Deeds versus Words: Inflation in the United States, Japan and Chile

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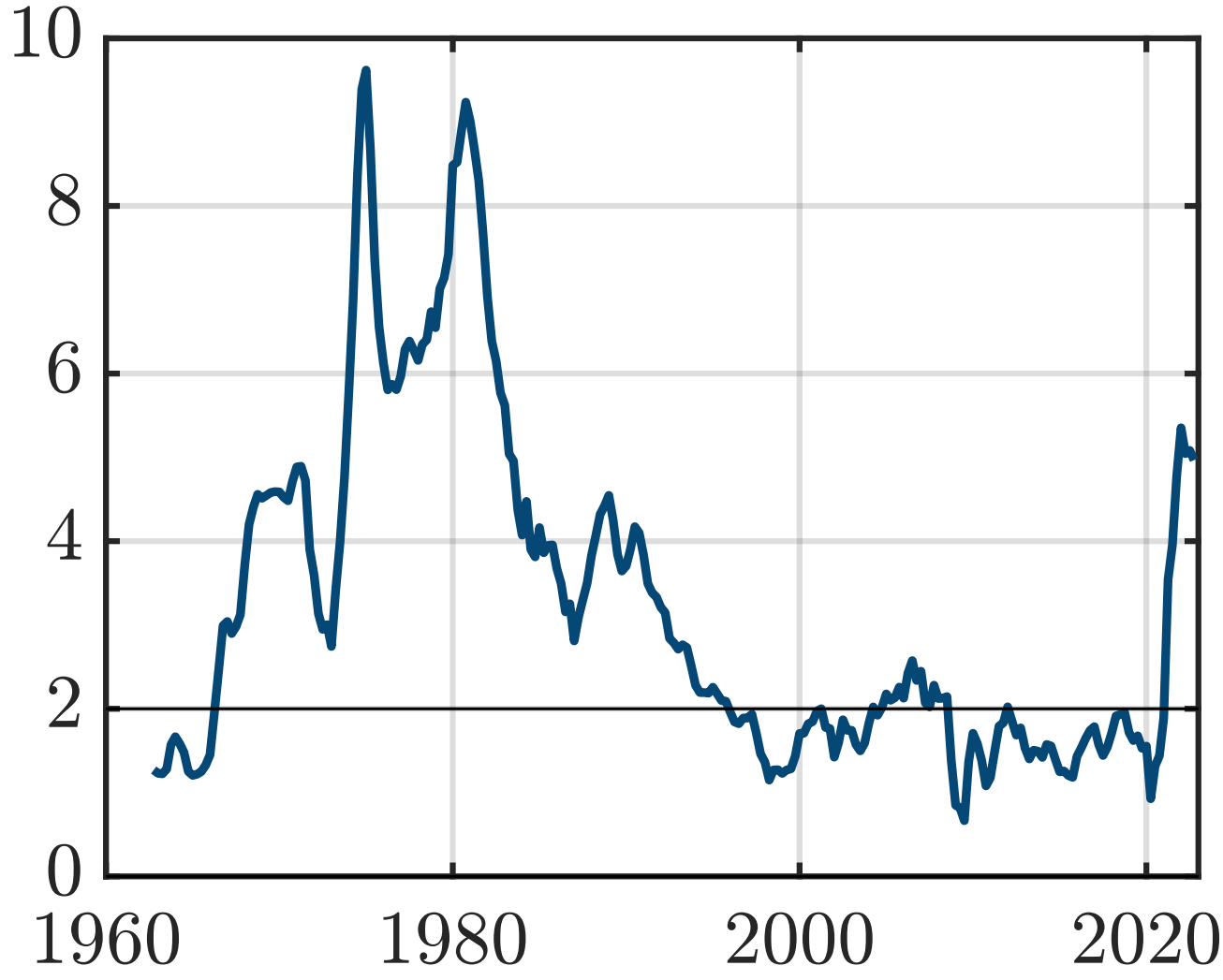
Motivation: Inflation Episodes

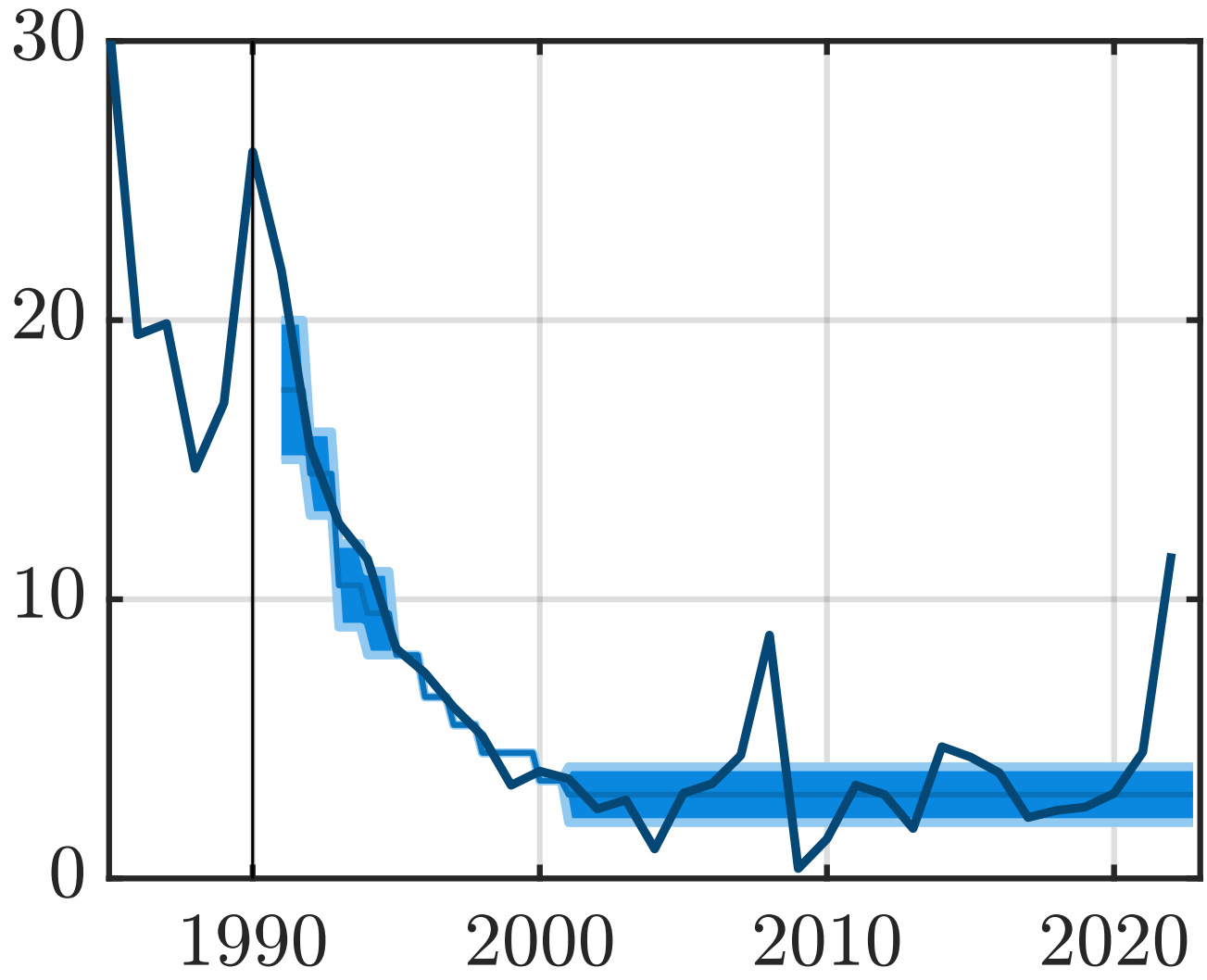
- Why was inflation high in the USA in the 70s?
  - ... and low after the 2009 crisis?
- Why was inflation so low in Japan in the last twenty-five years?
- Why did Chile's inflation rate go down during the 90s?

Inflation (Core PCE) in USA



Inflation in Japan

Inflation in Chile



Goal

- In this paper we "... measure the extent to which inflation and interest rate experiences can be understood in terms of purely classical, monetary forces."
  - Lucas (1980): "Two Illustrations of the Quantity Theory of Money"
- "Inflation": an increase in the general level of prices that is sustained for a relatively long period of time
- "Monetary forces": changes in monetary policy that are not meant to stabilize inflation around a certain target

Strategy

- We estimate a medium-scale NK model with Bayesian methods
  - For the three countries: Chile, Japan, US
- Allow for regime changes in monetary policy
  - Argue that it captures the "purely classical, monetary forces"
- Allow for all other usual shocks that can affect the price level
- Run a horse race among assumed shocks

Standard Model

- Standard Taylor rule:

$$i_t = i^* + \phi_\pi(\pi_t - \pi^*) + \phi_y(y_t - y^*) + \varepsilon_t^i,$$

- The constant determines the target
- Role of policy:
  - responds to endogenous variables
  - the AR(1) shock
- No role for "classical monetary forces"

What We Do

- In estimation, we allow for, but do not impose, changes in π^*
  - Can the systematic deviations from a target be accounted for by changes in the target?
  - Is estimated target (deeds) consistent with announced target (words)?
  - Is the estimated target consistent with independent evidence?
- Evaluate counterfactuals due to changes in π^*
- Implications for drivers of (nominal) variables
- Silent about why target changes

Smets and Wouters Model

Smets and Wouters Model

- Preferences

$$\sum_{t=0} \beta^t \left[\frac{C_t(i) - \kappa C_{t-1}(i)}{1-\sigma_c} \right]^{1-\sigma_c} \exp\left[- \left(\frac{1-\sigma_c}{1+\sigma_L} \right) L_t(i)^{1+\sigma_L} \right]$$

- Budget contraints

$$C_t(i) + I_t(i) + \frac{B_t(i)}{\xi_t^R (1+i_t) P_t} \leq \frac{W(i)_t}{P_t} L_t(i) + \frac{B_{t-1}(i)}{P_t} + K_t(i) R_t^K + \frac{D_t(i)}{P_t}$$

- Law of motion for capital

$$K_t(i) = (1-\delta) K_{t-1}(i) + \xi_t^I \left[1 - S\left(\frac{I_t(i)}{I_{t-1}(i)} \right) \right] I_t(i)$$

