

# Fiscal Policy and the US Economy

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## REFERENCE LIST (I)

- **Mountford A., and Uhlig H.**, 2009. "What are the effects of fiscal policy shocks?," *Journal of Applied Econometrics*, vol. 24(6), pages 960-992.
- **Blanchard O., and Perotti R.** 2002. "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output," *The Quarterly Journal of Economics*, vol. 117(4), pages 1329-1368.
- **Romer C. D., and Romer D. H.**, 2010. "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," *American Economic Review*, vol. 100(3), pages 763-801.
- **Ramey V. A.**, 2011. "Identifying Government Spending Shocks: It's all in the Timing," *The Quarterly Journal of Economics*, vol. 126(1), pages 1-50.

## REFERENCE LIST (II)

- **Mertens K., and Ravn M. O.**, 2013. "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States," *American Economic Review*, vol. 103(4), pages 1212-1247.
- **Caldara D., and Kamps C.**, 2017. "The Analytics of SVARs: A Unified Framework to Measure Fiscal Multipliers," *Review of Economic Studies*, vol. 84(3), pages 1015-1040.

### Research on other advanced and emerging economies:

- **Ilzetzki, E., Mendoza, E. G., and Vegh, C. A.**, 2013. "How big (small?) are fiscal multipliers?," *Journal of Monetary Economics*, vol. 60(2), pages 239-254.
- **Guajardo J., Leigh D., and Pescatori, A.** 2014. "Expansionary Austerity? International Evidence," *Journal of the European Economic Association*, vol. 12(4), pages 949-968.

# OVERVIEW OF THE LITERATURE

- Structural VARs have been extensively used to estimate the effects of shocks in government spending and taxes.
- Estimates of tax and spending multipliers vary substantially across studies and no consensus has been reached about their sign and size.
- Limited ability of this literature to provide guidance for theoretical modelling and for policy making.

- In this paper, we make two contributions:
  1. We develop an analytical framework to study the identification of fiscal shocks in SVARs.
  2. We provide new estimates of fiscal multipliers based on a novel identification strategy.
- Focus on identification because the importance of other factors (e.g .model specification) in accounting for the disagreement is limited.

Caldara & Kamps (2008); Chahrour & al. (2012)

# CALDARA & KAMPS (2017): FIRST CONTRIBUTION

- **First contribution:** We develop a novel analytical framework to study the identification of fiscal shocks in SVARs.
- Main idea: Identification of policy shocks amounts to specifying a policy rule to separate the endogenous response of policy from exogenous policy shock.
- We construct an analytical relationship between the parameters of the policy rules and the fiscal multipliers.

# CALDARA & KAMPS (2017): FIRST CONTRIBUTION

- We apply the analytical framework to study:
  1. How the specification of the policy rule affects the estimation of fiscal multipliers.
  2. What are the assumptions on the fiscal rules implied by the identification schemes used in the literature.
- We find that:
  1. Small changes in the fiscal rules can induce large changes in fiscal multipliers.
  2. Existing schemes imply very different assumptions on the fiscal rules. The observed differences in fiscal rules account for the bulk of the discrepancy across studies.

## CALDARA & KAMPS (2017): SECOND CONTRIBUTION

- **Second contribution:** We provide new estimates of the fiscal rules and, by implication, of the fiscal multipliers.
- Main idea: We use non-fiscal shocks (e.g. technology shocks), as instruments to identify the parameters of the fiscal rules.
- We find that:
  1. Systematic response of taxes to output positive and large.
  2. Systematic response of government spending to output mildly negative.
  3. Spending and tax multipliers are positive, with spending multiplier being larger.



# SVAR MODEL

- Structural VAR:

$$B_0 y_t = B_1 y_{t-1} + \cdots + B_p y_{t-p} + w_t$$

- Reduced form VAR:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + u_t$$

- Relationship between reduced form residuals and structural shocks:

$$B_0 u_t = w_t$$

# THE FISCAL POLICY RULE

- Assume the following partition of  $w_t$ :  $[w_{pol,t}, w_{np,t}]$ .
- First equation of the SVAR is the **policy equation**:

$$B_{0,1}y_t = B_{1,1}y_{t-1} + \cdots + B_{p,1}y_{t-p} + w_{pol,t}$$

- We can rewrite the policy equation in the form of a policy rule:

$$y_{pol,t} = y'_{np,t}\psi_0 + \sum_{i=1}^p y'_{t-i}\psi_i + \omega_p w_{pol,t}, \quad \text{for } 1 \leq t \leq T.$$

