

# Political Economy of Sovereign Debt

## Cycles of Debt Crisis and Inequality Overhang

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## Introduction

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- Fiscal consolidations have unequal effect across the population:
  - Ponticelli and Voth (2012): Lead to social unrest, often to reversal  
Cyclical behavior of fiscal policies
- Populist policy cycles (Dornbusch and Edwards (1991), Sachs (1989))
  - Latin american economies in the 20th century:  
Argentina under Perón, Chile under Allende, Brazil under Sarney
  - Typical dynamics:
    - Large redistributive programs, accumulation of foreign debt
    - Eventually country got into trouble
    - Repayment of foreign debt and reversal of redistributive policies

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  - Typical dynamics:
    - Large redistributive programs, accumulation of foreign debt
    - Eventually country got into trouble
    - Repayment of foreign debt and reversal of redistributive policies
- Theory of fiscal policy cycles in open economy based on
  - Redistributive motive
  - Lack of commitment

## What We Do

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- Small open economy
- OLG and heterogenous income/skill
- Government with redistributive motive
  - Redistribution within and across generations
  - Set income taxes, transfers and pensions
    - Efficiency-equality trade-off
  - Issues debt: domestically and abroad
- Gov't cannot commit to
  - Repay government debt
  - Future income taxes, transfers and pensions
- Two ways to determine policies:
  - Fictitious planner that cares about current and future generations
  - Outcome of probabilistic voting (Lindbeck and Weibull, 1987)

## Main Results

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When government highly (external) indebted:

- **Overshooting:** Drastic adjustment in external indebtedness
  - External debt reduced below its long-run sustainable level
  - Allow for large inequality
- **Repatriation:** Foreign debt is substituted with domestic debt

If gov't more impatient than foreign lenders (or probabilistic voting):

- **Cyclical fiscal policy**

## Main Results

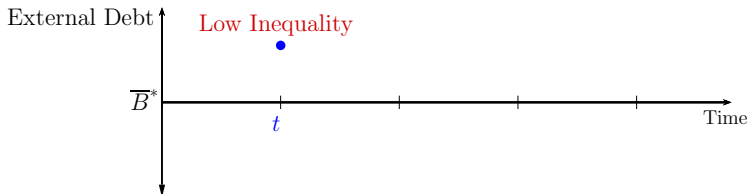
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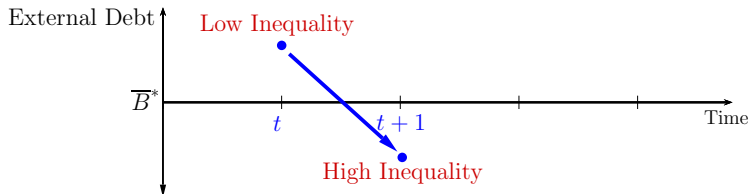
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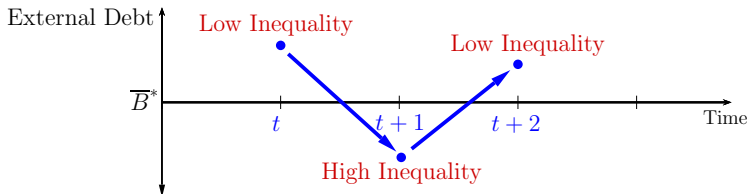
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- Two incentives to default:
  - **Foreign:** Reduce payments to foreigners
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  - **Foreign:** Reduce payments to foreigners
  - **Domestic:** Consumption inequality among the old is undesirable; always desirable 100% tax on assets for the current old and redistribute via pension
- If wealth inequality among old is large:
  - There is a strong domestic motive to default
  - Government can support low amount of foreign debt
- Consistent with Berg-Sachs (1988), Aizenman-Jinjarak (2012)

## Related Literature

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- Optimal Fiscal Policy: Barro (1979), Lucas and Stokey(1983), Werning (2007), Bhandari, Evans, Golosov, and Sargent (2013)
  
- Optimal Fiscal Policy without Commitment:
  - Open economy: Amador, Aguiar and Gopinath(2009), Aguiar and Amador (2014)
  - Closed economy: Farhi, Sleet, Werning and Yeltekin (2012), D'Erasmus and Mendoza (2014), Scheuer and Wolitzky (2014)

# ENVIRONMENT

## Environment

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- Time is discrete:  $t = 0, 1, 2, \dots$
- Small open economy
  - International interest rate  $1 + r^*$
- OLG structure:
  - Continuum of households; live for two periods
- Government

## Households

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- Preferences

$$u(c_{t,0}, y_t; \theta) + \beta u(c_{t,1})$$

where  $\theta \in \Theta = \{\theta^1, \dots, \theta^N\}$  is individual specific labor productivity and  $\Pr(\theta = \theta^i) = \mu^i$ .

- Analytical results for log-log preferences

$$u(c, y; \theta) = \log c + \psi \log \left(1 - \frac{y}{\theta}\right)$$

$$u(c) = \log c$$

- GDP:  $Y_t = \sum_i \mu^i y_t^i$ 
  - Normalization  $\sum_{i=1}^N \mu^i \theta^i = 1$ ;

## Households

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- Households have access to complete domestic asset markets;  
No access to international credit market
  - Without loss of generality: equivalent to households access to int'l credit market + capital control
- Taxes and transfers:
  - Linear tax on labor income:  $\tau_{l,t}$
  - Linear tax on assets:  $\tau_{a,t+1}$
  - Receive transfers when young and old:  $T_t$  and  $P_{t+1}$
- Budget constraint:

$$c_{0,t}^i + q_t a_{t+1}^i \leq (1 - \tau_{l,t}) y_t^i + T_t$$

$$c_{t,1}^i \leq (1 - \tau_{a,t+1}) a_{t+1}^i + P_{t+1}$$

## Government

---

- Government can issue debt to
  - International lenders:  $B_t^*$
  - Households:  $B_t$
- Government budget constraint

$$\delta_t B_t^* + (1 - \tau_{a,t}) B_t + T_t + P_t + G_t = \tau_{lt} \sum_i \mu^i y_t^i + q_t B_{t+1} + q_t^* B_{t+1}^*$$



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- Credit market clearing:

$$B_{t+1} = \sum_i \mu^i a_{t+1}^i$$

- If  $B_{t+1}^* > 0$  then  $q_t^* = \frac{\delta_{t+1}}{1+r^*}$

## Government Preferences

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- $\hat{\beta}^t \alpha^i$ : Pareto weight of agent of type  $i$  in generation  $t$
- Government objective

$$W = \frac{1}{\hat{\beta}} u_{1,-1} + \sum_{t=0}^{\infty} \hat{\beta}^t u_t$$

where

- $u_{1,-1}$ : Aggregate welfare among initial old
- $u_t$ : Aggregate welfare of generation born at  $t$ :

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where

- $u_{1,-1}$ : Aggregate welfare among initial old
  - $u_t$ : Aggregate welfare of generation born at  $t$ :
- **Assumption – Inequality aversion:**  $\alpha^1 \geq \alpha^2 \geq \dots \geq \alpha^N$ 
    - Utilitarian:  $\alpha^i = \alpha^j$
    - Rawlsian:  $\alpha^1 = 1, \alpha^i = 0, i > 1$
  - **Assumption:**  $\hat{\beta}(1 + r^*) \leq 1$