Smets and Wouters Model

- Final good

$$Y_t = \left[\int Y_t(j)^{1-\xi_t^C} dj \right]^{\frac{1}{1-\xi_t^C}}$$

- Intermediate goods production

$$y(j)_t = \xi_t^A k(j)^{\alpha} \left[\gamma^t l(j) \right]^{1-\alpha} - \gamma^t \Psi$$

- Labor market

$$\int_0^1 l_t(j) dj = L_t = \left[\int l_t(i)^{1-\xi_t^L} di \right]^{\frac{1}{1-\xi_t^L}}$$

Smets and Wouters Model

- Monetary policy

$$\frac{1+i_t}{1+i^*} = \left(\frac{1+i_{t-1}}{1+i^*}\right)^{\rho_i} \left(\frac{1+\pi_t}{1+\pi^*}\right)^{\theta_\pi} \left(\frac{Y_t}{Y_t^*}\right)^{\theta_Y} \left(\frac{Y_t/Y_{t-1}}{Y_t^*/Y_{t-1}^*}\right)^{\theta_{gy}} \xi_t^i$$

- Government budget

$$P_t G_t \xi_t^G + B_{t-1} = T_t + \frac{B_t}{1+i_t}$$

Shock to the Inflation Target

- Linearized Taylor rule

$$i_t = i_t^* + \phi_\pi(\pi_t - \pi_t^*) + \phi_y(y_t - y^*) + \varepsilon_t^i,$$

- Allow for an inflation target shock π_t^*.

$$i_t^* = r^* + \pi_t^*$$

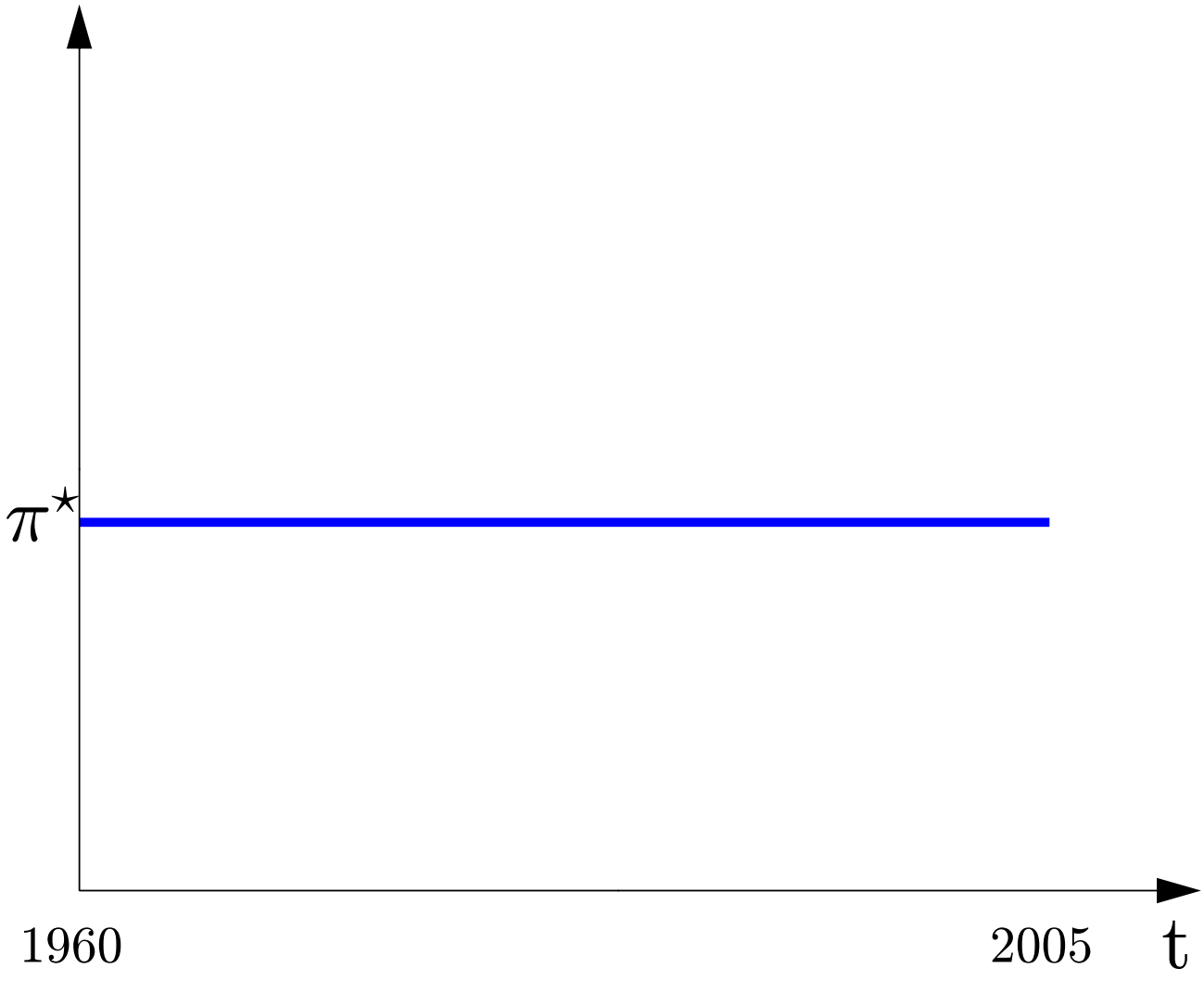
Inflation Target π^* Shocks

$$\pi_t^* = (1-\rho_\pi)\pi_j(\mathbb{I}) + \rho_\pi \pi_{t-1}^*$$

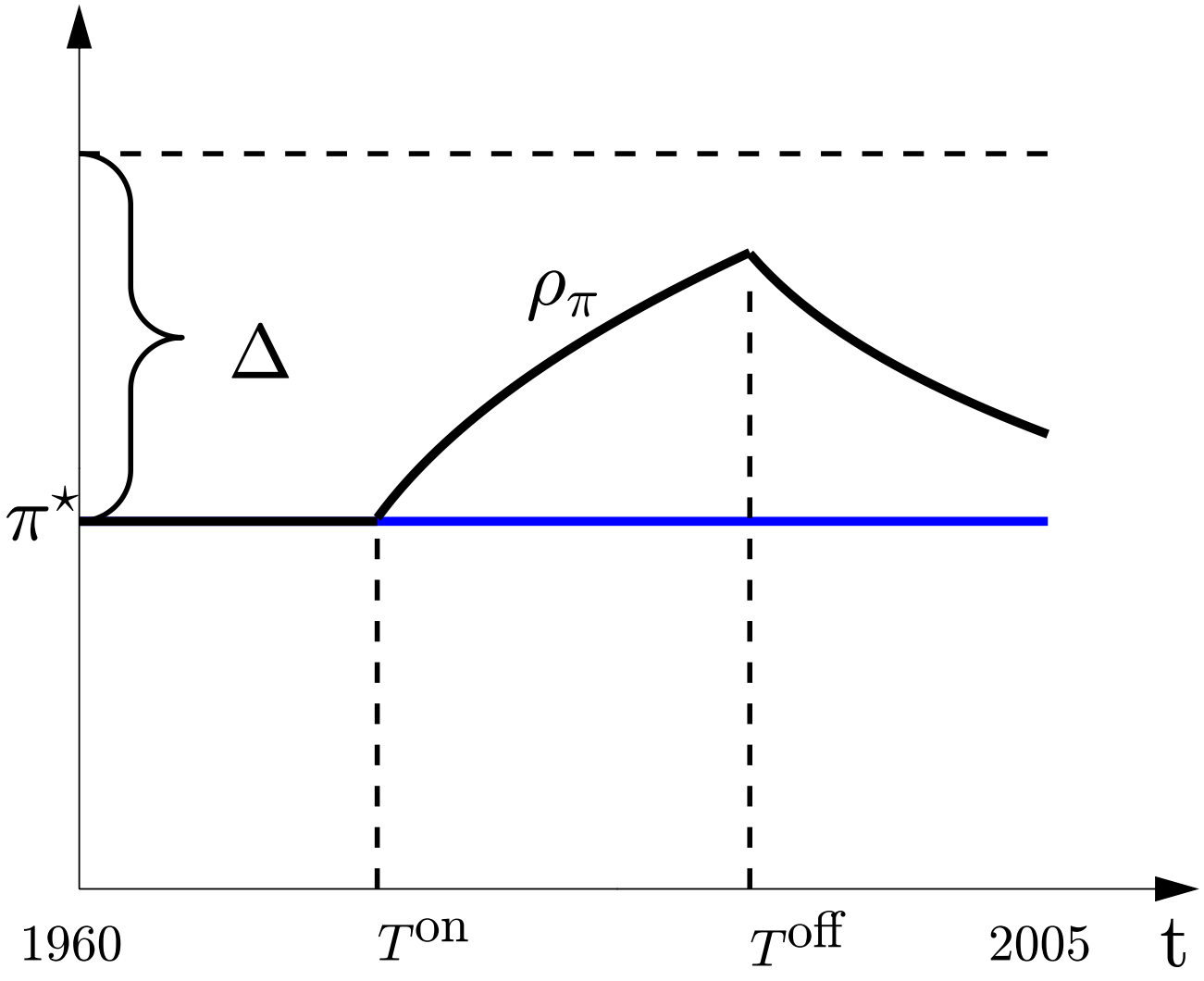
$$\mathbb{I} = \begin{cases} 0 & \text{for } t \in [T^0, T^{\text{on}}) \quad \text{and} \quad t \in [T^{\text{off}}, \infty) \\ 1 & \text{for } t \in [T^{\text{on}}, T^{\text{off}}) \end{cases}$$

$$\pi_j(0) = \pi_0^*$$
$$\pi_j(1) = \pi_0^* + \Delta_j$$

Usual NK assumption



Change in Target (US)



Inflation Target π^* Shocks

- Chile: one possible Δ that is permanent
  - Estimate size (Δ), persistence (ρ_π), and date T^{on}
- Japan: one possible Δ that is permanent
  - Estimate size (Δ), persistence (ρ_π), and date T^{on}
- US: two possible Δ's
  - Estimate size (Δ_1), persistence (ρ_π), and date (T_1^{on}, T_1^{off})
  - Estimate size (Δ_2), persistence (ρ_π), and date (T_2^{on})

