# The Long and Short of Financing Government Spending

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# Research Question

- Question: Does it matter how the US government finances its spending shocks?
  - *Does the size of fiscal multiplier depend on whether the debt used to finance government spending is of short or long maturity?*

- This paper: Yes it does!
  1. In US data financing short-term increases the fiscal multiplier.
  2. We explore a theory that can rationalize this.
  3. We explore the policy implications of theory and evidence.

# Methodology

- Empirics :
  - We present evidence from a battery of VARs identifying the maturity financing of spending shocks.
  - We first use a proxy-SVAR where spending is instrumented with news about military spending.
  - We also use projections using the both news based and Blanchard Perotti identification.
    - (These empirical exercises are by and large based on Priftis and Zimic (2021, EJ) and Broner et al (2022, Restud).
- Results:
  - The fiscal multiplier is larger when the US finances short-term, rather than long-term.
  - This is accounted for (mainly) by consumption, which is crowded in with short term financing (STF) but crowded out with long term financing (LTF).

# Methodology

- Theory :
  - We present a (deliberately simple) model that can explain this new fact.
  - Short bonds function like money, they provide *liquidity services* to the private sector (e.g. Greenwood, Hanson and Stein (JF, 2015)).
  - The model is based on Hagerdorn (2018), a Diamond-Dybvig model where households can use short bonds to finance urgent consumption needs.
  - The fiscal multiplier is larger under STF, when short debt relaxes a constraint on urgent consumption.

# Policy implications

We can use the simple model to think about policy: How would an optimizing government choose the debt portfolio?

- ...when short bonds imply a *larger fiscal multiplier*...
- but long bonds provide *fiscal hedging?*
- e.g. Angeletos (2002); Buera and Nicolini (2004); Lustig, Sleet and Yeltekin (2008) (long bonds are optimal for tax smoothing purposes); Faraglia, Marcet, Oikonomou and Scott (2019); Debortoli, Nunes and Yared (2017); Bhandari, Golosov, Evans and Sargent (2019); Greenwood, Hanson and Stein (2015) (short bonds can also be beneficial for tax smoothing).
- We find that the optimizing government will focus on issuing short debt. When the fiscal multiplier is larger under STF, revenues rise (relatively) following a spending shock and this enables tax smoothing.

# Empirical Analysis: Proxy VAR

Want to estimate:

$$\mathrm{A}\mathrm{Y}_t = \sum_{i=1}^{p} \mathrm{C}_i \mathrm{Y}_{t-i} + \varepsilon_t \tag{1}$$

or equivalently:

$$\mathrm{Y}_t = \sum_{i=1}^{p} \delta_i \mathrm{Y}_{t-i} + \mathrm{B}\epsilon_t \tag{2}$$

where $\mathrm{B} = \mathrm{A}^{-1}$, $\delta_i = \mathrm{A}^{-1}\mathrm{C}_i$ and let $\mathrm{u}_t = \mathrm{B}\varepsilon_t$.
Use covariance restrictions to identify $= \mathrm{B}$. Let $m_t$ be the vector of proxy (defense news) variables. Identification conditions are:

$$E\left[m_t \varepsilon_{g,t}^{'}\right] = \Psi$$

$$E\left[m_t \varepsilon_{x,t}^{'}\right] = 0$$

where $\varepsilon_{g,t}$ is spending shocks and $\varepsilon_{x,t}$ are other shocks.

