Optimal Monetary Policy with Uncertain Private Sector Foresight

Christopher Gust Edward Herbst David López-Salido

Federal Reserve Board

IMF Advances in Monetary Economics Conference

September 4, 2025

The views expressed in this paper are those of the authors and do not necessarily reflect those of the Board of Governors of the Federal Reserve System or its staff.

Motivation

- **Backdrop:** Persistent post-pandemic inflation revived fears of unanchored long-run expectations ("inflation scares").
- **Key question:** How should a central bank set policy when it is **uncertain** about expectation formation and faces the risk of inflation scares?
- **Punchline:** Optimal policy augments Clarida–Galí–Gertler (1999) *lean-against-the-wind* logic.
  - adds a **forward-looking, pre-emptive** term to guard against scares.
  - uncertainty about expectations makes policy more aggressive on average.

Methodology

- We study optimal discretionary policy in a finite-horizon planning (FHP) model (Woodford, 2018).
- **Planning**: Households and firms plan k periods ahead; beyond k, beliefs about continuation values are averages of past outcomes $\Rightarrow$ vulnerability to inflation scares.
- **Uncertainty**: The population share of short vs. long-horizon agents is time-varying; greater uncertainty **worsens** the inflation–output tradeoff frontier.
- **Policy problem**: Consider optimal policy for dual-mandate CB; has a risk-management motive to pre-empt drift in LR inflation expectations.

Why We Use the NK-FHP Model?

- **Empirical fit.** Estimated NK-FHP fits macro data *and* survey data on expectations well.
  - Better fit than hybrid NK–RE and other behavioral models.
  - Replicates long-run inflation-expectations dynamics in the 1970s–early 1980s.
  - Explains "underreaction then overreaction" in survey inflation forecasts (Angeletos et al., 2020).
- **Mechanism.** Finite planning horizons with longer-run learning $\Rightarrow$ disciplined approach for modeling drift in longer-run expectations.
- **Uncertainty in expectations formation.** Time-varying mix of short- vs. long-horizon agents captures shifts in beliefs and the risk of inflation scares.
- **Policy relevance.** Uncertainty in planning horizons requires an aggressive policy response to preempt drift in LR beliefs.

FHP and Bounded Rationality

- **Within horizon ($t \to t+k$).** Households/firms use all structural relationships to evaluate contingencies over next k periods. *As-if RE* conditional on finite horizon.

- **Beyond horizon (terminal beliefs).** Continuation values $(v_{p,t}, v_{h,t})$ are *learned from past data*, not pinned by the full infinite-horizon model $\Rightarrow$ departure from RE.

- **Beliefs about others.** Agents assume others share their own horizon k (a *common-horizon* belief) $\Rightarrow$ second departure from RE.

- **Policy perception gap.** Agents *perceive* the CB as having k-period horizon; the CB has infinite horizon-RE $\Rightarrow$ wedge between *perceived* and *implemented* policy.

The NK-FHP Model

Agents and planning

Two planner types $k \in \{k_0, k_1\}$ (short/long). At date t, a type-k agent forms a k-horizon plan over $\tau = t, \ldots, t+k$. Use j to denote how far from the end of an agent's planning horizon: $j = 0, 1, \ldots, k$ at $\tau = t+k-j$.

Beliefs within horizon for type-k

$$\pi_\tau^j = \beta\, \mathbb{E}_\tau\, \pi_{\tau+1}^{j-1} + \kappa\, y_\tau^j + u_\tau, \qquad y_\tau^j = \mathbb{E}_\tau\, y_{\tau+1}^{j-1} - \sigma\big(i_\tau^j - \mathbb{E}_\tau\, \pi_{\tau+1}^{j-1} - r_\tau^e\big).$$

End-of-Horizon Beliefs (next slide): at $j{=}0$, (π_{t+k}^0, y_{t+k}^0) are pinned by continuation values v_{pt}, v_{ht}.

Aggregation and uncertainty

$$\pi_t = \omega_t\, \pi_t^{k_0} + (1{-}\omega_t)\, \pi_t^{k_1}, \qquad y_t = \omega_t\, y_t^{k_0} + (1{-}\omega_t)\, y_t^{k_1},$$

with $\omega_t = \omega(m_t)$, where $m_t \in \{0, 1\}$ follows a Markov process (time-varying composition of horizons).