# REWRITING THE FISCAL RULE

- For given  $(A, \Sigma)$ , I can express the rule as follows:

$$u_{pol,t} = \psi_0 u_{np,t} + \omega_p w_{p,t}, \quad \text{for } 1 \leq t \leq T.$$

- Reduced-form residuals  $u_t$  embed information about lags of  $y_t$
- Lagged structural coefficients that enter in the rule can be recovered using the relationship  $A_i = B_0^{-1} B_i$ .
- Hence, the vector of contemporaneous elasticities  $\psi_0$  is all we need to know to characterize the systematic component of policy.

# UNDERSTANDING IDENTIFICATION

- Knowledge of  $\psi_0$  implies identification of  $w_{pol,t}$ .
- Knowledge of  $w_{pol,t}$  implies identification of  $\psi_0$ !
- Intuition in two steps:
  1. Use  $w_{pol,t}$  to estimate

$$u_{np,t} = \xi_0 u_{pol,t} + \Omega_{np} w_{np,t}$$

2. Use  $w_{np,t}$  to instrument  $u_{np,t}$  in the policy rule:

$$u_{pol,t} = \psi_0 u_{np,t} + \omega_{pol} w_{pol,t}.$$

- This mapping shows that we can use our framework to study any identification scheme.

# A SIMPLE FISCAL RULE

- For ease of exposition and to build intuition, our analysis concentrates on a simple rule in which the fiscal variable can respond contemporaneously only to output:

$$u_{pol,t} = \psi_{gdp}^{pol} u_{gdp,t} + \omega_{pol} w_{pol,t}, \quad \text{for } 1 \leq t \leq T$$

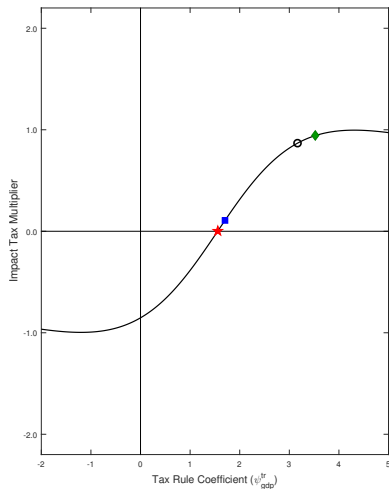
- We will see that this simple rule is also empirically relevant.
- Under this simple rule, we can derive a closed-form expression for the fiscal multiplier:

$$M_0(\psi_{gdp}^{pol}, \Sigma) \equiv \frac{L_0(A_0, A_+)_{gdp,pol}}{\omega_{pol}} = \frac{\sigma_{pol,gdp} - \psi_{gdp}^{pol} \sigma_{gdp}^2}{(\psi_{gdp}^{pol} \sigma_{gdp})^2 + \sigma_{pol}^2 - 2\psi_{gdp}^p \sigma_{pol,gdp}}.$$

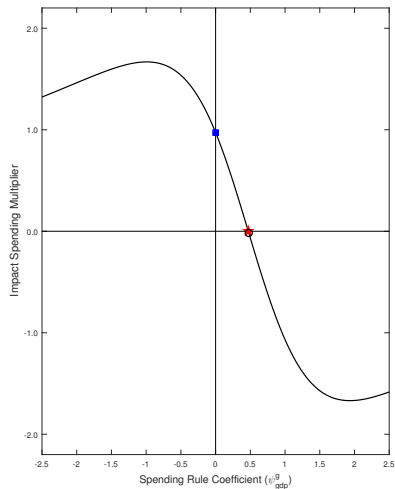
# ESTIMATION

- Estimation: five-variable and four-lag VAR in
  - ▶ GDP
  - ▶ Tax Revenue, Government Spending,
  - ▶ CPI and 3-month T-bill rate.
- Robustness:
  - ▶ News series of tax shocks  
[Leeper et al \(2013\)](#)
  - ▶ News series of spending shocks  
[Ramey \(2011\)](#)
- Sample: 1950:II – 2006:IV
- Bayesian estimation

