Public Debt as Private Liquidity: Optimal Policy

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Banque de France, Pierre Werner Chair Conference,
October 7, 2021, Paris

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- **Liquidity shocks and shortage of collateral** impede efficient allocation of resources

→ Public debt as collateral/buffer stock → Alleviate frictions (Great recession, COVID crisis) (Woodford, 1990, Aiyagari-McGrattan, 1998, Holmström-Tirole, 1998.)

- **Substantial spread** between private and public bonds + **Sensitive** to public debt (Krishnamurty and Vissing-Jorgensen, 2012)

→ What are the implications of these considerations for optimal fiscal policy?

What we do

- Study **optimal fiscal policy** in a model where
  - **public debt has a liquidity function** (→ influences the virulence of financial frictions)
  - but **does not generate a free lunch** for the government (→ distortionary taxation)

→ Offer new lessons for

❶ optimal long-run quantity of public debt

❷ desirability of tax smoothing

❸ optimal policy response to shocks (including financial crises)

What we find: With Financial Frictions

→ Public debt can alleviate financial frictions.

- Optimal policy **departs from**

  ✖ **Steady-state indeterminacy:** There exists (at least) one well-defined steady state level of debt to which the economy converges starting from any level below a threshold.

  ✖ **Tax smoothing:** Tax variations are used to mitigate the interest cost of public debt

→ Driven by **3 forces**

❶ Desire to smooth taxes

❷ Desire to ease the financial friction to improve allocation

❸ Desire to preserve the financial friction to suppress interest cost

Convenient Reduced Form Representation

- Collateral role of public debt ➞ Ramsey problem takes the form

$$\max_{(s,b)\in(0,\bar{s})\times[\underline{b},\bar{b}]} \int_0^{+\infty} e^{-\rho t}[U(s) + \mathrm{V(b)}]dt$$

$$\text{s.t.} \quad \dot{b} = \mathrm{R(b)}b + g - s$$

$$b(0) = b_0$$

➞ **Dual role of public debt** (≃ Woodford, Aiyagari-McGrattan or Holmström-Tirole):

(i) Allocation Efficiency (Captured by V)
(ii) Interest Rates Manipulation (Captured by $R = \rho - \pi(b)$).

} **Key Trade off**

- **Key:** Dependence of V and R (id. π) on b, not the exact reason of this dependence.
- **Non convex problem** due to pecuniary externality.

▸ Simple Micro Model

Euler Equation: $\dot{\lambda} = V'(b) - \lambda\pi(b)\left(\sigma(b) - 1\right)$

- First Order Condition:

Tax smoothing:
Welfare cost of varying tax

$$\dot{\lambda} = \underbrace{V'(b)}_{\text{Allocation Efficiency}} - \underbrace{\lambda\pi(b)(\sigma(b) - 1)}_{\text{Interest Rate Manipulation}}$$

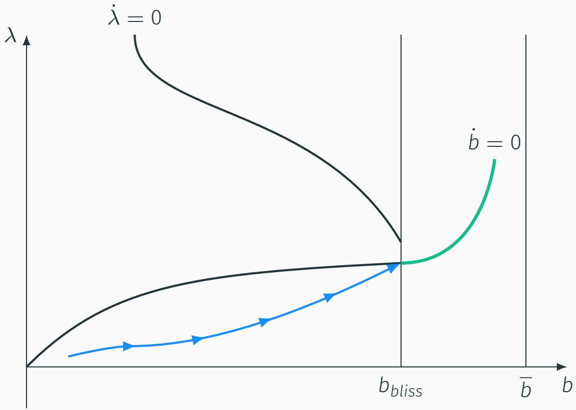
Allocation Efficiency:
Marginal social gain from easing the financial friction.

Interest Rate Manipulation:
Marginal increase in interest cost.

- Absent frictions: $\dot{\lambda} = 0$

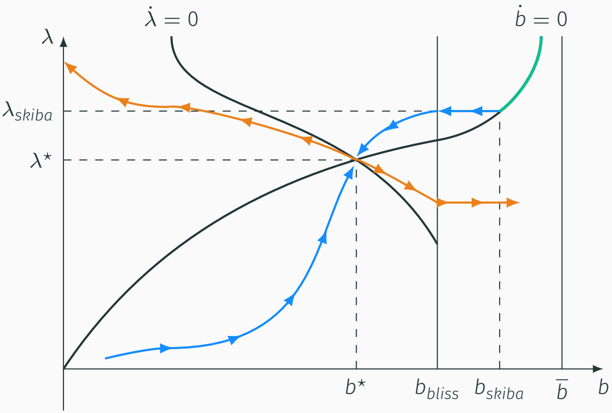
- **Not sufficient** → Need to characterize full dynamics.

