Fiscal-Monetary Interactions and the FTPL:

Empirics

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Topics in Macroeconomics A

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3 empirical papers on F-M interactions and the FTPL

Berndt et al. (2012)

- estimate fraction of military spending shocks financed by surpluses (large) and real debt returns (small)

Bouscasse and Hong (2023)

- estimate response of all parts of govt budget to MP shocks

Barro and Bianchi (2023)

- estimate fraction of Covid spending surge financed by inflation and real debt returns

Berndt et al. (2012)

"How Does the US Government Finance Fiscal Shocks?"

"The government budget constraint dictates that surprise increases in spending must be financed through either an increase in primary surpluses or a reduction in returns on the government's bond portfolio" $\Rightarrow$ *surplus channel* vs *debt valuation channel*

Fiscal shocks = news to current and future defence spending growth

Preview of results: surplus channel absorbs $72 - 94\%$ of risk, debt valuation 9%

Log-linearising the government budget constraint

Govt BC

$$B_{t+1} = R^b_{t+1}(B_t - S_t) \quad \Leftrightarrow \quad \frac{B_{t+1}}{B_t} = R^b_{t+1}\left(1 - \frac{S_t}{B_t}\right)$$

where B_t is the *real value* of government debt, S_t is real surplus including seigniorage, R^b_{t+1} is the *gross real return* between t and $t+1$

With a lot of log-linearisation (see paper for details) we get the key equation

$$\begin{aligned}(\mathbb{E}_{t+1} - \mathbb{E}_t)\sum_{j=0}^{\infty}\rho^j \Delta g^{def}_{t+j+1} = &-\frac{1}{\mu^{def}_g}(\mathbb{E}_{t+1} - \mathbb{E}_t)\sum_{j=0}^{\infty}\rho^j r^b_{t+j+1} \\ &+ \frac{1}{\mu^{def}_g}(\mathbb{E}_{t+1} - \mathbb{E}_t)\sum_{j=0}^{\infty}\rho^j \Delta ns^{ndef}_{t+j+1}\end{aligned}$$

where $\Delta x_{t+j+1} \equiv \log\left(\frac{x_{t+j+1}}{x_{t+j}}\right)$ are growth rates, and $\rho \in (0,1)$ depends on steady state values

Log-linearising the government budget constraint

$$(\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{j=0}^{\infty} \rho^j \Delta g^{def}_{t+j+1} = -\frac{1}{\mu_g^{def}} (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{j=0}^{\infty} \rho^j r^b_{t+j+1}$$
$$+ \frac{1}{\mu_g^{def}} (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{j=0}^{\infty} \rho^j \Delta ns^{ndef}_{t+j+1}$$

Interpretation in terms of shocks/surprises $\mathbb{E}_{t_1} - \mathbb{E}_t$:

$\uparrow$ (> 0 shock) defence spending growth must coincide with

- $\downarrow$ expected future real debt returns (debt valuation channel), and/or
- $\uparrow$ expected future non-defence surplus growth (surplus channel)

With complete markets, debt provides costless full insurance: 100% adjustment through the debt valuation channel

With incomplete markets, insurance is partial and surpluses adjust

Adjustment channels

Let $h_{t+1}(g^{def}), h_{t+1}(r^b), h_{t+1}(ns^{ndef})$ denote the change in expected future g^{def}, r^b, ns^{ndef}

Degree of insurance provided by govt debt is $\text{Cov}(h_{t+1}(g^{def}), h_{t+1}(r^b))$

Empirical strategy in two steps

1. estimate a VAR to construct the news/innovations variables (next slides)
2. run the following fiscal adjustment regressions

$$h_{t+1}(r^b) = \beta_0^r + \beta_1^r h_{t+1}(g^{def}) + \epsilon_{t+1}^r$$
$$h_{t+1}(ns^{ndef}) = \beta_0^{ns} + \beta_1^{ns} h_{t+1}(g^{def}) + \epsilon_{t+1}^{ns}$$