# IMPACT FISCAL MULTIPLIERS



★ Cholesky ( $\psi_{gdp}^{chol}$ )    ■ Blanchard-Perotti    ○ Penalty Function    ◆ Proxy SVAR



# A ROADMAP OF THE SVAR LITERATURE

- Structural VAR identification schemes as restrictions on the fiscal rule parameters:
  - ▶ Cholesky decomposition
  - ▶ Blanchard-Perotti
  - ▶ Penalty function approach
  - ▶ Proxy SVAR



# BLANCHARD & PEROTTI (2002)

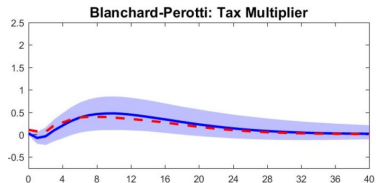
- Impose exact restrictions directly on the parameters of the fiscal rule.
- Restrictions based on public finance estimates of fiscal rules.
- Output elasticity of tax revenue:

$$\psi_{gdp}^{tr} = \sum_i \psi_{gdp}^{tr_i} \frac{tr_i}{tr},$$

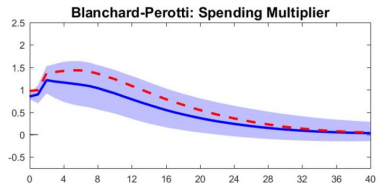
Item	$tr_i / tr$ (%)	$\psi_{tb_i}^{tr_i}$	$\psi_{gdp}^{tb_i}$	$\psi_{gdp}^{tr_i} = \psi_{tb_i}^{tr_i} * \psi_{gdp}^{tb_i}$
Personal Income	45.0%	1.72	1.00	1.72
Social Insurance	28.5%	0.78	1.00	0.78
Corporate Income	17.5%	0.80	4.20	3.36
Indirect Taxes	9.0%	1.06	1.00	1.06
$\psi_{gdp}^{tr} = 1.70$				

- Output elasticity of spending:  $\psi_{gdp}^g = 0.00$ .

# BLANCHARD PEROTTI: DYNAMIC MULTIPLIERS



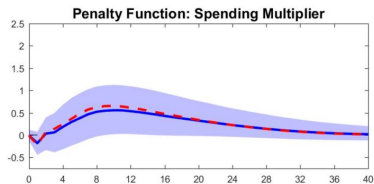
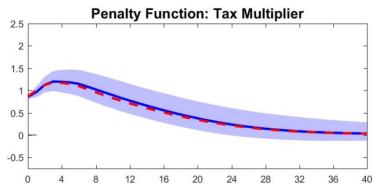
— General Fiscal Rule - - Simple Fiscal Rule



# Penalty Function Identification

- Penalty function identification: (sequentially) identify shocks that maximize the impulse responses of some target variables over a pre-specified horizon.
- Mountford and Uhlig (2009) proceeds in two steps:
  1. **Business cycle shock**: maximize positive response of output and taxes.
  2. **Fiscal shock**: maximize positive response of fiscal variable.
  3. Intuition (1): the bulk of business cycle fluctuations are unrelated to fiscal shocks.
  4. Intuition (2): Business cycle shock pins down the coefficients of the fiscal rule.

# PENALTY FUNCTION: DYNAMIC MULTIPLIERS



# PROXY SVAR IDENTIFICATION

- Observe proxy  $m_{pol,t}$  for the unobserved  $w_{pol,t}$ :

$$\begin{aligned}\mathbb{E}[m_{pol,t}w'_{pol,t}] &= \gamma, \\ \mathbb{E}[m_{pol,t}w'_{np,t}] &= 0.\end{aligned}$$

- Use proxy to identify fiscal rule coefficients in two steps.
  1. Use  $m_{pol,t}$  to estimate

$$u_{np,t} = \xi_0 u_{pol,t} + \tilde{w}_{np,t}$$

where  $\tilde{w}_{np,t} = \Omega_{np} w_{np,t}$

2. Use  $\tilde{w}_{np,t}$  to instrument  $u_{np,t}$  in the policy rule:

$$u_{pol,t} = \psi_0 u_{np,t} + \omega_{pol} w_{pol,t}.$$

- We use proxy for tax shocks.

