New evidence on monetary transmission: interest rate vs inflation target shocks

Elizaveta Lukmanova, Katrin Rabitsch

KU Leuven, WU Vienna

ASSA annual meeting 2022

January 3, 2022

Motivation

- **What are the co-movement properties of inflation and interest rates in response to monetary policy shocks?**

- Study monetary transmission with two shocks:

  temporary nom. interest rate shock $i \uparrow => \pi \downarrow$

  and *persistent* inflation target shock $i \uparrow => \pi \uparrow$, **?**

- This paper:

  empirical evidence on the **effects of persistent MP shocks**

  in a setting where agents, as in reality, *might not* understand the nature of the shock

- Result: in response to persistent shock: $i \uparrow => \pi \uparrow$ **Yes, with a lag**

Full vs imperfect information in a DSGE model

How the shock is perceived depends on how agents form their expectations.

$$i_t = \rho_i i_{t-1} + (1 - \rho_R) \left[\rho_\pi (\bar{\pi}_{4,t} - \boldsymbol{\pi_t^*}) + \rho_y (y_t - y_t^*) \right] + \boldsymbol{u_t} =$$

$$= \rho_i i_{t-1} + (1 - \rho_R) \left[\rho_\pi (\bar{\pi}_{4,t}) + \rho_y (y_t - y_t^*) \right] + \boldsymbol{\varepsilon_t} \tag{1}$$

$$\boldsymbol{\varepsilon_t} \equiv (1 - \rho_R) (-\rho_\pi) \boldsymbol{\pi_t^*} + \boldsymbol{u_t}. \tag{2}$$

$$\pi_t^* = \rho_{\pi^*} \pi_{t-1}^* + \varepsilon_{\pi^*,t}, \quad \varepsilon_{\pi^*,t} \sim N\left(0, \sigma_{\pi^*}^2\right) \tag{3}$$

Full information:
Agents observe $\boldsymbol{\pi_t^*}$ and $\boldsymbol{u_t}$ separately. Inflation expectations adjust immediately: $\pi_t^* \uparrow \to \mathbb{E}_t \pi_t^* \uparrow$

Imperfect information:
Agents observe $\boldsymbol{\epsilon_t}$, they need time to learn the nature of the shock: $\pi_t^* \uparrow \not\to \mathbb{E}_t \pi_t^* \uparrow$

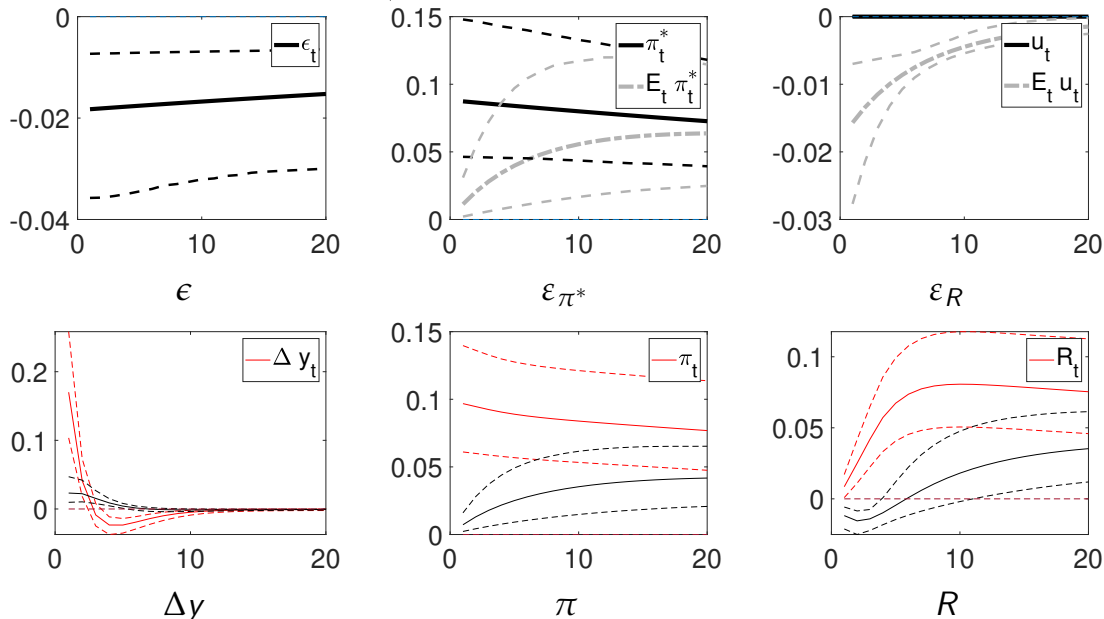# Impulse responses to a persistent inflation target shock