# Empirical Analysis: Proxy VAR

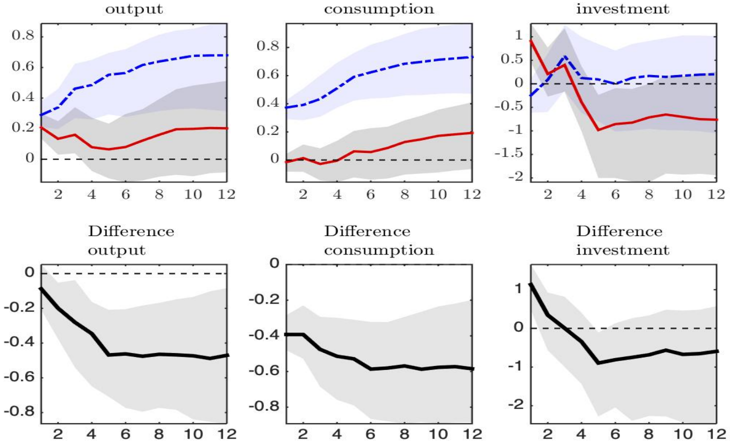
To disentangle STF spending shocks from LTF shocks we define $m_t = \begin{bmatrix} m_{s,t} \\ m_{l,t} \end{bmatrix}$ with

$$
\begin{aligned}
m_t = \quad & m_{S,t}, \quad \textit{if} \quad \widehat{\frac{b_{S,t}}{b_{L_t}}} \quad \textit{increases} \\
m_t = \quad & m_{L,t}, \quad \textit{if} \quad \widehat{\frac{b_{S,t}}{b_{L_t}}} \quad \textit{decreases},
\end{aligned}
$$

where $\widehat{\frac{b_{S,t}}{b_{L_t}}}$ denotes the ratio of short-term debt to long-term debt.

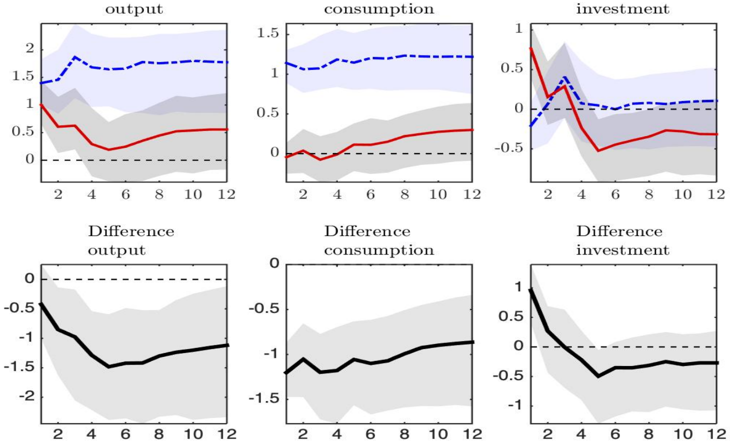
# Baseline Results: Proxy VAR

Impulse responses to spending shock (blue=G with short debt; red=G with long debt)



# Baseline Results: Proxy VAR

Cumulative multipliers (blue=G with short debt; red=G with long debt)

