

# Central Bank Swap Lines as Bilateral Sovereign Debt

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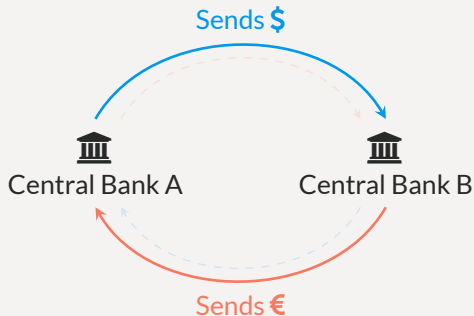
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# What is a Central Bank swap?

Swaps are **symmetric** currency exchanges

- A swap line is a contract between two Central Banks
- When activated, each institution provides an amount of its currency to the counterparty
- At maturity, positions are unwound

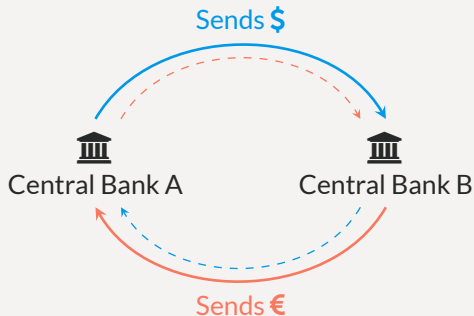


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... Symmetric swaps better understood, growing number of *asymmetric* ones

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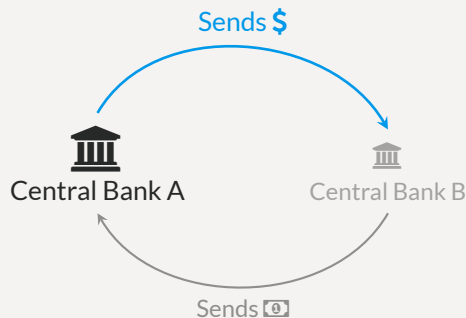
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in practice

- The Fed doesn't really want Mexico's pesos  
... treats them more like collateral
- Mexican authorities may need dollars for their BoP  
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## How are Central Bank Swap Lines different from Sovereign Debt?

- We abstract from **currencies**, **collateral**, and focus on the **borrowing**

For an EM using the swap line to **borrow** from an AE

### Regular debt (bond markets)

- Defaultable
- Many different lenders
- Interest rate (**spreads**) mainly reflects default risk

### Bilateral loan (swap line)

- Non-defaultable (Central Bank)
- No coordination issues
- Can be used to curb default risk
- **Interest rate?**

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# How do Central Bank Swap Lines interact with Sovereign Debt?

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## Main findings

- One type of debt affects borrowing conditions for the other
  - Borrowing from the market serves as threat in swap negotiations
  - Swap can be used when spreads on the market are high
- Lending around or in default maximizes surplus for bilateral loans
  - Without restricting swaps in default, welfare losses for government
- Swap lines worsen the debt dilution problem
- Today: Focus on the problem with swaps **only**



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- Central Bank swaps among advanced economies
  - ... Bahaj and Reis (2021); Cesa-Bianchi, Eguren-Martin, and Ferrero (2022)
- Data on Central Bank swaps
  - ... Perks, Rao, Shin, and Tokuoka (2021); Horn, Parks, Reinhart, and Trebesch (2023)
- Sovereign debt/default with non-defaultable debt
  - ... Hatchondo, Martinez, and Onder (2014)

## Model with Swaps only

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# Environment

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The government of a small open economy borrows from a monopolist

- Income  $y(z_t)$  follows an AR(1) process in logs
  - ... Only one good, representative risk-averse household, expected utility
- **Renegotiate** the swap  $m$  each period
  - ... Involves a transfer  $x$  and a new loan size  $m'$
  - ... Swap is non-defaultable  $\implies$  Repaying  $m$  is the natural threat point
- Should expect
  - ... Implicit interest rate  $r$  to vary over time
  - ... Interest rate to reflect **market power**
  - ... Interest rate to reflect **outside options**



$$x = \frac{1}{1+r} m' - m$$

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# Bargaining stage with monopolist