Figure: Red line - full information, black line - imperfect information, gray line - expectations under imperfect information.

VAR with uncertainty in identification

- **Problem**: full and imperfect information DSGE model give different predictions, which is true?

  Solution: address this through uncertainty in identifying assumptions

- Structural VAR model:

$$Ay_t = Bx_{t-1} + u_t,$$

$$y_t = [\pi_t^*, \Delta y_t, \pi_t, R_t]$$

- Reduced form:

$$y_t = \Psi x_t + \epsilon_t,$$

where $\Psi = A^{-1}B$, $\epsilon_t = A^{-1}u_t$

- f. Baumeister & Hamilton (JME 2018, AER 2019) use A to introduce uncertainty about contemporaneous effects and impacts of shocks
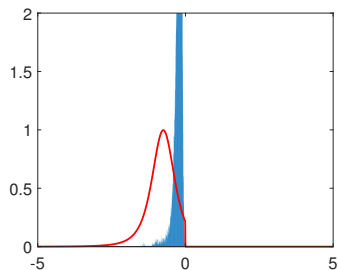

Figure: Prior (red line) and posterior (blue histogram) distributions for contemporaneous coefficient the a_{43} element of the A-matrix. Baseline model with perceived inflation target rate (PTR) measure from the FRB/US model (Brayton, Laubach, Reifschneider, 2014). Sample: 1962Q1 to 2019Q1. Horizontal axis: periods after the shock. Vertical axis: percentage change.

Identification

Data evidence is consistent with **IMPERFECT** information

- 1-2 quarters delay, then $i \uparrow \pi \uparrow$

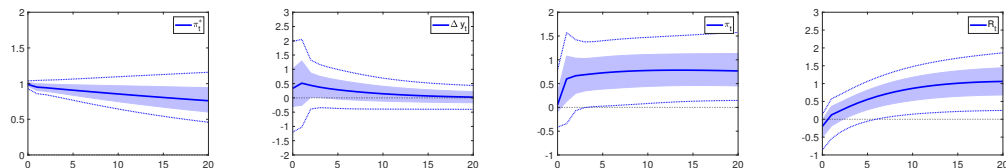 Impulse responses to a persistent inflation target shock

Figure: Shaded area - 68% confidence interval and blue dotted line 90% confidence interval to a persistent inflation target shock. Inflation target measure - SPF 10-year inflation expectations. Horizontal axis: periods after the shock. Vertical axis: percentage change. Sample: 1962Q1 to 2019Q1.

- Exclude ZLB , shadow rates : consistent with full information, i.e. $i \uparrow \pi \uparrow$ on impact

