The Optimal Inflation Target and the Natural Rate of Interest[1]

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December 2019

[1] The views expressed here do not necessarily represent those of the Banque de France, the Eurosystem, the Federal Reserve Bank of Boston or the Federal Reserve System.

Motivation

- Evidence of a decline in r^*
- Implications for monetary policy $\Rightarrow$ higher ZLB incidence, given an unchanged monetary policy rule (including inflation target)
- Calls for a higher inflation target (Ball, Blanchard, Williams,...)

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- This paper: Is a higher inflation target desirable? *How much* higher?

- *quantitative* analysis of the optimal inflation target (π^*) as a function of the steady state real rate (r^*)
- based on an estimated NK model of the US and EA economies
- focus on the role of *parameter uncertainty*

Related literature

- *Quantitative analyses of* π^*: Khan et al. (2003), Schmitt-Grohé and Uribe (2010), Amano et al. (2009), Carlsson and Westermark (2016), Bilbiie et al. (2014), Ascari et al. (2015), Adam and Weber (2019), Lepetit (2018),...
- *Quantitative analyses of* π^* *with a ZLB constraint*: Coibion et al. (2012), Dordal-i-Carreras et al. (2016), Kiley and Roberts (2017), Blanco (2016),...
- Our main contributions:

  (i) explicit analysis of the relation between r^* and π^*
  (ii) optimization under parameter uncertainty

- Main caveat: analysis "within the model"

The Model

- Medium-scale NK model
- Staggered price and wage setting à la Calvo
- Imperfect indexation of prices to lagged price inflation; and of wages to lagged price inflation and productivity.
- Shocks: risk premium, marginal utility of consumption, technology, monetary policy, price and wage markups
- Trend growth $\Rightarrow r^* = \rho + \mu_z$
- Monetary policy rule:

$$i_t = \max\{i_t^n, 0\}$$

where

$$i_t^n = (1-\rho_i)i + \rho_i i_{t-1}^n + (1-\rho_i)\left[a_\pi(\pi_t - \pi) + a_y(y_t - y_t^n)\right] + \zeta_{r,t}$$

with $i = r^* + \pi$ and where π defines the *inflation target*

Solution, Calibration, Estimation

- Linearized model with occasionally binding ZLB (Bodenstein et al, Guerrieri and Iacoviello)
- Calibrated parameters: $1/\phi = 0.7$; $\theta_p = 6$; $\theta_w = 3$
- Remaining parameters estimated using Bayesian approach on the model without ZLB and sample period 1985Q2-2008Q3
- Gaussian priors for (ρ, μ_z, π) with means consistent with inflation, GDP growth and real rate averages.
- Vector of observables:

$$x_t = [\Delta \log GDP_t, \Delta \log GDP\ Deflator_t, \Delta \log Wage_t, Short\ term\ rate_t]$$

The Case of No Parameter Uncertainty

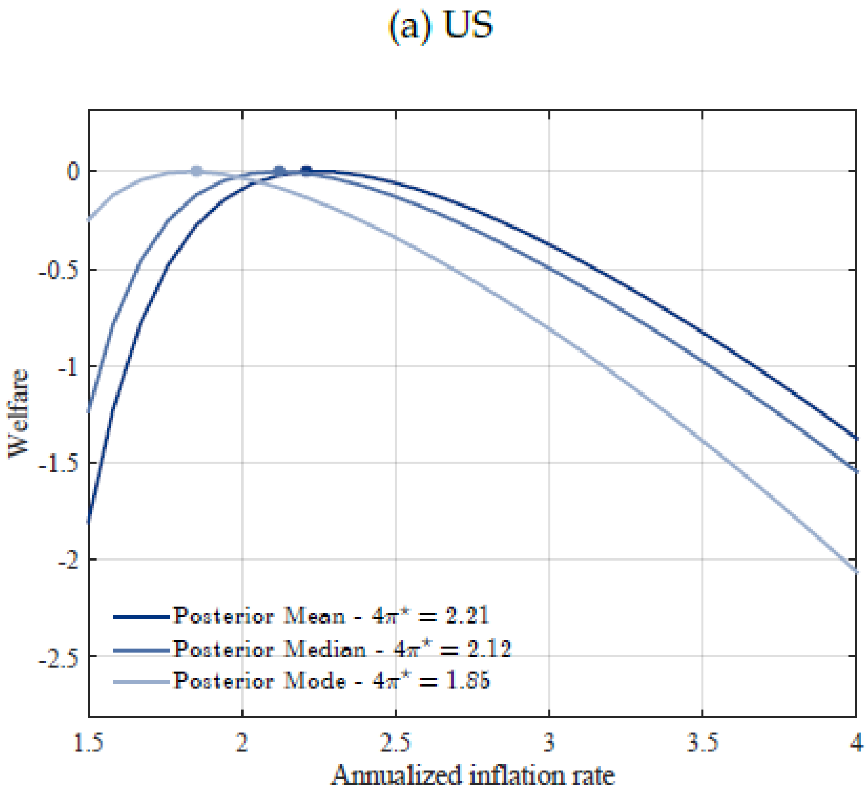
- Second order approximation to household expected utility: $\mathcal{W}(\pi;\theta)$
- The Optimal Inflation Target