Implication. Multiplicative uncertainty from ω_t breaks certainty equivalence.

Continuation Value Functions, Learning, and Inflation Scares

Terminal beliefs at horizon $t+k$

$$\pi^0_{t+k} = \beta\, v_{p,t} + \kappa\, y^0_{t+k} + u_{t+k}, \qquad y^0_{t+k} = v_{h,t} - \sigma\big(i^0_{t+k} - r^e_{t+k}\big).$$

Updating of Continuation Value Functions

$$\begin{aligned} v_{p,t+1} &= (1-\gamma_p)\, v_{p,t} + \gamma_p\, v^e_{p,t}, \qquad & v^e_{p,t} &= \pi_t, \\ v_{h,t+1} &= (1-\gamma_h)\, v_{h,t} + \gamma_h\, v^e_{h,t}, \qquad & v^e_{h,t} &= y_t + \sigma\, \pi_t. \end{aligned}$$

Interpretation: $v_{p,t}$ is firm's (marginal) continuation value function; $v^e_{p,t}$ represents new estimate coming from firm optimization; Through adaptive learning, persistent high $\pi_t \Rightarrow v_{p,t}$ drifts up $\Rightarrow$ **inflation scare**.

Perceived Monetary Policy

Perceived objective

- Private-sector agents believe the central bank minimizes discounted expected losses over a k-period horizon.
- In short: *as-if* time-consistent optimal policy, but only over $t \to t+k$.

Implied targeting rule

$$y^j_{t+k-j} \;=\; -\frac{\kappa}{\lambda}\,\pi^j_{t+k-j}, \qquad j = 0, \ldots, k-1.$$

Agents forecast a *lean-against-the-wind (LAW)* targeting rule à la CGG.

Perceived shock management

- **Demand shocks:** fully offset—outcomes remain on target.
- **Supply (cost-push) shocks:** contract demand ($y < 0$) to offset inflationary pressure ($\pi > 0$).

Implemented Policy: Modified LAW

Optimal targeting rule (actual CB policy)

$$\pi_t \; + \; \gamma_p \beta \, E_t W_{p,t+1} \; = \; -\frac{\lambda}{\kappa} \, y_t .$$

What is $W_{p,t}$? (incentive to anchor longer-run inflation beliefs)

$$\begin{aligned}
W_{p,t} &:= \text{marginal change in the CB's discounted loss from a unit increase in } v_{p,t}, \\
W_{p,t} &= \beta \, a_{p,t} \, \pi_t \; + \; \beta(1 - \gamma_p + \gamma_p \beta a_{p,t}) \, E_t W_{p,t+1}, \\
a_{p,t} &:= \frac{\partial \, E_t \pi_{t+1}}{\partial v_{p,t}} \quad \text{(sensitivity of near-term inflation to long-run belief).}
\end{aligned}$$

Interpretation

Preemption: If $E_t W_{p,t+1} > 0$, then CB expects belief drift to cause persistent future deviation of inflation. The CB will contract demand ($y_t < 0$) to dampen belief drift and re-anchor expectations.

Estimation Strategy and Policy Analysis

Data & estimation

- **Sample & observables.** U.S. data on output growth, inflation, and the policy rate over 1966Q1-2007Q4.
- **Method.** Bayesian estimation with time-varying parameter, ω_t, fraction of short-horizon planners.

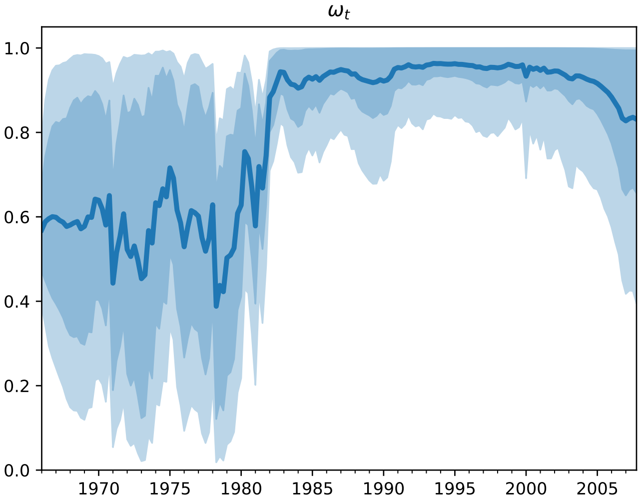
Time-varying planning horizon

- Two planner types with fixed horizons: $k_0 = 4$, $k_1 = 32$ (1y vs. 8y).
- Fluctuations in ω_t shift the economy-wide effective planning horizon over time.

