The drifting natural rate of interest and optimal inflation

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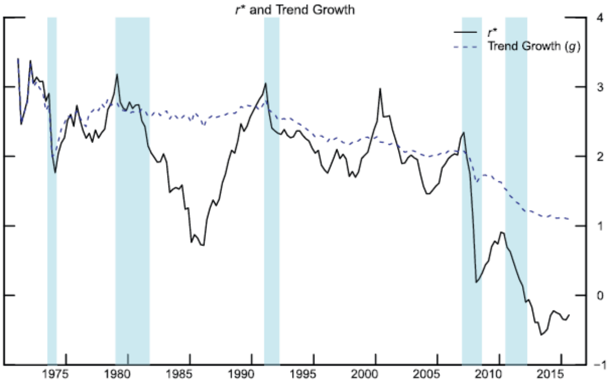
Empirical finding: the long-run natural rate is time-varying and has decreased

Estimated long-run natural rate for the Euro Area (straight line)



Source: Holston et al. 2017 (828 google scholar citations)

The decline in $(r^n)_t^L$ raises concerns for the conduct of MP

- It makes the interest rate policy less effective
- Several CBs have recently introduced new MP frameworks (e.g., the Fed in August 2020, the ECB in July 2021)

"As monetary policy everywhere has approached the lower bound, all major central banks have faced questions about their policy space and the traction of their tools on the economy. ***A key challenge has been the long-term fall in estimates of the natural interest rate.[...] we have to reflect on what will happen if natural rates remain low and inflation stays subdued*** *[...]"*

Speech by Christine Lagarde on 30th September, 2020

This paper

- Research questions
  1. What are the optimal monetary policy implications of permanent shocks to $(r_t^n)^L$?
  2. Would a simple price level targeting rule à la Eggertsson and Woodford (2003) work poorly, once we account for fluctuations in $(r_t^n)^L$?

- NK DSGE model + ELB constraint + optimal commitment

- Departure from the optimal MP literature:
  - treasury bonds have specific attributes relative to other assets
  - the TFP growth rate has a stochastic trend
    - $\Rightarrow$ $(r_t^n)^L$ is time-varying
  - numerical solution method: projection
    - $\Rightarrow$ effect of the ELB on expectations

Preview of the results

1. What are the optimal monetary policy implications of permanent shocks to $(r_t^n)^L$?
   - the optimal rate of inflation increases in response to permanent negative shocks to $(r_t^n)^L$ once this drifts below 1%
     - forward guidance gains importance as a policy tool
     - the SS value of the rate of inflation becomes positive

2. Would a simple price level targeting rule work poorly, once we account for fluctuations in $(r_t^n)^L$?
   - No!
   - A linear time trend benefits the economy when $(r_t^n)^L$ can drift towards zero
     - helps mitigating recessions after negative RR shocks
     - involves weaker expansions after positive RR shocks

Content

Literature review

- Estimation of $(r^n)_t^L$ and determinants of its decline

  *Laubach & Williams (2003), Laubach & Williams (2016), Holston et al. (2017), **Fiorentini et al. (2018)**, Carvalho et al. (2016), Gagnon et al. (2016), **Del Negro et al. (2017)***

- Optimal rate of inflation

  *Woodford (2003), **Adam & Billi (2006)**, Nakov (2008), Levin et al. (2010), Schmitt-Grohe & Uribe (2011), **Andrade et al. (2018)**, **Eggertsson & Woodford (2003)**,* **Billi et al. (2022)**

3. A modified NK DSGE model

Departure from the standard NK model, e.g., AB (2006)

- The long run TFP growth rate is time varying

⇒ TFP follows an integrated process of order 2

$$\log(A_t) = \log(A_{t-1}) + \xi_t \qquad \xi_t = \xi_{t-1} + \psi_t \qquad \psi_t = \sigma_\psi \varepsilon_{\psi,t}$$

where $\varepsilon_{\psi,t}$ follows a truncated standard normal (TSN) distribution between $\varepsilon_{\psi,L}(t-1)$ and $\varepsilon_{\psi,H}(t-1)$

- Treasury bonds have specific attributes relative to other assets

⇒ People derive utility from their real bond holdings relative to everyone else (Michaillat & Saez 2021)

$$U_{jt}\left(C_{jt}, H_{jkt}, \frac{M_{jt}}{P_t}\right) = \bar{C}_t\left[\log C_{jt} + v\left(\frac{M_{jt}}{P_t} - \frac{M_t}{P_t}\right) - \int_0^1 g(H_{jkt})dk\right]$$

Aggregate relations and policy constraint

$$\tilde{x}_t = (1 - \Delta^m)\left[\mathrm{E}_t \tilde{x}_{t+1} - (\breve{i}_t^m - \mathrm{E}_t \pi_{t+1} - (r_t^n)^S)\right] \quad (1)$$

$$\pi_t = \kappa \tilde{x}_t + \beta \mathrm{E}_t \pi_{t+1} \quad (2)$$

$$\breve{i}_t^m \geq -(r_t^n)^L \quad (3)$$

where $(r_t^n)^S = \bar{\delta}_t + \mathrm{E}_t \psi_{t+1}$ and $(r_t^n)^L = -\log \beta + \xi_t + \log(1 - \Delta^m)$

Permanent negative real rate shocks can have a quite strong destabilizing effect because