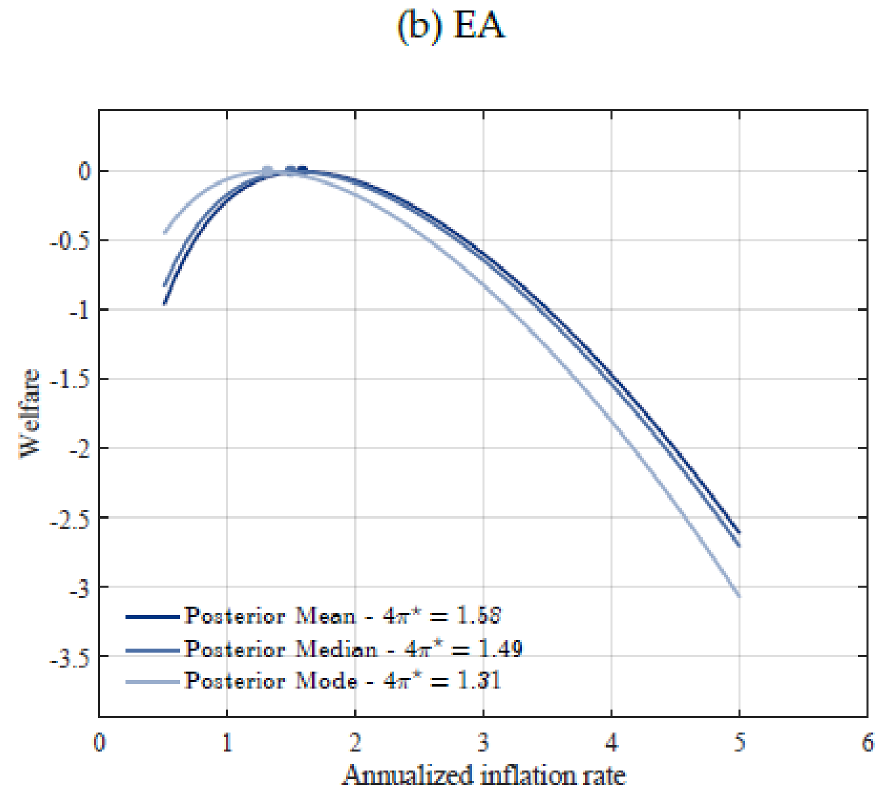
$$\pi^*(\theta) = \arg\max_{\pi} \mathcal{W}(\pi;\theta)$$

with solution obtained via numerical simulations of the estimated model, and with θ taken to be the *mean*, the *median* or the *mode* of the posterior distribution of parameter estimates

Welfare Losses and the Inflation Target

No Parameter Uncertainty





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- The *optimal inflation target*