Romer & Romer (2009); Mertens & Ravn (2013)

# ROMER AND ROMER (2010) NARRATIVE ANALYSIS

## Example of Endogenous Tax Change

### EXHIBIT 1—NARRATIVE ANALYSIS OF A COUNTERCYCLICAL TAX CHANGE

#### **Tax Reduction Act of 1975**

Signed: 3/29/75

Change in Liabilities (excluding retroactive changes):

1975:II            −\$45.3 billion            (Endogenous; Countercyclical)

1975:III          +\$32.5 billion            (Endogenous; Countercyclical)

Change in Liabilities (including retroactive changes):

1975:II            −\$58.1 billion            (Endogenous; Countercyclical)

1975:III          +\$45.3 billion            (Endogenous; Countercyclical)

Present Value:

1975:III          −\$13.32 billion            (Endogenous; Countercyclical)

# ROMER AND ROMER (2010) NARRATIVE ANALYSIS

## Example of Exogenous Tax Change

### EXHIBIT 2—NARRATIVE ANALYSIS OF A LONG-RUN TAX CHANGE

#### **Revenue Act of 1964**

Signed: 2/26/64

Change in Liabilities (excluding retroactive changes):

1964:II            −\$8.4 billion            (Exogenous; Long-run)

1965:I            −\$4.5 billion            (Exogenous; Long-run)

Change in Liabilities (including retroactive changes):

1964:II            −\$16.8 billion            (Exogenous; Long-run)

1964:III            +\$8.4 billion            (Exogenous; Long-run)

1965:I            −\$4.5 billion            (Exogenous; Long-run)

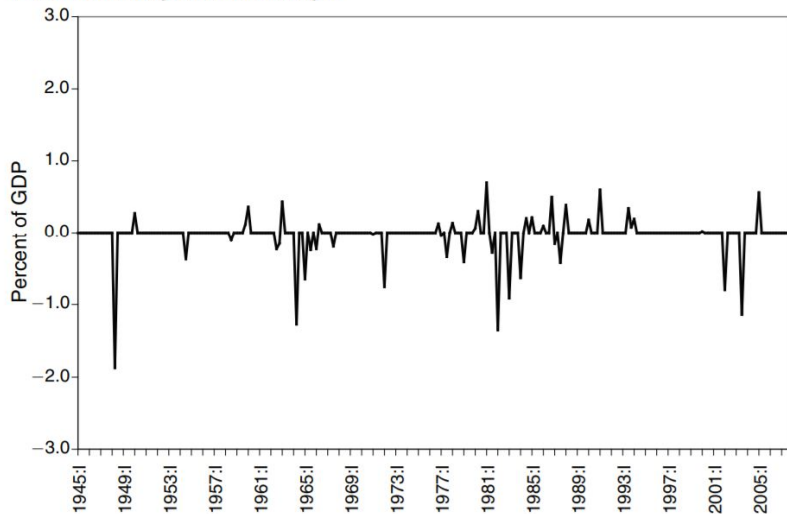
Present Value:

1964:I            −\$12.72 billion            (Exogenous; Long-run)

