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

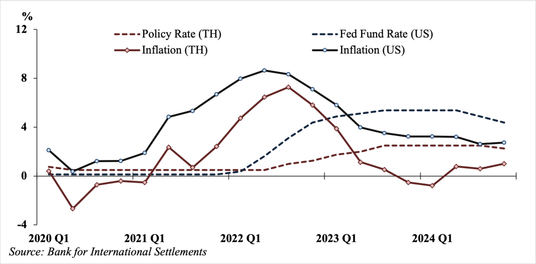
Anat Assoratgoon

Bank of Thailand

August 2026

I am grateful to Professor Kevin Sheedy of LSE for his guidance and supervision, and for providing the baseline framework on which this study builds.

Motivation



Central banks across the globe reacted more slowly to the 2022 inflation surge than conventional policy would suggest, on the grounds that the shock was transitory and should be looked through. Many later admitted the shock was more persistent than expected. Thailand was no exception.

Question: Had the central bank correctly identified the shock's persistence from the outset, would inflation, output, and the policy rate have evolved differently?

Overview

Key Question

- Does agents' imperfect belief formation about the *composition* of an energy price shock affect its inflation pass-through — and if so, does it matter *who* misperceives it?

Framework

- A New Keynesian small open economy model with a signal extraction problem
- Energy prices enter via the terms of trade (the import/export price ratio), which feeds directly into firms' marginal cost and, in turn, output
- Agents observe the terms-of-trade shock but cannot separate its permanent and transitory components, so they must infer them using the Kalman filter
- Four information regimes are compared

Reference Literature

Erceg, Lindé, and Trabandt (2024), *Monetary Policy and Inflation Scares*

Key features:

1. Nonlinear Phillips curve
2. Endogenous price indexation
3. Signal extraction over shock composition

Result: The economic costs of *look-through* policy and *going the last mile* — aggressive late-stage tightening — can be substantial, particularly when the shock is large enough to activate Phillips curve nonlinearities.

Novelty: asymmetric information across the central bank and the private sector

Model Overview

- Framework: small open economy New Keynesian model
- Households: representative household with (internal) habit persistence
- Firms: monopolistically competitive, use imported energy and domestic labor
- Price setting: Calvo pricing
- Wage setting: Calvo wages
- Monetary policy: forecast-based Taylor rule
- Signal extraction: agents observe the terms-of-trade shock but cannot decompose it into its permanent and transitory components; they infer these via the Kalman filter

How Energy Prices Affect the Economy

Two goods: domestic output (Y), and a tradable (export) good (E).

- The tradable good market is perfectly competitive, which implies domestic-currency export prices equal nominal wages.

Firms: a continuum of monopolistically competitive firms produce domestic goods using only imported energy Z_t and domestic labor N_t:

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

where $\alpha =$ the steady-state imported energy share.

How Energy Prices Affect the Economy (Cont.)

- With S_t and W_t denoting imported energy prices and wages, cost minimization implies fixed input shares:

$$Z_t(i) = \alpha\, Y_t(i), \qquad N_t(i) = (1-\alpha)\, Y_t(i)$$

Marginal cost:

$$\text{Nominal:} \quad X_t = \alpha S_t + (1-\alpha) W_t$$

$$\text{Real:} \quad x_t = (1-\alpha+\alpha s_t)\, w_t, \quad \text{where } w_t \text{ is the real wage}$$

The terms of trade $s_t \equiv S_t/W_t$ (the import/export price ratio) is taken as given by the small open economy and directly drives real marginal cost.

How Energy Prices Affect the Economy (Cont.)

Market clearing conditions:

- Goods market: $Y_t = C_t$
- Bond market
- Labor market: $L_t = N_t + E_t$
- *Financial autarky*: balanced trade requires energy imports to be paid for by exports, $W_t E_t = S_t Z_t$, hence $E_t = s_t Z_t$.

The aggregate production function therefore takes the form:

$$Y_t = \frac{L_t}{(1 - \alpha + \alpha s_t)\,\Delta_t}, \qquad \Delta_t \equiv \text{price dispersion}$$

Implication: a terms-of-trade depreciation acts like a negative productivity shock — more labor must be devoted to financing energy imports, leaving less for domestic value added.

