# Identifying the Effects of Funded vs. Unfunded Fiscal Shocks

Incomplete and preliminary!

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# Resurgence of interest in fiscal explanations of inflation

- Inflation and large fiscal deficits post-COVID
- Fiscal Theory of Price Level
  - Cochrane (2023), Barro and Bianchi (2024)

# Distinction between funded and unfunded deficits

- **Funded deficits:**
  - current deficit is offset by present value of future surpluses
  - lump-sum taxes, no frictions: Ricardian equivalence (deficits are neutral)
  - monetary policy is active, fiscal policy passive
- **Unfunded deficit shock:**
  - current deficit is not fully offset by future surpluses
  - inflationary (FTPL), expansionary (boost aggregate demand)
  - fiscal policy is active, monetary policy is passive

# Research question

- Can we identify funded vs unfunded fiscal deficit shocks?
- What are the effects of these shocks on economic activity?

# Existing approaches

**DSGE approach:** Bianchi, Faccini & Melosi (2023), Smets & Wouters (2024), Balke & Zarazaga (2024)

- Impose strong restrictions on the data generating process
- Many of these restrictions are auxiliary assumptions about the stochastic processes of shocks for which theory provides no guidance

# What we do

- Minimal restrictions on the data generating process
  - use VAR to model dynamics of the data
- Minimal assumptions used to identify funded vs unfunded fiscal shocks
  - mixture of zero and sign restrictions
  - Keep the framework as **agnostic** as possible

# Inflation and VARs

- **Conventional monetary VARs**
  - Unexpected inflation is typically attributed to monetary or other structural shocks.
  - Traditional VARs often omit fiscal variables, presume fiscal policy is neutral.
  - Shocks to primary surpluses are typically not treated as independent drivers of inflation.
- **Fiscal VARs**
  - Typically, do not separately identify funded vs unfunded shocks
  - Indirectly identified funded vs unfunded shocks when using regime switching VARs or time varying parameter VARs

# Our contribution

1. **FTPL / policy-regime literature:**
   by developing a data-driven identification of funded vs unfunded fiscal shocks.
   (Leeper (1991); Sims (1994); Woodford (1995); Cochrane (2001, 2011))
2. **Empirical fiscal SVAR:**
   assess the contribution of deficit shocks to output, inflation, and interest rates
   (Blanchard & Perotti (2002); Ramey (2011); Caldara & Kamps (2017))
3. **DSGE-based identification:**
   by proposing a parsimonious structural VAR as an empirical alternative to large DSGEs.
   (Smets & Wouters (2024); Balke & Zarazaga (2024); Bianchi, Faccini & Melosi (2022))

# Our findings

1. Funded deficit shocks "look" neutral
2. Unfunded deficit shocks on impact increase inflation, real GDP growth, and lower nominal returns on government debt
3. Fiscal shocks are only moderate contributor to historical fluctuations in inflation
4. Most of the fluctuations of fiscal variables are "endogenous" (i.e. government surpluses and debt respond to other shocks)
5. Results are fairly robust to alternative ways of implementing identification

# Government Budget Equation

**Flow budget equation**

$$S_t + V_t \;=\; \frac{R_t^V}{\Pi_t\, G_t}\, V_{t-1}$$

**Notation**

$S_t$: real primary surplus over GDP
$V_t$: real market value of debt over GDP
$R_t^V$: gross nominal return on government debt
$\Pi_t$: gross inflation
$G_t$: real GDP growth factor

# Government debt and future surpluses

**Implies value of debt is equal to PV of expected future surpluses**

$$V_t \;=\; E_t \sum_{j=1}^{\infty} \left( \prod_{i=1}^{j} \frac{R^V_{t+i}}{\Pi_{t+i}\, G_{t+i}} \right)^{-1} S_{t+j}$$

$V_t$: present value of future primary surpluses
$S_t + V_t$: PV of current and future primary surpluses

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**Definition**

| **Funded deficit shock** | **Unfunded deficit shock** |
|---|---|
| $\Delta E_t(S_t + V_t) = 0$ | $\Delta E_t(S_t + V_t) < 0$ |
| Fiscally neutral | Fiscally non-neutral |
| $V_t \uparrow$ one-for-one with deficit shock | No one-for-one change in $V_t$ with deficit shock |