– we expect coefficients $\beta_1^r/\mu_g^{def} \in [-1, 0], \beta_1^{ns}/\mu_g^{def} \in [0, 1]$
– can be mapped in fraction of defence spending financed by either channel

Real holding returns on govt bonds

Extract time-t nominal zero coupon curve using Nelson and Siegel (1987), converted to real using CPI

$$r_t^k = \frac{P_t^{k-1} - P_{t-1}^k}{P_{t-1}^k}, \qquad r_t^b = \sum_{k=1}^{120} w_{t-1}^k r_t^k, \qquad w_t^k = \text{the time}-t \text{ weight of maturity } k$$

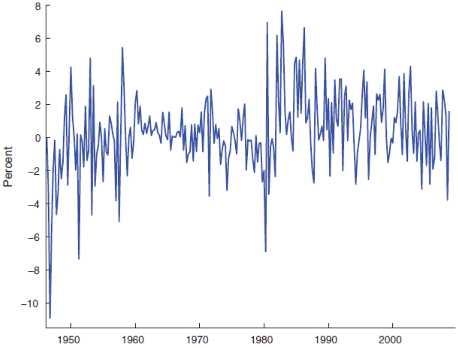


FIGURE 2. REAL HOLDING RETURNS ON GOVERNMENT DEBT

Notes: This plot shows the time series of value-weighted real holding returns on the government debt portfolio, r_t^b. The sample period is 1946:I–2008:III.

Government spending data

Spending data for g^{def}, ns^{ndef} from NIPA tables. ns^{ndef} includes seigniorage revenues

Real market value of bonds outstanding at the beginning of t is computed as

$$B_t = \sum_{k=1}^{120} s_{t-1}^{k} P_t^{k-1}$$

Detrend Δg_t^{def} and Δns_t^{ndef} using a one-sided Hodrick and Prescott (1997) with smoothing factor 8330

(cuts frequencies $\geq$ 15 years $=$ average time between consecutive defence spending increases)

Government spending data

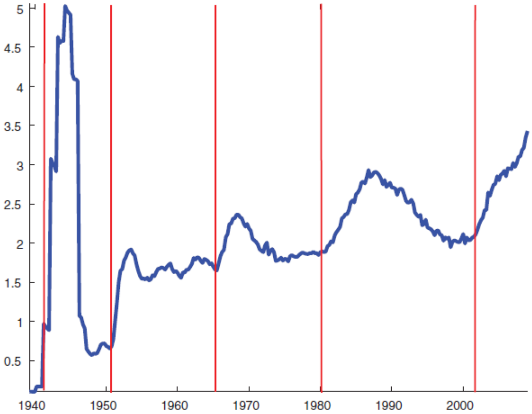


Figure 3. Real Defense Spending

Note: This plot shows the time series of real defense spending from 1939 to 2008, as well as the Ramey (2011) defense shock dates (vertical lines).

Estimating news

Run

$$\boldsymbol{z}_{t+1} = \boldsymbol{A}\boldsymbol{z}_t + \boldsymbol{\epsilon}_{t+1} \qquad \text{with} \qquad \boldsymbol{z}_t = [r_t^b \quad \pi_t \quad \xi_t^{ns,ndef} \quad CP_t \quad \xi_t^{g,def}]$$

where CP_t is the Cochrane and Piazzesi (2005) risk factor for bond excess returns

Recover news from

$$\begin{aligned} h_{t+1}(r^b) &= \boldsymbol{e}_1(\boldsymbol{I} - \rho\boldsymbol{A})^{-1}\boldsymbol{\epsilon}_{t+1} \\ h_{t+1}(ns^{ndef}) &= \boldsymbol{e}_3(\boldsymbol{I} - \rho\boldsymbol{A})^{-1}\boldsymbol{\epsilon}_{t+1} \\ h_{t+1}(g^{def}) &= \boldsymbol{e}_5(\boldsymbol{I} - \rho\boldsymbol{A})^{-1}\boldsymbol{\epsilon}_{t+1} \end{aligned}$$