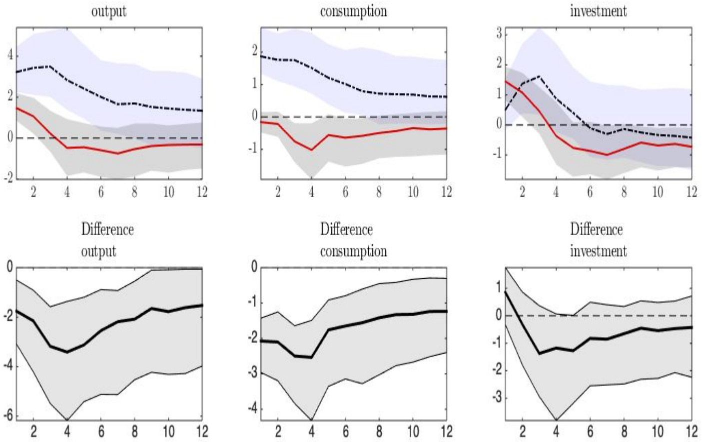


# Robustness

- Possible biases...
  1. Endogeneity of Treasury's decision to finance short or long.
     - STF when yield curve (YC) is upward sloping, LTF when downward sloping. (But downward sloping YCs predict recessions...). **Treatment:** add short and long rates (level and slope of the YC)
     - LTF usually more in high debt periods (when distortionary taxes are more likely to rise, or political controversy about how to manage/finance debt).
       **Treatment:** Run the estimates using high and low debt samples.
  2. Shocks are of a different nature and thus affect the macroeconomy differently. (e.g. A STF shock may put more upward pressure on wages, when the government is hiring in certain sectors...)
     **Treatment:** add wages, interest rates...
  3. Monetary Policy response. Different for STF and LTF, also different post/pre 1980s and post 2008.
     **Treatment:** Add short term interest rates, split sample post/pre 1980s, drop the Great recession observations.

# Robustness

Cumulative multipliers: All variables (blue=G with short debt; red=G with long debt)



# Theoretical model

- Incomplete Markets+ (temporarily) heterogeneous agents. (Based on Hagedorn (2018) and Diamond and Dybvig (1983)).

- Agents' utility:

$$u(C_t^i) + \theta v(c_t^i) - \chi \frac{{h_t}^{i,1+\gamma}}{1+\gamma} \tag{3}$$

- Agents decide (at the beggining of period) $C_t^i$ and a portfolio of short and long bonds.
- Short bonds can be used to finance $c_t^i$. We have:

$$c_t^i \leq b_{t,S}^i$$

where $b_{t,S}^i$ is the real value of debt purchased by household $h$; Agents will hold short term debt for the services that it provides + return properties. Long bonds (perpetuities with decaying coupons) are only held for return properties.

# Theoretical model

- Agents that have low $\theta$ are unconstrained. They will set (optimally)

$$U'(C_t^i) = \theta v'(c_t^i)$$

  In contrast, agents that have high $\theta$ are constrained. They consume $c_t^i = b_{t,S}^i$.
- Cutoff $\theta$ satisfies: $U'(C_t^i) = \widetilde{\theta}_t v'(b_{t,S}^i)$
- All agents are part of a family. Excess short bonds are given to the family, so that agents will not differ in any state variable in the beginning of next period. We can thus drop $i$...

# Theoretical Model

$$q_{t,S}u'(C_t^i) = F(\widetilde{\theta}_t)\beta E_t \frac{u'(C_{t+1}^i)}{\pi_{t+1}} + \int_{\widetilde{\theta}_t}^{\infty} \theta v'(b_{t,S}^i) dF_\theta \tag{4}$$

prices short term debt.

$$q_{t,L}u'(C_t^i) = \beta E_t \frac{u'(C_{t+1}^i)}{\pi_{t+1}}(1 + \delta q_{t+1,L}) \tag{5}$$

prices the long term bond.

+ New Keynesian Frictions, Monetary/Fiscal Policy...

# Fiscal Multipliers: Simple Analytics

- Assume lump sum taxes, log-log utility and consider a log-linear approximation of the model. The short bond Euler equation is:

$$\frac{\overline{q}_S}{\overline{C}}\hat{q}_{t,S} + F_{\bar{\tilde{\theta}}}\frac{\beta}{\overline{C}}E_t\hat{\pi}_{t+1} + F_{\bar{\tilde{\theta}}}\frac{\beta}{\overline{C}}\hat{C}_{t+1} = \underbrace{\left(\frac{\overline{q}_S}{\overline{C}} + (1-\beta)\frac{1}{\overline{C}}f_{\bar{\tilde{\theta}}}\bar{\tilde{\theta}}\right)}_{\alpha_1}\hat{C}_t$$

$$-\underbrace{\left((1-\beta)\frac{1}{\overline{C}}f_{\bar{\tilde{\theta}}}\bar{\tilde{\theta}} + \frac{1}{\overline{b}_S}\int_{\bar{\tilde{\theta}}}^{\infty}\theta dF_\theta\right)}_{\alpha_2}\hat{b}_{t,S}$$

where $\alpha_1, \alpha_2 > 0$.
Let us first assume that monetary policy sets the path of the nominal interest rate so that $\frac{\overline{q}_S}{\overline{C}}\hat{q}_{t,S} + F_{\bar{\tilde{\theta}}}\frac{\beta}{\overline{C}}E_t\hat{\pi}_{t+1} = 0$.