- Thus, evidence for Neo-Fisherian comovement in response to persistent monetary policy shock; an increase in nominal interest rate does not necessarily lead to fall in inflation or contraction
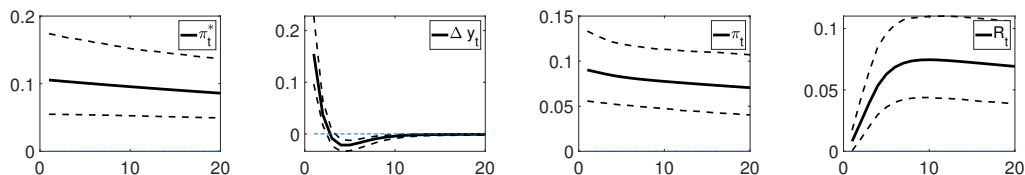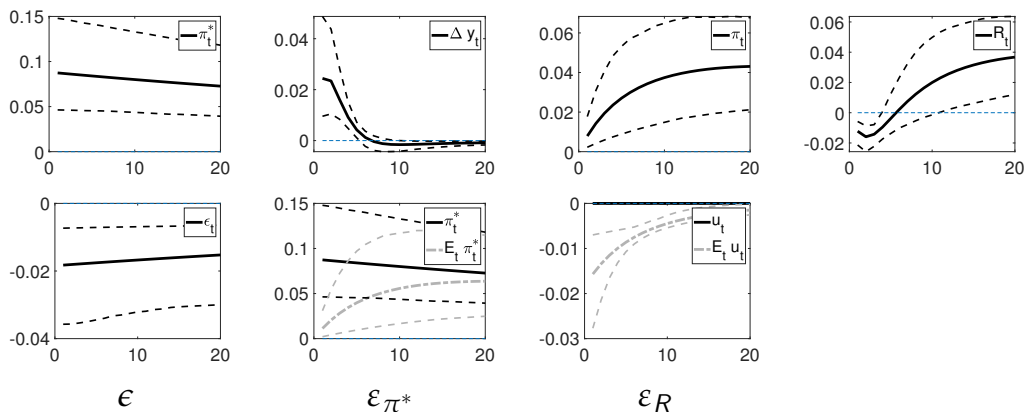
Data Model

Thank you!

Appendix
↓

Impulse responses to a persistent inflation target shock

DSGE estimated under FULL information
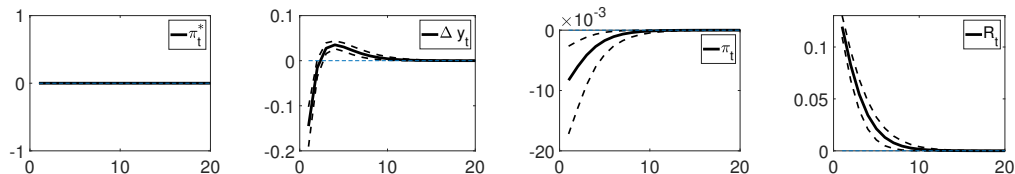
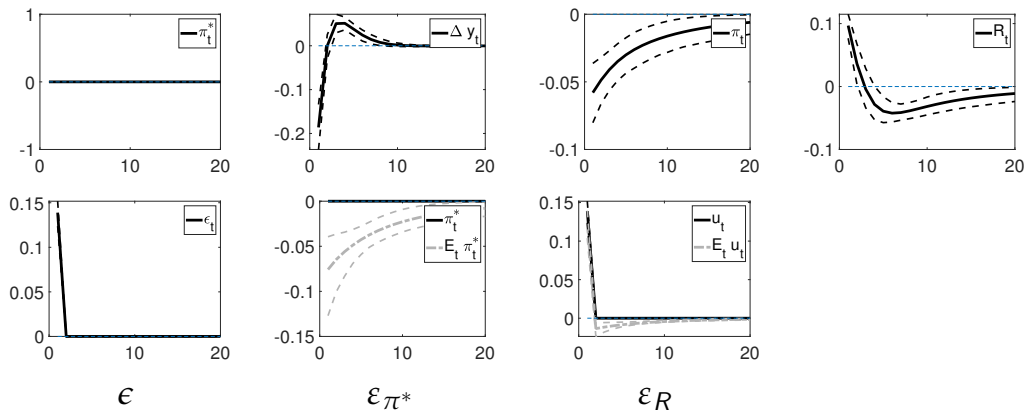DSGE estimated under IMPERFECT information

