, filtering the same signal, forms a more modest inflation forecast and raises the nominal rate only gradually, reaching a peak of approximately 1.4 percent in seven months before declining gradually. Output growth troughs at around -3 percent on impact before reaching its nadir at a little over -4 percent two periods later, a considerably shallower contraction than under full information, reflecting the more muted real rate response. However, the cost of this compressed initial response is persistence because each period brings a new terms-

[3]No. 93/2021, Monetary Policy Committee's Decision 8/2021, Bank of Thailand

[4]No. 31/2022, Monetary Policy Committee's Decision 3/2022, Bank of Thailand

[5]Source: Ministry of Commerce, Thailand.

of-trade realization exceeding the Kalman forecast, forcing sequential upward revisions to perceived inflation and further incremental tightening. Inflation consequently declines only slowly, exhibiting a hump-shaped profile—in contrast to the steep front-loaded reversion under full information—while output growth remains depressed for a more prolonged period.

6.2 Asymmetric Information

"Asymmetric" in this case means each agent believes the other perceives the shock as it does, when in fact they perceive the exact opposite. Each agent observes only the on-impact actions of the other, specifically realized inflation and the nominal interest rate, and neither updates its belief about how the other perceives the shock.

Under this scenario (right column of Figure 7), the inflation forecast entering the Taylor rule, $\hat{\pi}^{CB}_{t+1Q}$, is derived from the central bank's information set that differs from that of price-setting firms. This is generated by solving the model once under the central bank's own information regime, producing that regime's equilibrium path of forward-looking inflation, and importing this path as an exogenous input into the solve representing the economy's true equilibrium under firms' actual information. The central bank's forecast is therefore computed as if it does not know that firms' information differs from its own. The first asymmetric case has the central bank with full information and the private sector with limited information (pink), while the reverse case is shown in green.

Under CB Full / PS Limited (pink), the central bank correctly identifies the shock as persistent and tightens aggressively, closely mirroring the full information trajectory. The private sector, however, filters the same observed shock through the Kalman filter and attributes most of it to the transitory component, resetting prices and wages conservatively. Notably, inflation in this case follows a pattern broadly similar to the symmetric limited information case but is shifted upward throughout the horizon. In effect, aggressive tightening bears down on an economy whose price-setters have incorporated relatively little cost-push pressure, implying that output bears a disproportionate share of the adjustment cost while inflation remains persistent. Output growth troughs at just below -5 percent on impact—marginally less than under full information but more than under symmetric limited information—as the aggressive real rate response suppresses demand despite the muted private-sector pricing, before recovering gradually and turning positive after approximately ten months.

Under CB Limited / PS Full (green), the roles reverse. Private agents correctly identify the shock as persistent and reset prices aggressively from the outset, producing a high inflation response on impact of approximately 7 percent. The central bank, however, perceives the shock as largely transitory and leaves the nominal rate nearly flat throughout the horizon at roughly 0.5 percent. Despite this, output growth still drops on impact to around -3.5 percent, as the terms-of-trade shock directly compresses output through the production function. The recovery is nonetheless swift. With no meaningful monetary tightening, the real rate falls as inflation rises, and output growth turns positive earlier than in any other regime. Subsequently, inflation declines gradually from its peak, converging toward approximately 2 percent by the end of the horizon. The central bank's misperception thus produces a distinctive asymmetric outcome. Under this regime, the output cost of the shock is minimized relative to all other regimes, but at the cost of a prolonged period of above-target price pressure that the central bank—mistakenly reading the situation as self-correcting—makes no attempt to address.

To summarize, the identity of the misperceiving agent matters considerably. Both asymmetric information cases produce macroeconomic dynamics that are markedly distinct from each other. When it is the central bank that misreads the shock as transitory, inflation surges sharply while output remains relatively unscathed. When it is instead the private sector that misperceives, output bears the brunt of the adjustment while inflation remains persistently elevated. The two cases thus represent opposite ends of the inflation–output trade-off, underscoring that the consequences of misperception depend critically on *who gets it wrong.*

7 The 2022 Thai Episode: Which Regime Fits Best?

A natural question follows from the analysis in Section 6: which of the four information regimes best characterizes Thailand's 2022 inflation episode? There is no fully satisfactory way to answer this. Structural VARs capable of identifying a comparable terms-of-trade shock face well-known identification critiques, and the model itself is stylized along several dimensions. This section therefore adopts the simplest available metric, the root-mean-squared error (RMSE), while flagging clearly that the resulting ranking should be read as suggestive rather than as a formal model-selection exercise.