Shocks to the Real Interest Rate

- Also allow for regime changes in:
  - The subjective discount factor ρ

$$\beta = \frac{1}{1+\rho}$$

  - Growth rate of productivity
- To account for potential changes in real rates
- Estimate in similar fashion the size of the change and the date

$$i_t^* = r_t^* + \pi_t^*$$

Data

For each of Chile, Japan, US:

- Inflation
- Policy rate
- Wages
- Labor hours
- GDP
- Consumption
- Investment
- ZLB: survey data or yield curve (e.g. up to 9Y gov yields for Japan)

Chile

Chile: Priors and Estimates of Key Parameters

- Good test case: external evidence on targets/dates (Sargent, 1982)

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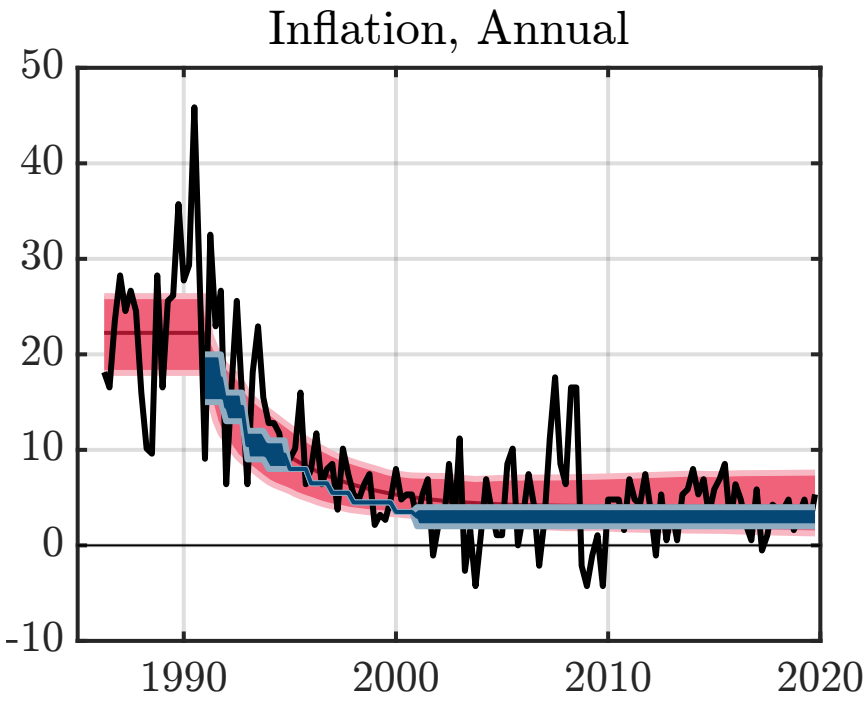
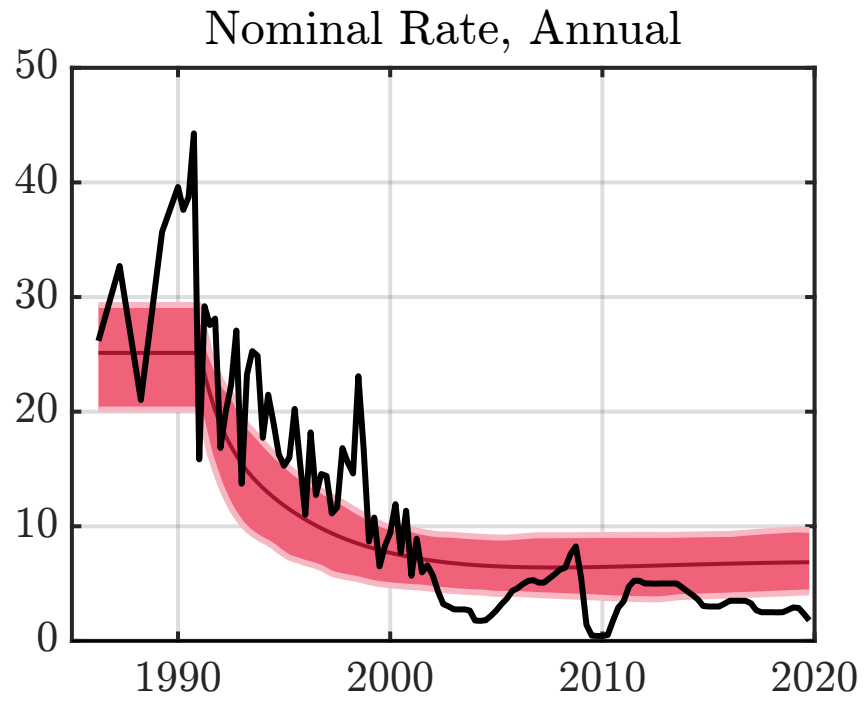
- Good test case: external evidence on targets/dates (Sargent, 1982)

	Prior	Mode
ρ_π	Beta(0.5,0.2)	0.95
π^*	Unif(0,40)	22.5
$\Delta\pi^*$	N(0,20)	-17.5
T^{on}	Unif(1988Q1,1999Q1)	1991Q2

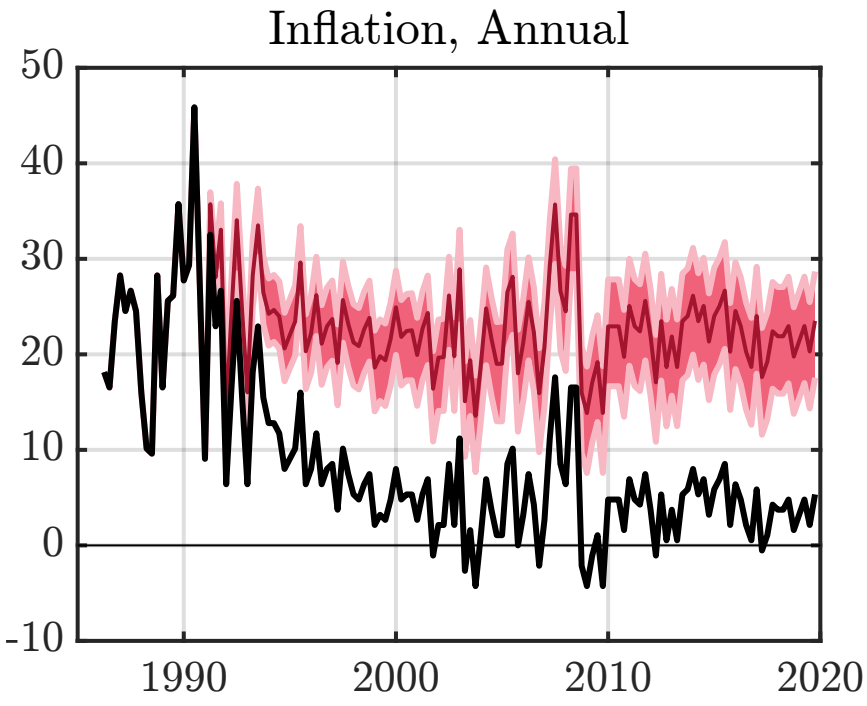
Chile: Counterfactual, Target Shocks Only

