

Debt, Monetary Policy, and Credit

The Dampening Effects of Government Indebtedness on the Transmission of Monetary Policy to Credit

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ECONOMICS BROWNBAG

Motivation

Background

- Public debt as a percentage of GDP is projected to grow for the foreseeable future
- Limited understanding of how credit responds to monetary policy as debt-to-GDP rises

This Paper

Public finance literature

- Rising debt-to-GDP creates distortions, inflation, and alters resource allocation

Monetary policy literature

- Rising debt-to-GDP alters the economy's response to monetary policy

Questions

- How does credit in the U.S. respond to monetary policy shocks as debt-to-GDP rises?
- What are the policy implications?

This Paper

Show how credit's response to monetary policy is affected by high debt

- **Lending:** monthly panel of U.S. commercial banks
- **Debt:** monthly data on U.S. federal debt as a percent of GDP
- **Monetary policy shock:** narrative data around FOMC announcements

Main findings:

- ⇒ Debt-state dependence of monetary policy's effects on bank credit
 - ⇒ Increased indebtedness reduces the monetary policy's effects on credit
- ⇒ Maturity structure of debt is a relevant factor
 - ⇒ Higher proportion of short-term debt exacerbates this phenomenon

This Paper

Construct model to rationalize findings

Mechanism

- Fiscal policy: non-Ricardian (i.e. "active" fiscal policy)
- Expectations: anticipations about future debt shift outcomes today
- With partially repaid debt (implicit default via inflation):
 - Higher debt today \Rightarrow More anticipated inflation tomorrow
- Wealth effects of short-term debt: net windfall for bondholders

Quantitative Model

- Medium-scale New Keynesian model with a financial sector
- "Active" fiscal policy — "Passive" monetary policy

\Rightarrow Policy implication:

- Credit exhibits dampened response to monetary policy in environment of high-indebtedness

Related Literature

Real Effects of High Indebtedness:

- Interaction with monetary policy: Beetsma, Jensen (2005); Cantero-Saiz et al. (2014); Caramp, Feilich (2024); Leith, Wren-Lewis (2008)
- Public debt burden and credit dynamics: Bottero et al. (2015); Emran, Farazi (2009); Williams (2018)

Active Fiscal/Passive Monetary Policy Regimes:

- Active-Fiscal Models: Cochrane (2022); Leeper (1991); Sargent & Wallace (1981); Sims (1994); Woodford (1995)
- Effects on agents' expectations: Brandao-Marques et al. (2024); Kose et al. (2019)

This paper: Active Fiscal/Passive Monetary + High Debt Burden + Credit Response to Monetary Policy

Data

Monetary Policy Shocks

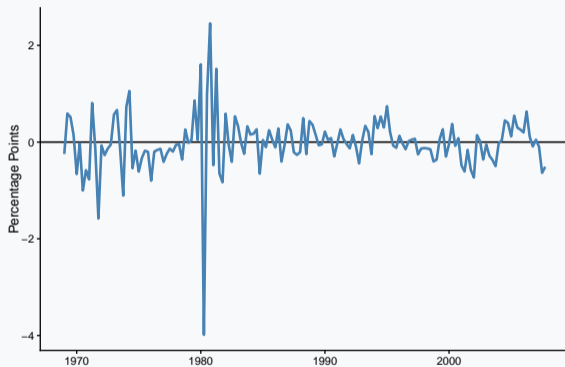
Data

- Narrative identification from Romer & Romer (2004)
- Aggregated to a monthly measure spanning 1968-2008 to identify monthly policy shocks
- Identification method:
 - **Dependent** variable: a composite of internal memos and documents such as the Fed's Bluebook
 - ▶ Pins down change in the Fed's intended federal funds rate around each FOMC meeting
 - **Independent** variables: the Fed's Greenbook forecasts
 - ▶ Contains data on important macro aggregates (output, inflation, unemployment)

⇒ **Residual** of this regression is the surprise to monetary policy that is not explained by forecast

[Details](#)

Monetary Policy Shocks Romer & Romer (2004)