Issues: defence spending news may be anticipated, and may be diluted during aggregation

Solution: add $r_t^{def,excess}$ in VAR specification. Helps explain $\xi^{g,def}$, leaves fiscal adjustment betas unchanged

Empirical correlations between news

Table 2—Correlations between Innovations for Benchmark VAR

	$h_{t+1}(r^b)$	$h_{t+1}(g^{def})$	$h_{t+1}(ns^{ndef})$
$h_{t+1}(r^b)$	0.04		
$h_{t+1}(g^{def})$	−0.72	0.08	
$h_{t+1}(ns^{ndef})$	−0.42	0.40	0.58

Notes: This table reports the standard deviations (diagonals) and the correlations (off-diagonals) of the news variables constructed from the benchmark VAR. The sample period is 1946.I–2008.III.

- <0 corr. btw g^{def} and r^b: strong fiscal insurance
- >0 corr. btw g^{def} and ns^{ndef}: fiscal adjustment through surpluses
- $\sigma(g^{def}) = 2\sigma(r^b)$

Fiscal adjustment betas

TABLE 3—FISCAL ADJUSTMENT RESULTS FOR BENCHMARK VAR

	β_0	β_1	R^2	Fraction
$h^c(r^b)$	0.0003 (0.2179)	−0.0690 (−2.2625)	0.0671	0.0181
$h^f(r^b)$	0.0017 (1.0098)	−0.2973 (−5.2064)	0.5620	0.0780
$h(r^b)$	0.0020 (0.8841)	−0.3663 (−4.8947)	0.5200	0.0961
$h(ns^{ndef})$	−0.0001 (−0.0035)	2.7962 (5.2112)	0.1586	0.7334

Notes: This table reports the results from regressing $h_{t+1}(r^b)$, its components $h^c_{t+1}(r^b)$ and $h^f_{t+1}(r^b)$, and $h_{t+1}(ns^{ndef})$ on $h_{t+1}(g^{def})$, as described in equations (11) and (12). The first two columns show the intercept and the fiscal adjustment beta, with their t-statistics in parentheses. The third column reports the R^2, and the final column shows the fraction of fiscal shocks financed by each channel. Innovations are computed from the benchmark VAR. The sample period is 1946:I–2008:III.

- $\beta_1^r = -0.37$, 10% of g^{def} absorbed by bondholders, g^{def} accounts for 52% of r^b variation
  - most of r^b response is given by *future* rather than *current* returns
- $\beta_1^{ns} = 2.8$, 73% of g^{def} absorbed by surpluses, g^{def} accounts for 16% of ns^{ndef} variation
  - decomposing ns^{ndef} further, taxes absorb 39% and spending absorbs $\approx$ 37% of g^{def},

The role of debt maturity

For $k \in \{1, 5, 10, 15, 20\}$, run a VAR that includes the real return on k-year maturity bonds, and then compute the fiscal adjustment betas

- 20-year debt has a beta of -0.66, financed 17% of g^{def}
- 1-year debt has a beta of -0.20, financed 7% of g^{def}

As theory suggests, long-term debt more effective in providing insurance and absorbing fiscal shocks

Bouscasse and Hong (2023)

Monetary-Fiscal Interactions in the United States

How does the US Congress respond to monetary policy? Does it matter?

Estimate the response of taxes, spending, interest payments, and real debt to Romer and Romer (2004) monpol shocks

A 1% point $\uparrow$ in the federal funds rate

- tax receipts $\downarrow$ by 0.2%, automatically
- govt transfers show no response
- interest rate payments $\uparrow$

$\Rightarrow$ real debt $\uparrow$

Then, estimate response of economy under counterfactual policy rules:

- an endogenous response of taxes or spending would make the hike more contractionary
- transfers instead finance themselves so could actually $\uparrow$

Methodology

Monetary shocks

Monetary shocks: "augmented" Romer and Romer (2004)