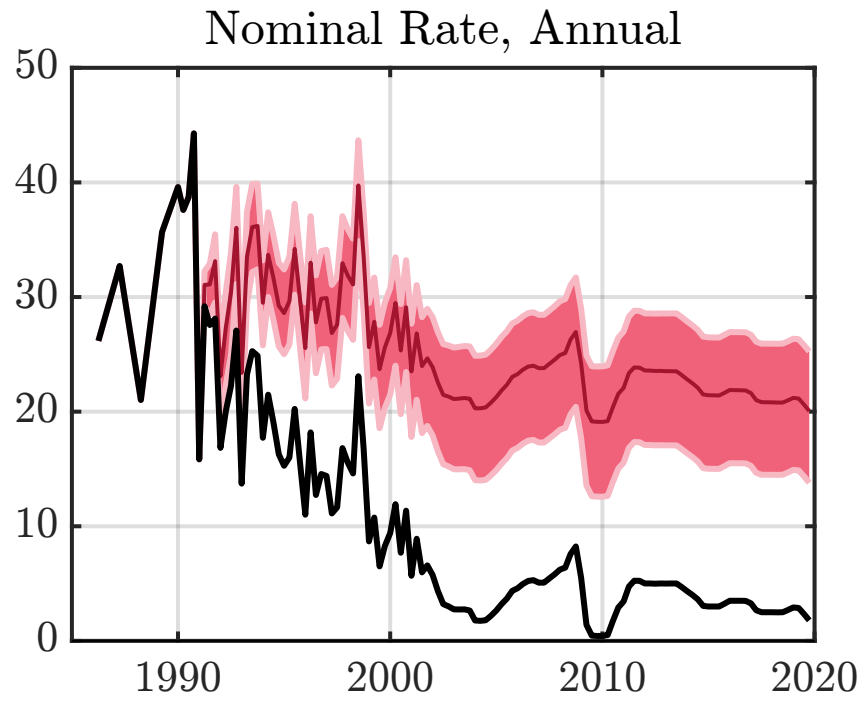




1,000 Realizations

Chile: Counterfactual, no Target Shocks





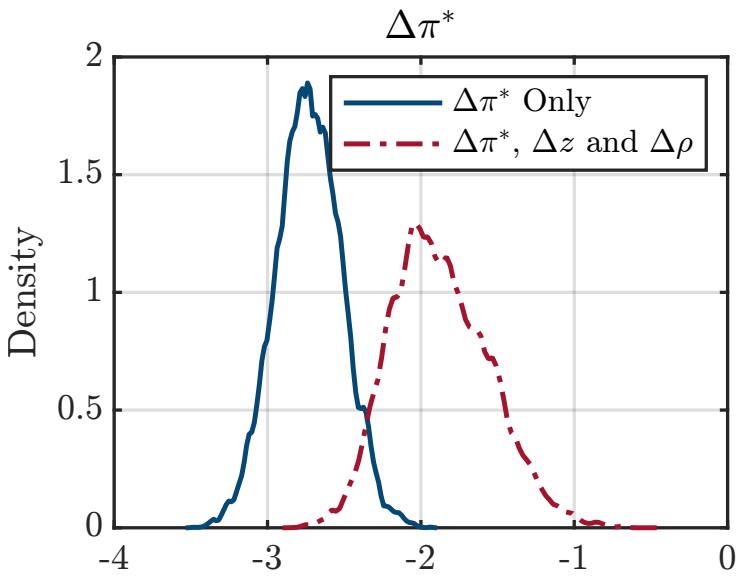
1,000 Realizations

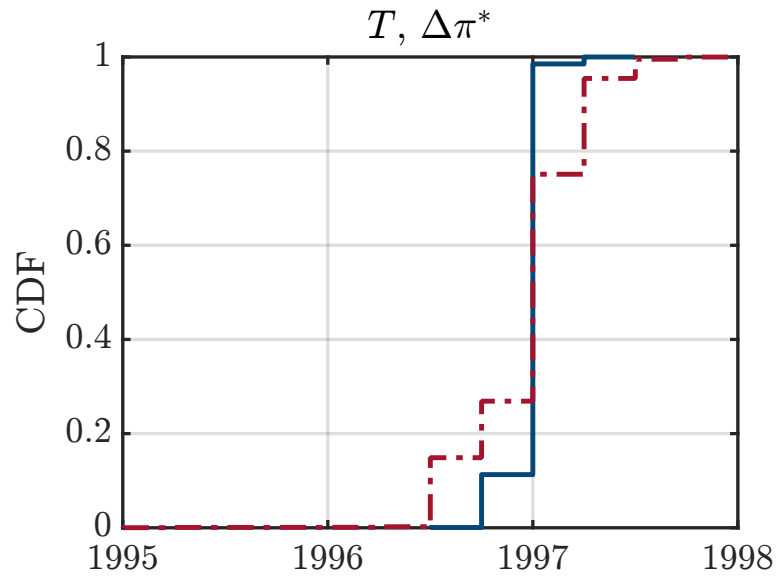
Japan

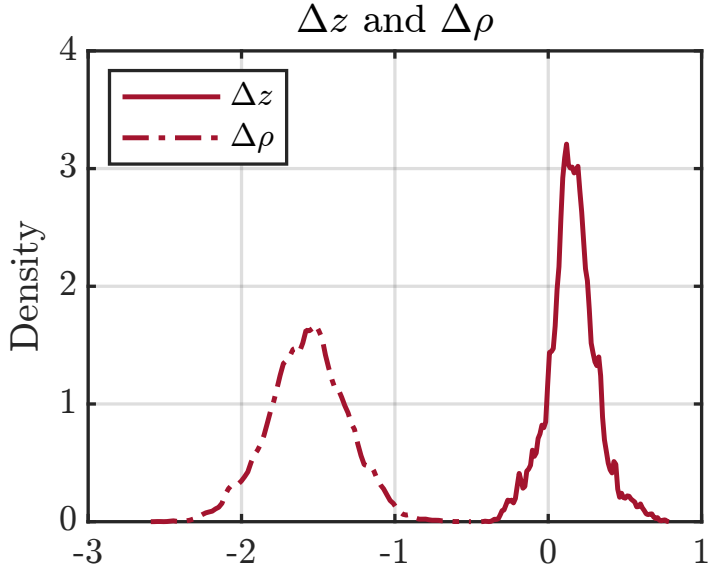
Japan: Priors and Estimates of Key Parameters

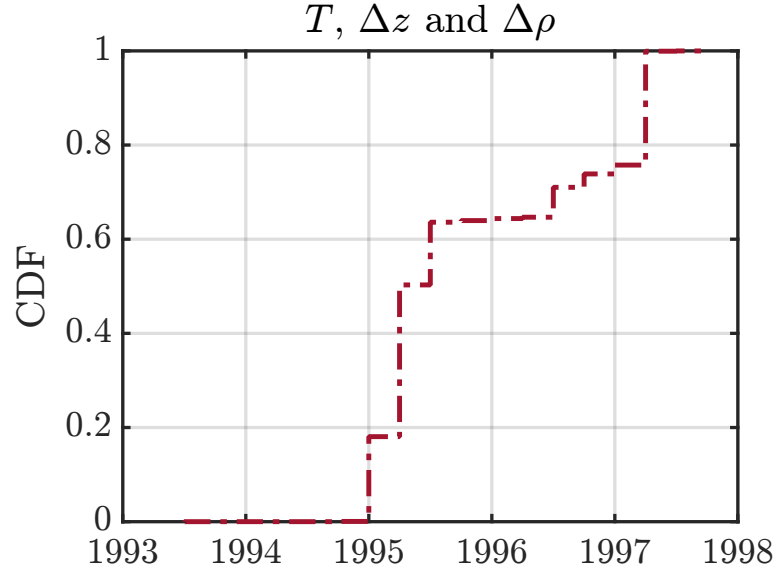
	Prior	Mode
ρ_π	Beta(0.5,0.2)	0.52
$\Delta\pi^*$	Unif(-10,10)	-2.0
T^{on}	Unif(1991Q4,1998Q4)	1997Q1