# Transmission of Fiscal deficit shocks to Economic Activity

**Government Flow Budget Equation**

$$S_t + V_t \;=\; \frac{R_t^V}{\Pi_t\, G_t}\, V_{t-1}$$

## Funded deficit shock

- $\Delta E_t(S_t + V_t) = 0$
- $R_t^V, \Pi_t, G_t$ individually may change, but $\frac{R_t^V}{\Pi_t G_t}$ unchanged
- No frictions: Ricardian equivalence, funded deficit shocks are neutral (no effect on $R_t^V, \Pi_t$, or $G_t$)
- Real effects due to myopia, liquidity constraints, distortionary taxes, distributional consequences

# Transmission of Fiscal deficit shocks to Economic Activity

**Government Flow Budget Equation**

$$S_t + V_t \;=\; \frac{R_t^V}{\Pi_t\, G_t}\, V_{t-1}$$

## Unfunded deficit shock

- $S_t + V_t \downarrow \implies \frac{R_t^V}{\Pi_t G_t} \downarrow$
- Demand for debt falls: $R_t^V \downarrow$
- Demand for goods rises: $\Pi_t\, G_t \uparrow$
- No frictions: FTPL $\implies \Pi_t \uparrow$
- Real effects due to frictions (price stickiness, myopia, liquidity constraints, distortionary taxes, etc).

# Transmission of Fiscal deficit shocks to Economic Activity

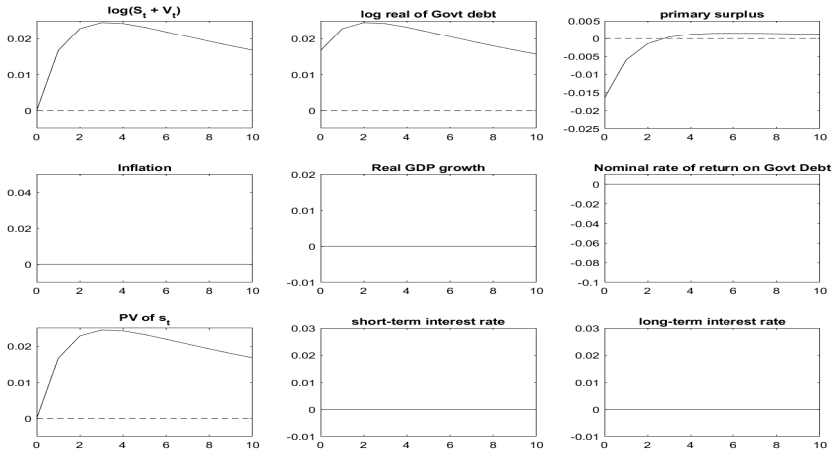
**The Stance of Fiscal Policy**

$$\frac{S_t + V_t}{V_{t-1}} = \frac{R_t^V}{\Pi_t \, G_t}$$

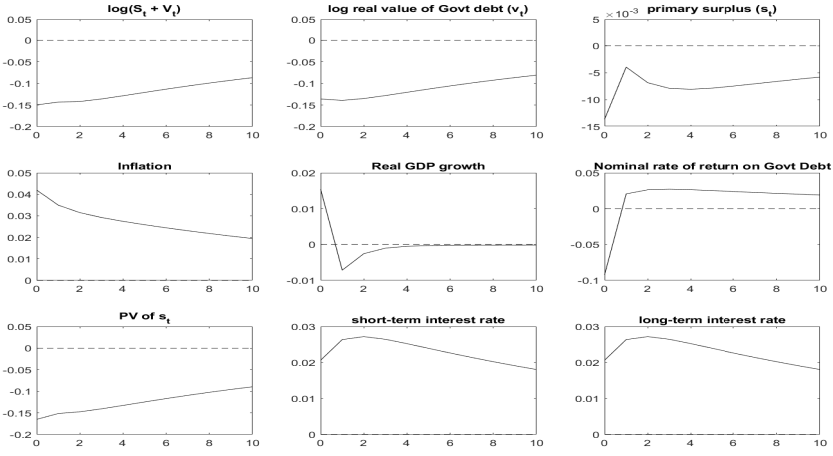
Expansionary fiscal policy

- fiscal stance $\frac{S_t+V_t}{V_{t-1}} \downarrow \implies \frac{R_t^V}{\Pi_t G_t} \downarrow$