# ROMER AND ROMER (2010) NARRATIVE ANALYSIS

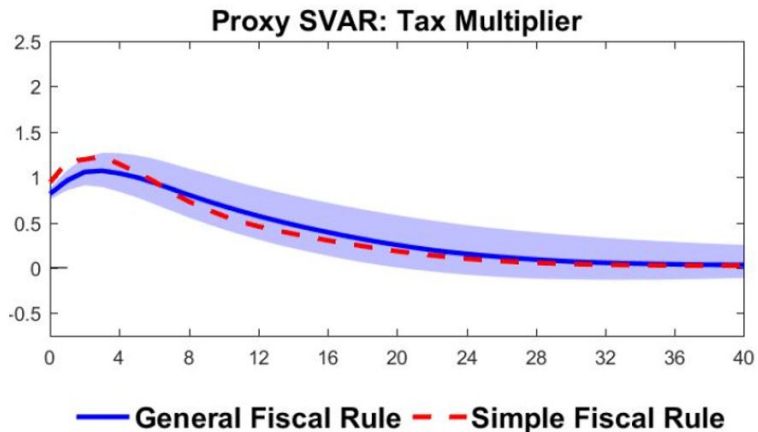
## All Exogenous Tax Change

Panel A. All exogenous tax changes

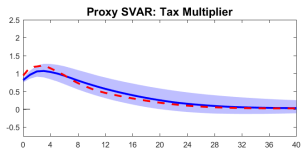
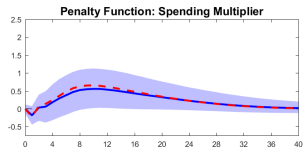
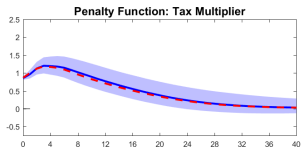
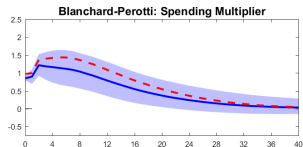
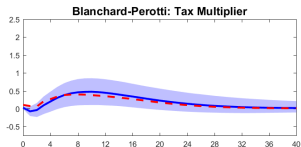




# PROXY SVAR: DYNAMIC MULTIPLIERS



# DYNAMIC MULTIPLIERS: SUMMARY



— General Fiscal Rule - - Simple Fiscal Rule

# ESTIMATED GENERAL FISCAL RULES

**Table:** CONTEMPORANEOUS ELASTICITIES IN THE FISCAL POLICY RULES  
(GENERAL RULES)

	Blanchard-Perotti	Penalty Function	Proxy SVAR
<i>(A.) Tax Rule</i>			
$\psi_{0,gdp}^{tr}$	1.70	3.24 [3.04 3.45]	3.58 [3.22 3.98]
$\psi_{0,\pi}^{tr}$	1.25	0.48 [0.23 0.74]	2.41 [1.95 2.91]
$\psi_{0,r}^{tr}$	0.00	-0.42 [-0.65 -0.20]	-0.01 [-0.42 0.39]
$\psi_{0,g}^{tr}$	-0.14 [-0.17 -0.10]	0.01 [-0.15 0.18]	-0.29 [-0.50 -0.09]
<i>(B.) Government Spending Rule</i>			
$\psi_{0,gdp}^g$	0.00	0.55 [0.44 0.66]	
$\psi_{0,\pi}^g$	-0.50	0.41 [0.30 0.52]	
$\psi_{0,r}^g$	0.00	-0.36 [-0.45 -0.26]	
$\psi_{0,tr}^g$	0.00	0.00	

# PROXY SVAR WITH NON-FISCAL PROXIES

- Same proxy SVAR methodology described previously...
- but we use non-fiscal proxies to directly estimate coefficients of the fiscal rules.
- Intuition: non-fiscal shocks move variables for reason unrelated to discretionary changes in fiscal policy.
- We use proxies for technology shocks, oil shocks, and monetary policy shocks.

Fernald (2012); Hamilton (2003); Romer & Romer (2004)

# PROXY SVAR WITH NON-FISCAL PROXIES

- Observe proxy  $m_{np,t}$  for the unobserved  $w_{np,t}$ :

$$\mathbb{E}[m_{np,t}w'_{np,t}] = \Gamma_{np},$$

$$\mathbb{E}[m_{np,t}w'_{pol,t}] = 0.$$

- Use proxy to identify fiscal rule coefficients in ONE step.
- Use  $m_{np,t}$  to instrument  $u_{np,t}$  in the policy rule:

$$u_{pol,t} = \psi_0 u_{np,t} + \omega_{pol} w_{pol,t}.$$

- In addition, we can use  $\tilde{w}_{pol,t} = \omega_{pol} w_{pol,t}$  as instrument to estimate.

$$u_{np,t} = \xi_0 u_{pol,t} + \tilde{w}_{np,t}$$

and recover the effects of policy variables on non-policy variables.

