Government Debt and Optimal Monetary and Fiscal Policy

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Motivation

- Build-up in government debt following financial crisis
- What normative implications from debt build-up for optimal conduct of monetary and fiscal policies?
- Not a paper about 'the crisis', but about the 'heritage' from crisis...

Motivation

- Monetary and Fiscal Policy:

  nominal interest rates; tax vs debt financing; government spending

  How do optimal *levels* depend on outstanding gov. debt?
  How do *stabilization responses* (techn. shocks) depend on debt?

- What do optimal policies imply for optimal debt evolution over time?
  Policy discussion vs. economic theory (Barro (1979))

  Standard models provide motives for debt reduction!

Model Sketch

- Model builds on Adam and Billi (2008,2009) & Schmitt-Grohé and Uribe (JET 2004)
- Private sector:
  - households: consumption & saving, labor supply
  - firm sector: monopoly power & nominal rigidities (à la Rotemberg) linear technology in labor, fixed capital, technology shocks
- Public sector:
  - nominal interest rate
  - gov. spending: public goods provision (non-standard)
  - labor income taxation (distortionary, Ricardian equivalence fails)
  - issues nominal non-contingent debt

Model Sketch

Three sources of economic distortions:

1. Monopoly power by firms
   => mark-up over costs & output inefficiently low (cannot be eliminated)
2. Distortionary labor income taxes
   => government spending & debt service cost give rise to adverse labor supply and output effects
3. Nominal rigidities:
   => MP affects output
   => MP cannot easily change P to raise state-contingent taxes (nominal debt)

Normative Implications: Levels

In the absence of shocks:

- Price stability optimal independently of debt level
- Tax rates increase with debt level
- Government spending lower the higher is government debt
- Government debt => large welfare implications

  Baseline parameterization:

  Every 100% increase in debt/GDP ratio => 5% cons. reduction per period

Normative Implications: Stabilization Policy

- **Optimal response to negative technology shock:**

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  - **No outstanding government debt:**
    reduced government spending to balance budget,
    no response of taxes, debt and inflation
    interest rates increase

Normative Implications: Stabilization Policy

- **Optimal response to negative technology shock:**
  - **No outstanding government debt:**
    reduced government spending to balance budget,
    no response of taxes, debt and inflation
    interest rates increase
  - **Positive government debt (100% of GDP)**:
    larger revenue shortfalls: taxes rates are higher
    stronger spending cut,
    persistent increase in debt and taxes
    temporary (but small) increase in inflation
    interest rates decrease

Normative Implications: Debt Evolution

Higher government debt $=>$ higher budget & tax risk

1st order approx: debt is a random walk as in Barro (1979)

2nd order motives for debt reduction: can be quantitatively significant

Ramsey Problem: Formal Description

$$\max_{\{c_t,h_t,\Pi_t,R_t\geq 1,\tau_t,g_t,b_t\}_{t=0}^{\infty}} \min_{\{\gamma_t^1,\gamma_t^2,\gamma_t^3,\gamma_t^4\}_{t=0}^{\infty}}$$

$$E_0 \begin{bmatrix} \sum_{t=0}^{\infty} \beta^t u(c_t, h_t, g_t) \\ +\beta^t \gamma_t^1 \begin{pmatrix} u_{c,t}(\Pi_t - 1)\Pi_t - \frac{u_{c,t} z_t}{\theta} h_t \left(1 + \eta + \frac{u_{h,t}}{u_{c,t}(1-\tau_t)} \frac{\eta}{z_t}\right) \\ -\beta u_{c,t+1}(\Pi_{t+1} - 1)\Pi_{t+1} \end{pmatrix} \\ +\beta^t \gamma_t^2 \left(\frac{u_{c,t}}{R_t} - \beta \frac{u_{c,t+1}}{\Pi_{t+1}}\right) \\ +\beta^t \gamma_t^3 \left(z_t h_t - c_t - \frac{\theta}{2}(\Pi_t - 1)^2 - g_t\right) \\ +\beta^t \gamma_t^4 \left(b_t - \frac{\tau_t}{1-\tau_t} \frac{u_{h,t}}{u_{c,t}} h_t - g_t - \frac{R_{t-1}}{\Pi_t} b_{t-1}\right) \end{bmatrix}$$

Recursive Representation of Solution

- Vector of decision variables

$$y_t = \left(c_t, h_t, \Pi_t, R_t, \tau_t, g_t, \gamma_t^1, \gamma_t^2, \gamma_t^3, \gamma_t^4\right)$$

& state variables

$$x_t = \left(z_t, \mu_t^1, \mu_t^2, b_{t-1}, R_{t-1}\right)$$

with $b_{t-1} = B_{t-1}/P_{t-1}$ given.

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with $b_{t-1} = B_{t-1}/P_{t-1}$ given.