# Example: New Keynesian Model Response to a Funded Deficit Shock



# Example: New Keynesian Model Response to an Unfunded Deficit Shock



# Data & SVAR

**Sample.** U.S., annual, 1959–2025; SVAR with 2 lags.

**Variables in the SVAR**

- fiscal stance: $\log(S_t + V_t) - \log(V_{t-1})$
- log debt-to-GDP ratio: $v_t = \log(V_{t-1})$
- Inflation: $\pi_t = \log(\Pi_t)$
- Real GDP growth: $g_t = \log(G_t)$
- 3-month T-bill rate
- 10-year Treasury yield

# Constructed variables

**Constructed variables implied by the SVAR**

- nominal rate of return on debt: $r_t^V = \log(S_t + V_t) - \log(V_{t-1}) + \pi_t + g_t$
- Primary surplus: $s_t = \log(S_t + V_t) - \rho \log(V_t)$
  - $\rho \approx (\frac{R^V}{\Pi G})^{-1}$, set $\rho = 0.9999$
- Present value of surpluses at a constant discount rate
  - $E_t \sum_{j=0}^{\infty} \rho^j s_{t+j}$

# Data & SVAR

**Companion form of the VAR**

$$Y_t = A\, Y_{t-1} + \epsilon_t$$

$E(\epsilon_t \epsilon_t') = \Sigma$

**Structural shocks**

$$\epsilon_t = A_0 u_t$$

- $u_t$ orthogonal ($E[u_t u_t'] = I$)
- pick $A_0$ to satisfy a combination of zero and sign restrictions ($A_0 A_0' = \Sigma$)

# Covariance of residuals from VAR

- correlation with innovations to fiscal stance:
  - negative for inflation (-0.56) and output growth (-0.73)
  - positive for nominal return on debt (0.83)
- Consistent with simple economics of the government flow constraint (and also New Keynesian model)

# Formal Identification Strategy

- **Funded shock**

$$\Delta E_t \log\left(\frac{S_t + V_t}{V_{t-1}}\right)\Big|_{\text{funded deficit shock, horizon}=0} = 0$$

- **Expansionary shock to stance of fiscal policy (unfunded shock)**

$$\Delta E_t \log\left(\frac{S_t + V_t}{V_{t-1}}\right)\Big|_{\text{unfunded deficit shock, horizon}=0} < 0$$

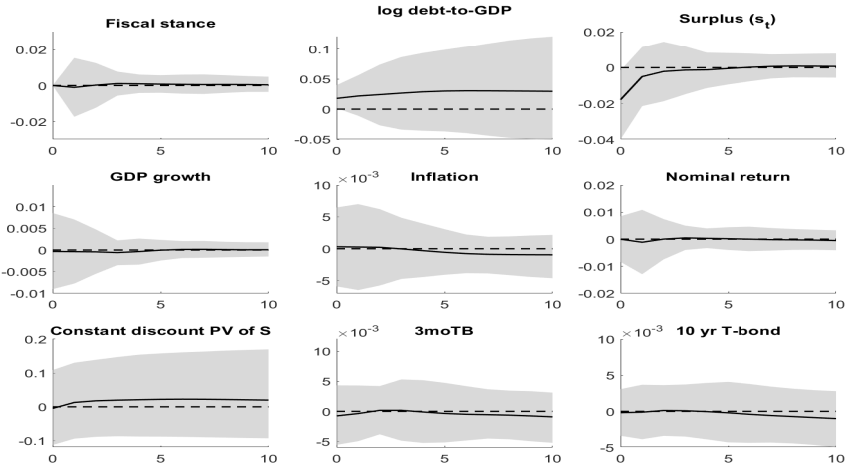
# Identification Strategy: additional restrictions

- Use the predictions from economic theory (New Keynesian model)
- Sign restrictions for expansionary fiscal stance shock:

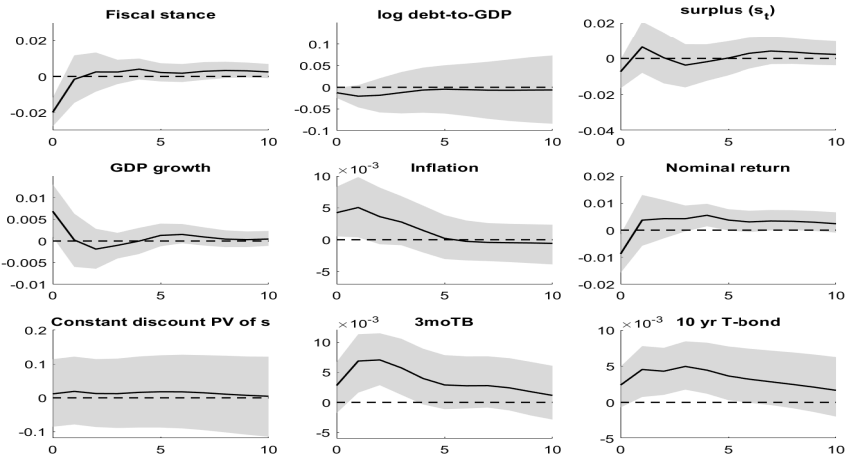
$$\Delta E_t \log(\Pi_t) > 0,\ \Delta E_t \log(G_t) > 0,\ \Delta E_t \log(R_t^V) < 0$$

- Unfunded deficit shock: $\Delta E_t\, s_t < 0$
- PV of future deficits rise: $\Delta E_t\ \log(V_t) < 0$

# Empirical IRFs: Funded Shock (90% confidence interval)



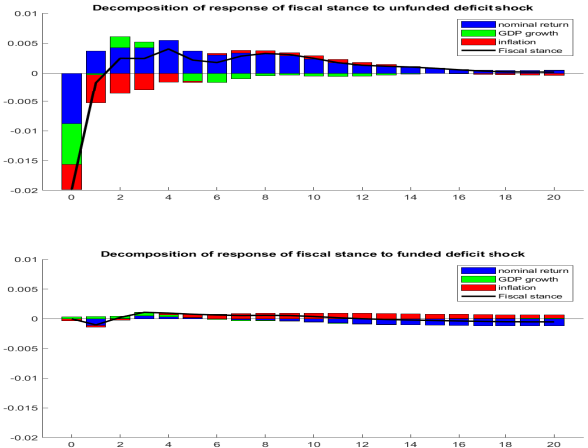
# Empirical IRFs: Unfunded Shock (90% confidence interval)



# Decomposition of fiscal stance response to deficit shocks

- Can break up fiscal stance into response of inflation, output and nominal returns
  - $\log\left(\frac{S_t+V_t}{V_{t-1}}\right) = r_t^V - \pi_t - g_t$
- unfunded shocks on impact
  - nearly half of the change in fiscal stance in accommodated by a change in nominal return on debt $\implies$ bond holders "pay" for the unfunded deficit
  - output growth and inflation accommodate approximately 25% each

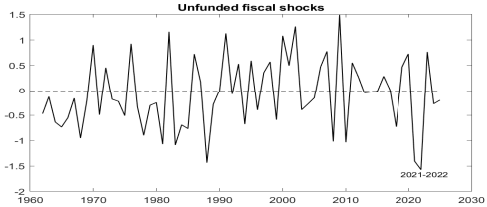
# Decomposition of fiscal stance response to deficit shocks

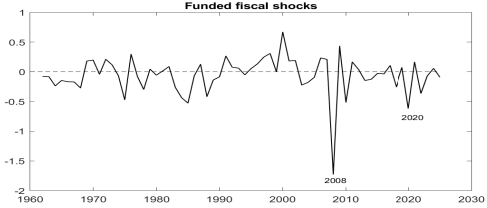


# Summary of IRF results for benchmark specification

- Funded deficit shocks look pretty "Ricardian"–not much of an effect on economic activity
- Unfunded deficit shocks appear to have stimulative effect on economic activity
  - Real GDP growth is positive on impact
  - Persistent increase in inflation
  - Relatively large decrease in nominal return on govt debt on impact
  - Persistent increase in nominal interest rates (humped shaped)
- Bond holders "pay" for unfunded deficits

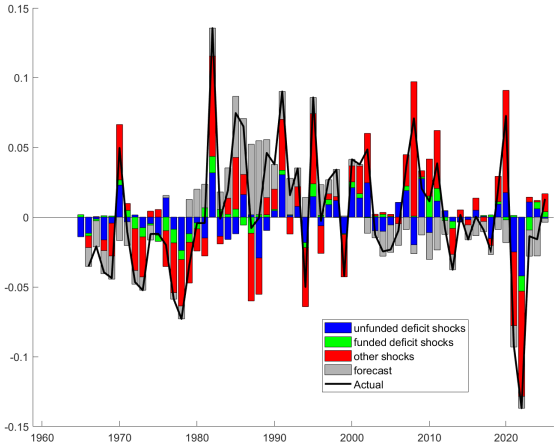
# Identified unfunded and funded fiscal deficit shocks