## Optimal Policy Problem

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$$\max_{\text{policy, all'n, prices}} W = \frac{1}{\hat{\beta}} u_{-1,1} + \sum_{t=0}^{\infty} \hat{\beta}^t u_t$$

subject to

- Policy, all'n, prices constitute a competitive equilibrium
  - Given an initial value of external government debt:  $B_0^*$
  - Given an initial distribution of assets:  $\{a_0^i\}_{i=1, \dots, I}$
- Sustainability constraint

$$\frac{1}{\hat{\beta}} u_{t-1,1} + \sum_{s=t}^{\infty} \hat{\beta}^{s-t} u_s \geq \underline{W}$$

## Government Value of Default

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- W:
  - The government is in financial autarky forever
  - No saving by households (expect 100% tax on assets)
  - No consumption inequality among the old
- Cost of default: Disruption of asset markets
  - Cannot borrow from foreign to smooth (relevant with shocks)
  - No saving by households  $\Rightarrow$  worse efficiency-equality trade-off
- W: value of the limit of the finite horizon game

▶ Details

## Characterization of Competitive Equilibrium \_\_\_\_\_

- To characterize equilibrium, sufficient to focus on aggregates  $(C_{t,0}, C_{t,1}, Y_t)$  that satisfies inter temporal budget constraint
  - determines  $\tau_{l,t}, T_t, P_{t+1}$
  - determines distribution of allocations through Negishi weights  $\Phi_t$
- With log-log preferences:

$$\varphi_t^i = 1 + \kappa \frac{\theta^i - 1}{1 - Y_t}$$

- $\varphi_t^i$ : the fraction of consumption by individual of type  $i$   
**consumption and wealth inequality**
- As  $Y_t$  increases,  $\Phi_t$  increases in SOSD.
- intuition: Higher taxes  $\Rightarrow$  lower inequality  $\Rightarrow$  lower GDP

## Government Preferences

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- Value for the government as function of  $C_0, C_1, Y$  with log-log:

$$U^P(C_0, C_1, Y) = \log C_0 + \psi \log(1 - Y) + \beta \log C_1 \\ + (1 + \psi + \beta) \sum_i \alpha^i \mu^i \log \varphi^i$$

$$U_1^P(C_1, Y) = \beta \log C_1 + \beta \sum_i \alpha^i \mu^i \log \varphi^i$$

## Optimal Policy Problem

---

Government chooses  $\{C_{t,0}, C_{t-1,1}, Y_t\}_{t=0}^{\infty}$  to

$$\max \frac{\beta}{\hat{\beta}} \left[ \sum_i \mu^i \alpha^i \log(a_0^i + P) \right] + \sum_{t=0}^{\infty} \hat{\beta}^t U^P(C_{t,0}, C_{t,1}, Y_t)$$

subject to

$$B_0^* + \sum_{t=0}^{\infty} \frac{1}{(1+r^*)^t} [C_{t-1,1} + C_{t,0} + G_t] \leq \sum_{t=0}^{\infty} \frac{1}{(1+r^*)^t} Y_t$$

$$\frac{1}{\hat{\beta}} U_1^P(C_{t-1,1}; Y_{t-1}) + \sum_{s=t}^{\infty} \hat{\beta}^{s-t} U^P(C_{s,0}, C_{s,1}, Y_s) \geq \underline{W}$$

given  $(B_0^*, \{a_0^i\})$

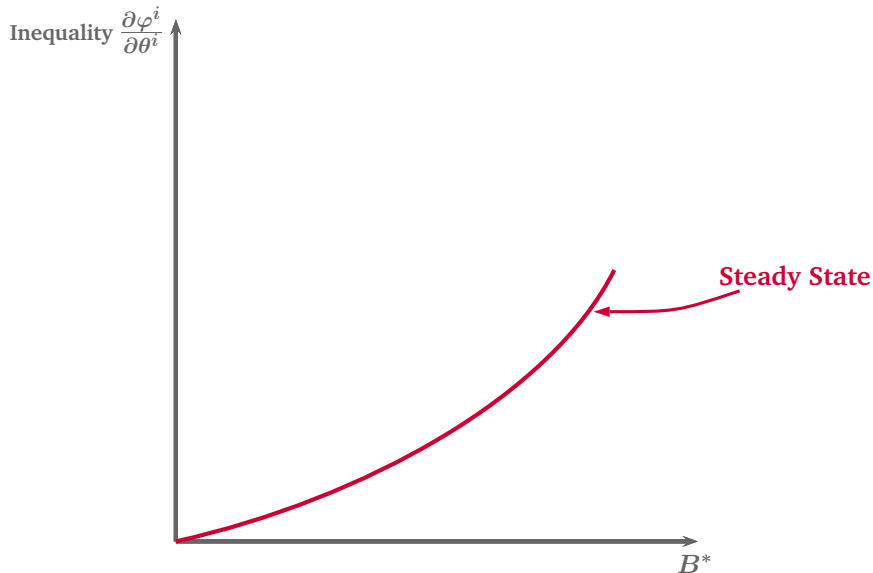


# OPTIMAL POLICY WITH COMMITMENT

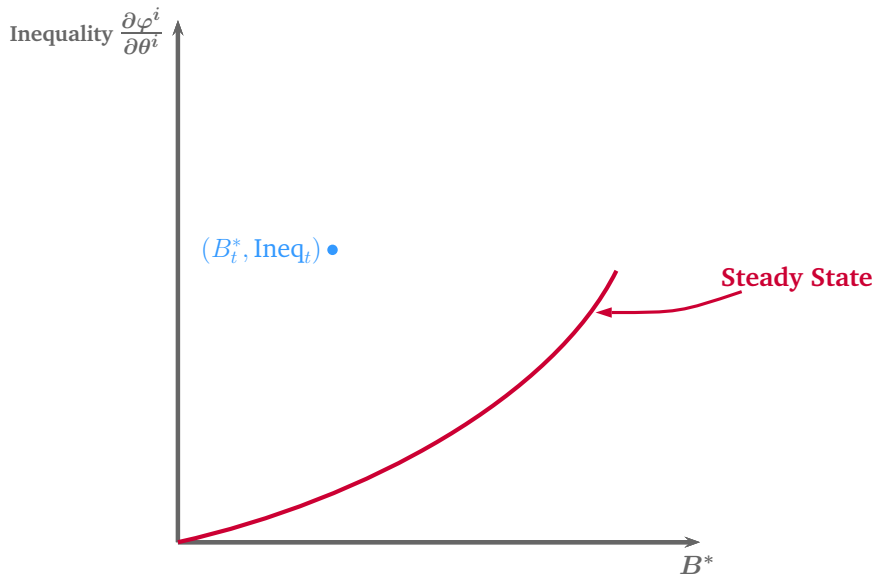
## Optimal Policy with Commitment and $\hat{\beta}(1 + r^*) = 1$ \_\_\_\_\_

- Constant consumption and output over time
- Constant inequality - except among initial old
- Roll over external debt; no repayment,  $CA_t = \frac{r^*}{1+r^*} B_0^*$