Interpretation: MP Shock $> 0 \Rightarrow$ Policy tightening | MP Shock $< 0 \Rightarrow$ Policy easing

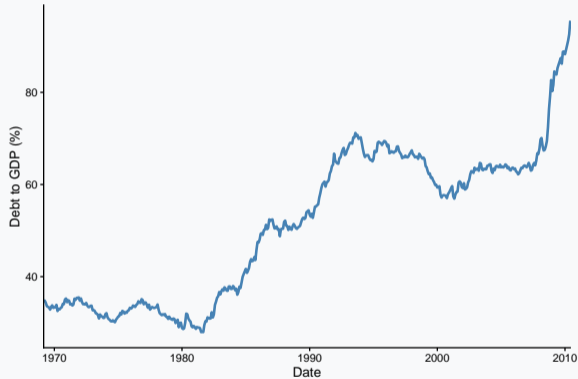
Remainder of Data

The Data

Coverage: 1973 Q1 – 2008 Q1, monthly frequency

- **U.S. government debt:** market value of total gross debt, Hall, Payne, & Sargent (2018)
- **GDP:** nominal GDP at monthly frequency, Stock & Watson (2010)
- **Bank data:** FRB H.8 Release for Commercial Banks
- **Controls** (FRB, FDIC, BLS):
 - *Macro:* industrial production, CPI, PPI, federal funds rate, unemployment rate
 - *Bank:* total securities, treasury securities, total assets, cash assets, other assets
- **Observations:** 420 observation months

Debt-to-GDP Series



U.S. market value of total gross debt as a percentage of GDP, March 1969 – June 2010. Monthly debt series from [Hall, Payne, & Sargent \(2018\)](#); monthly GDP from [Stock & Watson \(2010\)](#).

Empirical Results

Baseline Regression (Local Projections)

Following [Jorda \(2005\)](#), I specify log changes in the outcome variable at each horizon h relative to the baseline period:

$$y_{t+h}^{(h)} = \beta_h \text{MPS}_t + \gamma_h D_{t-1} + \delta_h (\text{MPS}_t \times D_{t-1}) + \sum_{i=1}^I \phi_{h,i} \text{MPS}_{t-i} + \sum_{i=1}^I \theta'_{h,i} \mathbf{X}_{t-i} + \varepsilon_{t+h}$$

Outcome:

$$y_{t+h}^{(h)} = \ln \text{Loans}_{t+h} - \ln \text{Loans}_{t-1}$$

Regressors of Interest:

- MPS_t : quarterly monetary policy shock | D_t : detrended log debt-to-GDP

[Details](#)

Controls:

- X_t : macro and financial controls

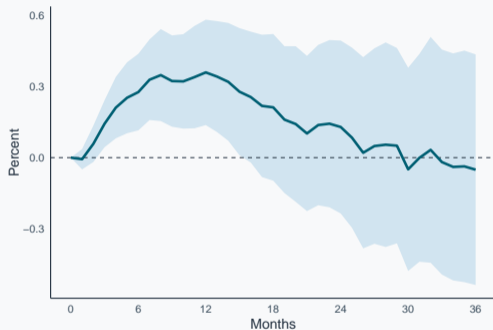
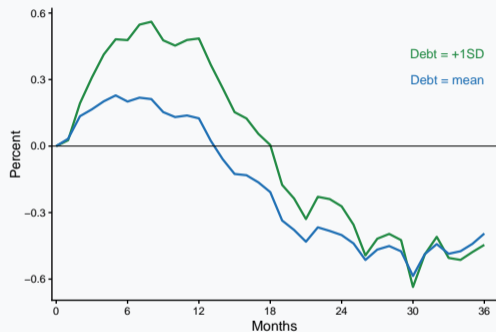
Split observations into high versus mean debt:

- $D_{t-1} = 0$ when debt is at or below sample mean for a particular observation
- $D_{t-1} = 1$ when debt is greater than or equal to one standard deviation above sample mean

LP Results (High - Mean Debt State)

Macro Aggregates

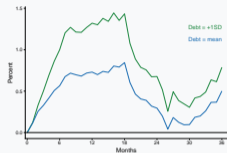
VAR Test



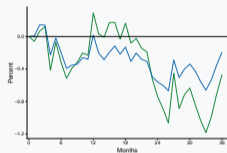
Aggregate Commercial Bank Lending

Notes: Left panel shows IRFs for high and mean debt states separately. Right panel shows the difference between the two, following [Caramp & Feilich \(2018\)](#), with 90% confidence bands.