- Solution: $y_t = g(x_t)$ that satisfies the FOCS.

Deterministic Setting: Steady States

- Continuum of deterministic steady states:

  FOC for bonds:

  $$0 = \gamma_t^4 - \beta E_t \gamma_{t+1}^4 \frac{R_t}{\Pi_{t+1}}$$

  From Euler equation

  $$0 = u_{c,t} - \beta E_t u_{c,t+1} \frac{R_t}{\Pi_{t+1}}$$

  FOC for bonds imposes no restrictions on SS outcome

  (one dimensional indeterminacy)

Deterministic Steady State : Analytic Results

- First best steady state (preferences & technology)

$$u_g = u_c = -u_h$$

- Ramsey steady states (with distortions)

$$\begin{aligned} -u_h &= \left(\frac{1+\eta}{\eta} - \frac{g + (\beta^{-1} - 1)b}{h} \right) u_c \\ -u_h &\leq u_g \\ \Pi &= 1 \end{aligned}$$

Reducing gov spending below first best => reduces tax wedge

Quantification

- Utility function

$$u(c_t, h_t, g_t) = \log(c_t) - \omega_h \frac{h_t^{1+\varphi}}{1+\varphi} + \omega_g \log(g_t) \quad (1)$$

- Parameterization

quarterly discount factor	$\beta = 0.9913$
price elasticity of demand	$\eta = -6$
degree of price stickiness	$\theta = 17.5$
1/elasticity of labor supply	$\varphi = 1$
utility weight on labor effort	$\omega_h = 19.792$
utility weight on public goods	$\omega_g = 0.2656$
technology shock process persistence	$\rho_z = 0.95$
quarterly s.d. technology shock innovation	$\sigma = 0.6\%$

Quantification: Deterministic Steady State

	priv. cons (c)	hours (h)	gov. cons. (g)	taxes (τ)	cons. equiv. variation
Zero debt	0.16	0.2	0.04	24%	**0.00%**
100% debt/GDP	-2.61%	-2.78%	-3.47%	+16.8%	**-5.58%**
200% debt/GDP	-5.25%	-5.62%	-7.02%	+33.3%	**-11.0%**

Quantification: Deterministic Steady State

	priv. cons (c)	hours (h)	gov. cons. (g)	taxes (τ)	cons. equiv. variation
Zero debt	0.16	0.2	0.04	24%	**0.00%**
First best SS debt/GDP -1076%	+25%	+26.5%	+32.5%	n.a. (-20%)	**+70.6%**

Quantification: Optimal Response to Technology Shocks

- **How Does Optimal Stabilization Policy Depend on Initial Debt?**
- 1st order approximation around 0% and 100% debt steady state
- Large sized negative technology shock: - 3 std deviations
- Technology initially decreases by 5.7%

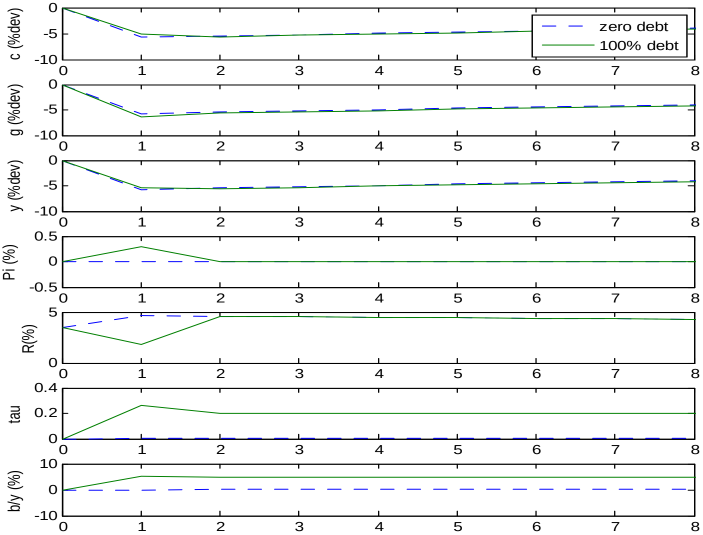
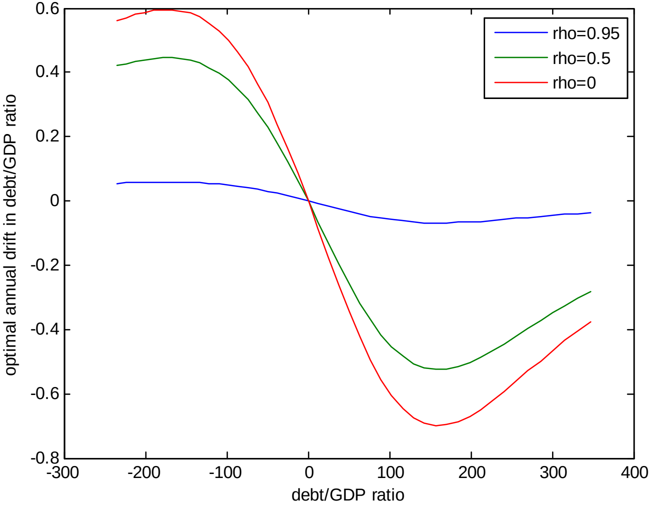
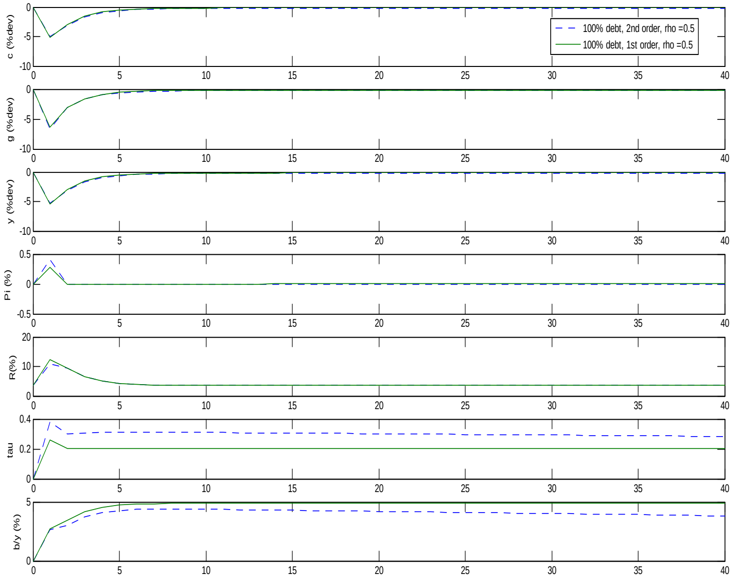