Results: Posteriors for Japan

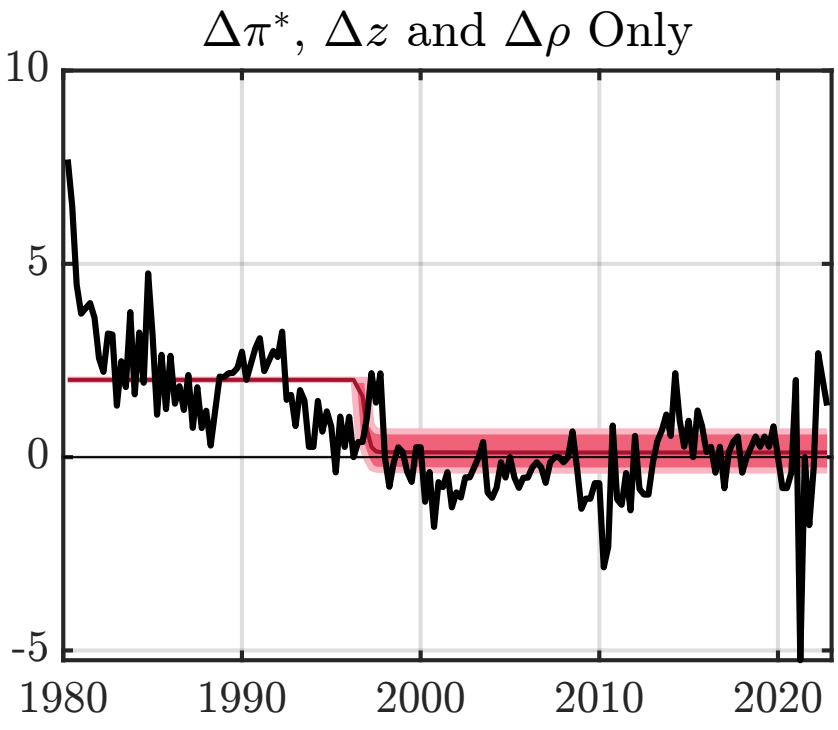


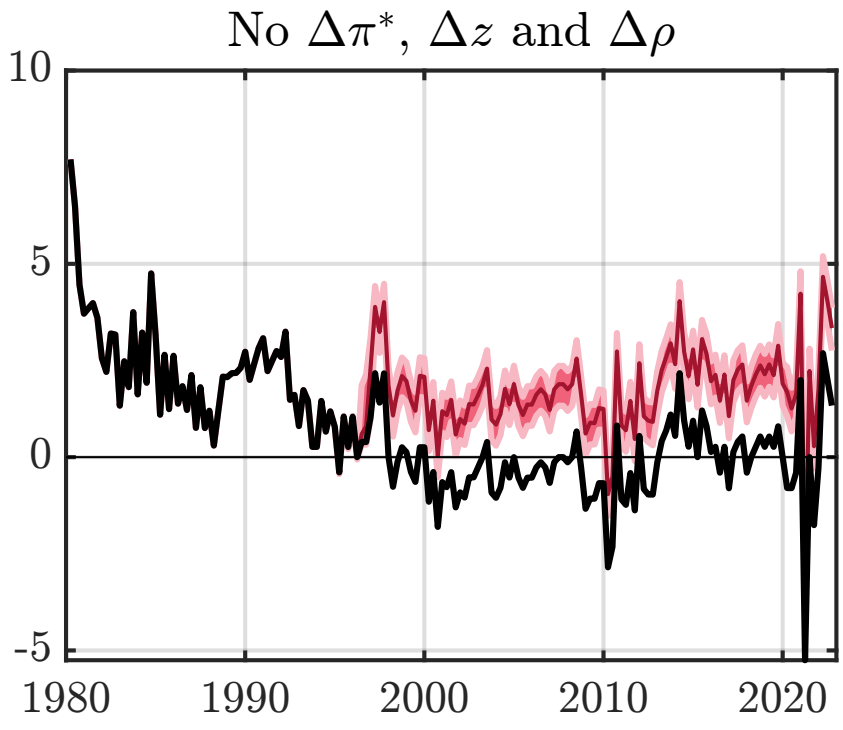






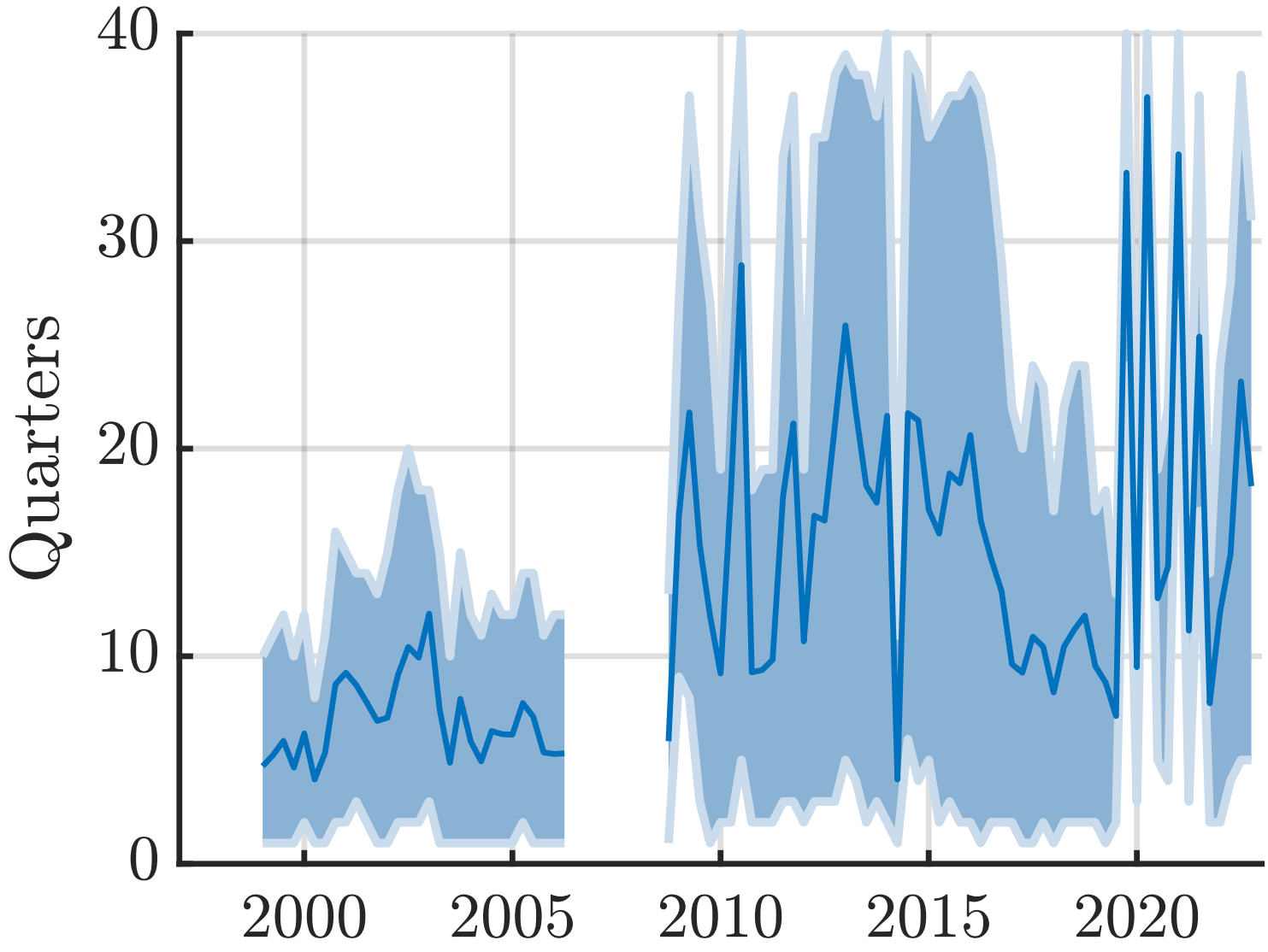
Counterfactual for Inflation





1,000 Realizations

ZLB Durations

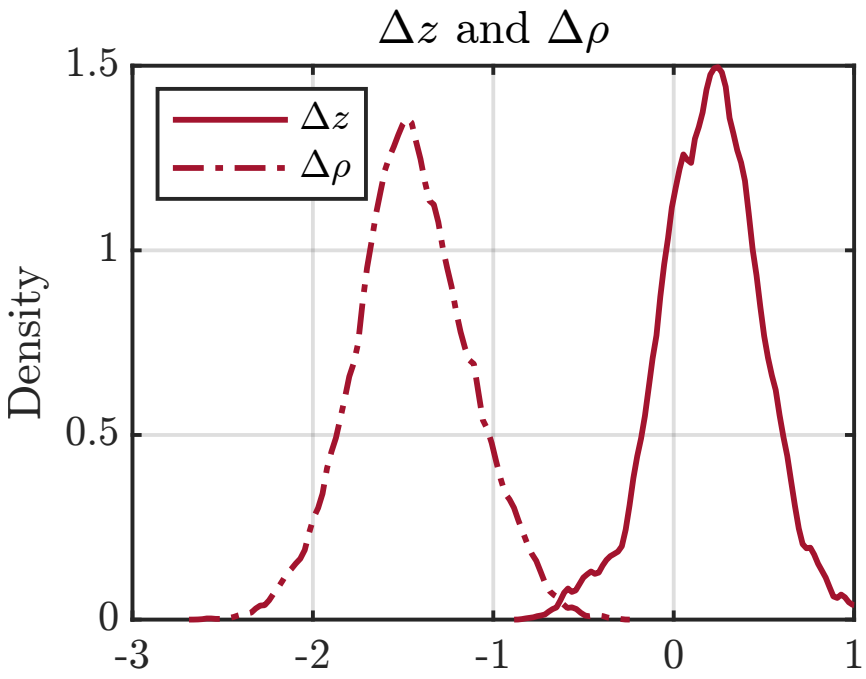


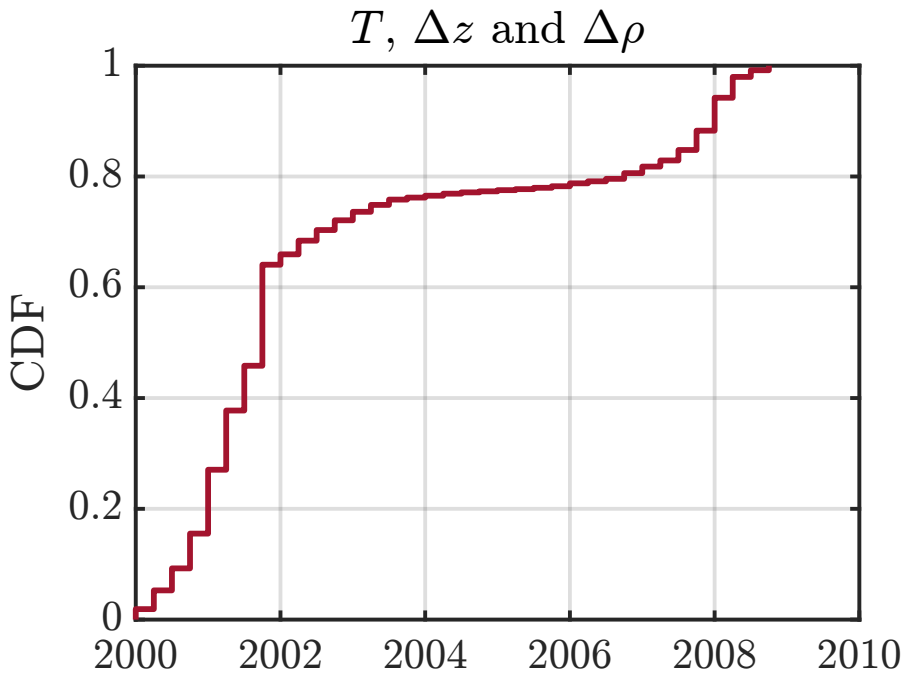
USA

USA. Priors and Estimates of Key Parameters

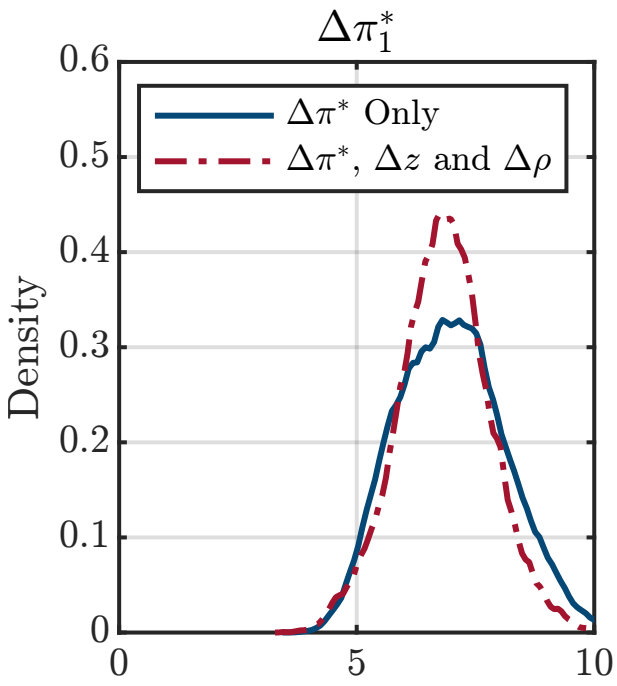
	Prior	Mode
ρ_π	Beta(0.5,0.2)	0.96
$\Delta\pi_1^*$	Normal(0,1)	6.8
$\Delta\pi_2^*$	Normal(0,0.6)	-0.2
T_1^{on}	Unif(1965Q1,1979Q2)	1968Q4
T_1^{off}	Unif(1979Q3,1987Q4)	1982Q4
T_2^{on}	Unif(2000Q1,2008Q4)	2000Q1

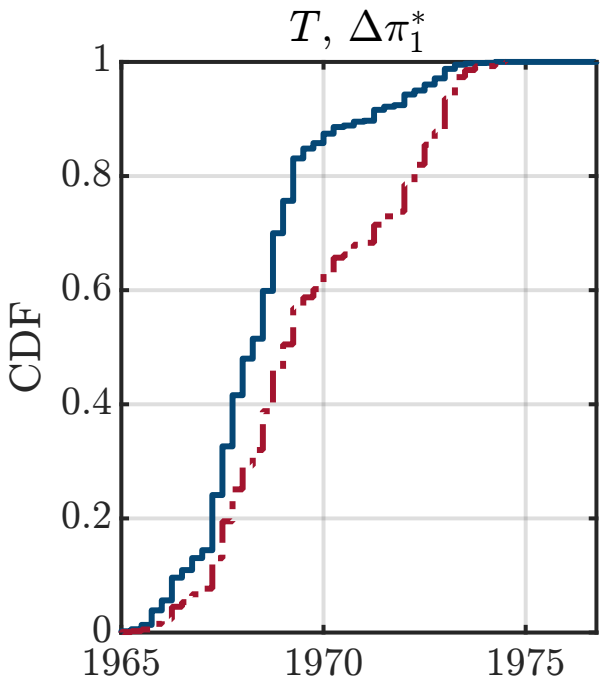
Results: Posteriors for USA, Δz and $\Delta\rho$

