Discussion of "Optimal Monetary Policy with $r^* < 0$ by Billi/Galí/Nakov

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Sep 23, 2022

Setting: NK model with $r^* < 0$

NKPC:	π_t	$= \beta E_t \pi_{t+1} + \kappa y_t$
IS:	y_t	$= E_t y_{t+1} - \frac{1}{\sigma}[i_t - E_t \pi_{t+1} - r_t^n]$
ZLB:	i_t	≥ 0
Natural rate:	r_t^n	$= r^* + z_t,\ r^* < 0, z_t$stationary.
Welfare:		$\frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t (\pi_t^2 + \vartheta y_t^2)$.

Flex-price steady state efficient.

Optimal policy and implementation

Optimal policy: (1) the steady state

- What is socially costly?
  - Working too much ($mrs > mrt$).
  - Price dispersion.

- Price dispersion linked to level of inflation (no indexation).
- NKPC: one-to-one mapping between inflation and output.

- Optimal policy: keep π as close to 0 as possible.

- Fisher equation $\pi_{ss} = i_{ss} - r^*_{ss} = i_{ss} + x$.

- To minimize social costs, set $i_{ss} = 0$.

Results for the steady state c'td

- $\pi_{ss} = -r^* > 0$.
- $y_{ss} = \frac{1-\beta}{\kappa}\pi_{ss} > 0$ (if NKPC not vertical in LR).

Optimal policy: (2) the transition

- Realize in $t = 0$ that $r^* < 0$
- Reoptimize (not bound by past commitment)

Optimal policy: (2) the transition cont'd

- iterate NKPC forward: $\pi_t = \kappa \left[y_t + \beta E_t y_{t+1} + ... + \beta^{T-1} E_t y_{t+T-1} \right] + \beta^T E_t \pi_{t+T}$
- Inevitable to let π rise above 0 eventually..
- But push inflation out to the future as much as is possible.
- Short-term recession (or smaller boom)

An example

- Central bank controls economic activity (IS).
- Suppose it sets interest rate such that

$$y_t = y_{ss} + \alpha^t (y_0 - y_{ss}),$$

  $y_0 < y_{ss}$, $\alpha \in (0, 1)$.
- Then (NKPC)

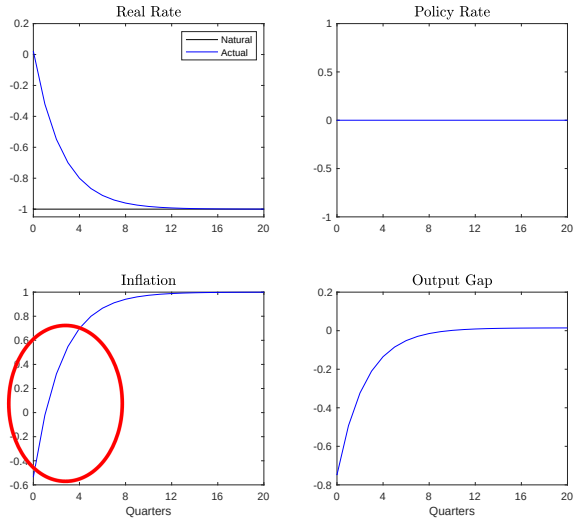
$$\pi_t = \pi_{ss} + \frac{\kappa}{1 - \beta\alpha}(y_t - y_{ss}).$$

An example cont'd

- And

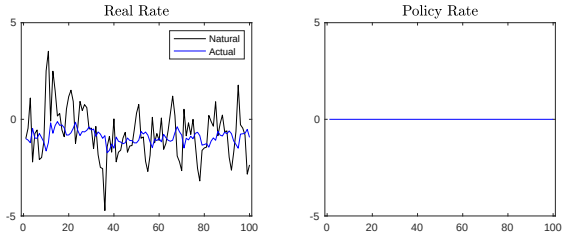
$$i_t = (y_t - y_{ss}) \left[\underbrace{\frac{\kappa\alpha}{1-\beta\alpha}}_{\text{expected inflation}} - \underbrace{(1-\alpha)}_{\text{output growth}} \sigma \right]$$

- Keep inflation low $\Rightarrow y_t < y_{ss}$.
- Term in square brackets strictly increasing in α (persistence).
- Since $i_t \overset{!}{\geq} 0$ (ZLB), if $y_t < y_{ss}$ upper bound on persistence
- Note that for α such that $[...] = 0$ (expected inflation and output growth just balance), can choose arbitrary y_0 – and have $i_t = 0$ always.



Discretionary policy would have short-term inflation bias.

Optimal policy: (3) with business cycle shocks



- **Question 1: What is wrong with the buffer logic?**

Optimal policy: (4) implementation

- Constant interest rates $\Rightarrow$ indeterminacy.
- Which simple rule could uniquely implement the Ramsey-optimal outcome?
- Set

$$i_t = \phi_\pi |\pi_t - \pi_t^{opt}| + \phi_y |y_t - y_t^{opt}|$$

- Paper shows sufficient conditions for local determinacy.
- These are satisfied if $\phi_y >> 0$.

Optimal policy: (4) implementation cont'd

$$i_t = \phi_\pi |\pi_t - \pi_t^{opt}| + \phi_y |y_t - y_t^{opt}|, \ \phi_y >> 0$$

- **Question 2: What is the economic rationale?**
- Positive non-fundamental shock: suppose expect non-fundamental output boom. Would come with higher inflation (NKPC), and higher inflation expectations (thus, lower real rate). If CB raises nominal rate enough, makes sure to invalidate expectations of a boom.
- Negative non-fundamental shock: CB *raises* rate if recessionary beliefs. That is, raises real rates ever further. Renders any (finite) recessionary expectation irrational, saying

  "whatever bad you believe, I will make sure that things will turn out even worse."

  Boundedness rules out ever worse outcomes; this renders equilibrium determinate.

Optimal policy: (4) implementation cont'd

$$i_t = \phi_\pi |\pi_t - \pi_t^{opt}| + \phi_y |y_t - y_t^{opt}|,\ \phi_y >> 0$$

- Logic not constrained to the case $r_t^n < 0$ or to indexing to the optimal π_t, y_t.
- That is, determinacy would hold with and without ZLB.
- **Question 3: Link to NK model with symmetric response**
- In the NK model, with symmetric policy, we typically focus on $\phi_y > 0$.
- Note that $\phi_y << 0$ also prevents AR(1) sunspots (same logic as above).

Optimal policy: (4) implementation cont'd

- **Question 4: Nominal indeterminacy and positive output deviation**.
- NK model with symmetric rule: $\phi_y \to \infty$ rules out real indeterminacy, but *nominal* indeterminacy?
- Why does $\phi_y >> 0$ rule out real *and* nominal indeterminacy here?
- Explanation for the output boom branch?

super-interesting paper