Impulse responses to a temporary monetary policy shock

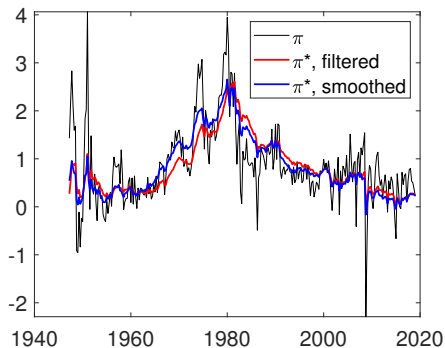### DSGE estimated under FULL information

DSGE estimated under IMPERFECT information

DSGE-implied inflation targets

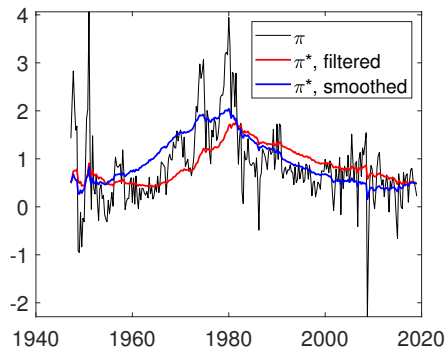full information   imperfect information

Figure: Dynamics of the inflation target series from the estimated New Keynesian DSGE model and actual inflation. Left panel: case of full information. Right panel: case of imperfect information. Black line: actual inflation. Blue line: smoothed inflation target estimate. Red line: filtered inflation target estimate.

Go back

Data

We estimate the DSGE model with Bayesian methods using the following data:

- Quarterly US data from 1947Q2 to 2019Q1

- Time series (from FRED II):
  - real output growth
  - CPI-based inflation
  - 3-month Treasury Bill rate

- Robustness:
  - add inflation expectations

- Inflation target process is (strictly speaking not permanent), but highly persistent: $\rho_{\pi^*} = 0.9889$, $\sigma_{\pi^*} = 0.1095$

Data for long-run inflation expectations
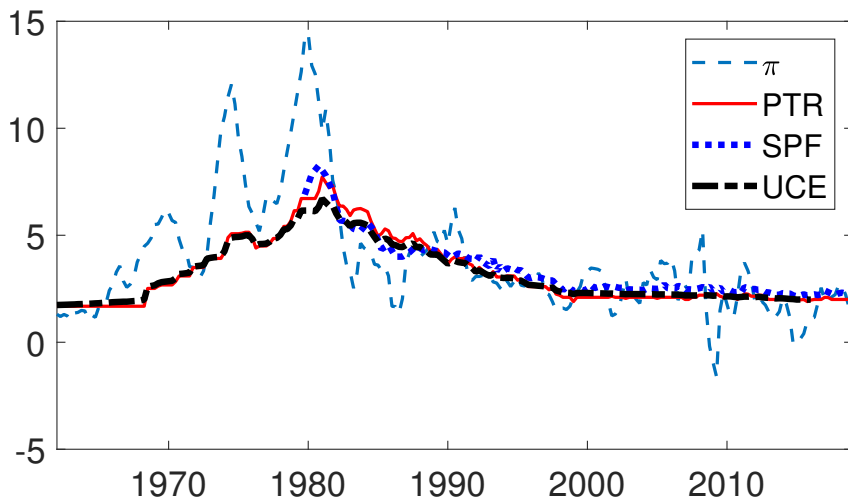
Go back

Empirical evidence from VAR model

$$y_t = \mathbf{\Psi} x_t + \epsilon_t, \tag{4}$$

where $x_t = [\pi^*, \Delta y, \pi, i]$ and intercept

- Independent Normal-Wishart prior, 2 lags

- Robustness checks: exclude ZLB, include shadow rates, 4 lags, alternative prior

How to introduce inflation target shock?
- *long-run inflation expectations*
    - FRB/US model (baseline), *PTR*
    - SPF long-run inflation expectations
- *trend inflation*:
    - Chan, Clark, Koop (JMCB, 2017) trend inflation of Stock, Watson (JMCB, 2007) augmented with inflation expectations
- *DSGE-implied* inflation target measure: full and imperfect information