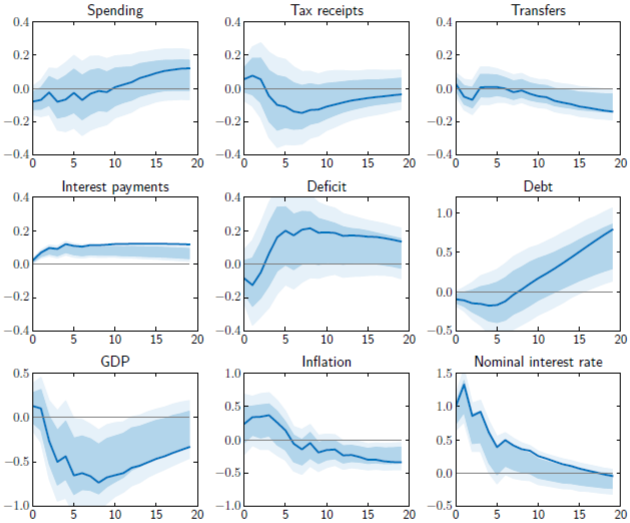
- regress Δi_m on Greenbook forecasts (prepared by Fed staff before FOMC meetings) for: GDP, inflation, unemployment, tax receipts, govt expenditures, budget surplus
- residuals are non-policy related component of monetary policy, which they use as shocks

Variables of interest

- 5 fiscal: spending, tax receipts, transfers, interest payments, debt (all in real terms)
- 3 macro: GDP, inflation, nominal interest rate
- all detrended in a budget-constraint-consistent way

Estimate a VAR (quarterly) with monetary policy shocks ordered first $\approx$ local projection

Response to RR monetary shock



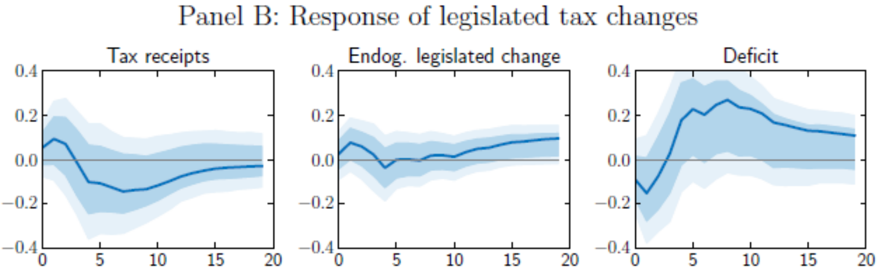
- Macro vars: well-know responses to RR monetary shocks
- Fiscal vars:
  - transfers and spending are flat
  - taxes fall, slightly
  - debt service increases
- combined effect is $\uparrow$ deficit
- adding medium-term $\downarrow$ in the CPI

$\Rightarrow$ real debt $\uparrow$ by $\approx 0.5 - 1\%$ of trend GDP

Interpretation and the response of taxes

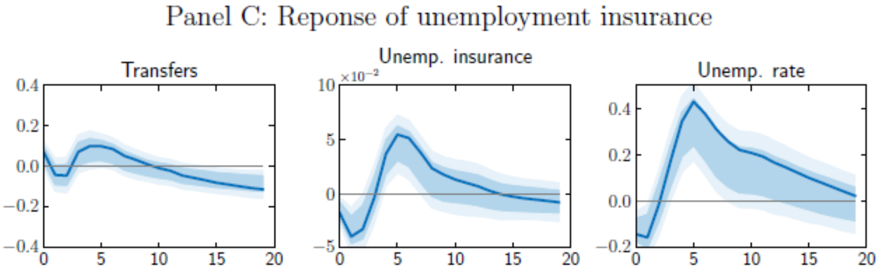
Bottomline is simple: the fiscal response is muted, so taxes and interests move mechanically, the deficit goes up, and debt rises because of that and because of the Fisher effect

What drives the fall in tax receipts? Use Romer and Romer (2010)'s database of legislated tax changes



⇒ fall in tax receipts due to output contraction, not Congress response

Transfers



Little countercyclical response: makes sense given composition of Federal transfers

Automatic stabilisers (UI, food stamps) are small (≈ 4%)

Medicare, Medicaid, Social Security account for ≈ 70%!