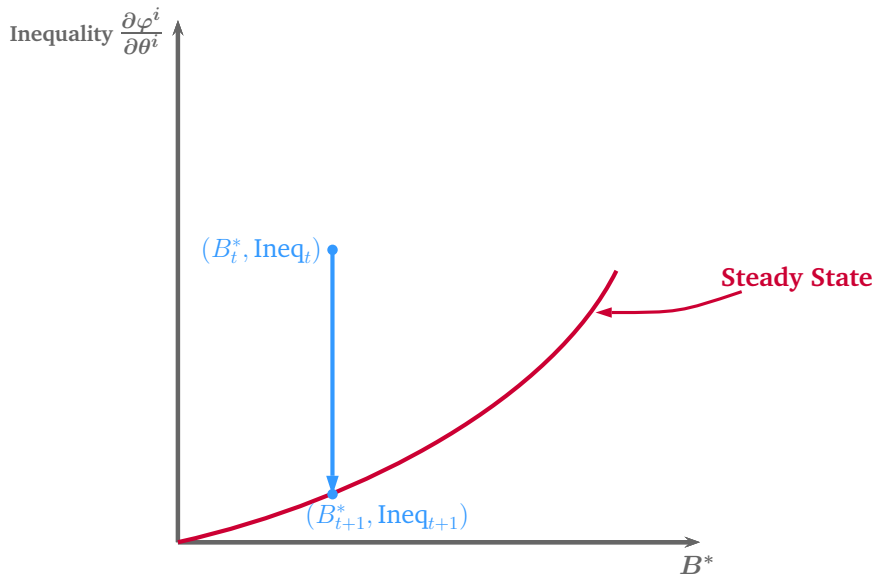
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# OPTIMAL POLICY WITHOUT COMMITMENT

## Two Incentives to Default

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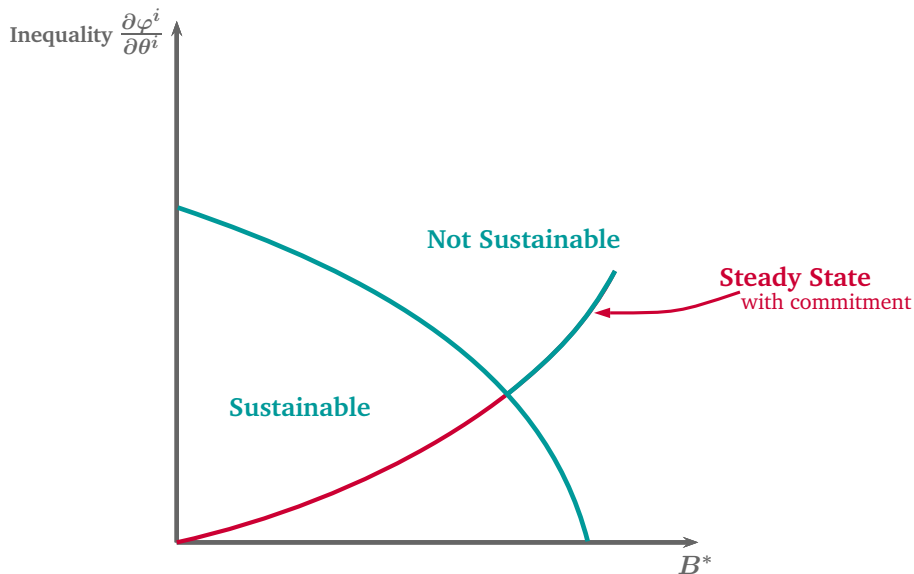
- **Foreign:** Reduce payments to foreigners
- **Domestic:** Consumption inequality among the old is undesirable; always desirable 100% tax on assets for the current old and redistribute via pension

Higher incentive to default if:

- High foreign debt
- Wealth inequality is high (inequality overhang)

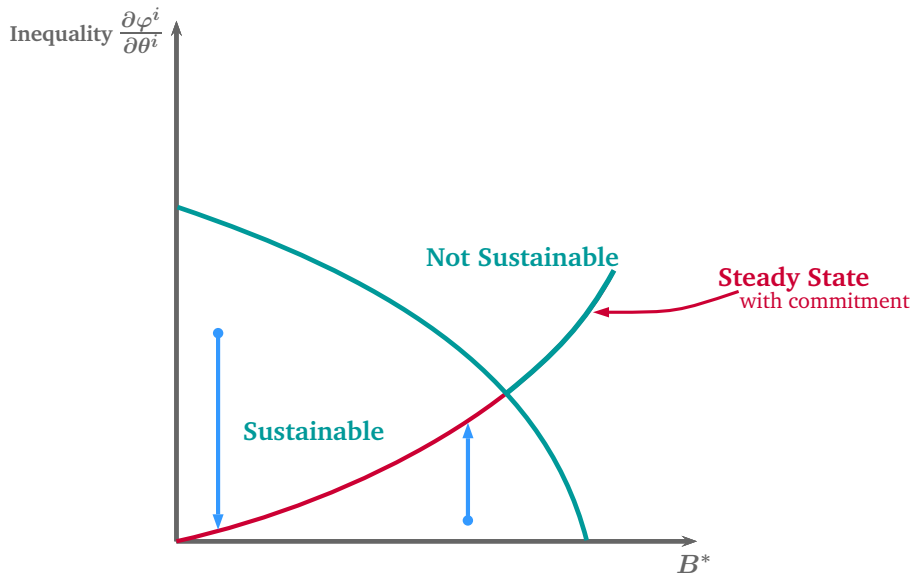
$$\frac{\beta}{\hat{\beta}} [\log C_{-1,1} + \sum_i \mu^i \alpha^i \log \varphi_{t-1}^i] + \sum_{t=0}^{\infty} \hat{\beta}^t U^p(C_{0,t}, C_{1,t}, Y_t; \Phi_t) \geq \underline{W}$$

