On Robustness of Average Inflation Targeting

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*The views expressed in this presentation are the authors' views and not the views of the Bank of Finland or the Eurosystem

Motivation

- In August 2020, Fed announces new policy framework of average inflation targeting (AIT).

  Powell (2020): "*We will seek to achieve inflation that averages 2 percent over time. ... when inflation has been running below 2 percent, appropriate monetary policy will likely aim to achieve inflation moderately above 2 percent for some time.*"

- Several papers studied AIT under RE.
  - RE is restrictive, especially in times that are outside "normal".
  - Bounded rationality (Budianto et al. 2020); rule-of-thumb (Amano et al. 2020).
  - Expectations and AIT (Coibion et al. 2020; Salle, 2021).

- **Question:** How does AIT perform if there is imperfect knowledge and private agents engage in learning to forecast future?

Preview of Results

Our analysis raises **warning signals** concerning robustness of AIT under conditions of imperfect knowledge:

1. Target equilibrium can be locally unstable under learning.
2. Standard IT policy may outperform AIT at the zero lower bound (ZLB).

Policy Implications:

1. Good communication and weighted average inflation targeting can improve some outcomes.
2. Symmetry matters.
3. We need to think carefully about policy rules.

Example 1: Fisherian Model

- Consider the Fisher relation:

$$\hat{R}_t = \beta^{-1}\hat{\pi}_t^e$$

- $\hat{R}_t$ is the nominal interest rate, β is the subjective discount rate.
- $\hat{\pi}_t^e$ is the expected inflation rate $\hat{\pi}_{t+1}$ in period $t+1$ and formed in period t.

Example 1: Fisherian Model

- **AIT monetary policy:** nominal interest rate is set in response to an average of deviations from inflation target π^*. Linearization around the steady state with π^* is

$$\hat{R}_t = \frac{\psi}{\pi^*} \sum_{k=0}^{L-1} \hat{\pi}_{t-k}.$$

- **Assumptions:**
  1. $\pi^* < \beta\psi$ (**Taylor principle**).
  2. Private agents do not know any details of policy rule (**Opacity**).

Example 1: Fisherian Model

- With opacity about monetary policy, private agents forecast inflation using a simple weighted average of past inflation (steady state learning with constant gain)

$$\hat{\pi}_t^e = \hat{\pi}_{t-1}^e + \omega(\hat{\pi}_{t-1} - \hat{\pi}_{t-1}^e),$$

  where $\omega > 0$ is small.

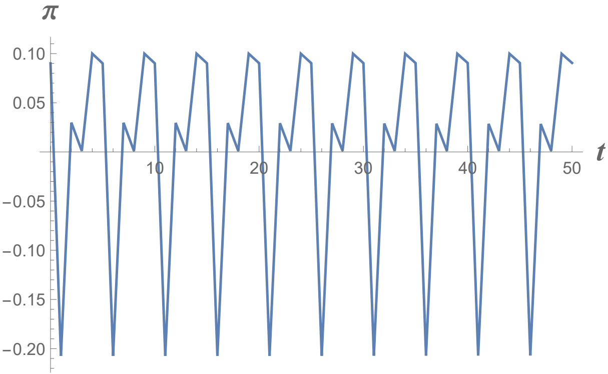
- Temporary equilibrium relation:

$$\hat{\pi}_t = \frac{\pi^*}{\beta\psi}\hat{\pi}_t^e - \sum_{i=1}^{L-1} \hat{\pi}_{t-i}.$$

Remark: *Assume that $\pi^* < \beta\psi$. The steady state π^* is locally stable under the above system if $L \leq 3$ but is explosive if $L = 4$ and for many higher values of L.*

Example 1: Fisherian Model

- Numerical example: $L = 4$ and $\pi^* = 1.005$, $\beta = 0.99$, $\psi = 1.5$ and $\omega = 0.001$.



Example 1: Fisherian Model

What drives instability under AIT?