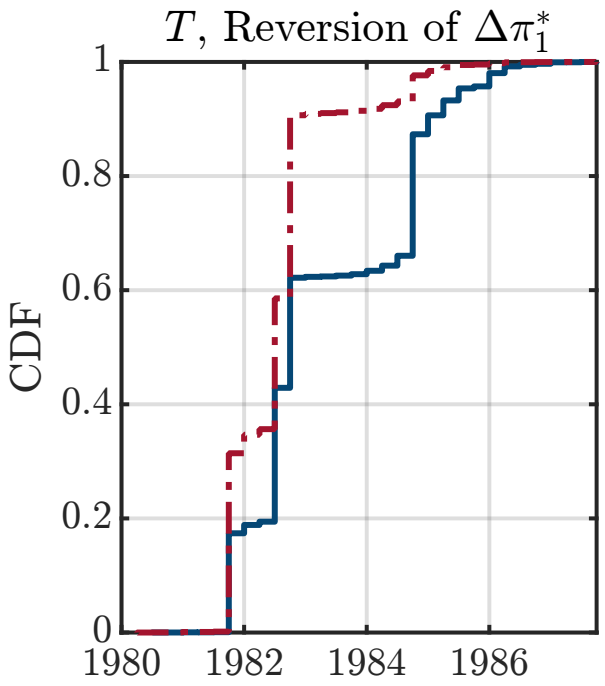




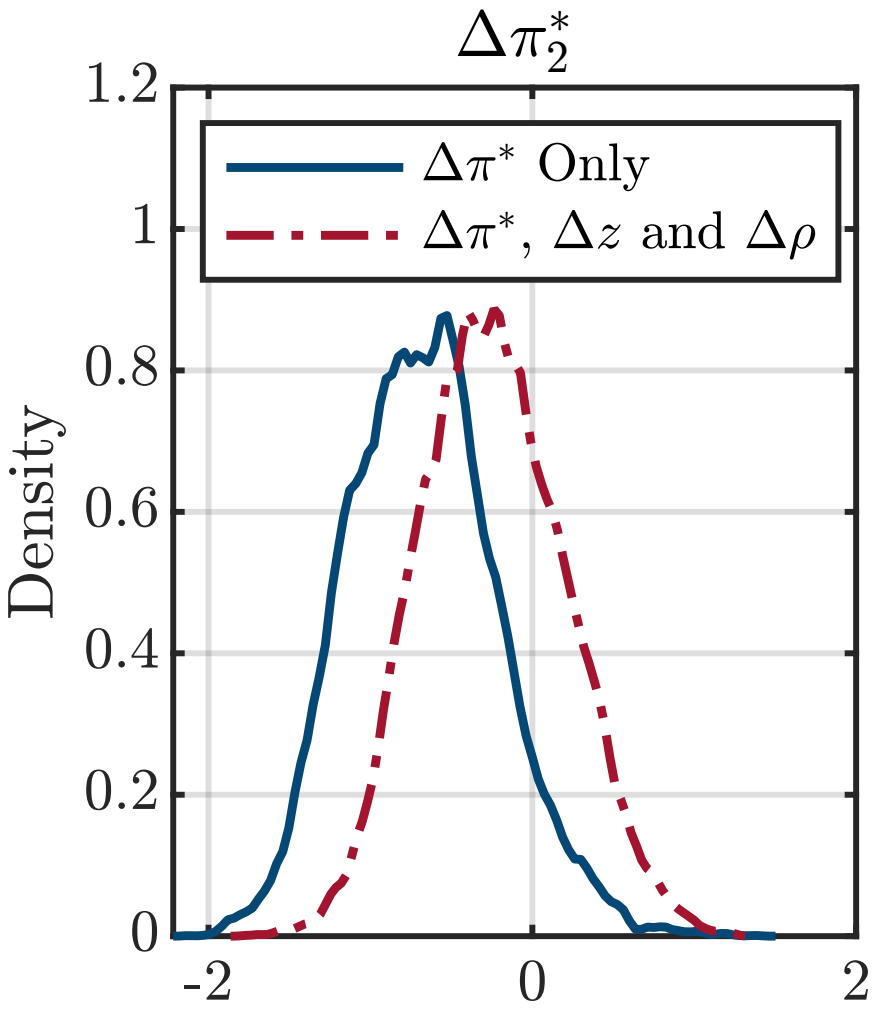
Results: Posteriors for USA, $\Delta\pi_1^*$

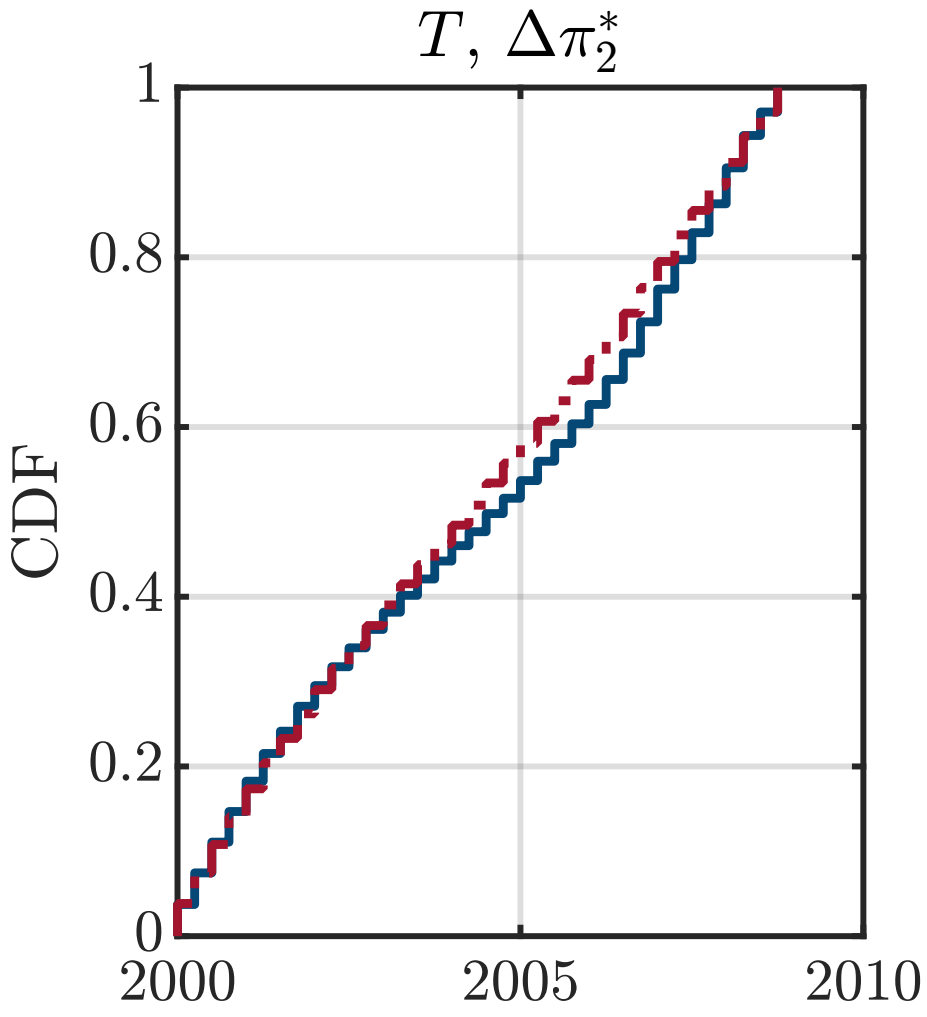




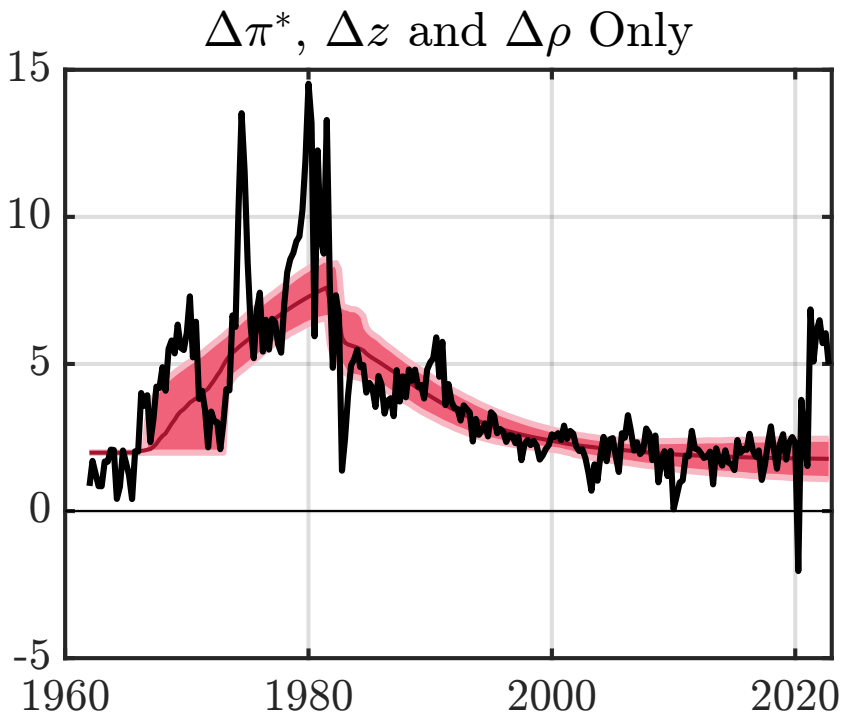


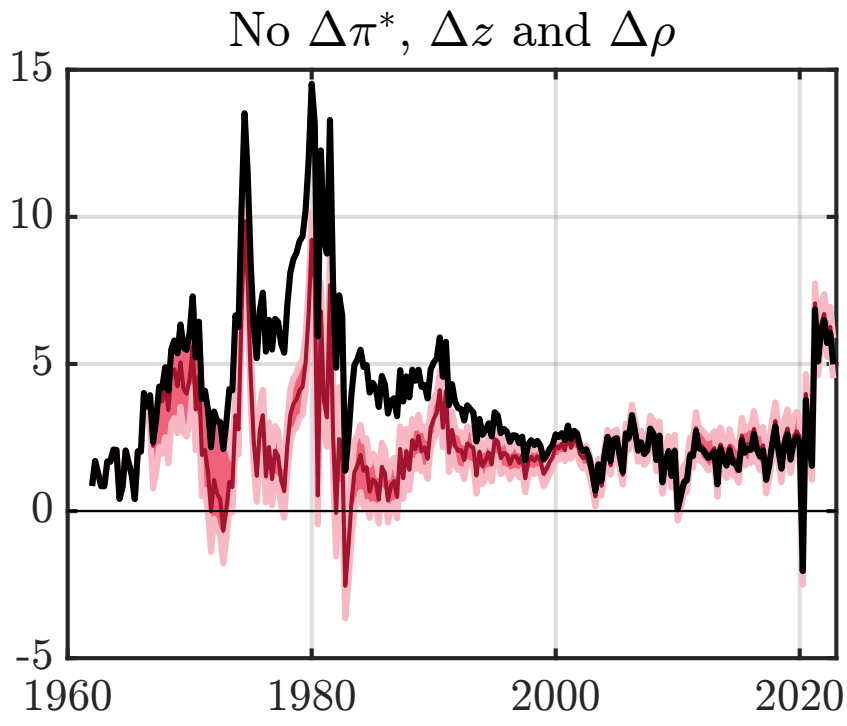
Results: Posteriors for USA, $\Delta\pi_2^*$