Counterfactual response to MP shocks under alternative *fiscal* rules

Adopt methodology of McKay and Wolf (2023): given the IRFs of endogenous variables under a given policy rule, one can recover the IRFs of such variables under a counterfactual policy rule, subject to mild theoretical assumptions

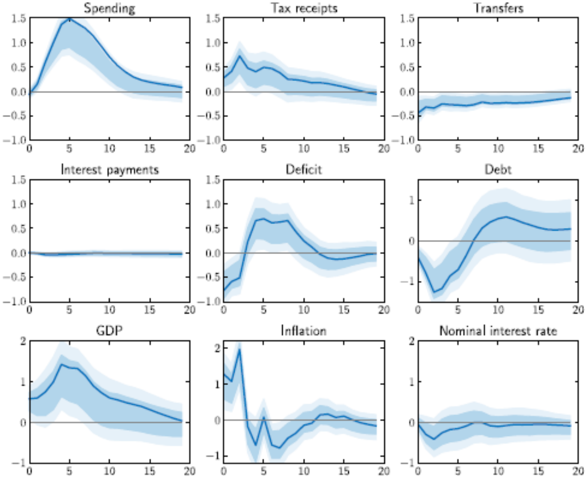
The idea is that the counterfactual rule has the same effects of an "appropriate sequence" of shocks that mimic said rule

The paper thus uses a variety of fiscal shocks to estimate IRFs of macro and fiscal variables, and then use the estimates to study the response of such variables to monetary policy shocks

- First, we look at the effects of these shocks on the government budget
- Second, we look at the counterfactual exercise

Response to spending shocks

Figure A.2: Response to Ramey spending shock

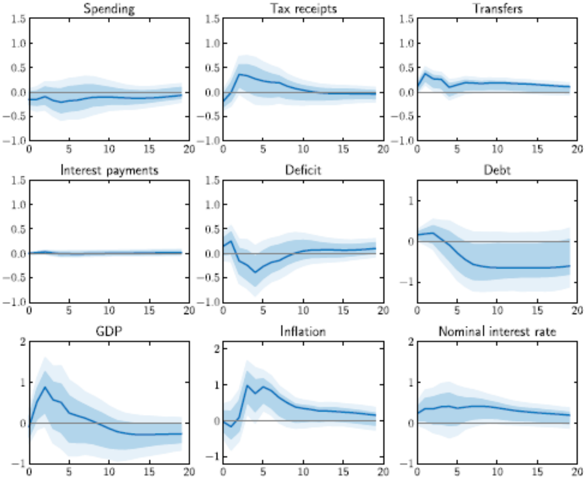


↑ GDP faster than ↑ spending (anticipation effects)

deficit ↓ first, then ↑

Response to transfer shocks

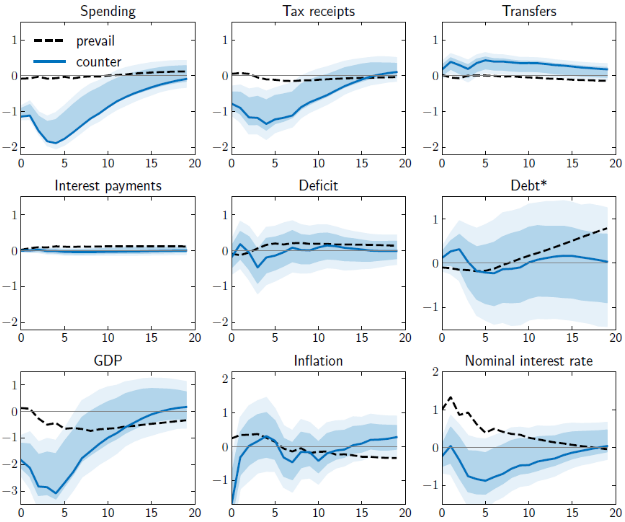
Figure A.7: Response to Romer-Romer transfer shock