Figure:

- **To 1st order: debt under optimal policy is random walk**
- **Innovation variance to random walk depends on debt level:**
  zero debt: zero innovation variance
  positive debt: positive variance
- Debt => debt risk => tax risk
- To capture risk aspects:2nd order approx at deterministic SS
  Use code by Gomme and Klein (2010)
  Constant/drift term emerges decision & state transition laws

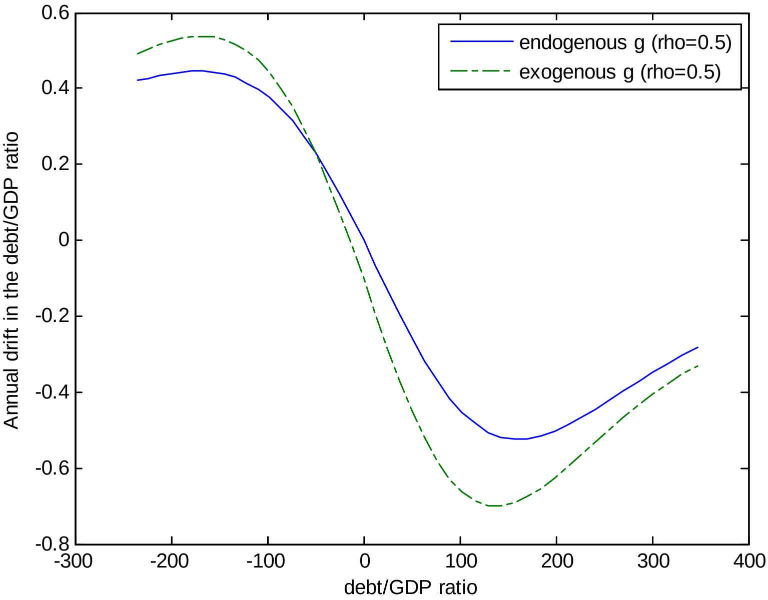
Incentives for Debt Reduction in a Stochastic Economy




100% debt, 2nd order, rho =0.5
100% debt, 1st order, rho =0.5
c (%dev)
g (%dev)
y (%dev)
Pi (%)
R(%)
tau
b/y (%)

- **Comparing 1st & 2nd order accurate impulse responses:**

  Optimal debt dynamics differ significantly from random walk!


endogenous g (rho=0.5)
exogenous g (rho=0.5)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-300
-200
-100
0
100
200
300
400
Annual drift in the debt/GDP ratio
debt/GDP ratio

Conclusions

- Level of debt has important implications for optimal public spending levels and optimal stabilization policy
- Debt => budget & tax risks
  => optimal to reduce debt levels over time
- Zero debt is absorbing steady state (to second order)
  Aiyagari, Marcet, Sargent Seppälä (2002): negative debt level
- Local analysis here: borrowing constraints not taken into account
  => additional incentives for debt reduction
- Additional risk from other shocks w/o tax revenue implications
  discount factor shocks = > real interest rate
  debt reduction even more desirable