Phase Diagram: Benchmark I: $g \leqslant \widehat{g}$.



- Efficiency considerations $\succ$ Fiscal considerations
- $b > b_{bliss}$ → Barro
  - → Tax smoothing
  - → Debt indeterminacy
- $b < b_{bliss}$
  - → Optimal to increase debt (efficiency)
  - → Slowly raise taxes (Fiscal)

Phase Diagram: Benchmark II: $g > \widehat{g}$.



- Fiscal considerations $\succ$ Efficiency considerations
- Well-defined steady state ← Trade-off
  - → Efficiency: Raise debt
  - → Interest rate manipulation: Squeeze debt
- $b \gg b_{bliss}$ $(b > b_{skiba})$ → Barro
- $b < b_{bliss}$ → Converges to a LR debt level
- $b_{bliss} < b < b_{skiba}$
  - → Debt squeezing + Tax smoothing

▸ Useful Lemma

Implications and Discussion

→ Optimal LR Quantity of Debt (Existence of a well defined steady state)

→ Importance of Tripartite Trade-Off

- The Optimal Response to shocks ▸ Go
- Crowding-out and Crowding-in ▸ Go
- Ricardian Equivalence ▸ Go

Concluding Remark

- **Question:** Is it always optimal to supply debt to alleviate financial frictions?
- Not always! The government may wish to exploit its collateral producing capacity to earn rents from the private sector and reduce reliance on distortionary taxation.
- **Open Questions:**
    - Quantitative Implications?
    - Interaction with Monetary policy

THANK YOU!

APPENDIX

A Simple Micro-Founded Model

- Similar to Barro (1979), AMSS (2002), Lucas-Stokey (1983):
    - Infinitely lived agents,
    - Competitive markets and flexible prices,
    - Government issues debt and collect taxes by distorting labor supply decisions only.
- Features financial frictions as in Kiyotaki-Moore (1997) or Holmström-Tirole (1998):
    - Agents are hit by idiosyncratic shocks → reallocation of goods across agents.
    - The reallocation requires borrowing; borrowing requires collateral.
    - Private supply of collateral is limited as so is the pledgeable income of the private sector.

→ Public debt can serve as collateral and alleviate financial frictions.

Micro-Founded Model: Timing

- Endowment (e) + asset (a_{it})
- Taste Shock (θ_{it})
- Decide consumption (x_{it})
- Decide IOU issuance (z_{it})

- Labor supply decision (h_{it})
- Labor income ($(1-\tau_t)w_t h_{it}$)
- Risk free asset holding (a_{it+1})
- Consumption decision (c_{it})
- IOU repayment

Morning: $$z_{it} \leq \xi w_t h_{it}^{def} + a_{it}$$

Afternoon: $$-a_{it+1} \leq \xi w_{t+1} h_{it+1}^{def}$$

→ Consider the Ramsey problem

▸ Equations

▸ Back

Crowding-out and Crowding-in

- So far physical capital assumed away.

- **Introduce capital** w/ financial friction impacting production (K-M, 1997, H-T, 1998)

→ By easing the friction, public debt can
  - enhance capital and labor allocation and raise aggregate TFP
  - lead to higher capital returns → crowd-in capital.

- Different microfoundations **but**
  - reduced form representation of optimal policy
  - main trade-offs

  } continue to hold

- Also applies to substitutability of private vs public assets as collateral/buffer stock.

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Ricardian Equivalence

- **Essential** for our results: debt is non-neutral
- Modify the model to make debt neutral:
  - Pledgeable income moves 1 for 1 with future tax obligations.
  - → Increase in aggregate collateral (public debt issuance) is offset by a commensurate reduction in pledgeable income.
  - → public debt is neutral still model does not reduce to Barro (1979)
- The liquidity premium is invariant to b but still positive → $\dot{\lambda} = \pi\lambda$
- Optimal taxes and debt both exhibit a positive drift → **satiation**.

→ Makes clear that our results depend on the **causal effect** of debt on liquidity premium and interest rates.

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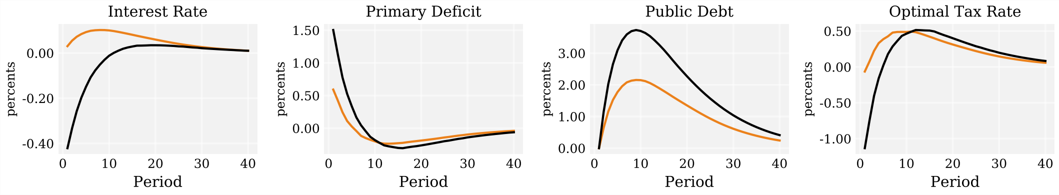
Optimal Response to Shocks: Traditional vs Financial Recession

- Engineer a recession by an exogenous shock on the labor wedge:
  - **Traditional:** leaves $V(b)$ and $\pi(b)$ unaffected
  - **Financial:** Raises both $V(b)$ and $\pi(b)$ by tightening the financial constraint



Financial Recession; Traditional Recession.