- At income state  $z$  and loan  $m$ , solve

$$\max_{x, m'} \mathcal{L}(x, m, m', z)^\theta \times \mathcal{B}(x, m, m', z)^{1-\theta}$$

Government surplus

Lender surplus

- Government (borrower) surplus

$$\mathcal{B}(x, m, m', z) = \underbrace{u(y(z) + x) + \beta \mathbb{E}[v(m', z') | z]}_{\text{agreement: receive } x, \text{ owe } m'} - \underbrace{(u(y(z) - m) + \beta \mathbb{E}[v(0, z') | z])}_{\text{threat point: repay } m, \text{ clean slate}}$$

- Lender surplus

$$\mathcal{L}(x, m, m', z) = \underbrace{a - x + \beta_L \mathbb{E}[h(m', z') | z]}_{\text{agreement}} - \underbrace{(a + m + \beta_L \mathbb{E}[h(0, z') | z])}_{\text{threat point}}$$

- Value functions  $v(m, z)$  and  $h(m, z)$  encode expected outcomes of future rounds

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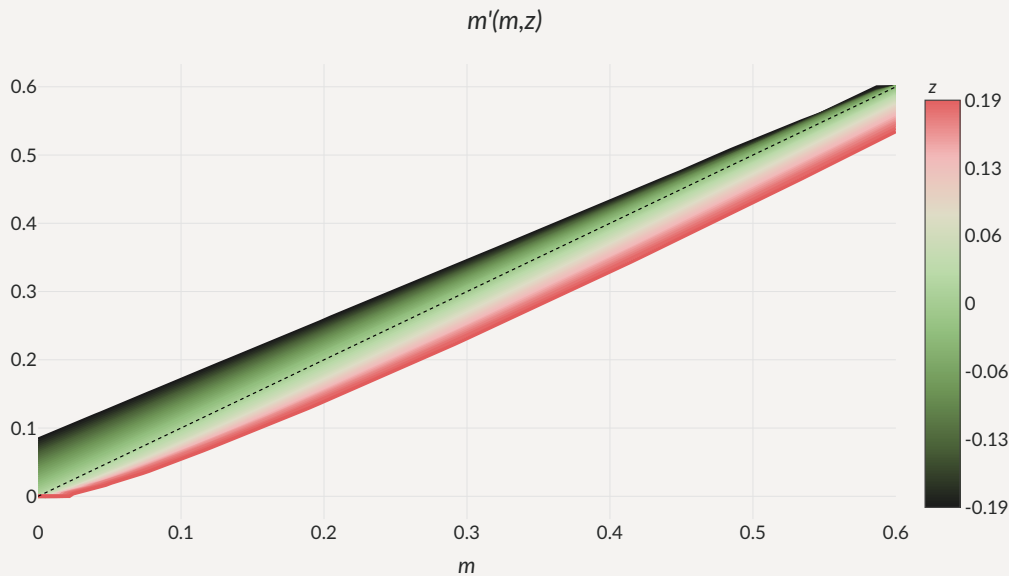
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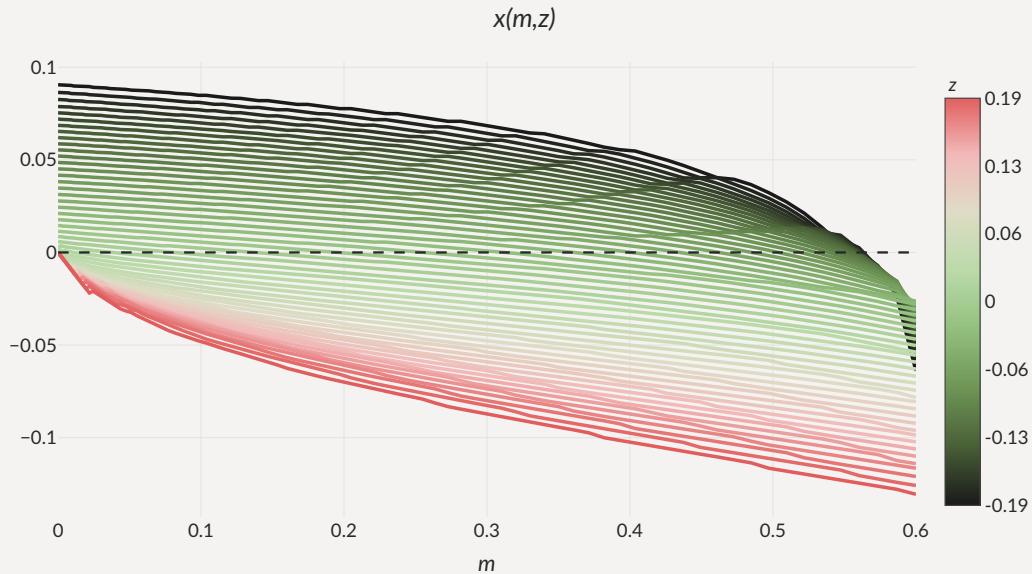
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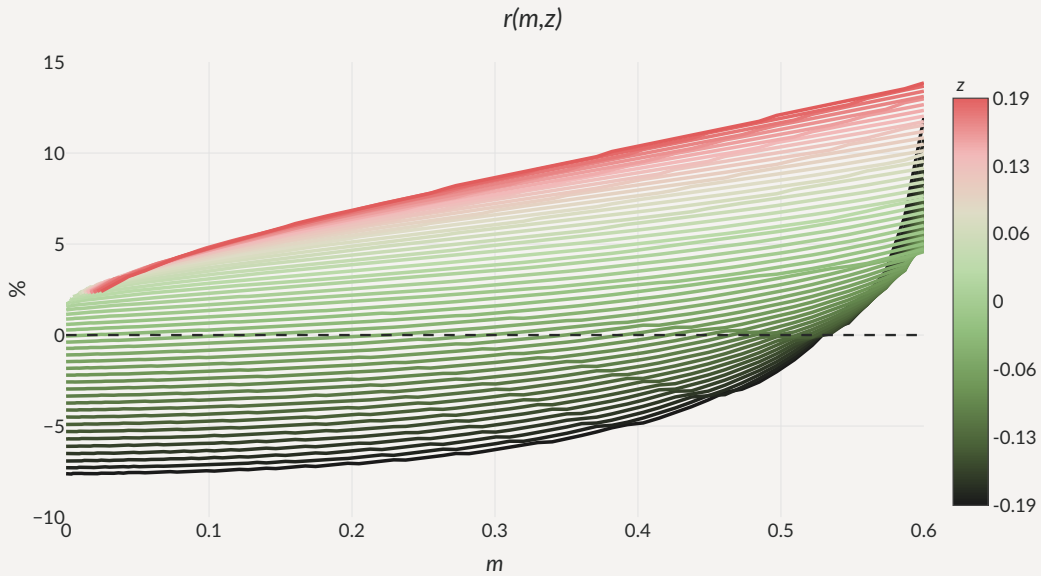
# Swap Line Terms: Loan Dynamics