1. **Makeup:** inflation overshoots after period of undershooting.
2. **Finite data window** ("bygones are bygones") $\rightarrow$ pattern of over-/undershooting.
3. **Opacity:** long-term expectations drift.

We have stability under price level targeting and traditional inflation targeting.

Example 2: New Keynesian Model

- Log-linearized model with Euler equation learning:

$$\begin{aligned} \hat{y}_t &= \hat{y}^e_t - \sigma(\hat{R}_t - \hat{\pi}^e_t) \\ \hat{\pi}_t &= \beta \hat{\pi}^e_t + \kappa \hat{y}_t \\ \hat{R}_t &= \psi \sum_{k=0}^{L-1} \hat{\pi}_{t-k}. \end{aligned}$$

  where $\hat{y}$ is the output gap. κ is decreasing in price rigidity.

- Steady state learning with constant gain:

$$\begin{aligned} \hat{\pi}^e_t &= \hat{\pi}^e_{t-1} + \omega(\hat{\pi}_{t-1} - \hat{\pi}^e_{t-1}) \\ \hat{y}^e_t &= \frac{1-\beta}{\kappa} \hat{\pi}^e_t \end{aligned}$$

Example 2: New Keynesian Model

- Temporary equilibrium relation is

$$\hat{\pi}_t = \frac{\kappa^{-1} + \sigma}{\kappa^{-1} + \sigma\psi}\hat{\pi}_t^e - \frac{\sigma\psi}{\kappa^{-1} + \sigma\psi}\sum_{k=1}^{L-1}\hat{\pi}_{t-k}.$$

  Flexibility as $\kappa \to \infty$ then instability.

- For any κ

$$\hat{\pi}_t = \frac{1 - \kappa\sigma\omega(\psi - 1)}{\kappa\sigma\psi + 1}\hat{\pi}_{t-1} - \frac{\omega\kappa\sigma\psi}{1 + \kappa\sigma\psi}\sum_{k=2}^{L}\hat{\pi}_{t-k} + \frac{\kappa\sigma\psi(1-\omega)}{\kappa\sigma\psi + 1}\hat{\pi}_{t-L}.$$

  - When prices are very sticky (κ is small), small ω

$$\hat{\pi}_t \approx A\hat{\pi}_{t-1}$$

  with A slightly smaller than 1 (given small ω).

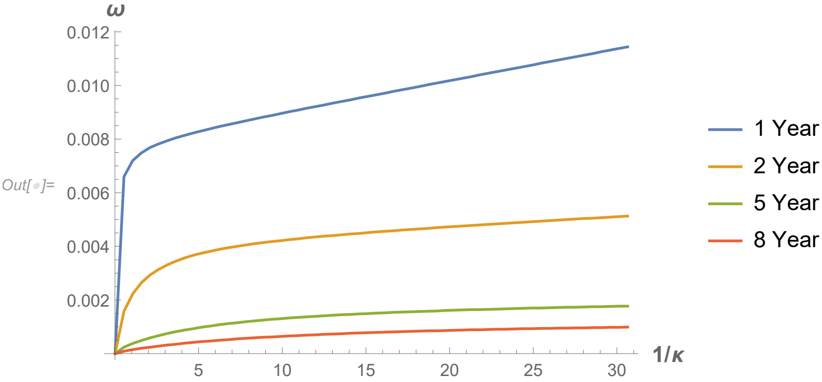
Formal Analysis

We develop a non-linear New Keynesian model with infinite horizon learning agents and AIT and investigate the following:

1. Stability of the target equilibrium under constant-gain learning with opacity.
2. The importance of discounting past inflation data.
3. The importance of communication near the target and at the ZLB.
4. The importance of symmetry.

#1. Stability of the Target Equilibrium

- Flexible prices $\implies$ instability of target equilibrium for $L \geq 4$.
- With sticky prices, target is not **robustly stable**.



- Estimates of gain parameter: $\omega \in [.002, .04]$.

