Fiscal Redistribution Risk in Treasury Markets.

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Motivation

- Governments and CBs face a **tradeoff** when deciding how to pay for major fiscal expansions—protect taxpayers or bondholders?
- Policymakers have often chosen to protect taxpayers at the expense of bondholders w/ **unbacked fiscal expansions** + monetary accommodation.
  - e.g., COVID, World Wars (25-50% real losses on gov't bonds)
  - persistent rise in unfunded obligations in the past few decades
- The nominal devaluation of debt helped to pay for these fiscal expansions.
- This paper: Fiscal redistribution risk between bondholders and taxpayers ↗ **gov't funding costs** through bondholders demanding higher risk premia.

Our Approach

- We construct a tractable two-agent endowment economy model featuring fiscal-monetary interactions.
  a. **agents**: asset holders and hand-to-mouth
  b. **policy stance**: simple monetary and fiscal rules
  c. **one shock**: gov't spending $\longrightarrow$ transfers
  d. **gov't budget**: nominal debt & taxation to fund expenditures
- Solve the model with pencil and paper using a risk-adjusted asset pricing approach to capture endogenous risk premia.
- Policy regimes: **Fiscally-led** (exposes bondholders to unfunded fiscal risk) and **Monetary-led** (protects bondholders against fiscal risk).

Main Results

- The combination of a fiscally-led policy regime + LAMP provides a **fiscal redistribution mechanism** that generates a fiscal bond risk premium.
  1. Fiscal regime $\longrightarrow$ ex-post real gov't bond returns are state-contingent
  2. Fiscal + LAMP $\longrightarrow$ fiscal risk is priced in equilibrium (unfunded fiscal expansions redistribute asset holders' wealth to the hand-to-mouth)

- Baseline model has **no deadweight costs** or other frictions (besides LAMP).
- Other specifications (Fiscal RA, Monetary LAMP, Monetary RA) generate **0** bond risk premia.
- Our model relies on **fiscal redistribution risk** rather than the stagflation risk featured in RA models of the term structure.
- Calibrated model: Unfunded fiscal risk can explain around **50%** of the bond risk premium and nominal term premium.

Analytical Framework

Agents

- A continuum of agents with limited asset market participation (LAMP).
  - $a.$ fraction ζ are intertemporal **asset holders** ("bondholders") with EZ preferences

$$U_{At} = \left\{(1-\beta)C_{At}^{\frac{1-\gamma}{\theta}} + \beta\left(\mathbb{E}_t\left[U_{At+1}^{1-\gamma}\right]\right)^{\frac{1}{\theta}}\right\}^{\frac{\theta}{1-\gamma}}$$

    $\longrightarrow$ important for pricing the intertemporal fiscal redistribution risk

  - $b.$ remaining fraction $1-\zeta$ are **hand-to-mouth**("taxpayers") that consume their disposable income

- Each household receives the constant real endowment $\overline{Y} > 0$ in each period.

Monetary & Fiscal Policy

- The CB follows a nominal interest rate rule

$$i_t = i^\star + \rho_\pi(\pi_t - \pi^\star)$$

- The gov't follows a real tax rule

$$\tau_t = \tau^\star + \delta_b(b_{t-1} - b^\star),$$

  – taxes are levied uniformly and in lump sum across all agents

- Net gov't spending ⟨**only shock** in the analytical model⟩

$$g_t = g^\star + x_t, \quad x_t = \rho x_{t-1} + \sigma\epsilon_t,$$

  – distributed uniformly as stimulus checks across all agents

- Gov't issues one-period nominal bonds and taxation to pay for g_t today

$$B_{t-1} = P_t s_t + Q_t^b B_t,$$

  ⟨$s_t \equiv \tau_t - g_t$ is the primary surplus⟩

  – implies $r_{st} = r_{gt} - \pi_t$ ("**Bondholder's return identity**")

Equilibrium Pricing Kernel

- The asset holder's optimal consumption-savings decision yields

$$1 = \mathbb{E}_t \left[M^{\$}_{t+1} R_{gt+1} \right]$$

$\langle M^{\$}_{t+1} \equiv M_{t+1}/\Pi_{t+1}$ and M_{t+1} is the IMRS of asset holders$\rangle$

- For cleaner analytical solutions, we consider the limit case ($\psi \to \infty$) that gives us a "**CAPM**" real pricing kernel

$$m_{t+1} = (1-\gamma)\log(\beta) - \gamma r_{At+1}$$

r_{At+1} is the return on wealth of the asset holder.