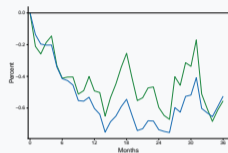
Loans by Category



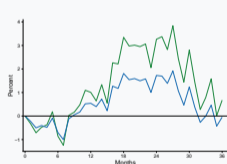
C&I Loans



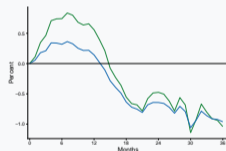
Other Loans



Consumer Loans



Interbank Lending



Real Estate Loans (Commercial and Residential)

Commercial Bank Lending by Category

Notes: Plots of each lending category where green lines correspond to response to a monetary contraction at +1 SD debt and blue lines correspond to monetary contraction at mean debt.

Model

Model Overview

Discrete-time economy with four key blocks:

- **Households:** CRRA utility, consume, supply labor, hold short- & long-term government debt, deposits
- **Firms:** Cobb–Douglas production, finance capital via bank loans, Calvo pricing
- **Banks:** differentiated loan & deposit products (CES), hold government bonds, subject to capital constraint
- **Government:** active fiscal / passive monetary regime

Key feature: Firms' capital accumulation is constrained by bank lending

$$K_t(j) \leq L_t(j)$$

This is the transmission channel linking monetary policy \rightarrow credit \rightarrow real activity.

Fiscal & Taylor rule calibrations follow [Cochrane \(2022a,b\)](#); **banking block** follows [Balloch & Koby \(2023\)](#).

Active Fiscal / Passive Monetary Regime

Policy rules:

$$i_t = \theta_{i\pi}\pi_t + \theta_{iy}y_t + u_t^i \quad \theta_{i\pi} < 1 \text{ (passive)}$$

$$s_t = \theta_{s\pi}\pi_t + \theta_{sy}y_t + \alpha_v v_t + u_t^s \text{ (active: surpluses don't fully back debt)}$$

Valuation equation pins down the price level:

$$\frac{M_{t-1} + \sum_{j=0}^{\infty} Q_t^{t+j} B_{t-1}^{t+j}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j}$$

Intuition: A negative surplus shock raises the value of debt (LHS). With surpluses not adjusting one-for-one, either $P_t \uparrow$ or $Q_t \downarrow$ must restore equality \Rightarrow inflation

Geometric maturity structure $B_t^{t+j} = \omega^{j-1} B_t$: lower ω (more short-term debt) \Rightarrow greater rollover exposure \Rightarrow more inflation per surplus shock

Banking Block: CES Loans and Deposits

Loan-services firm aggregates intermediate bank loans:

$$L_t = \left(\int_0^1 L_t(j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \quad \varepsilon > 1$$

(Symmetric CES aggregator for deposits with elasticity ε_D .)

Intermediate bank j 's balance sheet:

$$L_t(j) + Q_t B_t(j) = D_t(j) + E_t(j) \quad L_t(j) \leq \eta E_t(j)$$

Banks hold government debt $B_t \Rightarrow$ direct exposure to duration risk.

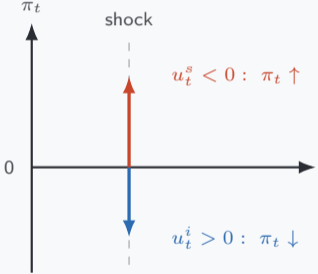
Optimal loan rate (with capital constraint binding):

$$R_t^L(j) = \underbrace{\frac{\varepsilon}{\varepsilon-1} \left(1 - \frac{1}{\eta}\right)}_{\text{markup}} R_t^D(j)$$

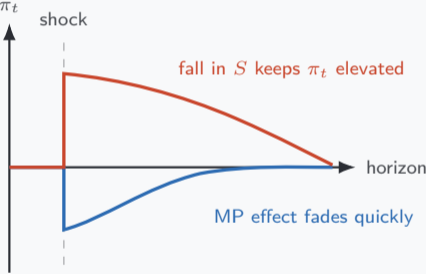
Wedge between lending and deposit rates depends on loan-market elasticity ε and leverage η .