- $\uparrow\uparrow$ GDP $\rightarrow$ $\uparrow$ taxes $\rightarrow$ deficit $\downarrow$ transfer spending is “self-financed”!
- inflationary effect such that $\downarrow$ real debt
- real interest rate $\downarrow$: central bank is accommodating

Counterfactuals

Figure 4: Counter-factual—debt stabilization with spending

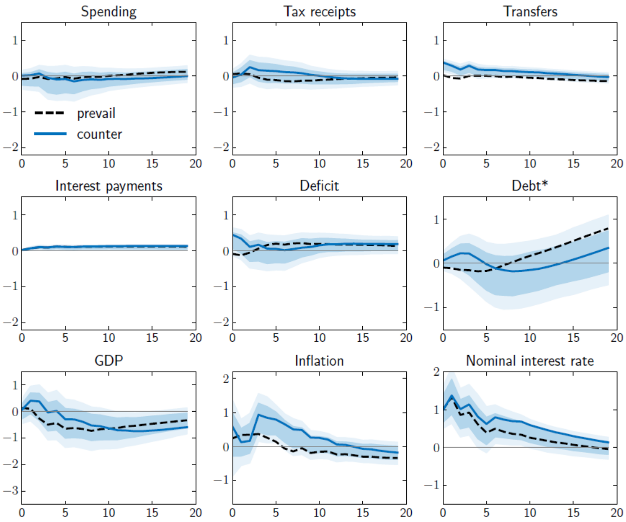


- Congress responds to $\uparrow i_t$ by cutting spending
- contractionary effect on GDP partly self-defeating, $\downarrow g_t$ must be large
- output contraction triggers monetary easing $\rightarrow$ no response to interest payments

$\Rightarrow$ fiscal response "undoes" monetary shock, with a large output cost

Counterfactuals

Figure 6: Counter-factual—debt stabilization with transfers



- Congress responds to $\uparrow$ i_t by increasing(!) transfers

- higher deficit, but expansionary effect on GDP, taxes, inflation

$\Rightarrow$ smaller increase in real debt

Barro and Bianchi (2023)

Motivation

- FTPL not taken seriously as a model of inflation until recently, because of stable inflation and responsible govt finance
- The picture changed with global spending expansion during Covid, which was an unanticipated global emergency similar to a world war
- Unanticipated surge in inflation optimal way to "default" on nominal debt and fund spending

Paper

- Examines the role of the Covid-related fiscal expansion as a determinant of inflation across OECD countries during 2020-2023

Framework

$$\frac{B_t}{P_t} = \sum_{i=0}^{\infty} \frac{T_{t+i} - G_{t+i}}{(1+r)^i}$$

where B_t nominal mkt value of debt, r real discount rate (assumed constant)

- Assume Covid starts at t, implies $\Delta G_{t+i} = G_{t+i} - \mathbb{E}_{t-1}[G_{t+i}] > 0$ for $i = 0, 1, \ldots, M$, unknown at $t-1$ but perfectly known at t

- Further assume GDP Y_t and pre-Covid spending grow at $g = r$

$$\text{real PV of spending surge} \quad = \sum_{i=0}^{M} \frac{\Delta G_{t+i}}{(1+r)^i} = Y_t \sum_{i=0}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}}$$

- Covid implies $\uparrow G_{t+i}$ with no expectation of corresponding $\uparrow T_{t+i}$, so ignore taxes
  - in 2020-2021, average rise in spending/GDP $= 9.7\%$ vs govt revenue/GDP $= 0.6\%$

Market value of debt

Let $B_t^i = \{B_t^0, B_t^1, \ldots, B_t^T\}$ denote the nominal payouts outstanding at t, due in period $t+i$

Nominal market value of *all* debt, at t

$$B_t = B_t^0 + \frac{B_t^1}{(1+r)(1+\pi_{t+1})} + \cdots + \frac{B_t^T}{(1+r)^T(1+\pi_{t+1})\ldots(1+\pi_{t+T})}$$