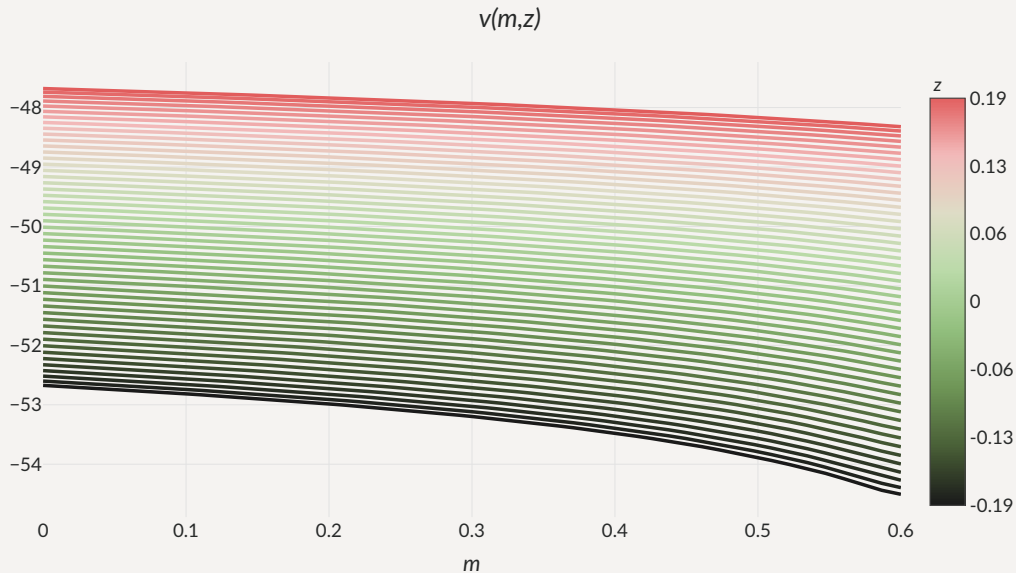
## Swap Line Terms: Transfers



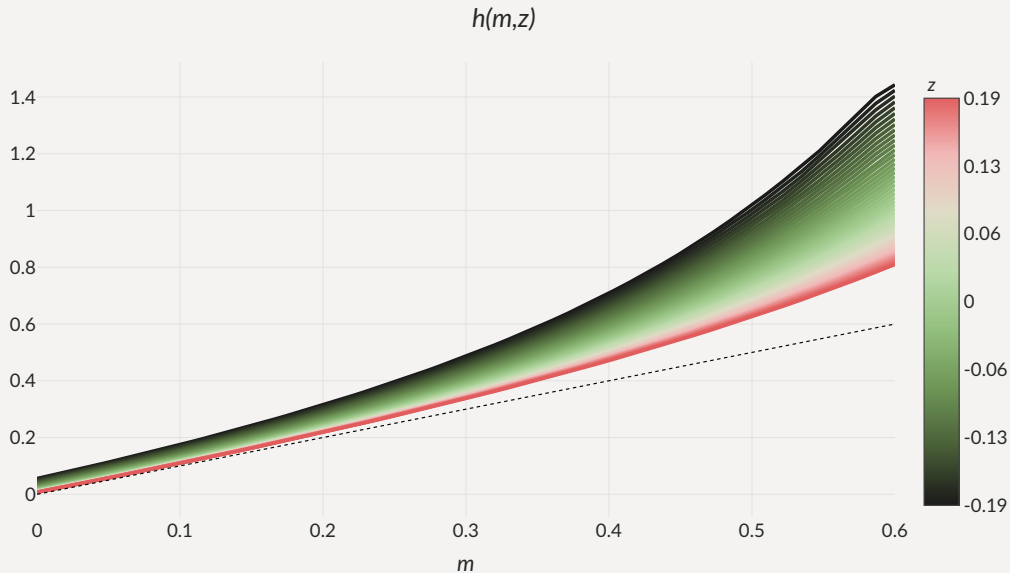
# Swap Line Terms: Interest rate



## Swap Line Terms: Borrower's value function



## Swap Line Terms: Lender's value function



## Swap Line Terms: Takeaways

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The threat point is less 'credible' when  $m$  is large

- This creates convexity in the lender's value function  
... making the lender act 'as if' risk-loving
- The lender initially subsidizes the loan to induce indebtedness and high profits
  - Gamble for debt overhang
- Initial subsidy and high rates consistent with B's risk aversion – 'Participation constraint'

## Our *want* operator

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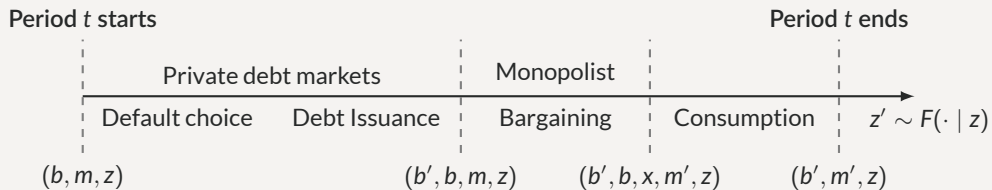
- **Embed** bargaining stage within an off-the-shelf sovereign debt/default model ✓
- Think carefully about **bargaining**: how to discipline  $\theta$  ?
- Data on swap lines ?
  - ... PBoC swap lines famously opaque: no terms or interest rate data
  - ... Amounts contracted are available
  - ... Amounts effectively drawn are more complicated
- Data counterparts for model ?
  - ... Model with two types of debt yields implications of swaps on regular debt terms