# Best Sustainable Allocations with $\hat{\beta}(1+r^*) = 1$ \_\_\_\_\_

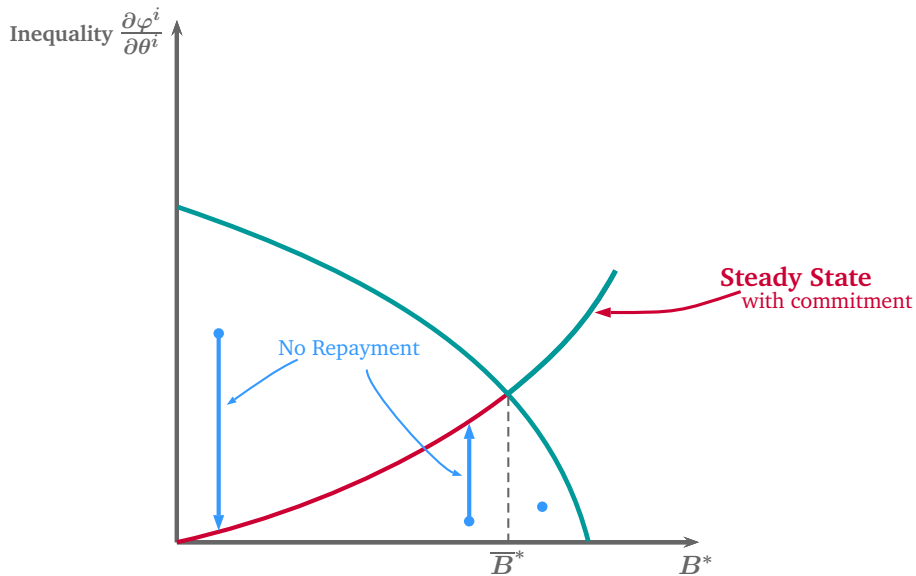




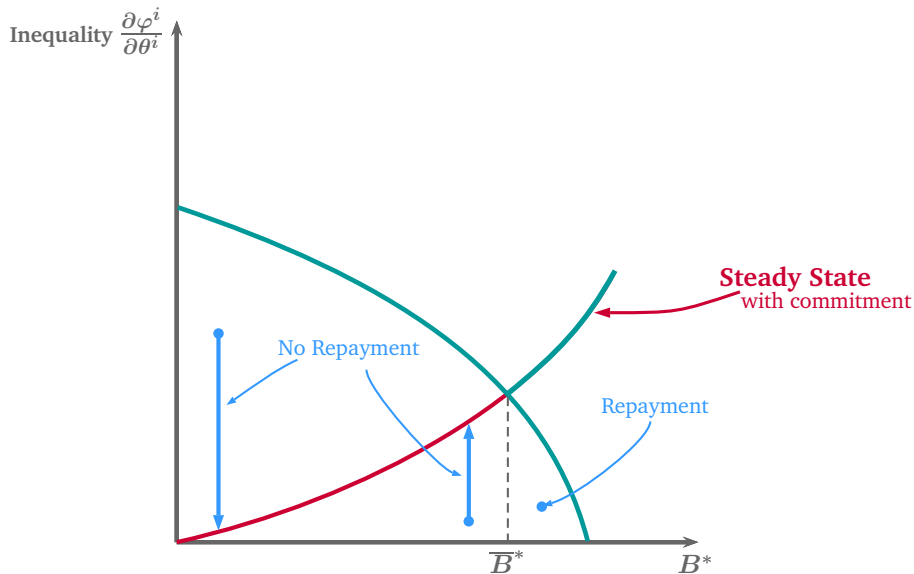
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## Solution

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- Problem has many dimensional states  $(B^*, \{a^i\})$
- For  $t \geq 1$ , aggregates and inequality for generations born at  $s \geq t$  are recursive in  $B^*$
- Problem at  $t = 0$  chooses aggregates for  $t = 0$ , foreign debt and inequality for current generation given  $(B_0^*, \{a_0^i\})$

## Recursive Problem

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- State variable: Value of foreign debt  $B^*$

$$V(B^*) = \max_{C_0, C_1, Y, V'} \frac{\beta}{\hat{\beta}} \log C_1 + \log C_0 + \psi \log(1 - Y) \\ + (1 + \psi + \beta) \sum_i \mu^i \alpha^i \log \varphi^i(Y) + \hat{\beta} V(B^{*'})$$

subject to

$$C_0 + C_1 + G + B^* \leq Y + \frac{1}{1 + r^*} B^{*'} \\ \frac{1}{\hat{\beta}} \sum_i \mu^i \alpha^i \log \varphi^i(Y) + V(B^{*'}) \geq \underline{W}$$

- Value for current gov't is

$$W(B^*, Y_-) = \frac{\beta}{\hat{\beta}} \sum_i \mu^i \alpha^i \log \varphi^i(Y_-) + V(B^*)$$

## Recursive Problem

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- State variable: Value of foreign debt  $B^*$

$$V(B^*) = \max_{C, Y, V'} \quad \kappa \log C + \psi \log(1 - Y) \\ + (1 + \psi + \beta) \sum_i \mu^i \alpha^i \log \varphi^i(Y) + \hat{\beta} V(B^{*'})$$

subject to

$$C + G + B^* \leq Y + \frac{1}{1 + r^*} B^{*'} \\ \frac{1}{\hat{\beta}} \sum_i \mu^i \alpha^i \log \varphi^i(Y) + V(B^{*'}) \geq \underline{W}$$

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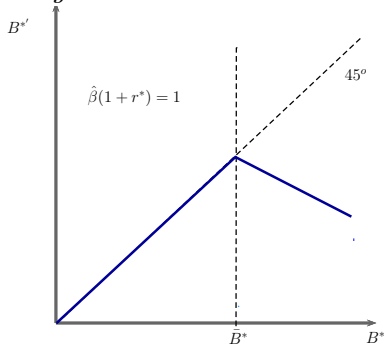
$$W(B^*, Y_-) = \frac{\beta}{\hat{\beta}} \sum_i \mu^i \alpha^i \log \varphi^i(Y_-) + V(B^*)$$

# Main Result: $B^{*'}(B^*)$ is Inverted U-shaped \_\_\_\_\_

## Theorem

There exists  $\bar{B}^*$  such that:

- for all  $B^* < \bar{B}^*$ ,  $B^{*'}(B^*)$  is increasing in  $B^*$  and the sustainability constraint is slack
- for all  $B^* > \bar{B}^*$ ,  $B^{*'}(B^*)$  is decreasing in  $B^*$  and the sustainability constraint is binding

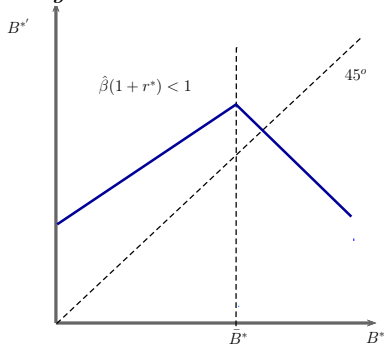


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## Idea of Proof: Low Foreign Debt

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- Low foreign debt  $\Rightarrow$  sustainability constraint is slack
  - Euler Equation:

$$V'(B^*) = \hat{\beta}(1 + r^*)V'(B^{*'})$$

- $V(\cdot)$ : concave and decreasing  $\rightarrow B^{*'}$  increasing in  $B^*$ .

## Idea of Proof: High Foreign Debt

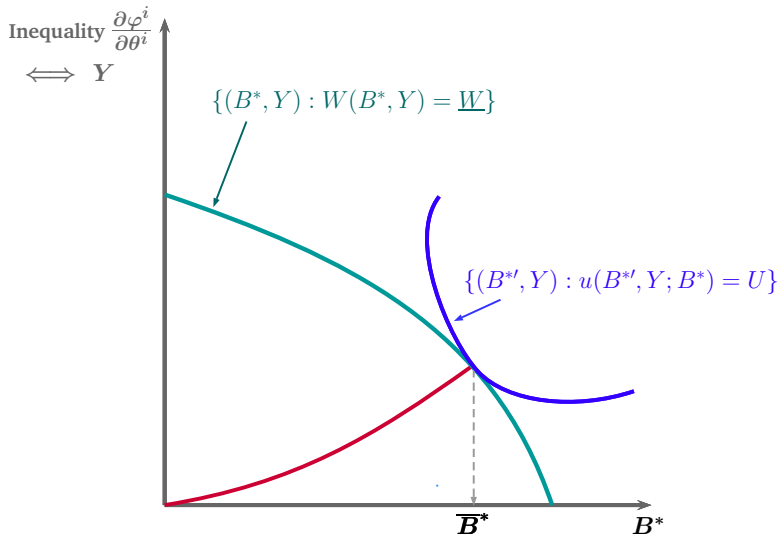
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- Low promised values  $\Rightarrow$  sustainability constraint is binding
  - Sustainability with equality

$$\frac{\beta}{\hat{\beta}} \sum_i \mu^i \alpha^i \log \varphi^i + V(B^{*'}) = \underline{W}$$

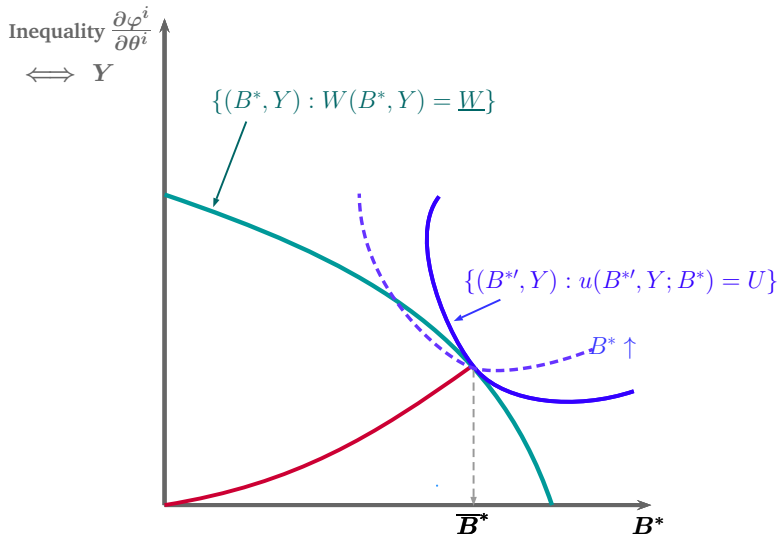
- As  $B^*$  increases: consumption, leisure and “equality” decrease
- “Equality” is a normal good
- $\Phi$  increases (SOSD)  $\Rightarrow$  to satisfy sustainability must decrease  $B^{*}$