The Signal Extraction Problem

The terms of trade decomposes into unobserved permanent and transitory components:

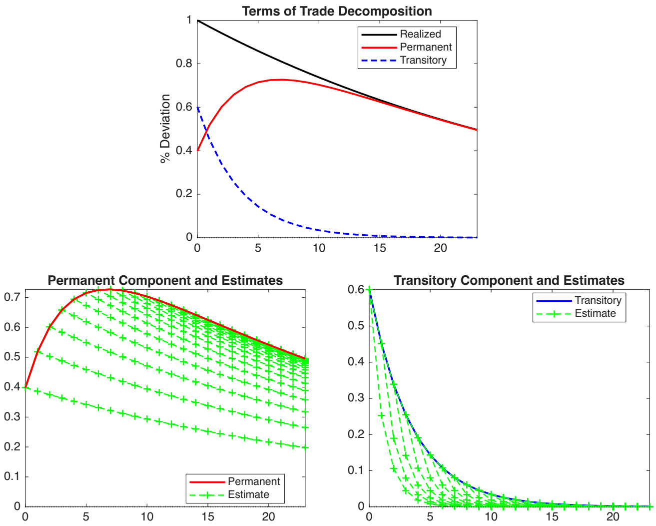
$$s_t = s_t^P + s_t^T, \qquad s_t^i = \rho_i s_{t-1}^i + \sigma_i \varepsilon_t^i, \quad i \in \{P, T\}$$

under the assumption that the transitory component is less persistent and noisier than the permanent one: $\rho_T < \rho_P$ and $\sigma_T \gg \sigma_P$.

Imperfect information: agents observe s_t but cannot separately observe s_t^P and s_t^T. Agents therefore use a Kalman filter to infer both components, applying the Riccati equation (details in the Appendix).

The larger the signal-to-noise ratio (σ_P/σ_T) **– determining how quickly agents learn about the underlying shocks – the more agents consider the shock to be permanent.**

Terms of Trade Decomposition



Why Misperception Matters

Observed energy shock

$\Downarrow$

Believed to be largely temporary

$\Downarrow$

Lower inflation expectations

$\Downarrow$

Lower reset prices

$\Downarrow$

More tame inflation

$\Downarrow$

Smaller rate hike

Log-Linear Model and Monetary Policy

Output:

$$y_t = l_t - \alpha s_t$$

Real marginal cost:

$$x_t = w_t + \alpha s_t$$

IS Curve:

$$y_t = \frac{1}{1+h}\mathbb{E}_t y_{t+1} + \frac{h}{1+h} y_{t-1} - \frac{1-h}{1+h}\sigma\left(i_t - \mathbb{E}_t \pi_{t+1}\right)$$

NKPC:

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \xi x_t \quad \text{where} \quad \xi = \frac{(1-\theta)(1-\beta\theta)}{\theta}$$

Forward-looking Taylor Rule:

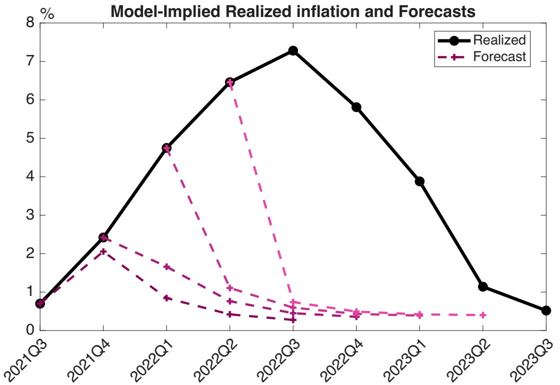
$$i_t = \phi i_{t-1} + (1-\phi)\left(\chi_\pi \mathbb{E}_t \hat{\pi}_{t+1} + \chi_y \hat{y}_t\right)$$

Calibration: to Replicate Thai Data

Parameter	Value	Source
Discount factor β	0.9975	Standard
Elasticity of intertemporal substitution σ	1.0	Standard
Frisch elasticity of labor supply ψ	1.0	Standard
Habit persistence h	0.70	ECM regression
Energy share α	0.0696	NESDC IO Table (2021)
Calvo probability θ	0.818	Apaitan et al. (2018)
Policy inertia ϕ	0.901	Phrommin (2018)
Inflation response χ_π	1.681	Phrommin (2018)
Output response χ_y	0.042	Phrommin (2018)
Persistent shock ρ_P	0.979	AR(1) estimate
Transitory shock ρ_T	0.429	ARMA(1,1) estimate
Signal-to-noise σ_P/σ_T	1/1.89	GMM