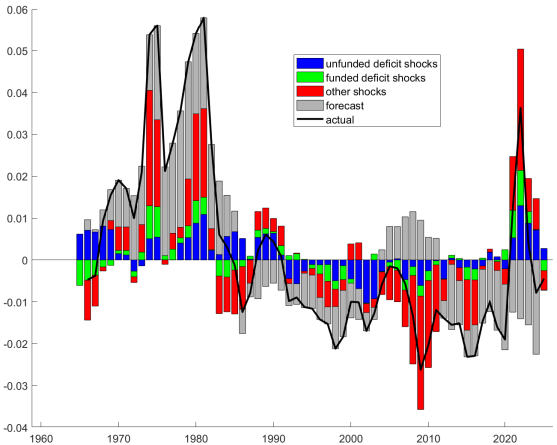
# Historical Decomposition (4 year forecast error) Fiscal Stance

Blue:unfunded, Green:funded, Red:other, Gray:forecast,



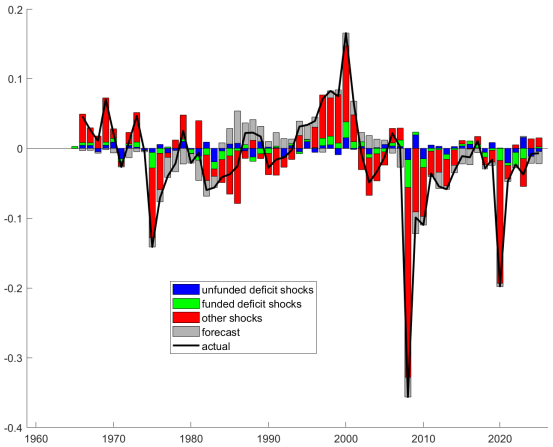
# Historical Decomposition (4 year forecast error) Inflation

Blue:unfunded, Green:funded, Red:other, Gray:forecast,

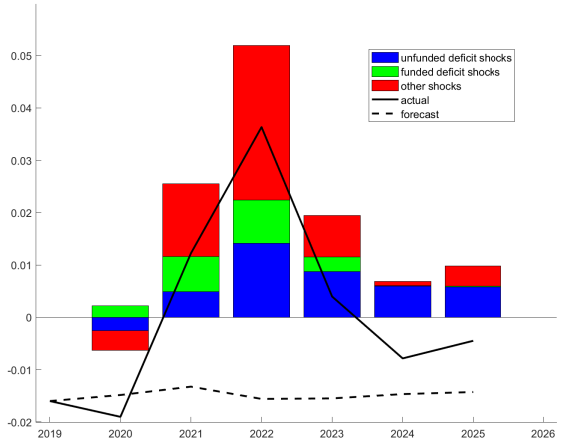


# Historical Decomposition (4 year forecast error) implied surplus ($s_t$)

Blue:unfunded, Green:funded, Red:other, Gray:forecast,



# Historical Decomposition: Inflation (COVID episode)



# Variance decompositions

Table: Contribution of funded deficit shocks

| horizon | Fiscal stance | surplus ($s_t$) | inflation | real GDP growth | nom. return govt debt |
|---|---|---|---|---|---|
| 0 | 0.0 | 12.8 | 14.8 | 10.2 | 1.7 |
| 1 | 5.7 | 11.9 | 13.9 | 12.4 | 5.1 |
| 5 | 8.2 | 12.9 | 14.4 | 13.0 | 4.5 |
| 10 | 8.9 | 12.9 | 14.6 | 12.9 | 4.3 |
| 20 | 9.2 | 13.0 | 14.3 | 13.0 | 2.6 |