# Overshooting



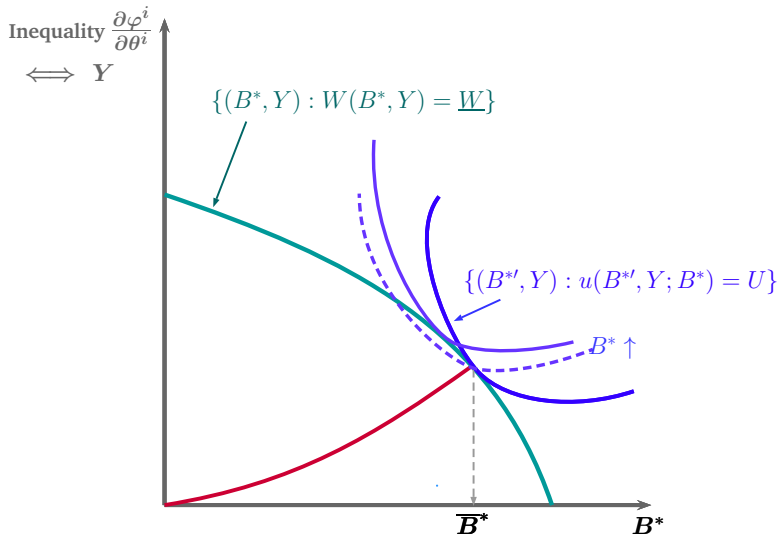
$$u(B^{*'}, Y; B^*) = \kappa \log C + \psi \log(1 - Y) + (1 + \psi + \beta) \sum_i \mu^i \alpha^i \log \varphi^i(Y) + \hat{\beta} V(B^{*'})$$

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## Why Gradual Adjustment is not Optimal? \_\_\_\_\_

Different government's perspective:

- Current government
  - Equality is a normal good: Willing to tolerate high inequality
  - Output gains come with increase in inequality
- Future government:
  - Cost of inequality among old lower than cost of extra unit of debt
  - Sustainability constraint more sensitive to  $B^*$  than  $Y$

Gov't better off by

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Gap in gov't budget made up by issuing more domestic debt

- Easier to sustain because held by domestic citizens
- **Repatriation**

## Who is Paying for the Adjustment? \_\_\_\_\_

- Burden of adjustment is on current generations:
  - Old receive low pensions
  - Young receive low consumption, high income inequality
  
- Compensated by higher future values:
  - Young promised high pension payments
  - Low income inequality for future generations
  - Front-loading of consumption if  $\hat{\beta}(1 + r^*) < 1$   
→ Accumulation of external gov't debt

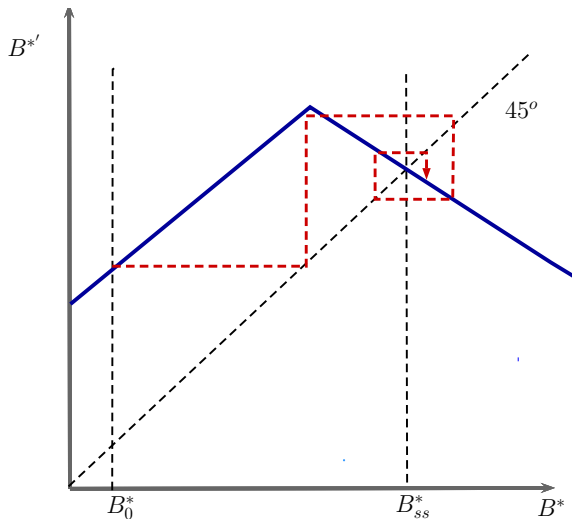


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  - Low income inequality for future generations
  - Front-loading of consumption if  $\hat{\beta}(1 + r^*) < 1$ 
    - Accumulation of external gov't debt
    - ⇒ This gives rise to cycles

# Cycles when $\hat{\beta}(1+r^*) < 1$

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## Summing-up

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In best outcome when government cannot commit and has redistributive motives, fiscal consolidations are characterized by

- Large adjustment in foreign debt position
- Increase in inequality
- Repatriation of gov't debt
- Burden on current generation (even if  $\hat{\beta}(1 + r^*) < 1$ )
- Cyclical policy is optimal if  $\hat{\beta}(1 + r^*) < 1$

## Assumptions

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- Imperfect redistribution [▶ Details](#)
  - Absence of type-specific transfers critical
- Preferences
  - Results robust to different preferences
  - Analytical results for GHH [▶ GHH](#)
  - Numerical results for BGP preferences

## Extensions

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- Economy with shocks [▶ Details](#)
  - Same logic
  - Justification for  $\hat{\beta}(1 + r^*) < 1$
  - Difference wrt RA economy a la Thomas-Worrall:  
Repayment can happen also in bad fiscal time
  
- Political economy model [▶ Details](#)
  - Consider two equilibria:
    - Best SPE
    - Selection in spirit of Eaton-Gersovitz
  - So far policies are set by fictitious gov't that attaches weights to *future generations*
  - Results survive if policies are set in best interest of generations currently alive only

## Conclusion

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- Fiscal and Redistributive policies when gov't lacks commitment
  - Interaction between domestic and foreign motive to default
- Optimal fiscal consolidation involves cyclical behavior of external debt and austerity type adjustments

## Populist Cycles

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Juan Perón in 1952:

*The justicialista [i.e. Peronist] economy asserts that the production of the economy should first satisfy the needs of its inhabitants and only export the surplus; the surplus, nothing more. With this theory the boys here, of course, eat more every day and consume more, so that the surplus is smaller. But these poor guys have been submerged for fifty years; for this reason I have let them spend and eat and waste everything they wanted to for five years . . . but now we undoubtedly must begin to reorder things so as not to waste any more.*

# EXTRA SLIDES



## Government Value of Default

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$$(1 - \hat{\beta})\underline{W} = \max_{\text{policy, all'n, prices}} \frac{1}{\hat{\beta}} \sum_i \alpha^i \mu^i \beta u(c_1^i) + \sum_i \alpha^i \mu^i u(c_0^i, y^i; \theta^i)$$

subject to

- Policy, all'n, prices constitute a competitive equilibrium with no assets trade:
  - Default on government debt:  $B_0^* = 0, a_0^i = 0 \Rightarrow c_1^i = P$  for all  $i$
  - Young households do not save anticipating default next period:  $a_1^i = 0$