Go back

Prior

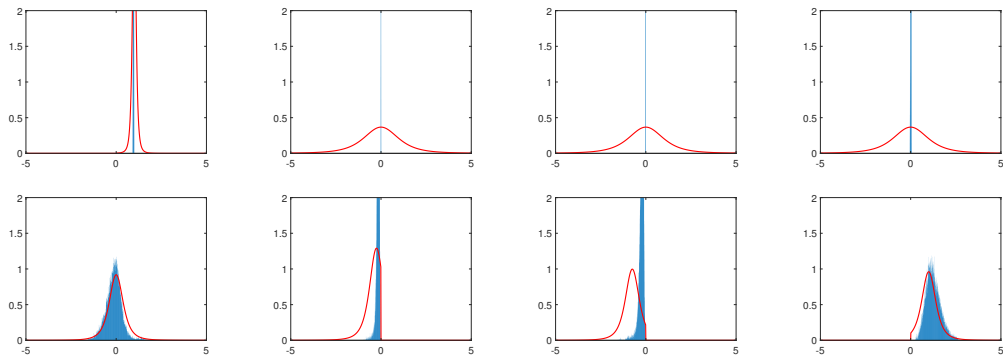all elements of $A \sim t - dist(\mu_h, \sigma_h, \nu_h, \lambda_h)$

Figure: Prior (red line) and posterior (blue histogram) distributions for contemporaneous coefficients the elements of the A-matrix. Baseline model with perceived inflation target rate (PTR) measure from the FRB/US model (Brayton, Laubach, Reifschneider, 2014). Sample: 1962Q1 to 2019Q1. Horizontal axis: periods after the shock. Vertical axis: percentage change.

Go back

VAR-based results: 1962Q1 to 2008Q3

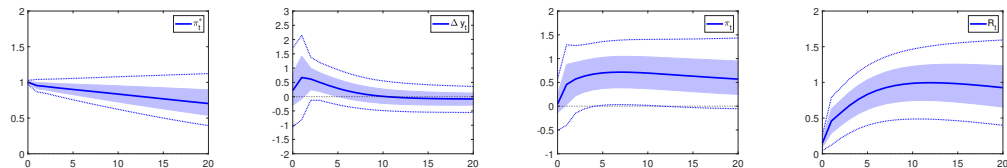## Impulse responses to a persistent inflation target shock

Figure: Baseline model with perceived inflation target rate (PTR) measure from the FRB/US model (Brayton, Laubach, Reifschneider, 2014). Shaded area - 68% confidence interval and blue dotted line 90% confidence interval to a persistent inflation target shock. Sample: 1962Q1 to 2008Q3. Horizontal axis: periods after the shock. Vertical axis: percentage change.

Go back

VAR-based results: 1962Q1 to 2019Q1 with shadow rates

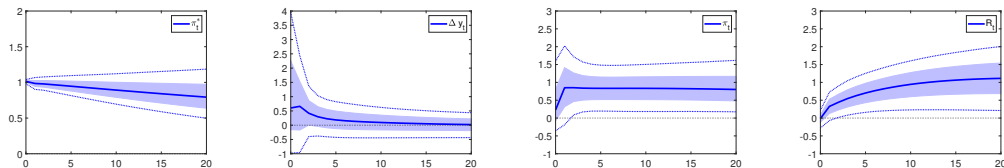Impulse responses to a persistent inflation target shock

Figure: Model with shadow rates and perceived inflation target rate (PTR) measure from the FRB/US model (Brayton, Laubach, Reifschneider, 2014). Shaded area - 68% confidence interval and blue dotted line 90% confidence interval to a persistent inflation target shock. Sample: 1962Q1 to 2019Q1. Horizontal axis: periods after the shock. Vertical axis: percentage change.

Go back