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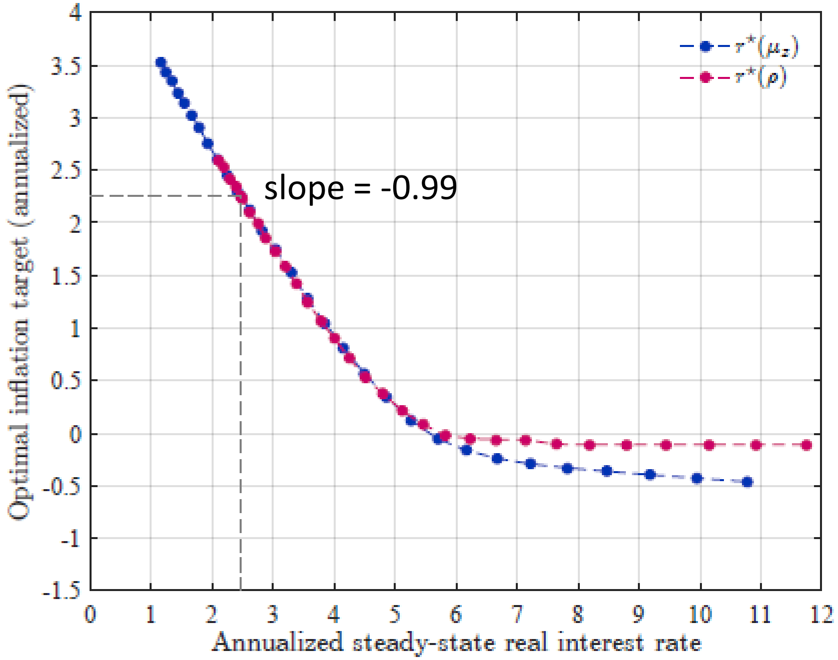
- The baseline (r^*, π^*) relation:

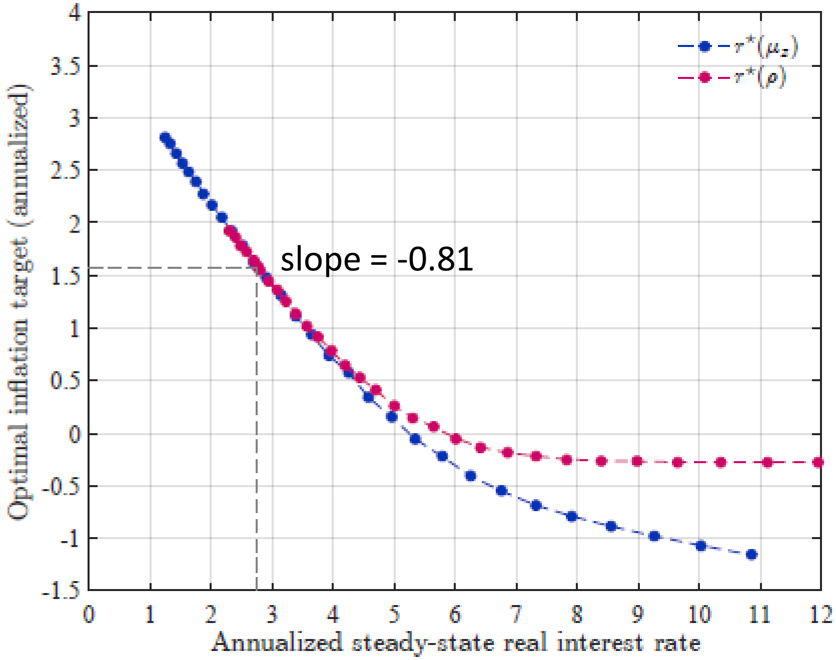
(a) varying μ_z
(b) varying ρ
while keeping other parameters constant

The (r*, π*) Locus
(at the posterior mean)

(a) US



(b) EA



The Case of Parameter Uncertainty

- The optimal inflation target under parameter uncertainty:

$$\pi^{**} = \arg\max_{\pi} \int_{\theta} \mathcal{W}(\pi;\theta) p(\theta | X_T) d\theta$$