For each regime and each of the three observables (inflation, output growth, and the nominal interest rate), I compute the RMSE between the steady-state-adjusted IRFs from the model and the corresponding realized series over the same 24-month window as Figure 7, beginning from the month inflation reached its peak, August 2022.[6] To aggregate across observables, the three RMSEs are combined into a single weighted score, with weights proportional to the inverse of each observable's own sample standard deviation over the window, so that no single series dominates the ranking purely by virtue of its scale. Table 2 reports the results.

The weighted column indicates that symmetric limited information achieves the lowest, and therefore best, overall score, and it is also the best-performing regime on inflation

[6] For the realized series, the steady states of inflation, output, and nominal interest rate are 2.0%, 3.05%, and 0.5%, respectively.

Table 2: RMSE of Model-Implied Impulse Responses against Realized Data

Regime	Inflation	Output Growth	Interest Rate	Weighted
Full Information	2.512	2.161	0.606	0.898
Symmetric Limited Information	2.128	1.492	0.853	0.877
CB Full / PS Limited	2.681	2.072	0.639	0.932
CB Limited / PS Full	3.143	1.427	1.262	1.220

Notes: RMSE computed over the same 24-month window as Figure 7; the weighted column aggregates the three observables' RMSEs using inverse-standard-deviation weights.

specifically. Its advantage is not uniform across all three observables, however. CB Limited/PS Full delivers a marginally lower output-growth RMSE, while on the nominal interest rate both Full Information and CB Full/PS Limited outperform it by a wide margin, with CB Limited/PS Full in fact the worst-performing regime on that particular dimension. Symmetric limited information's advantage is therefore concentrated in inflation and in the weighted aggregate, the two measures most directly tied to this paper's central question. Taken together, this implies that Thailand's 2022 inflation episode is most plausibly characterized by agents who shared a common misperception, treating the energy price shock as partly transitory rather than purely permanent, even though no single regime matches the data uniformly well. If this ranking is taken at face value, it admits at least two interpretations. Either the BOT's communication of the nature of the energy shock was sufficiently effective to anchor private-sector beliefs close to its own, or an energy price shock of this kind is commonly perceived as transitory by both agents. Disentangling these two explanations is left to future research.

A limitation of the paper concerns the treatment of asymmetric information between the central bank and price-setting firms. The central bank's forecast is generated from a separate solve under its own information regime rather than jointly with firms' equilibrium behavior. This deviates from a fully mutually consistent solution appearing in preceding literature. Svensson and Woodford (2004) achieve a joint fixed point for the simpler case where one agent's information nests the other's. More recent work, such as Han (2022), uses the frequency-domain solution method of Han, Tan, and Wu (2022) to jointly solve for the higher-order belief terms that arise across households, firms, and a central bank with non-nested information sets. Under my construction, firms' expectations do not respond to the central bank's forecast errors by construction, so the model can speak to the inflation dynamics that follow once a given information asymmetry is imposed, but not to whether persistent central bank misforecasting could itself de-anchor private inflation expectations. Extending the framework to solve jointly for the relevant higher-order beliefs, along the lines of either approach, is left for future work.

8 Conclusion

This paper asks whether informational frictions can account for the inflation dynamics that followed the 2022 energy price shock in Thailand, using a New Keynesian small open economy model in which agents solve a Kalman-filter signal-extraction problem to infer the persistence of an observed terms-of-trade shock. Four information regimes are compared – full information, symmetric limited information, and two asymmetric cases in which only the central bank or only the private sector misperceives the shock – and the resulting dynamics are evaluated against Thailand's 2022–2023 experience.

Two main findings emerge. First, informational frictions matter for matching the broad contours of the data. Relative to the full-information benchmark, in which inflation and the policy rate both respond immediately and aggressively, the symmetric limited-information regime generates a more gradual, persistent inflation path together with a delayed and more muted rate response, and the RMSE comparison in Section 7 indicates that this regime provides the closest overall match to the 2022 episode, though not on every observable individually. Second, and more novel to this paper, the identity of the misperceiving agent matters as much as the fact of misperception itself. Central bank misperception generates a prolonged inflation surge with relatively contained output costs, while private-sector misperception keeps inflation more contained at the cost of a sharper and more persistent output contraction – two configurations that sit at opposite ends of the same inflation-output trade-off.

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