# Variance decompositions

Table: Contribution of unfunded deficit shocks

| horizon | Fiscal stance | surplus ($s_t$) | inflation | real GDP growth | nom. return govt debt |
|---|---|---|---|---|---|
| 0 | 34.6 | 2.2 | 23.5 | 20.5 | 26.9 |
| 1 | 28.0 | 4.0 | 24.4 | 18.3 | 17.7 |
| 5 | 25.7 | 6.3 | 22.2 | 18.3 | 22.6 |
| 10 | 25.5 | 7.7 | 20.1 | 18.7 | 28.3 |
| 20 | 24.6 | 8.3 | 17.9 | 18.4 | 21.3 |

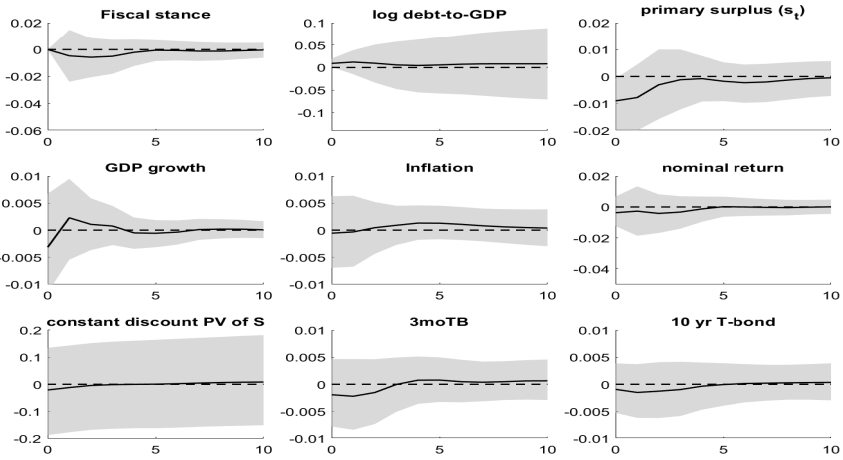
# Summary of decomposition results

- Exogenous unfunded fiscal shocks contribute moderately to the variability of economic variables
- Exogenous funded fiscal shocks contribute little to the variability of economic variables
- Most of variation of fiscal policy (fiscal stance and $s_t$) is endogenous
  - Policy "rule" more important than "shocks"

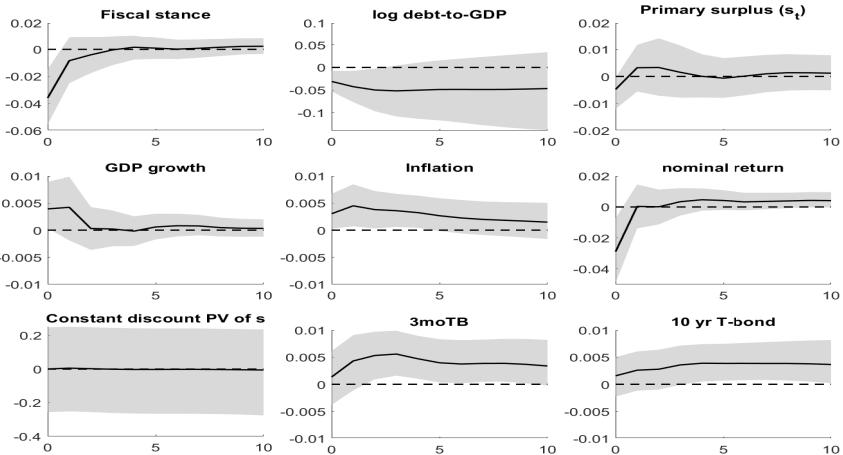
# Robust to

- alternative identification schemes
- replace implied $s_t$ with actual primary surpluses

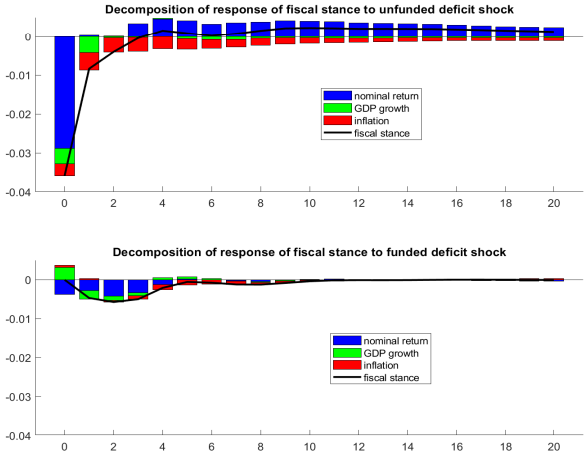
# Funded Shock: Alternative surplus



# Unfunded Shock: Alternative surplus



# Decomposition of fiscal stance: Alternative surplus



# Identification Strategy: Ricardian fiscal policy

**Funded deficit shock:** Future surpluses do all the work to offset current deficit shock

$$\Delta E_t \sum_{j=0}^{\infty} \rho^j \, s_{t+j} = 0$$

PV of current and future primary surpluses (discounted at constant rate)
is unaffected by funded deficit.