▶ Back

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subject to

$$c_1^i = P$$

the static implementability constraint:

$$u_c^i c_0^i + u_y^i y^i = T$$

and the resource constraint

$$\sum_i \mu^i c_1^i + \sum_i \mu^i c_0^i + G \leq \sum_i y^i$$

▶ Back

## Period-0 Problem

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$$W_0(B_0^*, \{a_0^i\}) = \max_{\hat{\beta}} \sum_i \mu^i \alpha^i \log((1 - \tau_a) a_0^i + P) + V$$

subject to

$$\frac{1}{\hat{\beta}} U_1^P(C_{1,-}; \Phi_{-1}) + V \geq \underline{W}$$

$$\hat{B}(V) - P - (1 - \tau_a) \sum_i \mu^i a_0^i = B_0^*$$

- Initial external Gov't Debt:  $B_0^*$  [▶ Back](#)

## Role of Imperfect Redistribution

---

- Inability to perfectly redistribute resources across households critical
- Suppose gov't had access to type-dependent transfers  $\{\mathbb{T}^i\}$
- In this case  $\alpha^i u_c^i = \alpha^j u_c^j \rightarrow \{\varphi^{i*}\}$
- Sustainability constraint is

$$\frac{\beta}{\bar{\beta}} [\log C_1 + \sum_i \mu^i \alpha^i \log \varphi^{i*}] + V' \geq \underline{W}$$

→ once sustainability binds  $C_1$  and  $V'$  independent of state  
(as in Thomas-Worrall, 1998)

▶ Back

## Role of Preferences

---

- With log-log preferences:
  - Wealth effect:  $Y(V)$  is decreasing in  $V$
  - Key factor: inequality is decreasing in  $V$
- Can prove the same result for GHH:

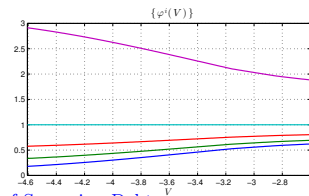
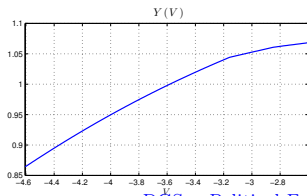
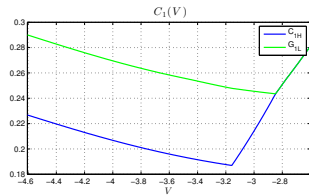
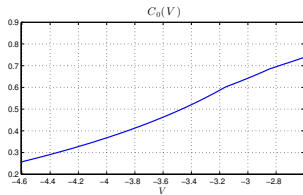
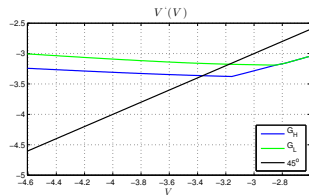
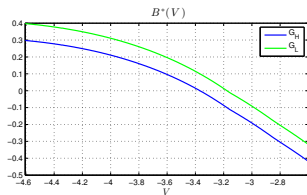
$$\log \left( c_0 - v \left( \frac{y}{\theta} \right) \right) + \beta \log c_1$$

- $Y(V)$  is increasing in  $V$
- Key factor: inequality is decreasing in  $V$

► Policies

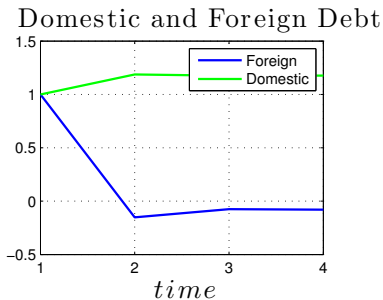
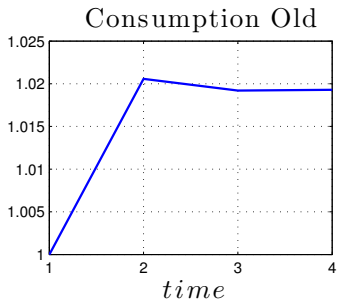
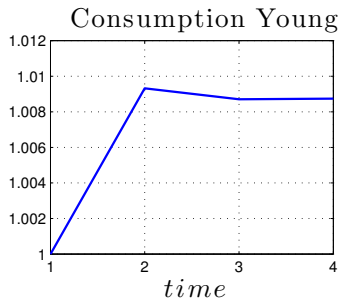
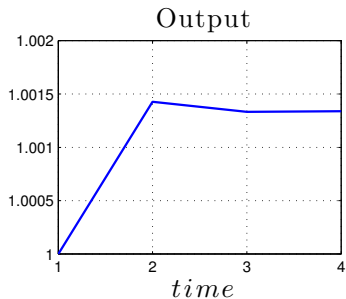
► Back

# Numerical Example with GHH: Allocations



# Fiscal Consolidation Dynamics with GHH

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# STOCHASTIC ECONOMY



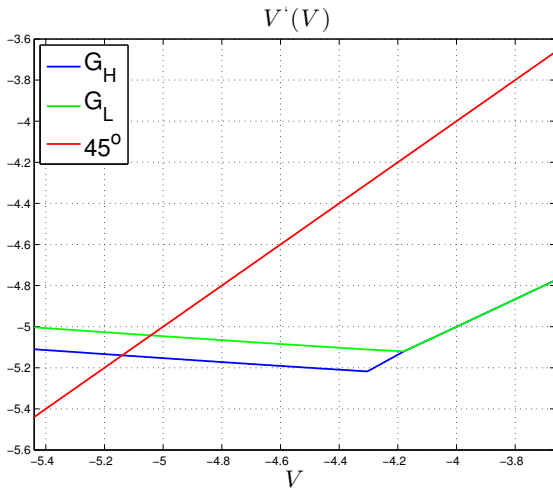
## Shocks

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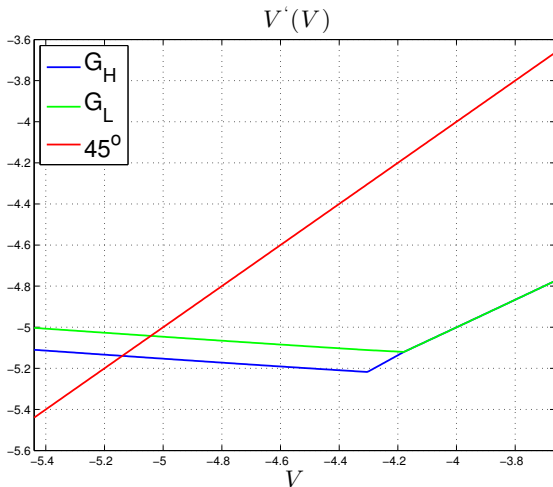
- Suppose  $G_t$ : i.i.d. where  $G_t \in \{G_L < G_H\}$
- Worst equilibrium is the same as before:  $\underline{W}_L > \underline{W}_H$ .
- Complete market for households and government
- **Assumption:**  $\hat{\beta}(1 + r^*) < 1$
- Why impatience?
  - Continuum of identical countries
  - Lack of commitment in each country
  - Market clearing interest rate is low:
    - Countries oversave to avoid default/renegeing on tax policies
    - Alvarez and Jermann (2000), Aiyagari(1994)

## $V'(V, G)$ is U-Shaped

---



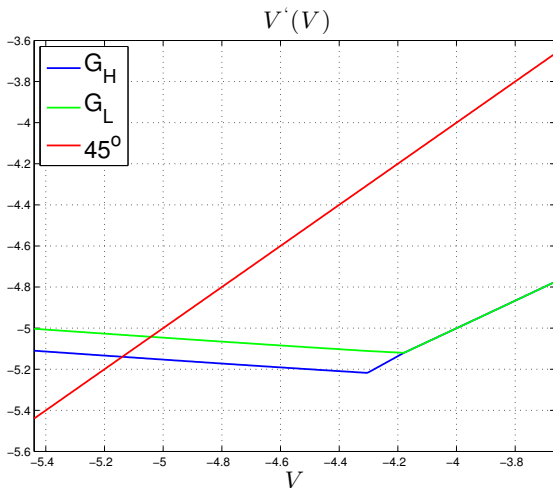
## Overshooting More Pronounced When G Low