5-Equation Model

$$[1.] \quad 1 = \mathbb{E}_t\left[\exp\left((1-\gamma)\log(\beta) - \gamma r_{At+1} - \pi_{t+1} + i^\star + \rho_\pi(\pi_t - \pi^\star)\right)\right]$$

$$[2.] \quad 1 = \mathbb{E}_t\left[\exp\left((1-\gamma)\log(\beta) + (1-\gamma) r_{At+1}\right)\right]$$

$$[3.] \quad i^\star + \rho_\pi(\pi_{t-1} - \pi^\star) - \pi_t = r_{st}$$

$$[4.] \quad C_{Ht} = \overline{Y} - s^\star + x_t - \delta_b(b_{t-1} - b^\star)$$

$$[5.] \quad C_{At} = \overline{Y} + \frac{1-\zeta}{\zeta}\left(s^\star + \delta_b(b_{t-1} - b^\star) - x_t\right)$$

- Campbell-Shiller approximation for the returns r_{At} and r_{st}.
- Use an iterative procedure to obtain the risky steady states.

Determinacy Regions

- The parameter space for the policy coefficients (ρ_π, δ_b) can be partitioned into four distinct regions as in Leeper '91.
- Two regions deliver unique and bounded solutions for debt and inflation:

  * **Fiscally-led**: passive monetary $\langle \rho_\pi < 1 \rangle$, active fiscal $\langle \delta_b < s^\star \rangle$
  * **Monetary-led**: active monetary $\langle \rho_\pi > 1 \rangle$, passive fiscal $\langle \delta_b > s^\star \rangle$

- **This paper**: Fiscally-led regime + LAMP generates a fiscal bond risk premium through a persistent redistribution mechanism.

  Fiscal RA, Monetary LAMP, Monetary RA $\longrightarrow$ 0 fiscal bond risk premium

Fiscally-Led ⟨Overview⟩

- FTPL framework with the risk of the gov't pursuing **unbacked fiscal expansions** ($\delta_b < s^\star$) that reduce PDV of surpluses

$$(R_{gt}/\Pi_t)b_{t-1} = \mathbb{E}_t\Big[\sum_{j=0}^{\infty} M_{t,t+j}s_{t+j}\Big]$$

$\longrightarrow$ requires inflationary finance, devaluing real gov't bond returns

- CB **accommodates** fiscal expansions by preventing gov't funding costs from exploding ($\rho_\pi < 1$).

Fiscally-Led ⟨Solution⟩

- Using method of undetermined coefficients, solve for log real value of debt **forward** using the Euler equation ($1 = E_t \left[\exp\left(m_{t+1} + r_{st+1}\right)\right]$).
- Solve for log inflation **backward** using the intertemporal gov't budget equation ($\pi_t = r_{gt} - r_{st}$)
- Obtain consumption policies using the hand-to-mouth's budget constraint and goods market clearing.
- Using method of undetermined coefficients, solve for asset holder's wealth using the Euler equation ($1 = E_t \left[\exp\left(m_{t+1} + r_{At+1}\right)\right]$).

Fiscally-Led ⟨Risky Debt⟩

- Inflationary finance pays for the unfunded portion of surprise fiscal expansions ($\epsilon_t > 0$)

$$\pi_t = \Gamma_\pi + \rho_\pi \pi_{t-1} + \underbrace{\Big(- \kappa_1 A_1 + \kappa_2 \Big)}_{>0} \sigma \epsilon_t$$

- Ex-post real gov't bond returns are state-contingent

$$r_{st+1} = \bar{r}_s + \underbrace{\Big(\kappa_1 A_1 - \kappa_2 \Big)}_{<0} \sigma \epsilon_{t+1}.$$

  – surprise unbacked fiscal expansions lead to real losses on gov't bonds

  – bond return dynamics do not directly depend on ζ (mass of asset holders)

Fiscally-Led ⟨Contemporaneous Redistribution⟩

- Asset holders cover the initial costs of a fiscal expansion ($\epsilon_t > 0$).

  a. asset holder's consumption ↘

  $$C_{At} - \mathbb{E}_{t-1}[C_{At}] = -\left(\frac{1-\zeta}{\zeta}\right)\sigma\epsilon_t < 0,$$

  bond loss > transfer, decreasing consumption

  b. hand-to-mouth consumption ↗

  $$C_{Ht} - \mathbb{E}_{t-1}[C_{Ht}] = \sigma\epsilon_t > 0.$$

  higher transfer w/out incurring financing costs increases consumption

- Contemporaneous redistribution responses are the same in both regimes, but the **future redistribution effects depend on the policy stance**.

