The Systematic Component of Monetary Policy in SVARs: An Agnostic Identification Procedure*

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March 18, 2016

*The views expressed here are the authors’ and not necessarily those of the Federal Reserve Bank of Atlanta or the Board of Governors of the Federal Reserve System.
Introduction

- Consensus view:
  - Contractionary monetary policy shocks negatively affect output

- Consensus based on SVAR analysis:
  - Bernanke and Blinder (1992), CEE (1996), Leeper, Sims and Zha (1996), Bernanke and Mihov (1998), ...

- Cornerstone behind New Keynesian DSGE models

- DSGE models estimated by matching IRFs to a MP Shock:
  - Rotemberg and Woodford (1997)
  - Christiano, Eichenbaum and Evans (2005)
  - Altig, Christiano, Eichenbaum and Linde (2011)
  - Christiano, Eichenbaum and Trabandt (2015)
Uhlig’s (2005) Critique

- Uhlig’s (2005) agnostic procedure challenges the consensus
- MP shock identified with sign restrictions on IRFs
- No restriction on the response of output to MP shock
- Main finding: MP Shocks do not negatively affect output!
  - “One can suspect that an important ingredient has so far been left out in my agnostic identification approach”
    - Uhlig (2005)
The Systematic Component of MP

• We follow the tradition in *What Does Monetary Policy Do?*
  - “Even the harsher critics of monetary authorities would not maintain that policy decisions are unrelated to the economy”
    – Leeper, Sims, and Zha (1996)

• We discipline the systematic component of MP:
  - Identification based on sign and zero restrictions
  - No restriction on the response of output to MP shock

• Our results:
  - Output drops following a contractionary MP shock
  - Robust across different MP specifications
Reduced Form VAR Estimation Details

- Consider a six-variables and twelve lags at monthly frequency

  1. Real GDP ($y_t$)
  2. GDP deflator ($p_t$)
  3. Commodity price index ($p_{c,t}$)
  4. Total reserves ($tr_t$)
  5. Nonborrowed reserves ($nbr_t$)
  6. Federal funds rate ($r_t$)

- Sample period: January 1965-December 2003

- Bayesian + Normal-Inverse Wishart prior as Uhlig (2005)
Identification: The Monetary Policy Equation

- Specifying a MP shock is equivalent to specifying MP equation

\[ r_t = \psi_y y_t + \psi_p p_t + \psi_{pc} p_{c,t} + \psi_{nbr} n_{br} t + \psi_{tr} t + \sigma \epsilon_{MP,t} \]

- FFR is the policy instrument: \( \psi_{nbr} = \psi_{tr} = 0 \)

\[ r_t = \psi_y y_t + \psi_p p_t + \psi_{pc} p_{c,t} + \sigma \epsilon_{MP,t} \]

- FFR reacts to output: \( \psi_y > 0 \)

- FFR reacts to domestic prices: \( \psi_p > 0 \)

- Normalization of the MP equation: \( \sigma > 0 \)
Baseline Identification

Restrictions

Monetary Policy Instrument:
The federal funds rate is the monetary policy instrument and it only reacts contemporaneously to output and prices (i.e. $\psi_{tr} = \psi_{nbr} = 0$)

Systematic Monetary Policy:
The contemporaneous reaction of the federal funds rate to output and the GDP deflator is positive (i.e. $\psi_y, \psi_p > 0$ while $\psi_{pc}$ remains unrestricted)

Normalization:
We normalize the monetary policy equation by imposing $\sigma > 0$, and we normalize the IRFs by imposing that the federal funds rate increases on impact in response to a monetary policy shock
The Role of the Prior

- Identification comes only from stated restrictions
  - Arias, Rubio-Ramirez, and Waggoner (2016)

- Agnostic procedure $\Leftrightarrow$ agnostic prior

- Not agnostic prior $\Rightarrow$ identification $=$ prior $+$ restrictions

- Why is this important?
  - Because the differences in results are only due to identification
Baseline Identification

IRFs to a MP Shock
Relationship with Existing Literature

- **Uhlig (2005).** Why?
  - Neither of us restricts the response of output
  - Both of us set and partially identify the model
  - Both of us use agnostic priors
  - We obtain different IRFs for output

- **CEE (1996).** Why?
  - Motivates our MP instrument restriction
  - Questionable exclusion restrictions
Uhlig (2005): Agnostic Identification Procedure

Uhlig’s (2005) Restrictions:
A monetary policy shock leads to a negative response of the GDP deflator, commodity prices, and nonborrowed reserves, and to a positive response of the federal funds rate, all at horizons $t = 0, \ldots, 5$
Uhlig (2005)
IRFs to a MP Shock

[Graphs showing output, GDP deflator, and federal funds rate over time]
Systematic MP in Uhlig (2005)