# RELEVANCE AND EXOGENEITY OF $m_{np,t}$

Table 2: PREDICTABILITY REGRESSIONS

(A.) <i>Relevance of Non-Fiscal Proxies</i>			
	$u_{gdp}$	$u_{\pi}$	$u_r$
$m_{tfp}$ (Utilization-Adjusted Productivity)	0.10 [0.01]	0.00 [0.01]	
$m_{oil}$ (Oil Shocks)	-0.01 [0.01]	0.01 [0.01]	
$m_r$ (Monetary Policy Shocks)			0.79 [0.07]
F-statistic	26.27	2.46	120.52
(B.) <i>Exogeneity of Non-Fiscal Proxies</i>			
	$m_{tfp}$	$m_{oil}$	$m_r$
$m_{tax}$ (Narrative Tax Shocks)	-2.06 [1.53]	0.93 [2.22]	-0.04 [0.31]
$m_g$ (Military Spending Shocks)	-0.23 [0.21]	0.38 [0.31]	0.04 [0.04]
F-statistic	1.44	0.85	0.54

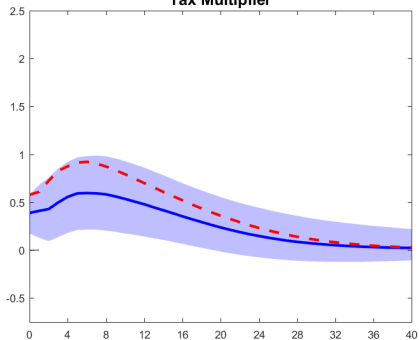
# PROXY SVAR WITH NON-FISCAL PROXIES

**Table:** CONTEMPORANEOUS ELASTICITIES IN THE FISCAL POLICY RULES  
(PROXY SVAR IDENTIFICATION WITH NON-FISCAL PROXIES)

	General Rule	Simple Rule
<i>(A.) Tax Rule</i>		
$\psi_{0,gdp}^{tr}$	2.18 [1.96 2.41]	2.43 [2.21 2.66]
$\psi_{0,\pi}^{tr}$	1.06 [0.09 2.10]	
$\psi_{0,r}^{tr}$	0.56 [0.39 0.73]	
$\psi_{0,g}^{tr}$	-0.23 [-0.46 -0.02]	
<i>(B.) Government Spending Rule</i>		
$\psi_{0,gdp}^g$	-0.13 [-0.28 0.01]	-0.15 [-0.27 -0.03]
$\psi_{0,\pi}^g$	-0.75 [-1.62 -0.08]	
$\psi_{0,r}^g$	0.01 [-0.09 0.13]	
$\psi_{0,tr}^g$	0.00	

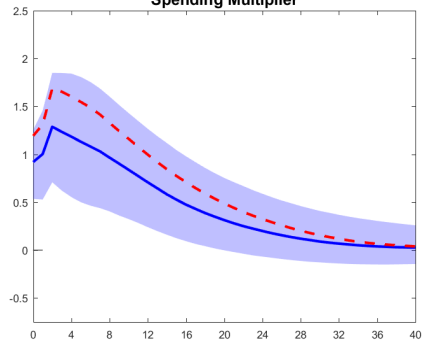
# PROXY SVAR WITH NON-FISCAL INSTRUMENTS: DYNAMIC MULTIPLIERS

**Tax Multiplier**



— General Fiscal Rule

**Spending Multiplier**



- - Simple Fiscal Rule

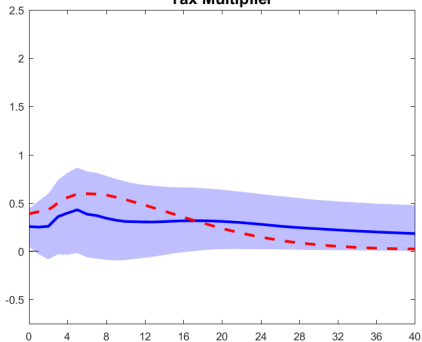


# ROBUSTNESS OF PROXY SVAR WITH NON-FISCAL PROXIES

- Specification of the reduced-form model:
  - ▶ Add measures of fiscal news.
  - ▶ Alternative detrending of the data.
- Alternative definition of fiscal multipliers.
- Alternative identification within fiscal policy block.