Fiscally-Led ⟨Intertemporal Redistribution⟩

- Asset holders pay for the entire future unfunded costs of the fiscal expansion ($\epsilon_t > 0$), but share the benefits with the hand-to-mouth.

  a. asset holder's PDV of future consumption ↘

$$p_{At} - \mathbb{E}_{t-1}[p_{At}] = \frac{\alpha_{A2}\left(\frac{1-\zeta}{\zeta}\right)\left(\rho - \delta_b A_1\right)}{\alpha_{A1}\rho - 1}\sigma\epsilon_t < 0$$

  b. hand-to-mouth PDV of future consumption ↗

$$p_{Ht} - \mathbb{E}_{t-1}[p_{Ht}] = \frac{\alpha_{H2}(\rho - \delta_b A_1)}{1 - \alpha_{H1}\rho}\sigma\epsilon_t > 0$$

- Unfunded fiscal expansions redistribute asset holders' wealth to subsidize transfers to hand-to-mouth agents **through bond markets**.

Fiscally-Led ⟨Pricing Kernel & Risk Premia⟩

- Surprise fiscal expansions ($\epsilon_t > 0$) reduce the real wealth of asset holders → **increase in the real pricing kernel**.

$$m_{t+1} - \mathbb{E}_t[m_{t+1}] = -\gamma \left\{ \alpha_{A0} D_{A1} - \alpha_{A2} \left(\frac{1-\zeta}{\zeta} \right) \right\} \sigma \epsilon_{t+1} > 0$$

where $D_{A1} = \alpha_{A2} \left(\frac{1-\zeta}{\zeta} \right) \left(\rho - \delta_b A_1 \right) / (\alpha_{A1} \rho - 1)$

- **Fiscal bond risk premium**:

$$\mathbb{E}_t[r_{st+1} - r_t] + \frac{1}{2}\sigma_t^2(r_{st+1}) = \gamma \left\{ \alpha_{A0} D_{A1} - \alpha_{A2} \left(\frac{1-\zeta}{\zeta} \right) \right\} \left(\kappa_1 A_1 - \kappa_2 \right) \sigma^2 > 0$$

– compensation for fiscal redistribution risk

- In the **RA case** ($\zeta = 1$), the real pricing kernel is protected against fiscal risk as $m_{t+1} - \mathbb{E}_t[m_{t+1}] = 0$, implying no fiscal bond risk premium.

– real bond losses offset by the agent receiving entire transfers

Fiscally-Led ⟨Nominal Term Structure⟩

- Inflation and real pricing kernel solutions imply a **one-factor** model

$$-m^{\$}_{t+1} = \theta_m + \rho_\pi \pi_t + \lambda_m \sigma \epsilon_{t+1}$$

– inflation solution gives the **state variable** dynamics

$$\pi_{t+1} = \Gamma_\pi + \rho_\pi \pi_t + \Big(-\kappa_1 A_1 + \kappa_2 \Big) \sigma \epsilon_{t+1}$$

- Endogenous **price of risk**

$$\lambda_m = \underbrace{\gamma \left\{ \alpha_{A0} D_{A1} - \alpha_{A2} \left(\frac{1-\zeta}{\zeta} \right) \right\}}_{-\eta_m} + \underbrace{\Big(-\kappa_1 A_1 + \kappa_2 \Big)}_{\eta_\pi}$$

- **Nominal term premium**:

$$E_t[r^{(n)}_{t+1}] - i_t + \frac{1}{2}\sigma^2_t(r^{(n)}_{t+1}) = \underbrace{-\chi^{(n-1)}_1 \eta_\pi}_{<0} \lambda_m \sigma^2 > \mathbf{0}$$

→ $\lambda_m < 0$, real pricing kernel sensitivity to fiscal shocks is larger than the

Monetary-Led ⟨Overview⟩

- Textbook monetary framework where CB targets & stabilizes inflation ($\rho_\pi > 1$) independently of fiscal concerns.
- Gov't accommodates CB by fully backing all fiscal expansions with expected **future taxation** ($\delta_b > s^\star$) to stabilize debt – rules out inflationary finance.
- In contrast to the fiscal regime, gov't bond returns and pricing kernel are insulated from fiscal risk.

Monetary-Led ⟨Solution⟩

- Solve inflation **forward** in the monetary-led regime using the nominal bond pricing Euler equation, $\exp(-i_t) = E_t\left[\exp\left(m_{t+1} - \pi_{t+1}\right)\right]$.