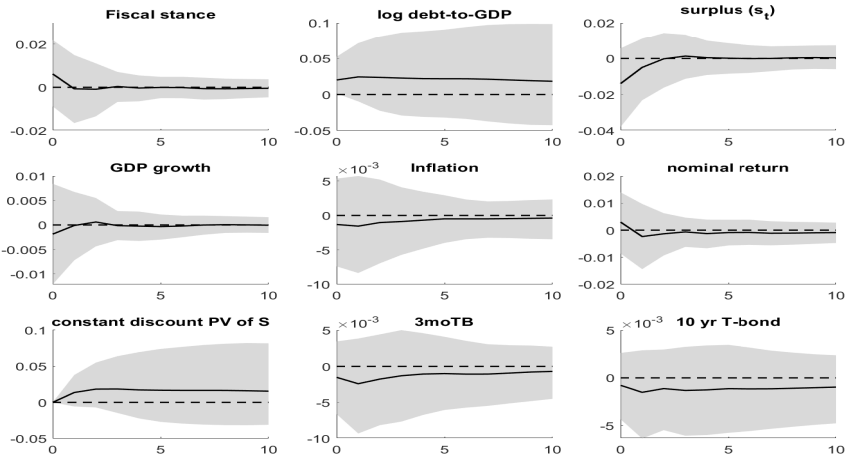
# Identification Strategy: Ricardian surpluses

**Funded deficit shock:** Pick $A_0$ matrix so that

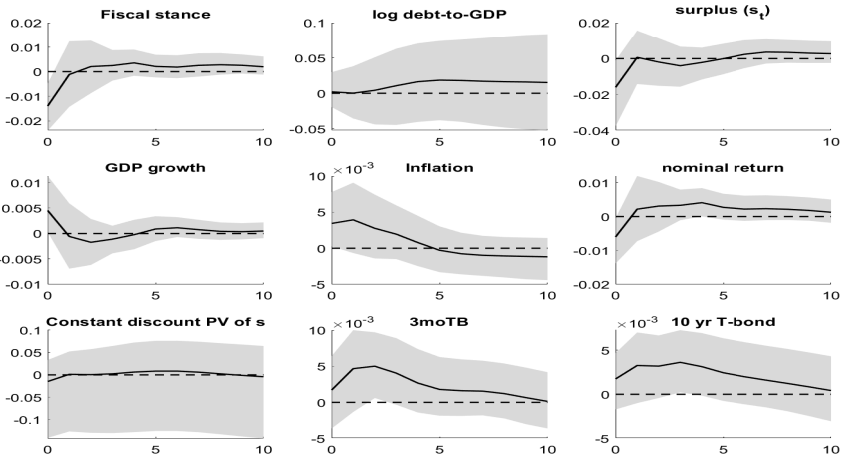
$$H^{\textit{funded surplus}} \left(I - \rho A\right)^{-1} A_0 J^{\textit{funded deficit}} u_t = 0$$

- $H^{\textit{funded surplus}}$ selects surplus ($s_t$) from the variables in VAR
- $J^{\textit{funded deficit}}$ $u_t$ selects funded deficit shock from vector of exogenous shocks
- $A_0$ must also satisfy the sign restrictions for unfunded deficit shock

# Empirical IRFs Ricardian surpluses: Funded Shock



# Empirical IRFs Ricardian surpluses: Unfunded Shock



# Summary

- Estimate SVAR that identifies funded vs unfunded fiscal deficit shocks
- Funded deficit shocks look neutral – do not affect economic activity
- Unfunded deficit shocks have real affects consistent with FTPL
- Fiscal shocks only moderate contributor to historical fluctuations in inflation
- Most of the fluctuations of fiscal variables are "endogenous" (i.e. government surpluses and debt respond to other shocks)

# Future work

- Add narrative approach to identification