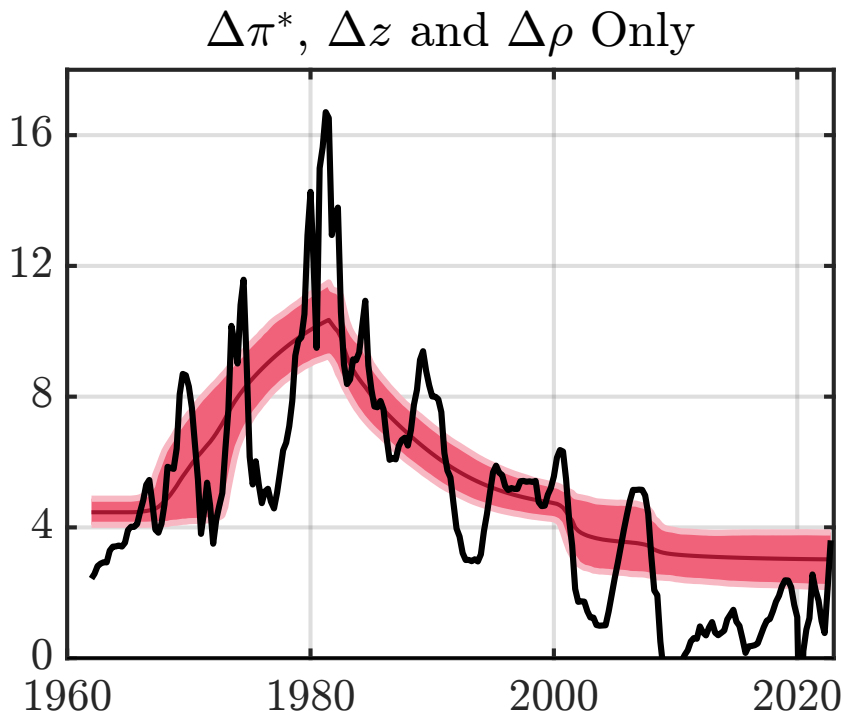
Results: Counterfactual for USA, Inflation

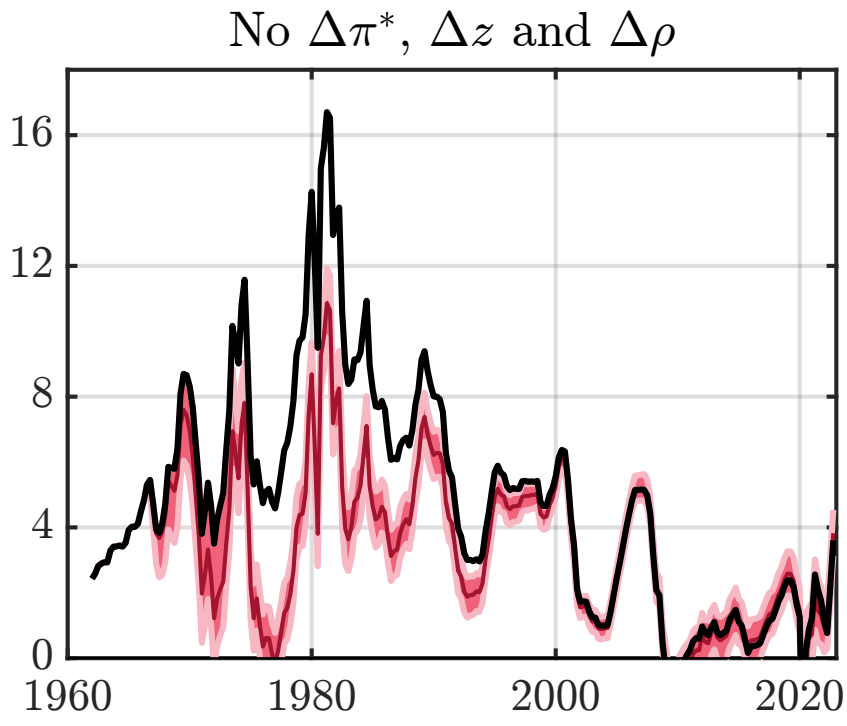




1000 Realizations.

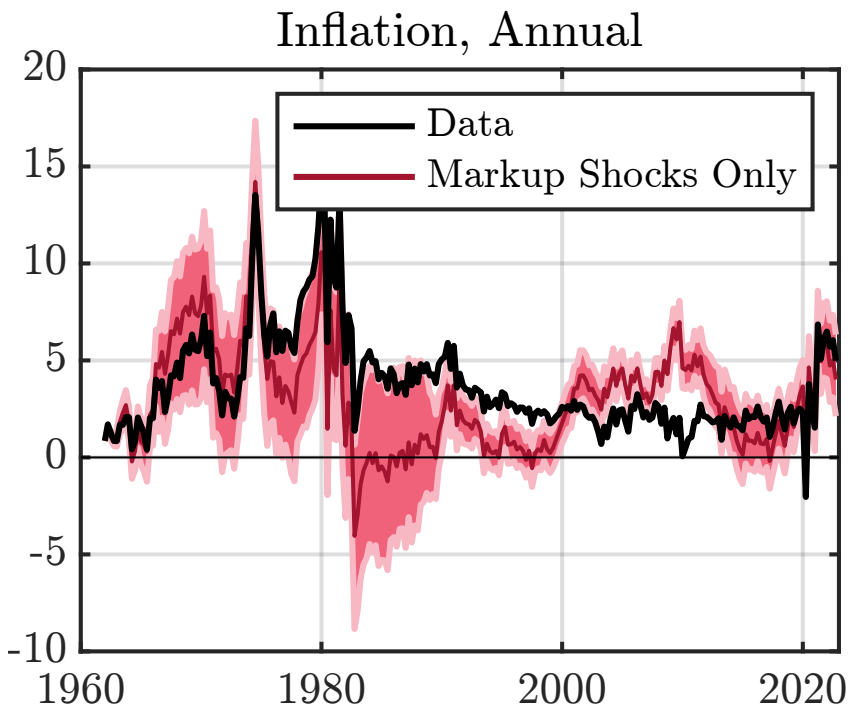
Results: Counterfactual for USA, Policy Rate

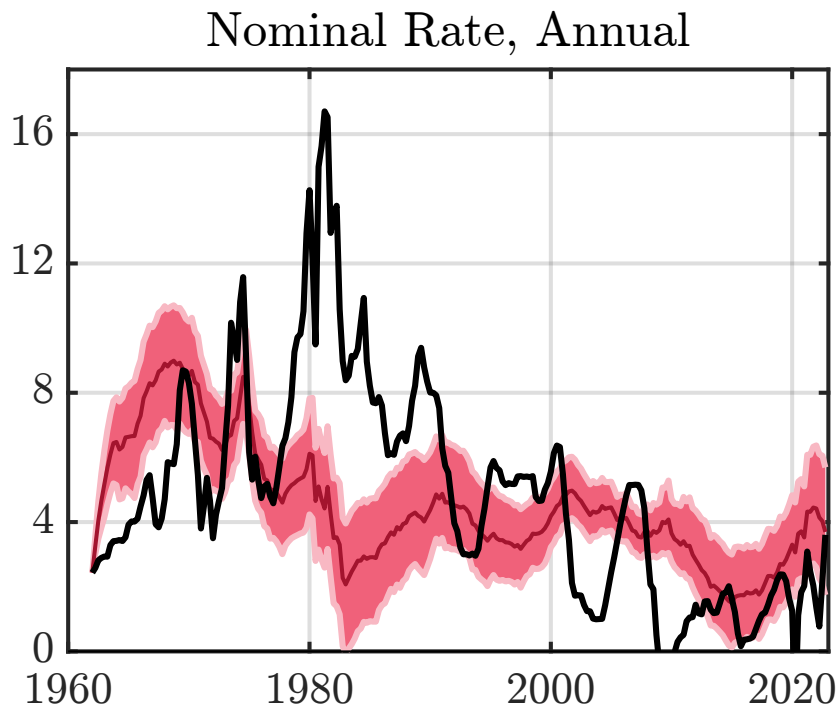




1000 Realizations.

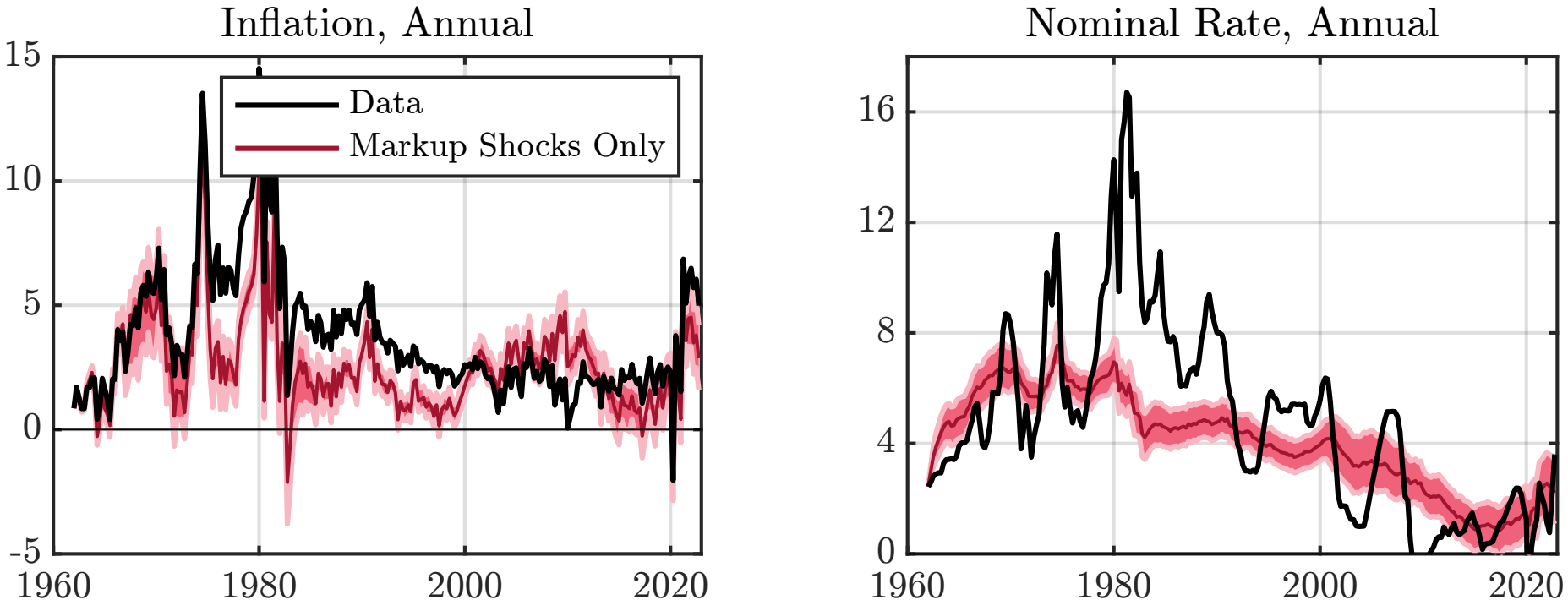
Markup Shocks Only, US, (Estimation Without $\Delta\pi^*$)