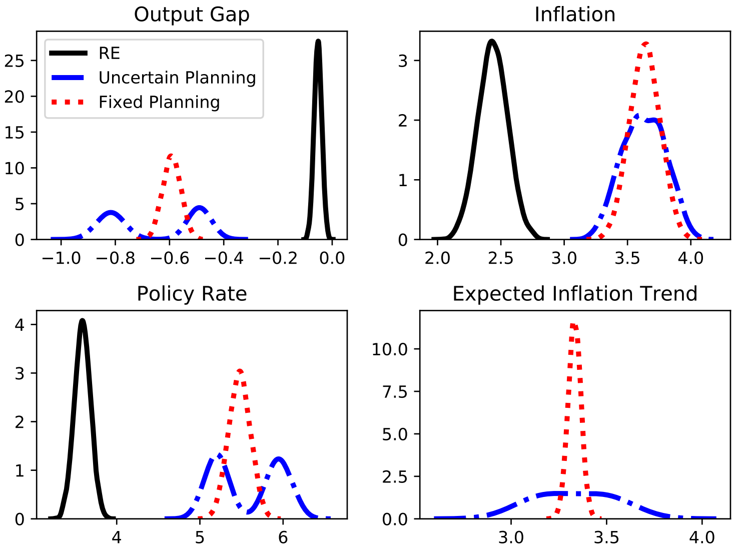
Policy analysis setup

- **Scenario.** March 2023 FOMC SEP: analyze “inflation-scare” risk when it was a concern for policymakers.
- **Design.** Stochastic simulations around shocks chosen to reproduce the SEP medians.

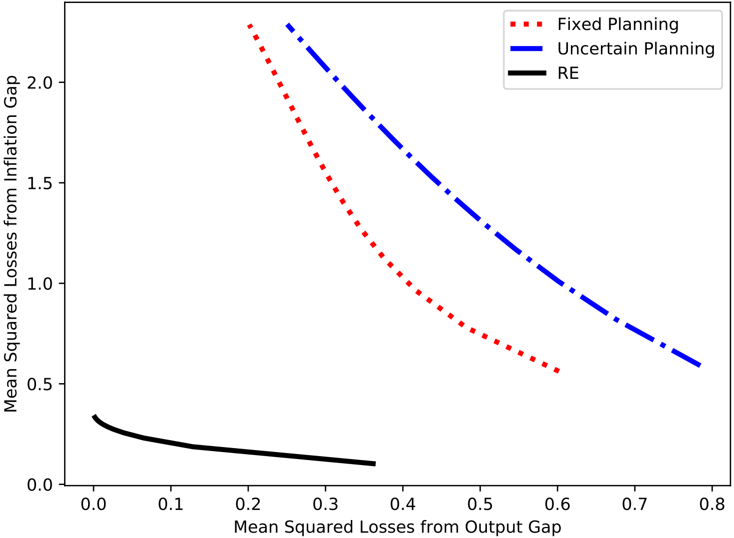
Estimated Fraction of Short-Horizon Planners, ω_t



Distribution of Outcomes under Optimal Discretion



Inflation–Output Variance Frontier



Takeaways

1. FHP + Long-Run Learning: longer-run inflation expectations can drift with realized inflation.

2. Optimal discretion adds a **preemptive term** to LAW of CGG (1999): strengthens anti-inflation stance when scares are plausible.

3. Planning-horizon uncertainty worsens the policy frontier and skews outcome distributions.

4. In the 2023 context, guarding against scares delivers materially lower *expected* losses for CB with dual-mandate objective.