#2. Weighted Average Inflation Targeting

1. A discounted average inflation target modestly improves stability outcomes:

$$R_t \equiv 1 + \max[\bar{R} - 1 + \psi_p \left[\sum_{i=0}^{L-1} \mu^i \left(\frac{\pi_{t-i}}{\pi^*} - 1\right) \right] + \psi_y [\frac{y_t}{y^*} - 1], 0],$$

   where $0 < \mu < 1$.

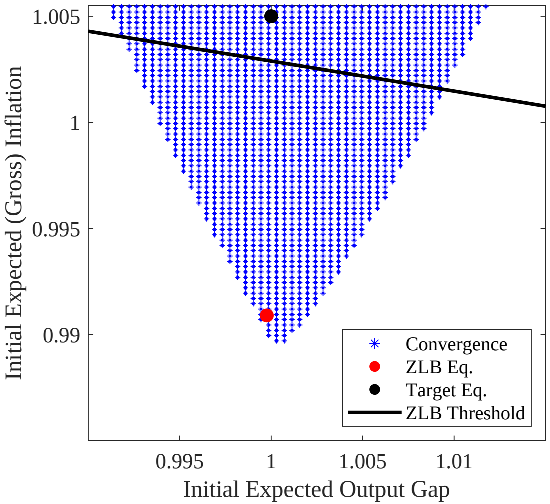
2. An exponential moving average inflation target may destabilize expectations:

$$\begin{aligned} R_t &= 1 + \max[\bar{R} - 1 + \psi_p \left(\frac{\pi_t^{w_c} (\pi_t^{cb})^{1-w_c}}{\pi^*} - 1 \right), 0] \\ \pi_t^{cb} &= \pi_{t-1}^{w_c} (\pi_{t-1}^{cb})^{1-w_c} \end{aligned}$$

   where $0 < w_c < 1$.

#3. Importance of Communication

- If agents understand L, then the target is more robustly stable.
- At ZLB, traditional inflation targeting is about as effective.



#4. Symmetry vs. Asymmetry

- Consider the following asymmetric AIT rule;

$$R_t = 1 + \max[\bar{R} - 1 + \psi_p[\mathcal{P}_t - 1] + \psi_y[(y_t - y^*)/y^*], 0],$$

$$\mathcal{P}_t = \begin{cases} \prod_{i=0}^{L-1} (\pi_{t-i}/\pi^*) & \text{if } \prod_{i=1}^{L} \pi_{t-i} < (\underline{\pi})^L \\ \pi_t/\pi^* & \text{if } \prod_{i=1}^{L} \pi_{t-i} \geq (\underline{\pi})^L, \end{cases}$$

- $\underline{\pi} < \pi^* \implies$ robust stability under asymmetric AIT rules.

Escaping the ZLB

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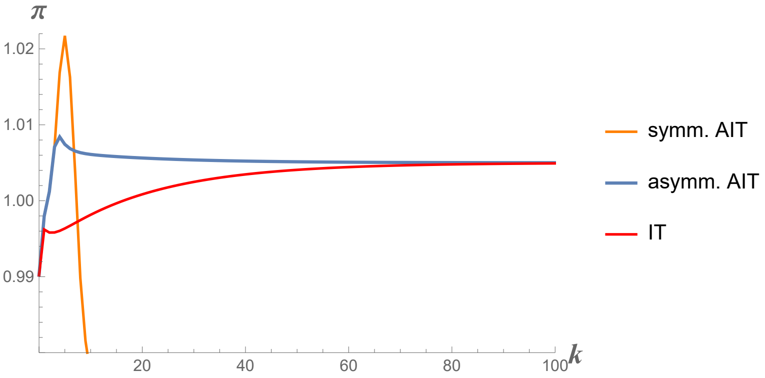

Conclusion

- Policymakers should be cautious when implementing AIT.
- Stability of target steady state under learning is not robust.
- Structural information to private agents, discounting older data, or asymmetric rules are useful to mitigate the problem.
- **Extensions:**
  - Imperfect and evolving credibility after new regime is introduced.
  - Asymmetric and switching rules.