Signal-to-noise Ratio Estimation

- **Target:** match model-implied inflation forecast errors to the BOT's actual real-time forecast errors
- **Moments:** 4 vintages (2021Q3–2022Q2) $\times$ 4 quarterly horizons $=$ 16 moments; both series normalized by their 1Q-ahead value $\Rightarrow$ targets *shape*, not scale
- **Estimator:** GMM, identity weighting matrix (too few vintage clusters for a reliable covariance estimate): $\hat{\sigma}_T = \arg\min_{\sigma_T} g(\sigma_T)' g(\sigma_T)$
- **Search & Result:** two-stage grid search, coarse (step 0.1) $\rightarrow$ fine (step 0.01) $\Rightarrow$ $\hat{\sigma}_T = \mathbf{1.89}$



Symmetric Information

are the cases where all agents form identical expectations.

- **Full information:** both the central bank (CB) and the private sector (PS) correctly identify the shock as purely permanent
- **Limited information:** both CB and PS misperceive the composition of the shock in the same way

IS Curve:

$$y_t = \frac{1}{1+h}\mathbb{E}_t y_{t+1} + \frac{h}{1+h} y_{t-1} - \frac{1-h}{1+h}\sigma\left(i_t - \mathbb{E}_t \pi_{t+1}\right)$$

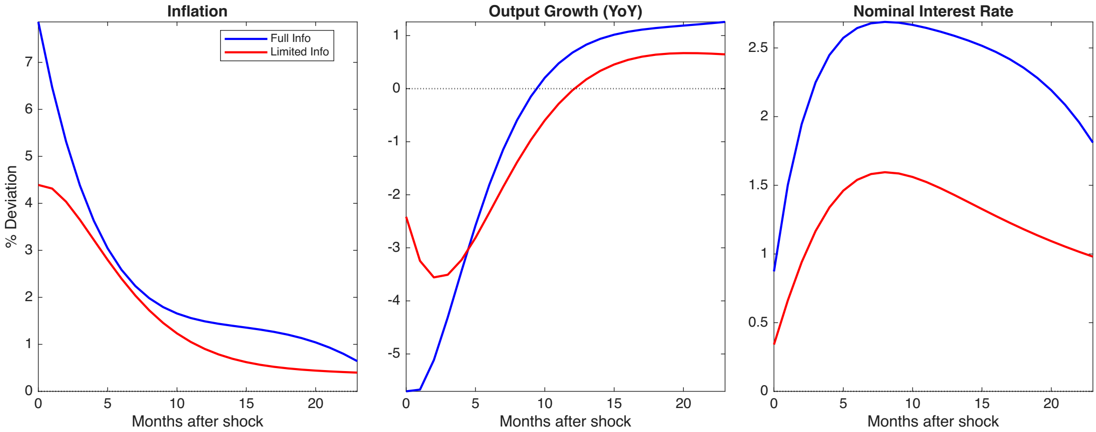
NKPC:

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \xi x_t$$

Taylor Rule:

$$i_t = \phi i_{t-1} + (1-\phi)\left(\chi_\pi \mathbb{E}_t \hat{\pi}_{t+1} + \chi_y \hat{y}_t\right)$$

Main Result: Symmetric Info



are the cases where all agents form different expectations.

- **CB full / PS limited:** the central bank correctly identifies the shock; the private sector does not
- **CB limited / PS full:** the private sector correctly identifies the shock; the central bank does not

CB full/ PS limited

IS Curve:

$$y_t = \frac{1}{1+h}\mathbb{E}_t^{PS} y_{t+1} + \frac{h}{1+h} y_{t-1} - \frac{1-h}{1+h}\sigma\left(i_t - \mathbb{E}_t^{PS}\pi_{t+1}\right)$$

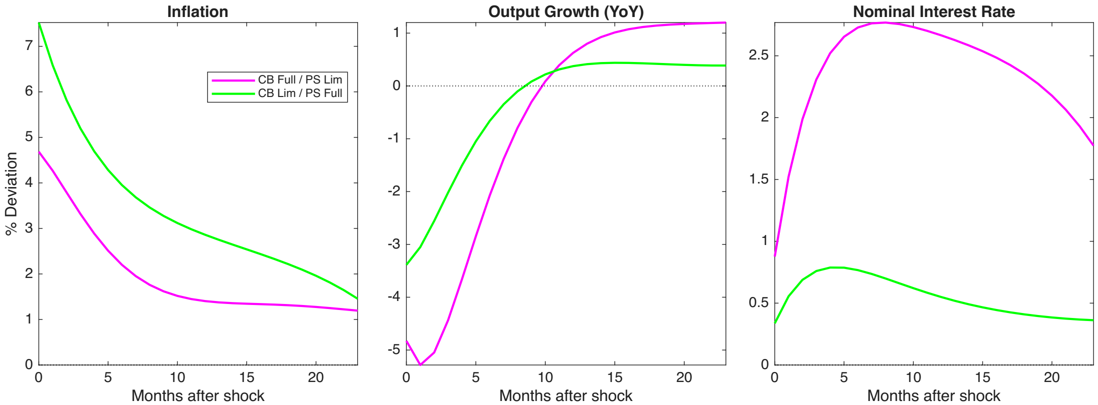
NKPC:

$$\pi_t = \beta\mathbb{E}_t^{PS}\pi_{t+1} + \xi x_t$$

Taylor Rule:

$$i_t = \phi i_{t-1} + (1-\phi)\left(\chi_\pi \mathbb{E}_t^{CB}\hat{\pi}_{t+1} + \chi_y \hat{y}_t\right)$$

Main Result: Asymmetric Info



Who Gets It Wrong?

Central bank misperceives (CB limited / PS full)

- Inflation surges and remains elevated
- Policy tightens little; the nominal rate stays nearly flat
- The output cost of the shock is minimized

Private sector misperceives (CB full / PS limited)

- Inflation is contained relative to the CB-misperceives case
- The central bank tightens aggressively
- Output bears a disproportionate share of the adjustment

Who gets it wrong matters.

Can the Model Account for Thai Data?

More rigorous calibration is needed, but on a rough, RMSE comparison, the 2022 Thai inflation episode is likely characterized by **symmetric limited information**.

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.

The alignment possibly reflects effective CB communication or a salient characteristic of the energy price shock, which is transitory by its nature.

Thank You

Appendix

Appendix: State-Space Representation

Agents observe the total terms-of-trade shock but not its constituent parts. Define the state vector $a_t = (s_t^P, s_t^T)'$:

Observation equation:

$$s_t = \underbrace{\begin{bmatrix} 1 & 1 \end{bmatrix}}_{H'} a_t$$

State transition equation:

$$a_{t+1} = \underbrace{\begin{bmatrix} \rho_P & 0 \\ 0 & \rho_T \end{bmatrix}}_{F} a_t + \underbrace{\begin{bmatrix} \sigma_P & 0 \\ 0 & \sigma_T \end{bmatrix}}_{Q} \begin{bmatrix} \varepsilon_{t+1}^P \\ \varepsilon_{t+1}^T \end{bmatrix}$$

Agents recover s_t^P and s_t^T from the observed history of s_t using the optimal linear (Kalman) filter applied to this state-space system.

Appendix: Kalman Filter Recursions

Updating step, given the prior $\hat{a}_{t|t-1}$:

$$\hat{a}_{t|t} = \hat{a}_{t|t-1} + L_t \left(s_t - H' \hat{a}_{t|t-1} \right)$$

$$L_t = P_{t|t-1} H \left(H' P_{t|t-1} H \right)^{-1}, \qquad P_{t|t} = P_{t|t-1} - L_t H' P_{t|t-1}$$

One-step-ahead forecasting step:

$$\hat{a}_{t+1|t} = F \hat{a}_{t|t-1} + K_t \left(s_t - H' \hat{a}_{t|t-1} \right)$$

$$K_t = F P_{t|t-1} H \left(H' P_{t|t-1} H \right)^{-1}, \qquad P_{t+1|t} = (F - K_t H') P_{t|t-1} (F - K_t H')' + QQ'$$

For horizons $j > 1$ (no new information arrives), the forecast simply decays:

$$\hat{a}_{t+j|t} = F^j \, \hat{a}_{t|t}, \qquad j = 1, 2, \ldots$$

Appendix: Steady-State Gain and the Riccati Equation

- Agents are assumed to hold an infinite history of past observations, so the Kalman gain and error covariance are evaluated at their fixed point:

$$P_{t+1|t} = P_{t|t-1} = P^*$$

- P^* solves the **discrete algebraic Riccati equation**, implying *time-invariant* gain matrices L and K.
- Intuition: agents consistently underestimate the shock at impact (it is initially attributed largely to the noisy transitory component), then revise their beliefs upward each period as the observed value keeps exceeding the forecast — until the permanent and observed series converge (around period 10 in the baseline calibration).