Simplifying assumptions

- As of $t-1$, $\pi_{t+i} = \pi^*$. As of t, different and known path of inflation
- Maturity structure of debt arranged s.t. $B_t^i = B_t^0(1+g)^i$

imply

$$B_t = B_t^0 \left[1 + \frac{1+\pi^*}{1+\pi_{t+1}} + \cdots + \frac{(1+\pi^*)^T}{(1+\pi_{t+1})\ldots(1+\pi_{t+T})}\right]$$

so that

- $B_t^* = B_t^0(1+T)$ if $\pi_{t+i} = \pi^*$
- $B_t < B_t^*$ if there is an inflation surge sometime in the future

Market value of debt

Change in market value of debt generated by unanticipated inflation surge at t

$$\Delta B = \frac{B_t^*}{1+T}\left[\left(\frac{1+\pi^*}{1+\pi_{t+1}} - 1\right) + \cdots + \left(\frac{(1+\pi^*)^T}{(1+\pi_{t+1})\dots(1+\pi_{t+T})} - 1\right)\right]$$

Focus on perfect smoothing of inflation: $\pi_{t+i} = \pi > \pi^*$ for $i = 1, \dots, T$, so that

$$\Delta B = \frac{B_t^*}{1+T}\left[\frac{1+\pi^*}{\pi - \pi^*}\left(1 - \left(\frac{1+\pi^*}{1+\pi}\right)^T\right) - T\right] \quad \approx -B_t^* \frac{1}{2} T(\pi - \pi^*)$$

Funded and unfunded spending

Let *funded* surge in spending $\sum_{i=0}^{M} \Delta(T_{t+i}/Y_{t+i}) = (1-\eta)\sum_{i=0}^{M} \Delta(G_{t+i}/Y_{t+i})$

Assume throughout that P_t does not jump

Then the *unfunded* fraction η must be financed by a change in inflation and the market value of debt

$$\frac{\Delta B}{P_t Y_y} \approx \frac{-B_t^* \frac{1}{2} T(\pi - \pi^*)}{P_t Y_t} = -\eta \sum_{i=0}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}}$$

$$\pi = \pi^* + \eta \left(\sum_{i=0}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}} \right) \Big/ \left(\frac{B_t^*}{P_t Y_t} \frac{T}{2} \right)$$

- $T/2$ is the "average maturity" of outstanding debt
- In a Ricardian world, $\eta = 0$
- Given η, surge in inflation is increasing in spending, decreasing in $B_t^*/(P_t Y_t)$ (more "tax base") and T (more periods to "tax")

Estimation

Data

- GDP and gross debt of the general government (IMF WEO, BIS)
- debt maturity (OECD)
- Euro Area as a single country

Estimate η via panel regression, for $t = 2010 - 2023$ and 20 OECD countries + EA

$$\pi_{i,t} = \pi_i^* + \eta\,(\text{composite spending surge})_{i,t} + X_t + \beta Z_{i,t} + u_{i,t}$$

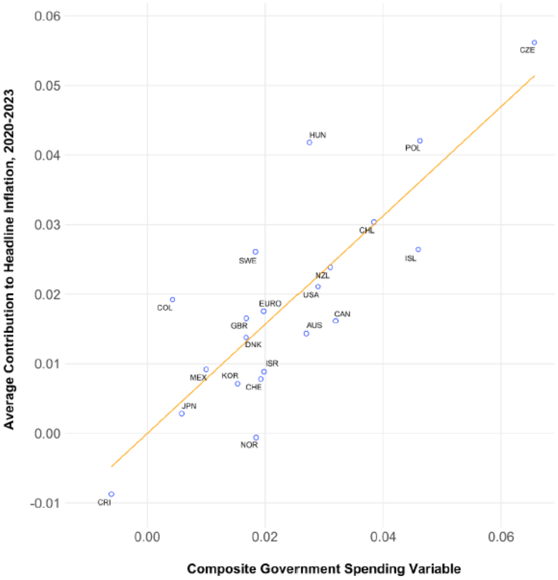
- Spending variable is set to zero for $2010 - 2019$, then is equal to $\frac{(G/Y)_t}{(G/Y)_{2019}} / \left(\frac{B_t^*}{P_t Y_t}\frac{T}{2}\right)$
  Argument is that average $(G/Y)_t$ is $[36\%, 41.4\%, 39\%, 36.4\%, 37\%]$ for 2019-2023
- $Z_{i,t}$ is country-specific control for Russia/Ukraine border in $2022 - 2023$
- π_i^* and X_t are country and time fixed effects