# Fiscal Multipliers: Simple Analytics

- then

$$\hat{C}_t = \frac{\alpha_2}{\alpha_1} E_t \sum_{\bar{t} \geq 0} (F_{\bar{\tilde{\theta}}} \frac{\beta}{\alpha_1 \overline{\overline{C}}})^{\bar{t}} \hat{b}_{t+\bar{t},S}$$

- Lets also assume that $\hat{b}_{t,S} = \varrho \hat{G}_t$ is sufficient to determine the response of the share to the spending shock. STF sets $\varrho > 0$, LTF $\varrho < 0$.

$$\hat{TC}_t = \kappa_1 \varrho \rho_G^t \hat{G}_0$$

where $\kappa_1 > 0$

The impact multiplier is:

$$m_0 = \frac{\overline{Y} d\hat{Y}_0}{\overline{G} d\hat{G}_0} = 1 + \frac{1}{\overline{G}} \left[ \frac{\alpha_2}{\alpha_1} \frac{\overline{C}(1 + \int_0^{\bar{\tilde{\theta}}} \theta dF_\theta)}{1 - F_{\bar{\tilde{\theta}}} \frac{\beta}{\alpha_1 \overline{\overline{C}}} \rho_G} + \overline{b}_S (1 - F_{\bar{\tilde{\theta}}}) \right] \varrho \quad (6)$$

# Fiscal Multipliers: Simple Analytics

- The same can be shown with a Taylor rule:

$$\hat{i}_t = \phi_\pi \hat{\pi}_t$$

$$m_0 = \alpha_3 \left[ 1 + \left( \frac{1}{\overline{G}} \frac{\alpha_2}{\alpha_1} \frac{\overline{C} \left( 1 + \int_0^{\overline{\tilde{\theta}}} \theta dF_\theta \right)}{1 + \frac{1+\eta}{\omega} \frac{1}{\alpha_1} \frac{\overline{q}_S}{\overline{C}} \phi_\pi} + \overline{b}_S (1 - F_{\overline{\tilde{\theta}}}) \right) \varrho \right]$$

where $\alpha_3 < 1$

# Fiscal Multipliers: A calibrated model.

$$\hat{s}_t^{\text{Short/Long}} = \varrho \hat{G}_t \tag{7}$$

where $s$ is the share of short (defined as debt of maturity less than one year) over long.

$$\hat{s}_t^{\text{Short/Long}} = \frac{1}{\overline{s}^{\text{Short/Long}}} \frac{\overline{b}_S}{\overline{b}_L \frac{\delta^4}{1-\delta}} \left( \hat{b}_{S,t} - \hat{b}_{L,t} \right).$$

Baseline rule for lump sum taxes.

$$\hat{T}_t = \phi_T \hat{D}_{t-1} \tag{8}$$

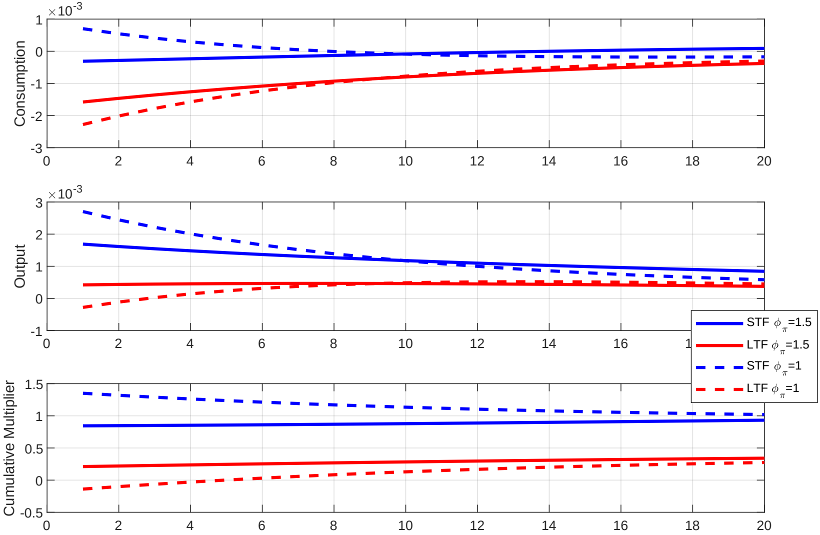
+Monetary policy follows a simple inflation targeting rule.

