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

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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 $i \uparrow \Rightarrow \pi \downarrow$
  
  and *persistent* inflation target shock $i \uparrow \Rightarrow \pi \uparrow$, ?

• 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: $i \uparrow \Rightarrow \pi \uparrow$ Yes, with a lag
Full vs imperfect information in a DSGE model

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

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

\[ = \rho_i i_{t-1} + (1 - \rho_R) \left[ \rho_\pi (\pi_{4,t}) + \rho_y (y_t - y_t^*) \right] + \epsilon_t \quad (1) \]

\[ \epsilon_t \equiv (1 - \rho_R) (1 - \rho_\pi) \pi_t^* + u_t. \quad (2) \]

\[ \pi_t^* = \rho_{\pi^*} \pi_{t-1}^* + \epsilon_{\pi^*,t}, \quad \epsilon_{\pi^*,t} \sim N (0, \sigma_{\pi^*}^2) \quad (3) \]

**Full information:**
Agents observe \( \pi_t^* \) and \( u_t \) separately. Inflation expectations adjust immediately: \( \pi_t^* \uparrow \Rightarrow E_t \pi_t^* \uparrow \)

**Imperfect information:**
Agents observe \( \epsilon_t \), they need time to learn the nature of the shock: \( \pi_t^* \uparrow \nRightarrow E_t \pi_t^* \uparrow \)
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, Reifsneider, 2014). Sample: 1962Q1 to 2019Q1. Horizontal axis: periods after the shock. Vertical axis: percentage change.
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
Thank you!

Appendix

↓
Impulse responses to a persistent inflation target shock

DSGE estimated under FULL information

DSGE estimated under IMPERFECT information

\( \epsilon \)  \( \epsilon_{\pi} \)  \( \epsilon_R \)
Impulse responses to a temporary monetary policy shock

DSGE estimated under FULL information

DSGE estimated under IMPERFECT information

\[ \epsilon \]
\[ \epsilon_{\pi^*} \]
\[ \epsilon_R \]
DSGE-implied inflation targets

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
Empirical evidence from VAR model

\[ y_t = \Psi x_t + \epsilon_t, \quad (4) \]

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
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.
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.
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.