$$\pi^{**}_{US} = 2.40\% \quad ; \quad \pi^{**}_{EA} = 2.20\%$$

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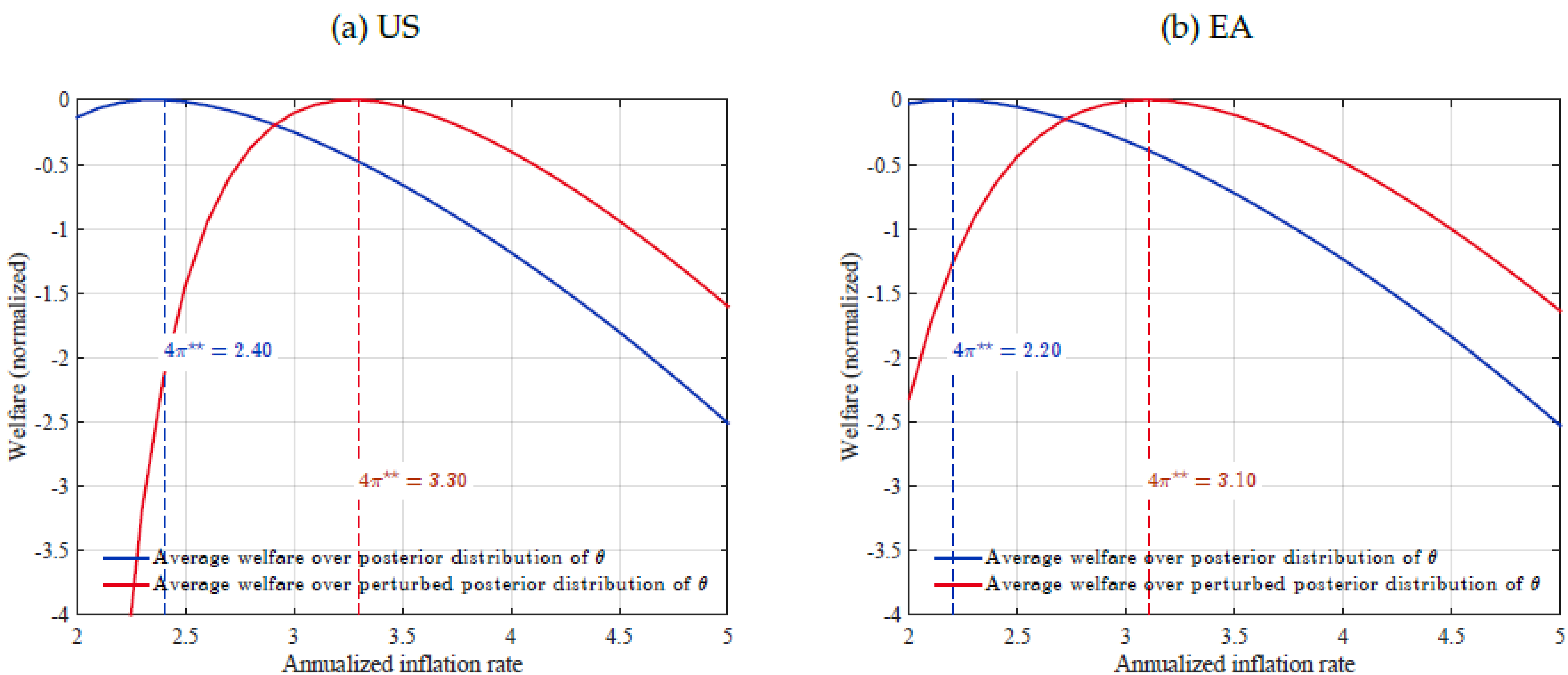
- Optimal inflation target after a shift of -1% shift in the mean of $r^*(\theta)$

$$\pi^{**}_{\Delta} = \arg\max_{\pi} \int_{\theta_\Delta} \mathcal{W}(\pi;\theta_\Delta) p(\theta_\Delta|X_T) d\theta_\Delta$$

Impact on Welfare of a Downward Shift in $r^*(\theta)$ under Parameter Uncertainty



Robustness

- Larger shocks: $+30\%$ increase in standard deviation of risk premium and preference shocks.
- Alternative steady state price markups: $\theta_p \in \{3, \mathbf{6}, 10\}$
- Alternative steady state wage markups: $\theta_w \in \{1.5, \mathbf{3}, 8\}$
- Alternative degrees of indexation
- Negative Effective Lower Bound: $i_t \geq -0.4$
- Traditional Taylor rule (no inertia, 4Q inflation)
- Inertial rule with lagged actual rate (no shadow rate)

Robustness to Two "Unconventional Policies"