# Fiscal Multipliers: A calibrated model.

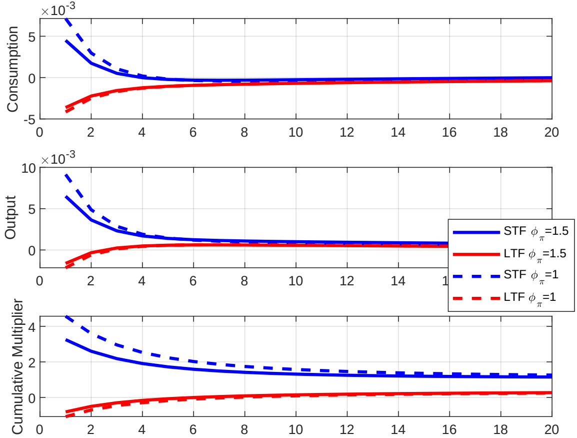
Most of the calibration is standard. What is worth noting is the following:

1. We calibrate the short term return to be 1 percent per annum + the term spread is also 1 percent.
2. We set $\varrho = 0.6$. (For proxy VAR, short term financing was identified in periods where the average increase in the share of 0.6 percent and the spending shock is 1 percent).
3. $F$ is log normal. The variance of $F$ is so that the model matches the evidence presented in Greenwood et al (2015) (an increase in T-Bill ratio to GDP reduces the spread between T-bills and T-notes/bonds by 16 basis points in the case of 4 week bills and about 8 basis points for 10 week yields.

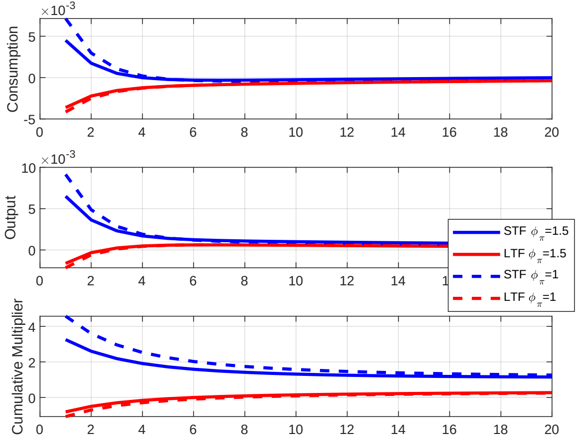
# Fiscal Multipliers: Simple Taylor rule $\hat{i}_t = \phi_\pi \hat{\pi}_t$



# Fiscal Multipliers: Inertial rule $\hat{i}_t = 0.9\hat{i}_{t-1} + .1\phi_\pi\hat{\pi}_t$



# Fiscal Multipliers: Fiscal Theory $\phi_\pi < 1$, $\phi_T = 0$

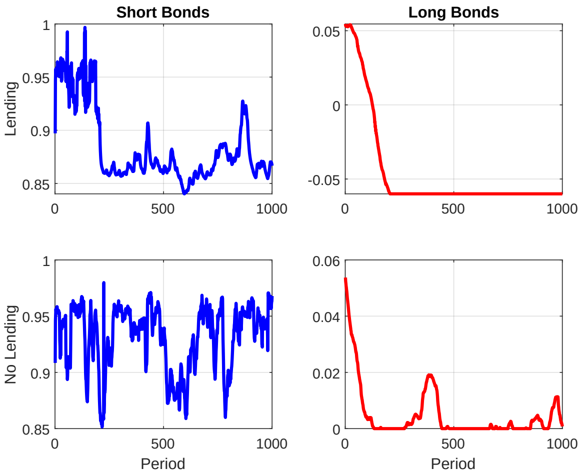


# Optimal Policy

The Problem: Finance short or long?