Interaction Effects: Joint Monetary and Fiscal Shocks

A. Impact at shock date



B. Persistence



— monetary policy

— surplus shock

Mechanism: Debt Weakens MP Transmission to Credit

Capital demand

$$k_t \propto -\chi(i_t - E_t\pi_{t+1}), \quad \chi > 0$$

$\Rightarrow k_t$ is decreasing in the expected real rate $r_t \equiv i_t - E_t\pi_{t+1}$

Effect of larger surplus shocks

- After a contractionary monetary shock, i_t rises
- But as debt rises (absent offsetting expected future surpluses) $E_t\pi_{t+1}$ rises more:

$$E_t\pi_{t+1} \uparrow \Rightarrow r_t = i_t - E_t\pi_{t+1} \text{ rises by less}$$

Mechanism: Why Debt Dampens Transmission

The transmission chain:

1. Monetary contraction: $i_t \uparrow$
2. Higher i_t raises government debt service costs
3. Under active fiscal policy, surpluses don't adjust \Rightarrow valuation equation forces $\pi_t \uparrow$
(or $Q_t \downarrow$)
4. Real rate $r_t = i_t - E_t\pi_{t+1}$ rises *less* than nominal rate
5. Firms' capital demand (tied to lending) contracts *less*
6. \Rightarrow **Lending responds less to the same monetary shock**

Quantitative implication: For every 5% deviation of surpluses below trend, real rates rise by 0.15% *less* after a 1% MP contraction

Quantitative Analysis

Calibration: Fixed Parameters

Parameter	Value	Description	Source
$\theta_{i\pi}$	0.80	Taylor rule, inflation response	Cochrane (2021)
θ_{iy}	0.50	Taylor rule, output response	Cochrane (2021)
$\theta_{s\pi}$	0.25	Surplus response to inflation	Cochrane (2021)
θ_{sy}	1.00	Surplus response to output	Cochrane (2021)
α_v	0.20	Surplus response to debt	Cochrane (2021)
ω	0.70	Debt maturity structure	Cochrane (2021)
η	10	Bank leverage constraint	Balloch and Koby (2023)
ε	7	Loan demand elasticity	Balloch and Koby (2023)

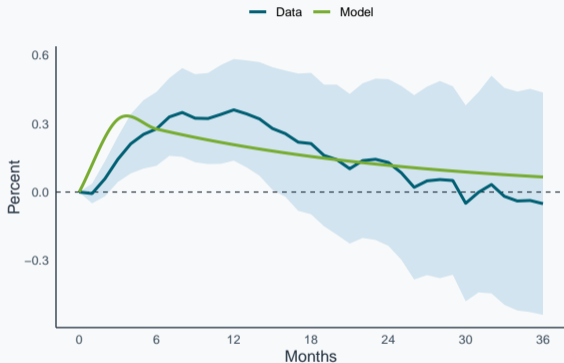
- Policy and debt parameters follow Cochrane's FTPL calibration.
- Banking parameters are taken from Balloch and Koby.