- Contemporaneous coefficients in the MP equation

<table>
<thead>
<tr>
<th></th>
<th>$\psi_y$</th>
<th>$\psi_p$</th>
<th>$\psi_{pc}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uhlig’s (2005) Restrictions</td>
<td>$-0.43$</td>
<td>$2.25$</td>
<td>$0.11$</td>
</tr>
<tr>
<td></td>
<td>$(-2.54,0.82)$</td>
<td>$(0.11,7.21)$</td>
<td>$(0.00,0.37)$</td>
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<tr>
<td>Baseline Restrictions</td>
<td>$1.22$</td>
<td>$3.52$</td>
<td>$-0.02$</td>
</tr>
<tr>
<td></td>
<td>$(0.34,3.11)$</td>
<td>$(0.98,9.88)$</td>
<td>$(-0.41,0.32)$</td>
</tr>
</tbody>
</table>

- MP instrument and systematic monetary policy are violated

- Even after imposing MP instrument
  - About 90% of draws violate systematic monetary policy
Uhlig (2005) + Baseline Identification

IRF to a MP Shock
Robustness

• Commodity Prices
  
  • Baseline Restrictions + $\psi_{pc} = 0$

• Lagged Federal Funds Rate
  
  • Baseline Restrictions + $\psi_r > 0$

• Long-run Coefficients on Output and Prices ($\ell_y$ and $\ell_p$)
  
  • Baseline Restrictions + $\ell_y > 0$ and $\ell_p > 0$

• Monetary Policy Equation in First Differences

$$r_t = \psi_y \Delta y_t + \psi_p \Delta p_t + \psi_{pc} \Delta p_{c,t} + \psi_{tr} \Delta tr_t + \psi_{nbr} \Delta nbr_t + \sigma \varepsilon_{1,t}$$

  • Baseline Restrictions in FD
Money Rules

- Systematic components that focus on the relationship between the fed funds rate, output, and prices are not the only ones.

- Focus on the relationship between interest rates and money:
  - Leeper, Sims, and Zha (1996)
  - Leeper and Zha (2003)
  - Sims and Zha (2006)

- In particular, we look at money rules.
Identification: The Monetary Policy Equation

• Specifying a MP shock is equivalent to specifying MP equation

\[ r_t = \psi_y y_t + \psi_p p_t + \psi_{pc} p_{c,t} + \psi_m m_t + \sigma \varepsilon_{MP,t} \]

• FFR is the policy instrument and only reacts contemporaneously to commodity prices and money (i.e. \( \psi_y = \psi_p = 0 \))

\[ r_t = \psi_{pc} p_{c,t} + \psi_m m_t + \sigma \varepsilon_{MP,t} \]

• The contemporaneous reaction of the FFR to money is positive (i.e. \( \psi_m > 0 \))

• Normalization of the MP equation: \( \sigma > 0 \)
Monetary Policy Instrument:
The federal funds rate is the monetary policy instrument and it only reacts contemporaneously to commodity prices and money (i.e. $\psi_y = \psi_p = 0$)

Systematic Monetary Policy:
The contemporaneous reaction of the federal funds rate to money is positive. (i.e. $\psi_m > 0$)

Normalization:
We normalize the monetary policy equation by imposing $\sigma > 0$, and we normalize the IRFs by imposing that the federal funds rate increases on impact in response to a monetary policy shock
MP Instrument + Systematic MP

IRFs to a Monetary Policy Shock
Uhlig (2005) + Alternative Identification
IRFs to a Monetary Policy Shock
Conclusion

- The consensus was that MP shocks are contractionary.
- Uhlig (2005) challenged this consensus.
- We propose to set identify monetary policy shocks disciplining the systematic component of monetary policy.
  - We find monetary policy shocks are indeed contractionary.
  - Systematic component of monetary policy implied by Uhlig (2005) violates our restrictions.
- Results are robust to alternative restrictions on the systematic component consistent with the literature.
IRFs to a Monetary Policy Shock

Baseline Restrictions + $\psi_{pc} = 0$
IRFs to a Monetary Policy Shock

Baseline Restrictions + $\psi_r > 0$
IRFs to a Monetary Policy Shock

Baseline Restrictions + $\ell_y > 0$ and $\ell_p > 0$
IRFs to a Monetary Policy Shock

Baseline Restrictions in FD

(A) Output
(B) GDP Deflator
(C) Commodity Price Index
(D) Total Reserves
(E) Nonborrowed Reserves
(F) Federal Funds Rate
Systematic Component of Monetary Policy in CEE (1996)

- Probability of violating restrictions on the systematic component of monetary policy

<table>
<thead>
<tr>
<th></th>
<th>$P(\psi_y &lt; 0)$</th>
<th>$P(\psi_p &lt; 0)$</th>
<th>$P(\psi_y &lt; 0 \cup \psi_p &lt; 0)$</th>
</tr>
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<tbody>
<tr>
<td>CEE (1996)</td>
<td>0.00</td>
<td>0.10</td>
<td>0.10</td>
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**Table:** Probability of Violating Zero and Sign Restrictions