- Shadow rate rule with *higher inertia* coefficient ("lower for longer")
- *Price level targeting* rule:

$$i_t^n - i = \rho_i(i_{t-1}^n - i) + (1-\rho_i)\left[a_p(p_t - p_t^*) + a_y(y_t - y_t^n)\right] + \zeta_{r,t}$$

where $p_t^* = p_0 + \pi \cdot t$ and $a_p \in \{0.1, 0.5\}$

Figure 15: $(r^{\star}, \pi^{\star})$ relation with alternative ρ_i

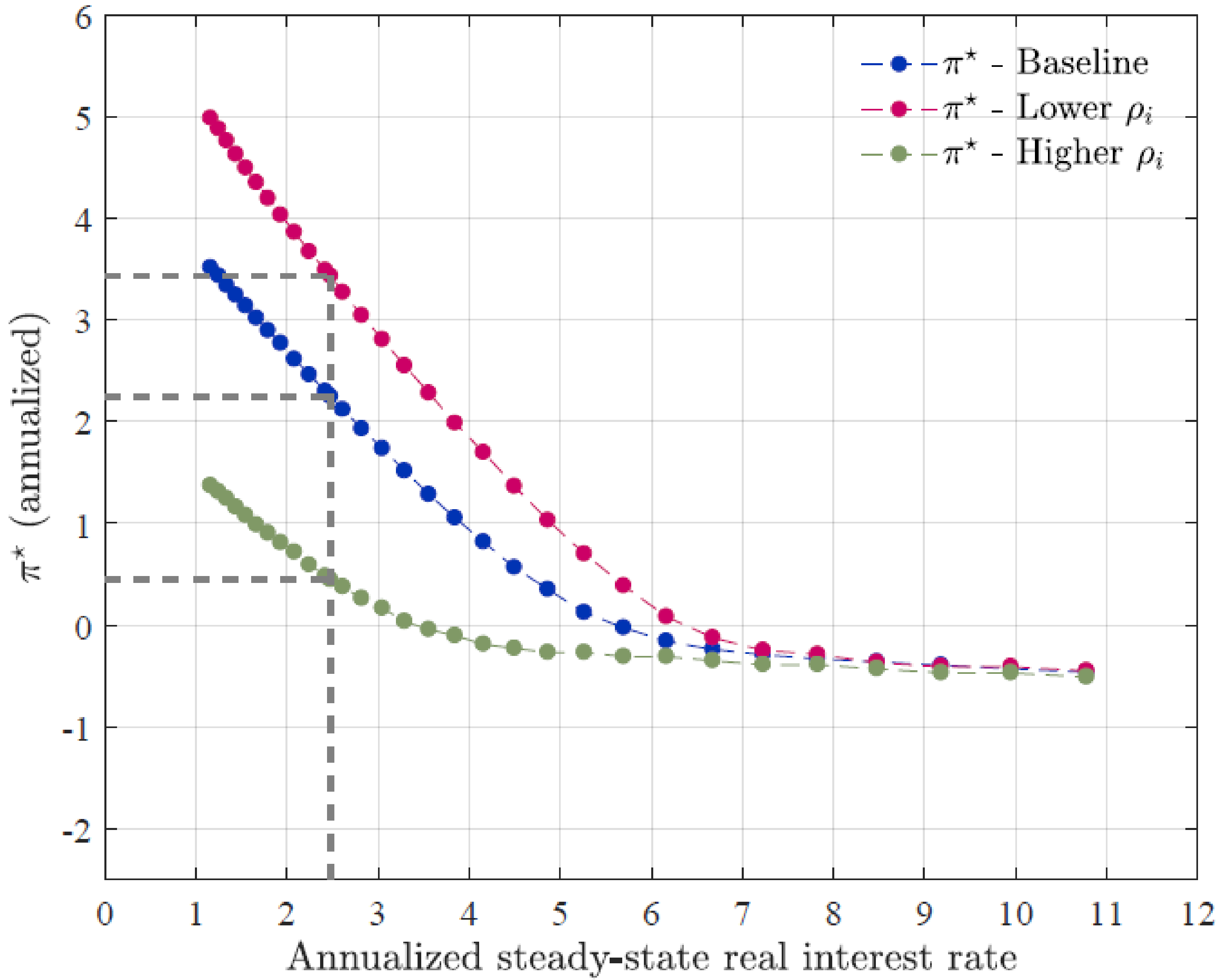
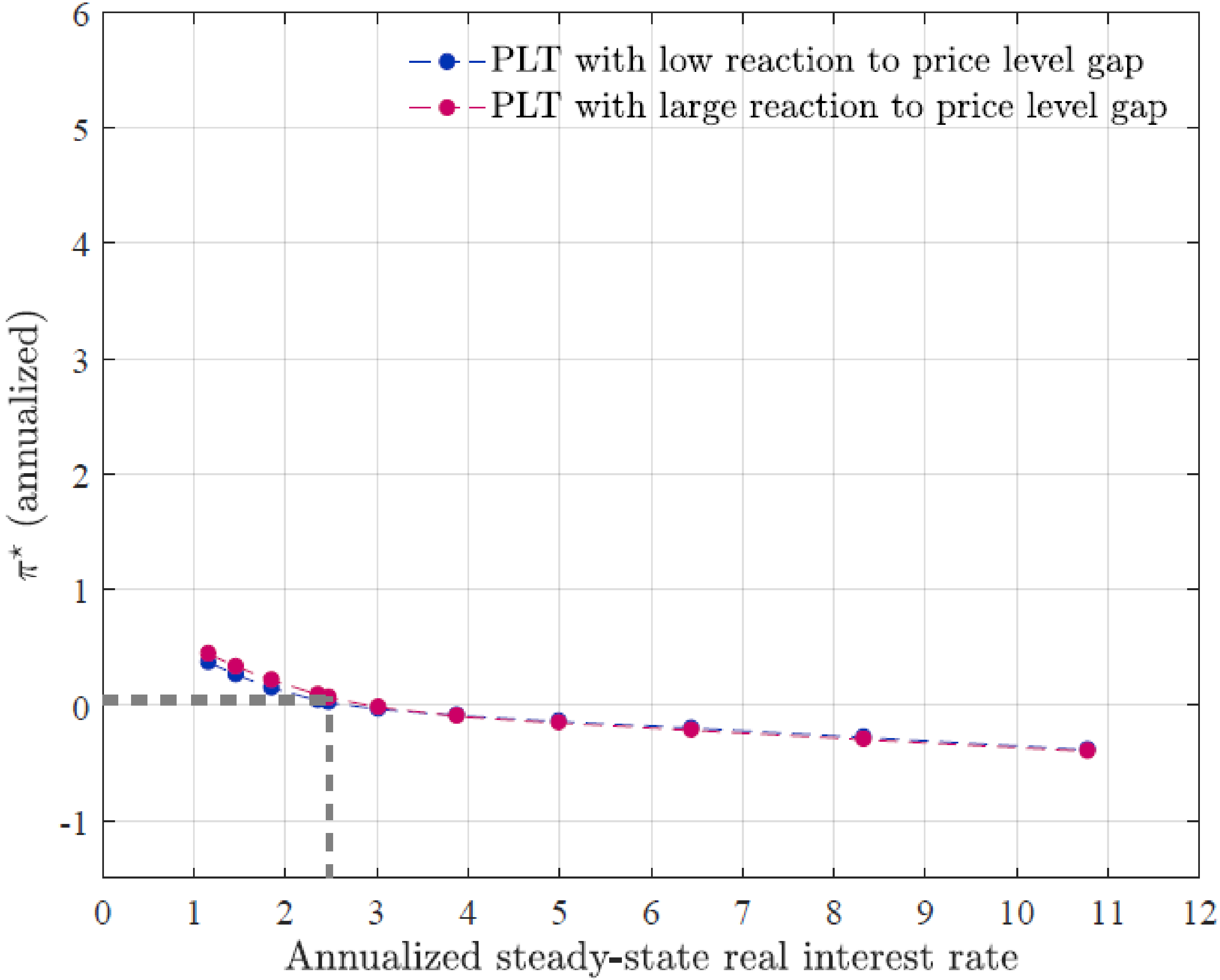


Figure 18: $(r^{\star}, \pi^{\star})$ relation with price level targeting strategy



Summary and Conclusions

- A decline in r^* calls for an increase in the inflation target
- How large an increase?
- Under the baseline estimated policy rule: *close to one-for-one*. Robust finding.
- Under an alternative rule with stronger inertia or a price level targeting rule: smaller adjustment $\Rightarrow$ robustness to changes in r^*
- The ad-hoc unconventional policies adopted by the Fed and the ECB have helped stabilizing (Eberly at al., Chung et al., Debortoli et al.), but may still fall short of replicating these alternative rules.
- Advantage of higher π^*: no need to rely on time inconsistent policies.
- Caveat: transition and credibility