Calibration: Fitted Parameters

Parameter	Value Range	Optimal Value	Description
σ	[1.0, 3.0]		Risk aversion
ρ_i	[0.10, 0.95]		MP shock persistence
ρ_s	[0.10, 0.95]		Fiscal shock persistence
ρ	[0.50, 0.95]		Debt valuation parameter
β	[0.96, 0.995]		Discount factor
κ	[0.05, 1.00]		NKPC slope
ρ_a	[0.70, 0.99]		TFP persistence

- Value ranges based on previous literature

Calibration: Fitted Parameters



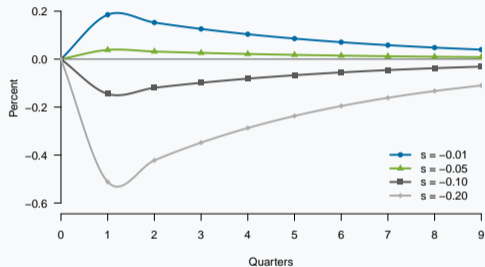
- Model fit measured by $SSE = \sum_{h=0}^{36} (\widehat{IRF}_h^{model} - IRF_h^{data})^2$, where the model IRF is estimated at monthly horizons to match the LP data; resulting $SSE = 0.317224$.

Calibration: Fitted Parameters

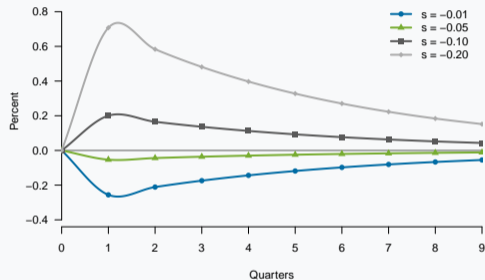
Parameter	Value Range	Optimal Value	Description
σ	[1.0, 3.0]	1.498	Risk aversion
ρ_i	[0.10, 0.95]	0.370	MP shock persistence
ρ_s	[0.10, 0.95]	0.713	Fiscal shock persistence
ρ	[0.50, 0.95]	0.622	Debt valuation parameter
β	[0.96, 0.995]	0.990	Discount factor
κ	[0.05, 1.00]	0.500	NKPC slope
ρ_a	[0.70, 0.99]	0.900	TFP persistence

- Value ranges based on previous literature

Joint Shocks



(a) Real Interest Rate



(b) Lending

Notes: Both panels face a 1% monetary policy contraction. (a) shows IRFs for real interest rate at varying deviations of expected future surpluses from trend. (b) does the same for lending.

Maturity Structure

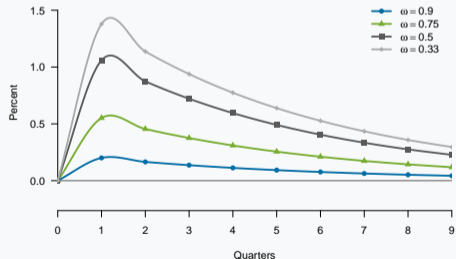
Empirical Pattern

- Shorter maturity structure \rightarrow more debt to roll over

Model

- Shorter maturity structure \equiv lower ω
- More debt to roll over \rightarrow more inflation from unbacked fiscal expansions

Lending



Conclusion

1. **Finding:** Monetary policy has state-dependent effects on credit
⇒ Higher debt-to-GDP significantly dampens lending responses to policy shocks
2. **Mechanism:** Active fiscal policy raises expected inflation following monetary contractions
⇒ Real rates rise less ⇒ weaker contraction in capital demand and lending
3. **Model:** NK model with banking sector matches key empirical moments
⇒ Generates dampened credit responses under high debt
4. **Policy implication:** Monetary policy effectiveness depends on fiscal conditions
⇒ High indebtedness weakens central bank control over credit cycles

Thank You

Appendix

Detrended Debt-to-GDP Return

Sources:

- Market value of total gross U.S. debt, monthly, from [Hall \(2018\)](#)
- Monthly GDP from [Stock & Watson \(2010\)](#)

Debt-to-GDP ratio:

$$d_{t-1} = \frac{\text{Debt}_{t-1}}{\text{GDP}_{t-1}}$$

Standardized:

$$\delta_{t-1} = \frac{d_{t-1} - \bar{d}}{\sigma_d}$$

Romer & Romer (2004) Monetary Policy Shocks

Return

Regression of intended funds rate changes on Greenbook forecasts:

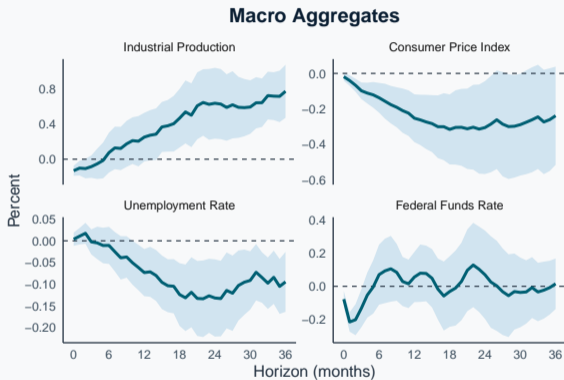
$$\begin{aligned}\Delta f f_m &= \alpha + \rho f f_m^{\text{before}} \\ &+ \sum_i \beta_i \tilde{y}_{m,i} + \sum_i \gamma_i \Delta \tilde{y}_{m,i} \\ &+ \sum_i \delta_i \tilde{\pi}_{m,i} + \sum_i \theta_i \Delta \tilde{\pi}_{m,i} \\ &+ \phi \tilde{u}_{m,0} + \varepsilon_m\end{aligned}$$

Where:

- $f f_m^{\text{before}}$ — intended funds rate prior to meeting m
- $\tilde{y}_{m,i}, \tilde{\pi}_{m,i}$ — Greenbook forecasts of output growth and inflation at horizon i
- $\Delta \tilde{y}_{m,i}, \Delta \tilde{\pi}_{m,i}$ — forecast revisions since the previous meeting
- $\tilde{u}_{m,0}$ — contemporaneous unemployment forecast

Monetary policy shock: $\text{MPS}_m \equiv \varepsilon_m$

Macro Aggregates LPs Return



Following [Caramp & Feilich \(2018\)](#), I take the difference between the IRFs of the high and mean debt states for each outcome variable with the corresponding 90% confidence bands.

State-Dependent VAR Return

Specification:

$$Y_t = \alpha + \Gamma D_{t-1} + \sum_{i=1}^p \beta_i Y_{t-i} + \sum_{i=1}^p \Phi_i(D_{t-1} \cdot Y_{t-i}) + u_t$$

Endogenous variables (Y_t): industrial production, CPI, unemployment, bank securities, treasury holdings, total assets, other assets, real loans, federal funds rate

Debt state (D_{t-1}):

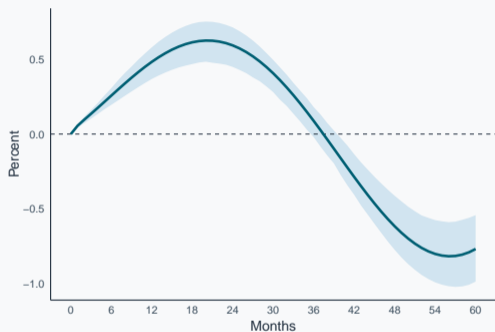
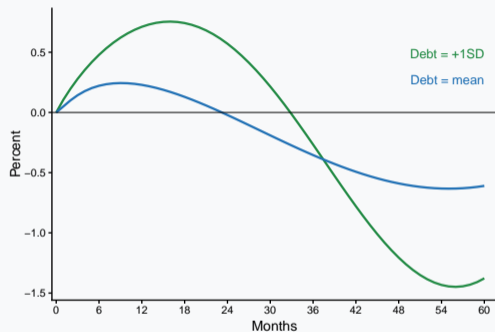
- $D_{t-1} = 0$ if debt \leq sample mean
- $D_{t-1} = 1$ if debt \geq one s.d. above mean

Implementation:

- Lag length: BIC selects $p = 1$, AIC selects $p = 12$; dynamics similar, use $p = 1$
- Identification: Cholesky decomposition, **shock via federal funds rate**
- Compute regime-specific IRFs for high and mean debt states

VAR Results

Return



Aggregate Commercial Bank Lending (VAR - FFR Shock)

Notes: Response of lending in VAR to a +1 SD *federal funds rate* shock. Left panel shows IRFs for high and mean debt states separately. Right panel shows the difference between the two, following [Caramp & Feilich \(2018\)](#), with 90% confidence bands.