→ formal basis for the argument made by Krugman, DeLong and others that the reduction in the government's cost of borrowing during a financial crisis calls for larger deficits.

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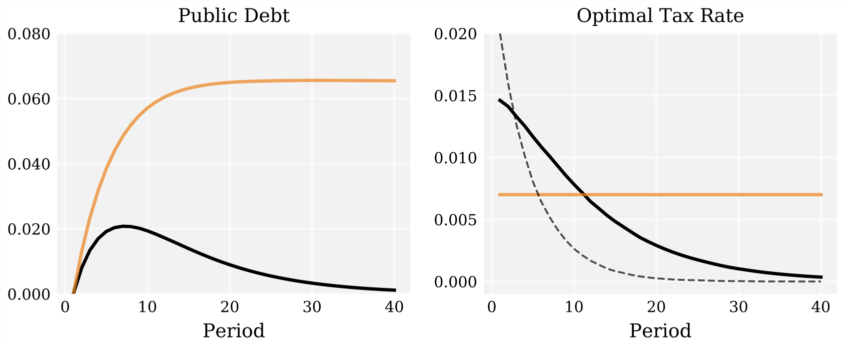
Optimal Response to Shocks: A Transitory War



_ _ _ _ Government Spending; Debt and Taxes in Barro/AMSS; Debt and Taxes in our Model.

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Useful Lemma

Define $\mathcal{H}(b,\lambda) = \max_s H(s,b,\lambda) \equiv U(s) + V(b) + \lambda(s - [\rho - \pi(b)]b - g)$, we have

Lemma (Skiba, 1978, Brock and Dechert, 1983)

For any b_0 and any $\lambda_0 \in \Lambda(b_0)$, the path in $\mathcal{P}(b_0)$ that starts from initial point (b_0, λ_0) yields a value that is equal to $\mathcal{H}(b_0, \lambda_0)/\rho$.

Lemma

$\mathcal{H}(b,\lambda)$ is convex in λ (upper envelop of linear functions of λ).

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Micro-Founded Model

- Households:

$$\max \ \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \left(c_{it} + \theta_{it} u(x_{it}) - \nu(h_{it}) \right) \right]$$

$$\text{s.t.} \quad c_{it} + p_t x_{it} + q_t a_{it+1} = a_{it} + (1 - \tau_t) w_t h_{it} + p_t \bar{e}$$

$$z_{it} \equiv p_t (x_{it} - \bar{e}) \leq \phi + a_{it}$$

$$-a_{it+1} \leq \phi$$

- Firms: $y_t = A h_t$
- Government: $q_t b_{t+1} + \tau_t w_t h_t = b_t + g$
- Market clearing: $y_t = c_t + g, \quad \int x_t(\theta) \mathrm{d}\mu(\theta) = \bar{e}, \quad \int a_{t+1}(\theta) \mathrm{d}\mu(\theta) = b_{t+1}.$

▸ Social Value of Debt

▸ Back

Social Value of Debt

- $V(b)$ is the value of the following problem:

$$
\begin{aligned}
\max_{(p,q)\in\mathbb{R}^2_+ \& (x,a):[\underline{\theta},\bar{\theta}]\to\mathbb{R}_+\times[-\phi,+\infty)} \quad & \int \theta u(x(\theta))\varphi(\theta)\mathrm{d}\theta \\
\text{subject to} \quad & \int x(\theta)\varphi(\theta)\mathrm{d}\theta = \bar{e} \\
& \int a(\theta_-)\varphi(\theta_-)\mathrm{d}\theta_- = b \\
& \phi + a(\theta_-) - p(x(\theta) - \bar{e}) \geq 0 \quad \forall(\theta,\theta_-) \\
& \theta u'(x(\theta)) \geq p \quad \forall\theta \\
& \left[\theta u'(x(\theta)) - p\right]\left[\phi + a(\theta_-) - p(x(\theta) - \bar{e})\right] = 0 \quad \forall(\theta,\theta_-) \\
& a(\theta_-) + \phi \geq 0 \quad \forall\theta_- \\
& \beta + \mathcal{U}_a(a(\theta_-),\theta_-,p) \leq q \quad \forall\theta_- \\
& \left[\mathcal{U}_a(a(\theta_-),\theta_-,p) - \pi\right]\left[a(\theta_-) + \phi\right] = 0 \quad \forall\theta_-
\end{aligned}
$$

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