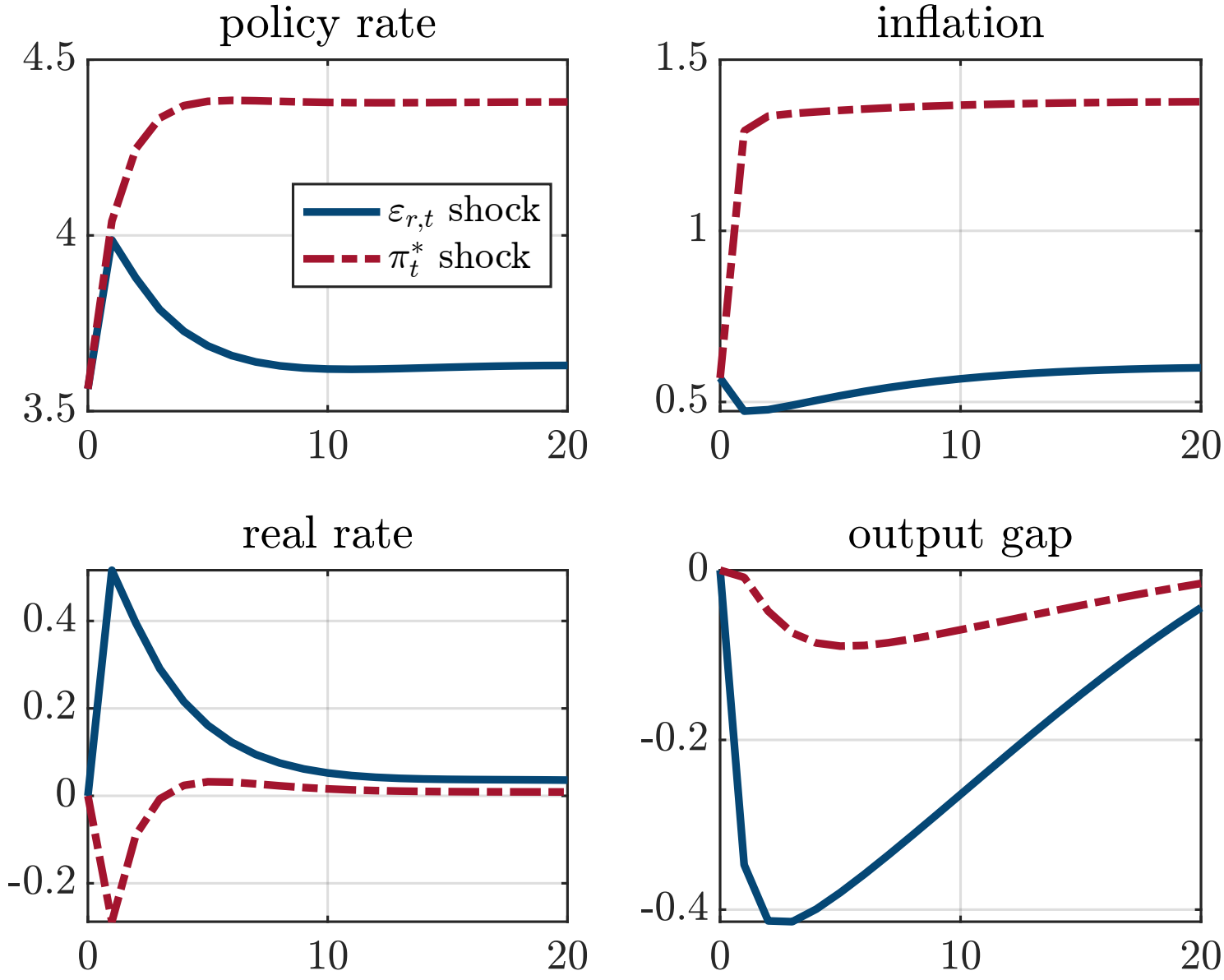
1,000 Realizations

Markup Shocks Only, US, (Estimation With $\Delta\pi^*$)



1,000 Realizations

Impulse Responses: A monetary shock and a target shock



The target shock persistence parameter is 0.5

Conclusions

- The estimated target coincides with announced targets in Chile's disinflation in the 90s
- Liquidity trap in Japan since 1998 (Benhabib, Schmitt-Grohe and Uribe)
- No Liquidity trap in the USA
  - Normalization in 2015 key?
- Substantial component of the up and down of US inflation in the 70s and 80s due to classical monetary forces

Appendix

Two Illustrations

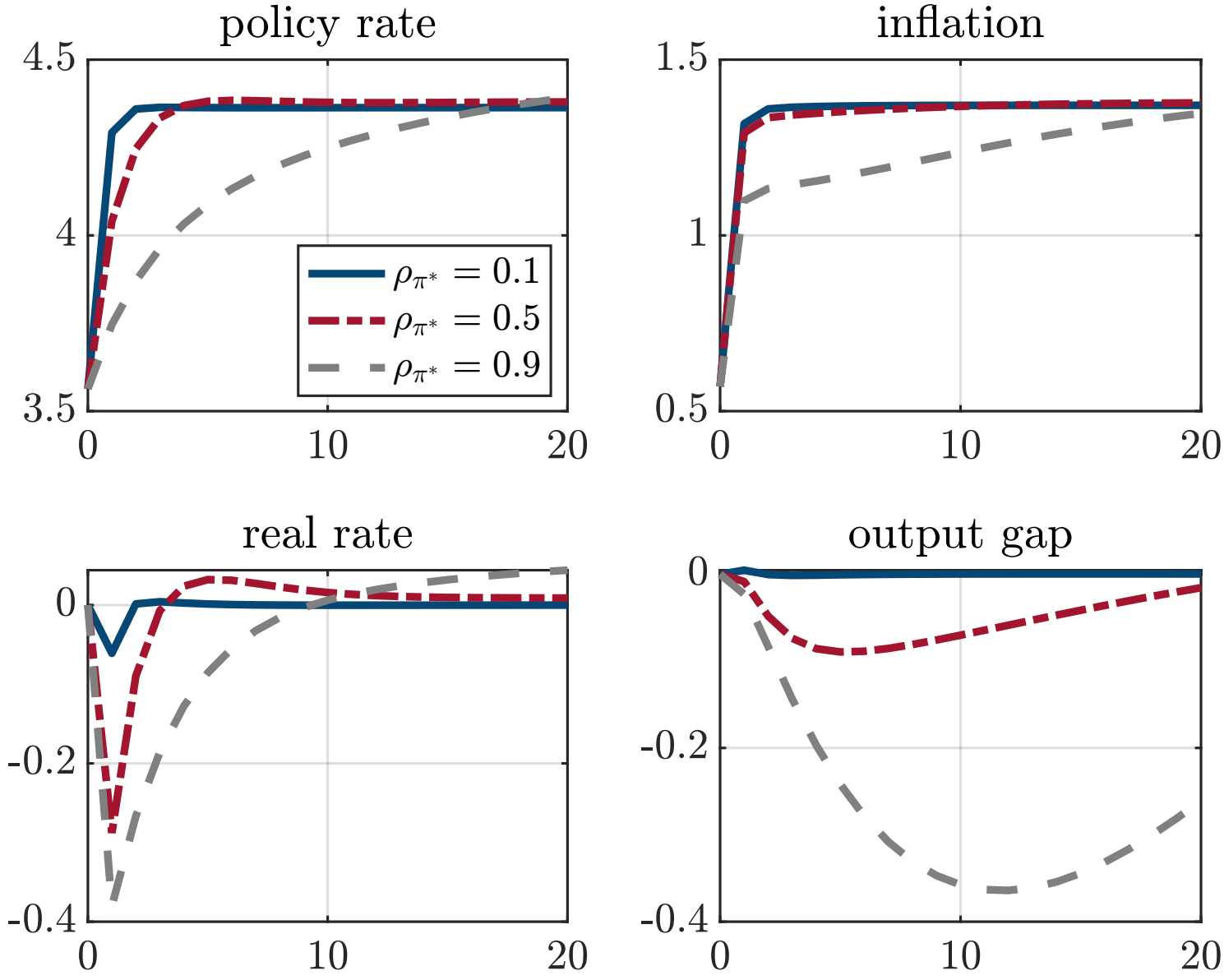
- With flexible prices, real and nominal variables roughly independent
- Two equations on three nominal variables $\{\frac{P_{t+1}}{P_t}, \frac{M_{t+1}}{M_t}, i_t\}$

$$\pi_t = \mu_t - g_t^y - \frac{1}{2} g_t^i + \varepsilon_t$$

$$\pi_t = i_t - r_t - u_t$$

- $\frac{M_{t+1}}{M_t}$ or i_t determined by policy
- No need to take a stand on policy instrument
- With frictions in price setting, feedback between real and nominal variables

Impulse Responses: Target shock, different persistence



Persistence parameters are 0.1, 0.5 and 0.9