- With distortionary taxes a higher multiplier will translate to lower fiscal deficits in times of high expenditures. This will enable the government to better smooth tax distortions across time.
- Short term yields are lower, and therefore issuing short bonds lowers the overall costs of servicing debt and hence lowers also the average level of taxes.
- However, an increase in the spending level leads to a drop in long bond prices (when consumption is crowded out) . Thus, a government that issues long term debt, benefits from *fiscal insurance* and can smooth taxes through time.

# Optimal Policy



# Conclusions

**Financing Short-term increases the fiscal multiplier.**

- We provide evidence from structural VARs
- We explore a theory that can rationalize this finding
- An optimizing government will focus on issuing short term debt, to exploit the larger fiscal multiplier.

# Appendix: Local Projections.

$$Y_{t+h} = I_{t-1}\left[a_{A,h} + \beta_{A.h}\varepsilon_t + \psi_{A,h}(L)X_{t-1} +\right]$$
$$+ (1 - I_{t-1})\left[a_{B,h} + \beta_{B,h}\varepsilon_t + \psi_{B,h}(L)X_{t-1}\right] + qtrend + u_{t+h}$$

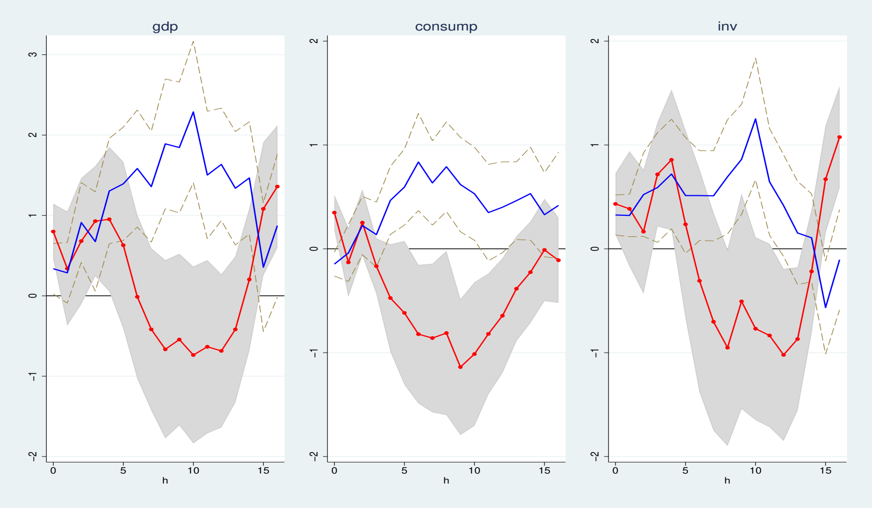
$Y$ is output, consumption, investment, $h$ is the horizon. $X$ is a vector of control variables (including lags of output, consumption investment to control for serial auto-correlation), $\psi_{A,h}(L)$ is polynomial in the lag operator, and $\varepsilon$ is the shock.

Moreover, $I_{t-1} = 1$ when the ratio of short over long debt increased between periods $t-2$ and $t-1$, and $I_{t-1} = 0$ otherwise.[1]

[1](Note we also experimented with $I_t$ and with $\frac{1}{4}(I_{t-1} + I_t + I_{t+1} + I_{t+2})$ it didn't make a difference).

# Appendix: Local Projections.

IRFS, news instrument (blue=G with short debt; red=G with long debt)



# Appendix: Local Projections.

IRFS, Blanchard-Perotti (blue=G with short debt; red=G with long debt)