Regression results

	(1)	(2)	(3)	(4)
	Headline CPI		Core CPI	
	Coefficients of composite government spending			
2020	0.472** (.189)	--	0.507*** (.150)	--
2021	0.533*** (.189)	--	0.804*** (.150)	--
2022	1.156*** (.191)	--	1.320*** (.152)	--
2023	0.969*** (.191)	--	0.737*** (.152)	--
2020-2023	--	.777*** (.109)	--	.838*** (.088)
p-value equal coefficients	0.018	--	0.001	--
	Coefficients of border dummy			
2022	.028*** (.008)	--	.009 (.007)	--
2023	.047*** (.008)	--	.037*** (.007)	--
2022-2023	--	.040*** (.006)	--	.025*** (.005)
p-value equal coefficients	0.098	--	0.002	--
	Statistics			
R-squared	0.80	0.79	0.80	0.78
s.e. of regression	0.013	0.013	0.010	0.011
log(likelihood)	882.281	875.184	949.292	936.249
p-value 6 equal coefficients	0.015	--	0.0001	--

- Cols (1), (3) allow for individual year coefficients
- Cols (2), (4) lump spending together, suggest $\eta \approx 80\%$

Cross-country evidence



Keynesian effects vs FTPL

Spending may affect inflation via its effects on aggregate demand, in a world where fiscal policy is Ricardian

Linearise the composite spending variable around its cross-country mean $\bar{\Omega} := \bar{G}/(\bar{B}\bar{D})$ where $\bar{G}, \bar{B}, \bar{D}$ are cross-sectional means for $\Delta(G/Y), B/Y, T$. Then re-run regression with main regressor being

$$\Omega \left[\beta_G \frac{G - \bar{G}}{\bar{G}} + \beta_B \frac{B - \bar{B}}{\bar{B}} + \beta_D \frac{D - \bar{D}}{\bar{D}} \right]$$

Keynesian effects vs FTPL

	(1)	(2)
	Headline CPI	**Core CPI**
$(G - \bar{G}) \cdot \bar{\Omega}/\bar{G}$	.749***	.825***
	(.169)	(.141)
$(B - \bar{B}) \cdot \bar{\Omega}/\bar{B}$	-.520***	-.554***
	(.144)	(.120)
$(D - \bar{D}) \cdot \bar{\Omega}/\bar{D}$	-.721**	-.781***
	(.306)	(.255)
Border with Ukraine/Russia	.0412***	.0262***
	(.0069)	(.0058)
Number of Observations	294	294
R-squared	.776	.750
s.e. of regression	.0138	.0115
log(likelihood)	863.079	915.942
p-value	.406	.166

- Coefficients are significant and with signs suggested by FTPL
- Keynesian logic would predict no role for debt or duration
- Repeating analysis without adjusting $\Delta(G/Y)$ by debt and duration delivers poorer fit

Takeaways

Berndt et al. (2012)

- look at PVBC of the government
- estimate fraction of shocks financed by surpluses (large) and debt returns (small)

Bouscasse and Hong (2023)

- look at period-by-period BC of the government
- contemporaneous response to MP shocks muted
- counterfactual response via taxes/spending or transfers have $\neq$ effects on GDP

Barro and Bianchi (2023)

- large fraction of spending surge financed by debt returns
- difference with Berndt et al. (2012) could be explained by exceptionality of circumstances
- significant role for size and maturity of debt

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