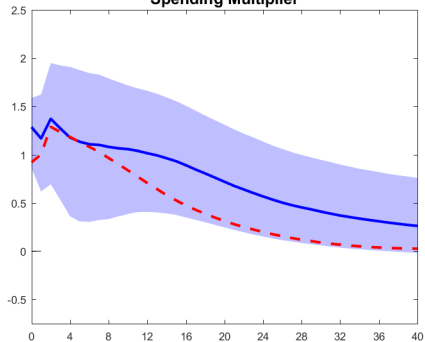
# FISCAL FORESIGHT

**Tax Multiplier**



— Model with Fiscal News

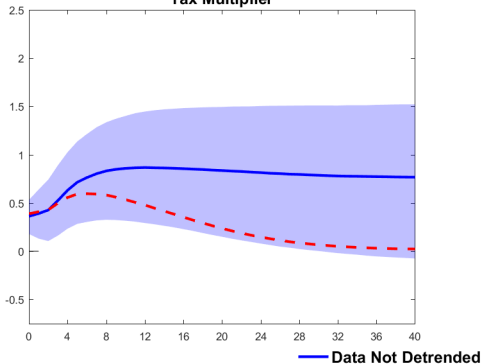
**Spending Multiplier**



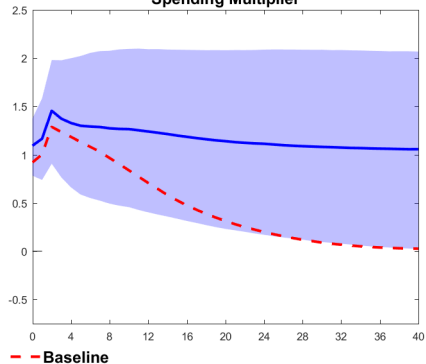
- - Baseline

# DETRENDING OF DATA

**Tax Multiplier**

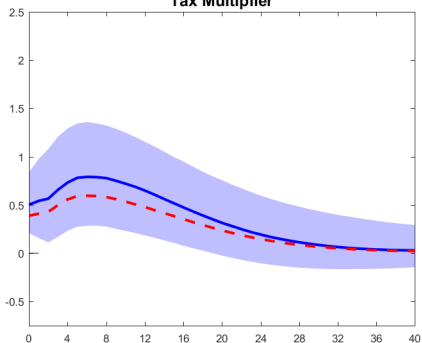


**Spending Multiplier**



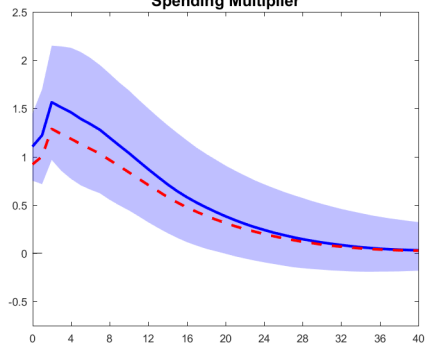
# ALTERNATIVE DEFINITION OF MULTIPLIERS

**Tax Multiplier**



— Alternative Scaling of Shocks

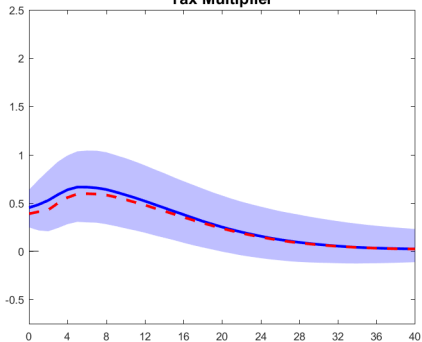
**Spending Multiplier**



- - Baseline

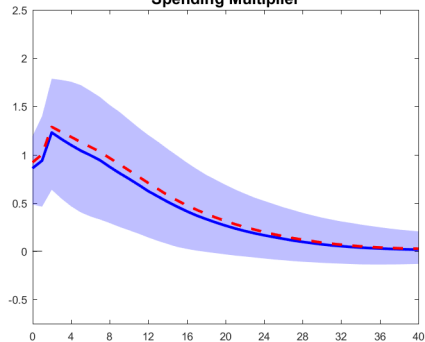
# IDENTIFICATION WITHIN POLICY BLOCK

**Tax Multiplier**



— Gov. Spending Ordered Second

**Spending Multiplier**



- - Baseline

# CONCLUSIONS

1. We derived an analytical framework to compare fiscal multipliers implied by commonly used identification schemes.
2. Key to this framework is the relationship between fiscal rules and fiscal shocks.
3. Commonly used identification schemes imply different fiscal rules and consequently different fiscal multipliers.
4. We provide new estimates for fiscal rules based on proxy SVARs.
5. We find that spending multiplier are larger than tax multiplier.