  – inflation is constant $\pi_t = \pi^\star$ and the bond return is constant $r_{gt} = i^\star$

  $\longrightarrow$ ex-post real bond return $r_{gt} - \pi_t = i^\star - \pi^\star$ is constant (**safe debt**)

- We use the gov't budget equation to solve debt **backward**.

- We obtain the consumption policies of each agent type using the market-clearing conditions and budget constraints.

Monetary-Led ⟨Contemporaneous Redistribution⟩

- **Initial redistribution effects** of a surprise fiscal expansion ($\epsilon_t > 0$).

  a. asset holder's consumption ↘

$$C_{At} - \mathbb{E}_{t-1}[C_{At}] = -\left(\frac{1-\zeta}{\zeta}\right)\sigma\epsilon_t < 0,$$

  – absorb entire new debt issuance but share the gov't transfers

  b. hand-to-mouth consumption ↗

$$C_{Ht} - \mathbb{E}_{t-1}[C_{Ht}] = \sigma\epsilon_t > 0.$$

  – enjoy higher transfers without facing initial upfront costs

- Consumption innovations are <u>the same</u> in both regimes (although underlying mechanics differ).

Monetary-Led ⟨Intertemporal Redistribution⟩

- Cumulative future redistribution response to the surprise fiscal expansion ($\epsilon_t > 0$) **reverses** the initial effects.

  a. asset holder's PDV of future consumption ↗

$$P_{At} - \mathbb{E}_{t-1}[P_{At}] = \left(\frac{1-\zeta}{\zeta}\right)\sigma\epsilon_t > 0,$$

  – receive entirety of the higher future surpluses from owning bonds but share the higher future tax bill

  b. hand-to-mouth PDV of future consumption ↘

$$P_{Ht} - \mathbb{E}_{t-1}[P_{Ht}] = -\sigma\epsilon_t < 0.$$

  – face a higher future tax bill without receiving any benefits of the future bond appreciation

- The future responses exactly offset the realized responses → asset holder's wealth–and therefore m_{t+1}–are protected against fiscal shocks.

Quantitative Evaluation

Quantitative Framework ⟨Outline⟩

- We extend our endowment economy framework to a **TANK** framework to quantitatively evaluate the fiscal redistribution mechanism.
  - *a*. endogenous production and labor supply
  - *b*. sticky prices
  - *c*. long-term nominal debt
  - *d*. additional structural shocks (MP, productivity, preferences)
- We focus on a **fiscally-led** regime with partially-backed gov't spending.
  - tax rule with $\delta_b < 0 \longrightarrow$ partial tax financing in fiscal expansions
- Calibrate to match the **unfunded share** of gov't spending volatility to discipline the extent that inflationary finance is used in fiscal expansions.

Quantitative Framework ⟨Results⟩

	Model	Data
Panel A: First Moments		
E(5y-1q yield spread)	87 bps	98 bps
E(Inflation)	2.9%	2.9%
Panel B: Second Moments		
σ(Unfunded)/σ(total)	74%	79%
σ(Nominal short rate)	3.7%	3.1%
σ(Inflation)	3.9%	3.6%
σ(Δ Consumption)	1.1%	2.2%
σ(Δ Surplus to GDP)	1.0%	3.2%

- Baseline model generates a sizable nominal yield spread with moderate risk aversion ($\gamma = 10$).
- Consistent with macroeconomic and surplus fluctuations.

Quantitative Framework ⟨Results⟩

	Base LAMP	Base-S LAMP	Fisc RA	Mon LAMP	Mon RA	Fisc-U LAMP	Fisc-U RA	Hybrid LAMP
Total (bps)	**87**	**126**	**39**	**21**	**18**	**91**	**40**	**95**
Contribution (bps):								
Preference	39	40	38	18	17	40	38	40
Monetary Policy	0	0	0	0	0	0	0	0
TFP	2	2	1	1	1	2	1	2
Fiscal (total)	45	84	-0	1	0	49	-0	52
Unfunded								51
Funded								1

- **Fiscal shocks** account for most of the average term spread.
- Extension with stochastic volatility in government spending provides risk amplification.

  → deficit shocks increase nominal term premia and expected inflation

Conclusion

- We examine the bond market consequences of monetary-fiscal policies that protect taxpayers at the expense of bondholders.
- We demonstrate how the **risk of unbacked fiscal expansions** produces a **fiscal bond risk premia** in equilibrium.
    1. reduced fiscal backing ⟶ real losses on bond returns
    2. fiscal redistribution ⟶ increases pricing kernel
- When calibrating to the dynamics of the unfunded share, we find that unbacked fiscal risk is a **significant cost to gov't financing**.