- they affect negatively the LR value of the policy rate
- which reduces the space for the interest rate policy
- which amplifies recessions
- which affects negatively expectations in the long run
- which further reduces the LR value of the policy rate

4. Some results

Experiments

$$r_t^n = -\log\beta + \xi_t + \log(1 - \Delta^m) + \bar{\delta}_t + \mathrm{E}_t\psi_{t+1}$$

- Focus on a calibration such that $(r_t^n)^L \in [\frac{0}{400}, \frac{2}{400}]$ with an unconditional mean of 1%

⇒ consistent with recent empirical estimates for both the US and the EA (Holston et al. 2017; Fiorentini et al. 2018)

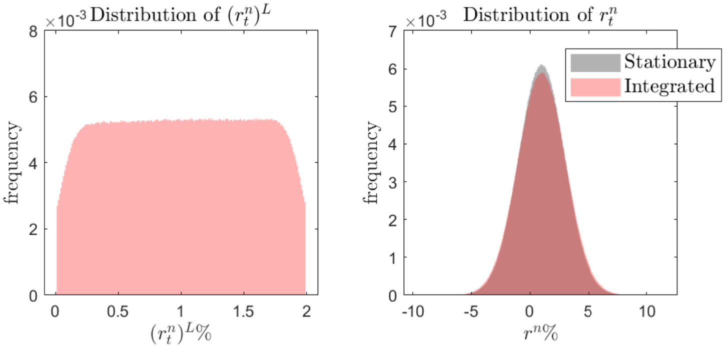
1. Optimal MP implications of shocks to $(r_t^n)^L$
2. Implementation of optimal MP: a simple GAPL targeting rule (Eggertsson & Woodford 2003)

GAPL: $\tilde{P}_t \equiv \log p_t + \frac{\lambda}{\kappa}\tilde{x}_t$

Target: $P_t^* = P_{t-1}^* + \pi^*$ with $\pi^* = \chi \cdot \sigma_\psi$

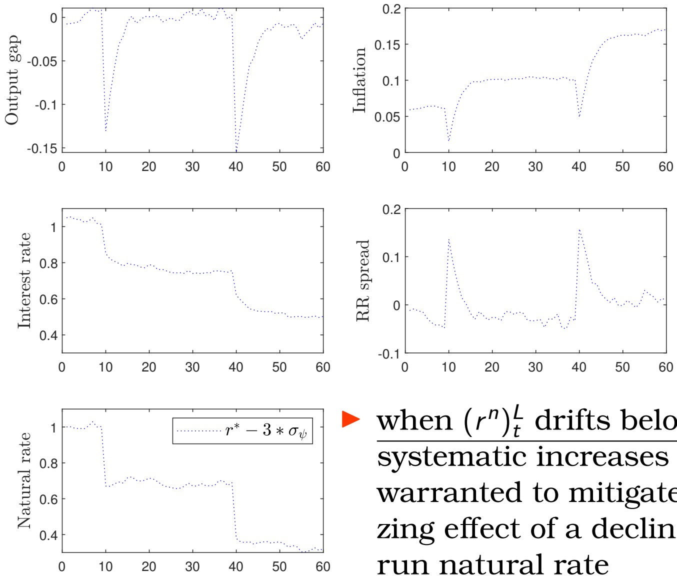
⇒ main features of the OSPLT rule: $\pi^* > 0$; yields a 64% higher unconditional welfare loss

(Unconditional) Distribution of the natural rate of interest



Optimal MP: IRFs to shocks to $(r_t^n)^L$

1% 0.5%



- when $(r^n)_t^L$ drifts below 1%: systematic increases in π^* become warranted to mitigate the destabilizing effect of a decline in the long run natural rate

Conclusion

- Contribution: to analyze the optimal MP commitment and its implementation in an environment where $(r_t^n)^L$ is time-varying and can drift towards zero

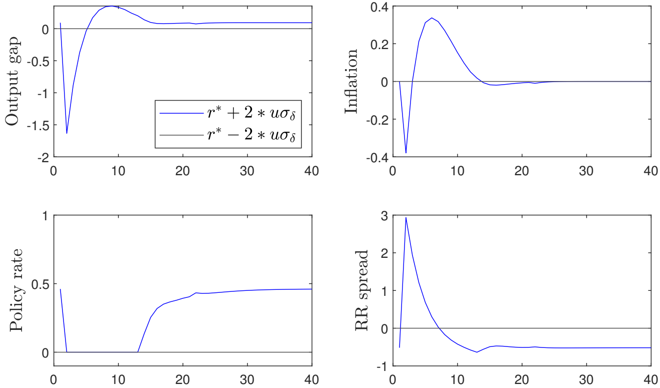
- Main results:
  1. the optimal inflation rate should increase in response to permanent negative shocks to $(r_t^n)^L$ once this drifts below 1%
     - forward guidance gains importance as a policy tool
     - the SS value of the rate of inflation becomes positive
  2. a simple price level target continues to provide a reasonably good approximation to optimal policy
  3. a linear time trend benefits the economy when $(r_t^n)^L$ can drift towards zero
     - helps mitigating recessions after negative RR shocks
     - involves weaker expansions after positive RR shocks

Thank you!

Appendix

Deterministic IRFs to temporary real rate shocks conditional on $(r_t^n)^L = 1\%$

Back



Deterministic IRFs to temporary real rate shocks conditional on $(r_t^n)^L = 0.5\%$

Back