In general equilibrium: Transition from highest value of external debt to *negative* external debt

## But Can Happen Also When $G$ High

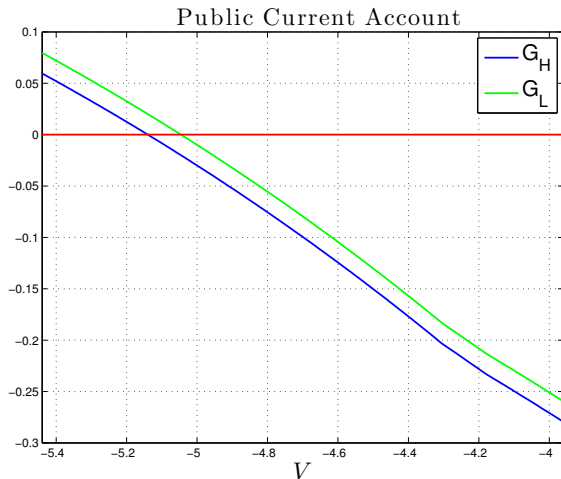
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Not true in standard Thomas-Worrall type model (RA economy)

## Net Repayment Also When $G$ High

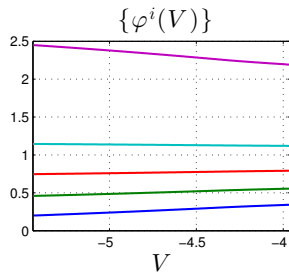
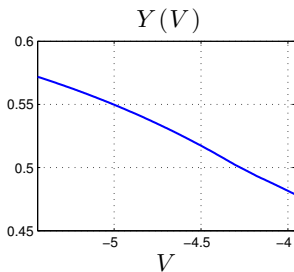
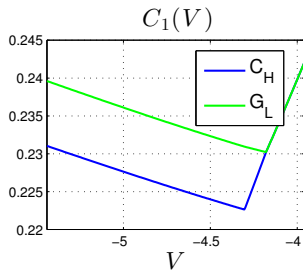
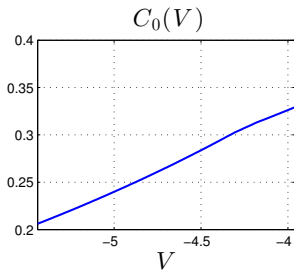
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When government is highly indebted: Positive public current account also when  $G$  is high [▶ Back](#)

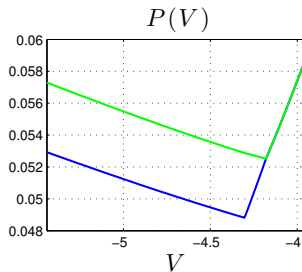
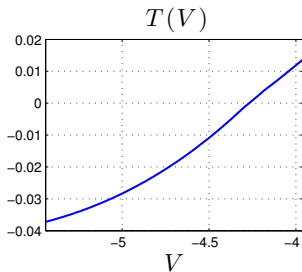
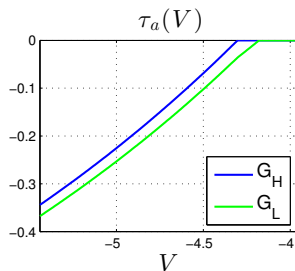
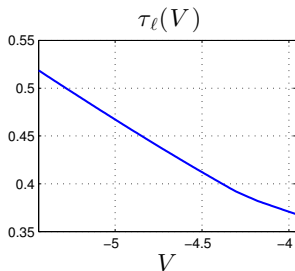
# Allocations with Log-Log

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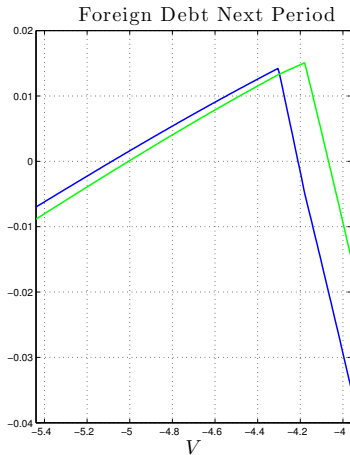
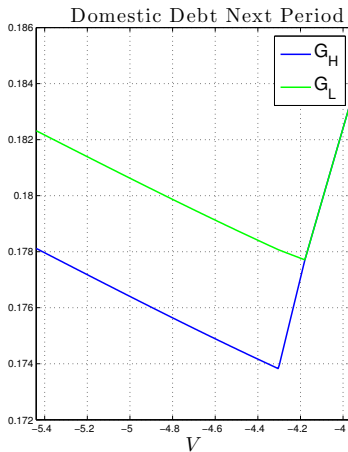


# Policies with Log-Log

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# Repatriation of Government Debt



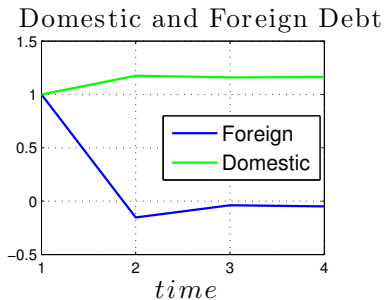
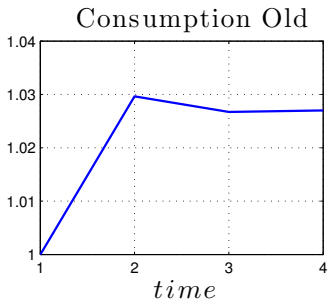
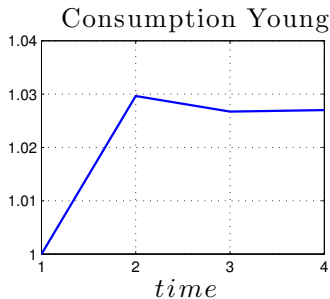
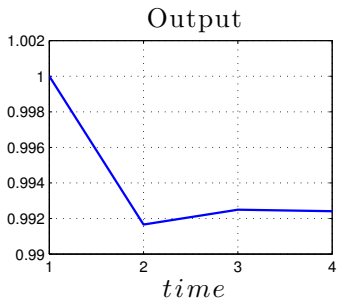
► Total Debt and Shares

► Details

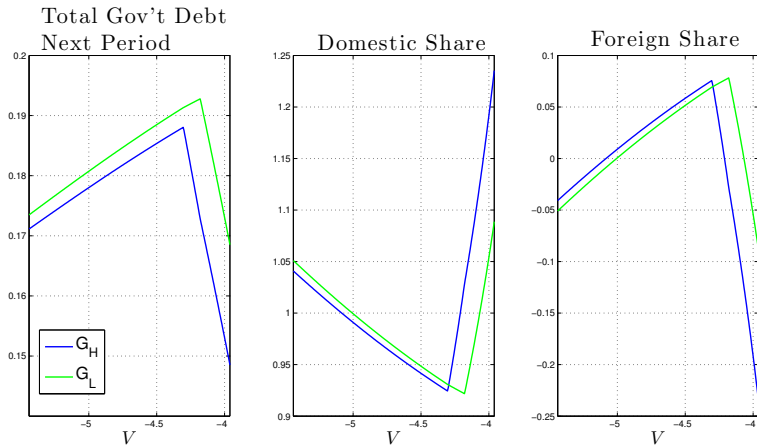


# Fiscal Consolidation Dynamics

---



# Repatriation of Government Debt



► Back

## Repatriation of Government Debt

---

When there is repayment:

- Gov't debt held by foreign investors goes from high to low
- Gov't debt held domestically goes from low to high
  - Under our preferred decentralization:

$$\begin{aligned} B(V, G) &= \sum_i \mu^i a^i(V, G) = \sum_i \mu^i [c^i(V, G) - P(V, G)] \\ &= C_1(V, G) - c_1^1(V, G) = [1 - \varphi^1(V, G)] C_1(V, G) \end{aligned}$$

- $C_1 \uparrow$  and  $\varphi^1 \downarrow \Rightarrow B \uparrow$

▶ Back

# POLITICAL ECONOMY MODEL

## Political Economy Model

---

- Policies are set in best interest of generations currently alive
- Policies outcome of political game between two short lived parties: [Probabilistic Voting a la Lindbeck and Weibull \(1987\)](#) [▶ Details](#)
- Everything the same as before except sustainability constraint:

$$\omega u_1^p(C_{t,1}, Y_t) + v_{t+1} \geq \underline{v}$$

where

$$v_t = U^p(C_{t,0}, C_{t,1}, Y_t)$$

and  $\underline{v}$  is the value of worst equilibrium for current government

## Political Economy Model: Results

---

Consider two SPE outcomes:

- Selection in spirit of Eaton-Gersovitz
  - If gov't reneges on debt or pension payments reversion to worst equilibrium
- Best SPE

For both:

- Burden of adjustment on current young
  - Even if current gov't attaches zero weight on future generations
- Total debt is cyclical
- Foreign debt is cyclical when  $\omega$  is large enough

## Political Economy Model

---

- Policies outcome of political game between two short lived parties:

### Probabilistic Voting a la Lindbeck and Weinbull (1987)

- Stage 1: Each party proposes a policy: default, taxes, transfers, pensions
- Stage 2: households receive ideological bias shock and vote.  
winner: majority of votes
- Stage 3: Policies are implemented

## Political Equilibrium

---

- Utility of agent  $i$  from policy by party  $j$ :  $u_{t,j}^i + \epsilon_{t,j}$   
 $\epsilon_{t,j}^i$  uniform

- Probability of winning for party  $j$ :

$$\sum_i \mu^i F_o^i (u_{t-1,1,j}^i - u_{t-1,1,-j}^i) + \sum_i \mu^i F_y^i (u_{t,j}^i - u_{t,-j}^i)$$

- Symmetric equilibrium + uniformity assumption: Government maximizes:

$$\omega \sum_i \alpha^i \mu^i u_{t-1,1}^i + \sum_i \alpha^i \mu^i u_t^i$$

- Strategic interaction: pensions chosen by government at  $t + 1$  affect government's choice at  $t$



## Subgame Perfect Equilibria

---

- Everything the same as before except sustainability constraint:

$$\omega U_1^P(C_{t,1}, Y_t) + v_{t+1} \geq \underline{v}$$

where

$$v_t = U^P(C_{t,0}, C_{t,1}, Y_t)$$

and  $\underline{v}$  is the value of worst equilibrium for current government

- Consider two SPE outcomes:
  - Selection in spirit of Eaton-Gersovitz
    - If gov't reneges on debt or pension payments reversion to worst equilibrium
  - Best SPE

## Eaton-Gersovitz Equilibrium

---

- State:  $(\mathbb{B}, z)$  where  $\mathbb{B} = (B^*, \{a^i\}, P^e)$ ,  $z$  indicator of past default
- If  $z = 1$ : value for the current government is  $\underline{V}$
- If  $z = 0$ :  $V(\mathbb{B}, 0) = \max\{v(\mathbb{B}), \underline{V}\}$  where

$$v(\mathbb{B}) = \max_{(P, C_0, Y, B')} \omega \sum_i \mu^i \alpha^i \log(a^i + P) + U^P(C_0, C_1, Y)$$

subject to

$$\sum_i \mu^i (a^i + P) + C_0 + B^* + G \leq Y + \frac{1}{1+r^*} B^{*'}$$

$$\bar{v}(B') \geq \underline{V}, \quad P \geq P^e$$

$$C_1 = \left( \sum_i \mu^i a^{i'} + \bar{P}(B') \right), \quad a^{i'} + \bar{P}(B') = \varphi^i(Y) C_1$$

## Eaton-Gersovitz Equilibrium

---

- State:  $(\mathbb{B}, z)$  where  $\mathbb{B} = (B^*, \{a^i\}, P^e)$ ,  $z$  indicator of past default
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$$\bar{v}(B') \geq \underline{V}, \quad P \geq P^e$$

$$C_1 = \left( \sum_i \mu^i a^{i'} + \bar{P}(B') \right), \quad a^{i'} + \bar{P}(B') = \varphi^i(Y) C_1$$

For  $t \geq 1$  outcomes recursive in “total debt”:  $\hat{B} = B^* + \sum_i \mu^i a^i + P^e$

## Auxiliary Problem

---

- For  $t \geq 1$

$$w(\hat{\mathbb{B}}) = \max_{C_0, Y, C'_1, B^{*'}} U^P(C_0, C_1, Y)$$

subject to

$$\begin{aligned} \hat{\mathbb{B}} + C_0 + G &\leq Y + \frac{B^{*'}}{1 + r^*} \\ \omega [H(Y) + \log(C'_1)] + w(B^{*'} + C'_1) &\geq \underline{V} \end{aligned}$$

- At  $t = 0$

$$v(\mathbb{B}) = \max_{P \geq P^e} \omega \sum_i \mu^i \alpha^i \log(a^i + P) + w(B^* + \sum_i \mu^i a^i + P)$$

- Sustainability constraint similar to normative benchmark

## Main Result: Overshooting and Cycles

---

### Theorem

$\hat{B}'(\hat{B})$  is decreasing.

The theorem implies that:

- Burden of adjustment on current young
  - Even if current gov't attaches zero weight on future generations
- Total debt is cyclical
- Foreign debt is cyclical when  $\omega$  is large enough

Similar result can be proven for best SPE

[▶ Details](#)

[▶ Back](#)

## Best SPE

---

$$\max_{\hat{\beta}} \frac{1}{\hat{\beta}} U_1^P(C_{1,-1}, \Phi_{-1}) + \sum_{t=0}^{\infty} \hat{\beta}^t U^P(C_{t,0}, C_{t,1}, Y_t)$$

subject to

$$B_0^* + \sum_{t=0}^{\infty} \frac{1}{(1+r^*)^t} [C_{t-1,1} + C_{t,0} + G_t] \leq \sum_{t=0}^{\infty} \frac{1}{(1+r^*)^t} ZY_t$$
$$\omega U_1^P(C_{t-1,1}, Y_{t-1}) + U^P(C_{t,0}, C_{t,1}, Y_t) \geq \underline{v}$$

given  $\Phi_{-1}, B_0^*$

## Main Result

---

- Problem is recursive in  $v_t$

## Main Result

---

- Problem is recursive in  $v_t$

### Theorem

Suppose that  $\hat{\beta}(1 + r^*) \leq 1$ . Then there exists  $v^*$

1. When  $v > v^*$ ,  $v'(v)$  is increasing
  2. When  $v < v^*$ ,  $v'(v)$  is decreasing
- Total debt is cyclical in  $v$
  - Foreign debt is cyclical only when  $\omega$  is large enough
  - Similar property holds for a class of Markov equilibria:
    - Assumption: future governments cannot renege on pensions (triggers punishment)

▶ Back