## Model with Swaps and Debt

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# Timeline of events



# Borrowing from markets

- Debt is a geometrically-decaying coupon  
... get 1, pay  $\kappa, (1 - \rho)\kappa, \dots (1 - \rho)^{s-1}\kappa$
- Government enters first stage owing  $b$  in debt,  $m$  in swaps, income state  $z$

$$v(b, m, z) = \max \{ v_R(b, m, z) + \epsilon_R, v_D(m, z) + \epsilon_D \}$$
$$v_R(b, m, z) = \max_{b'} w_R(b', b, m, z)$$

- Lenders in competitive markets need to anticipate interactions with the monopolist

$$q(b', b, m, z) = \beta_L \mathbb{E} [(1 - 1_{\mathcal{D}}(b', m', z')) (\kappa + (1 - \rho)q(b'', b', m', z')) \mid z]$$
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same sdf as monopolist

- Same as before with extra state variables  $(b, b')$

$$\mathcal{L}_R(b', x, m, m', z) = (a - x + \beta_L \mathbb{E} [h(b', m', z') \mid z]) - (a + m + \beta_L \mathbb{E} [h(b', 0, z') \mid z])$$

$$\begin{aligned} \mathcal{B}_R(b', b, x, m, m', z) &= u(y(z) + B(b', b, m, z) + x) + \beta \mathbb{E} [v(b', m', z') \mid z] \\ &\quad - (u(y(z) + B(b', b, m, z) - m) + \beta \mathbb{E} [v(b', 0, z') \mid z]) \end{aligned}$$

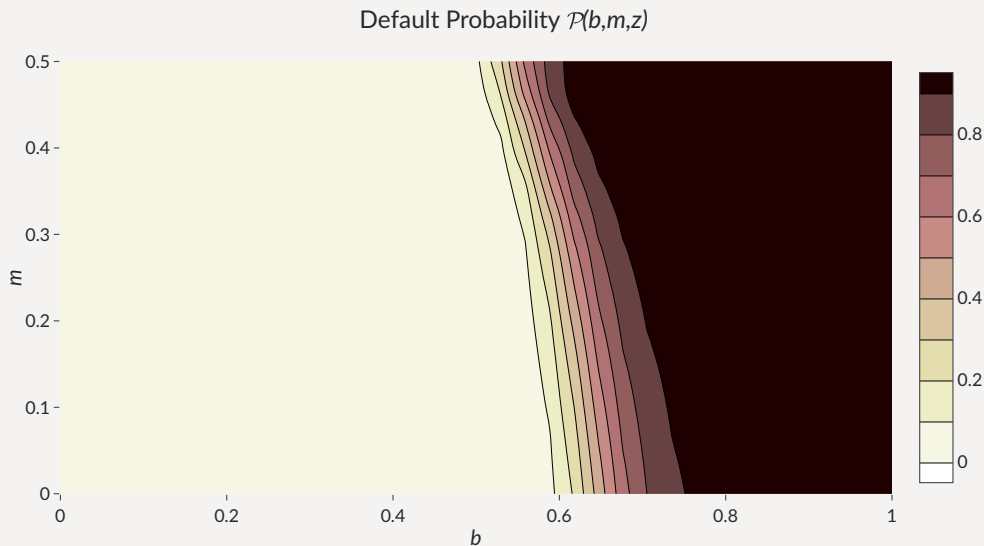
$$B(b', b, m, z) = q(b', b, m, z)(b' - (1 - \rho)b) - \kappa b$$

## Quantitative Effects of Swap Lines

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# Default probability

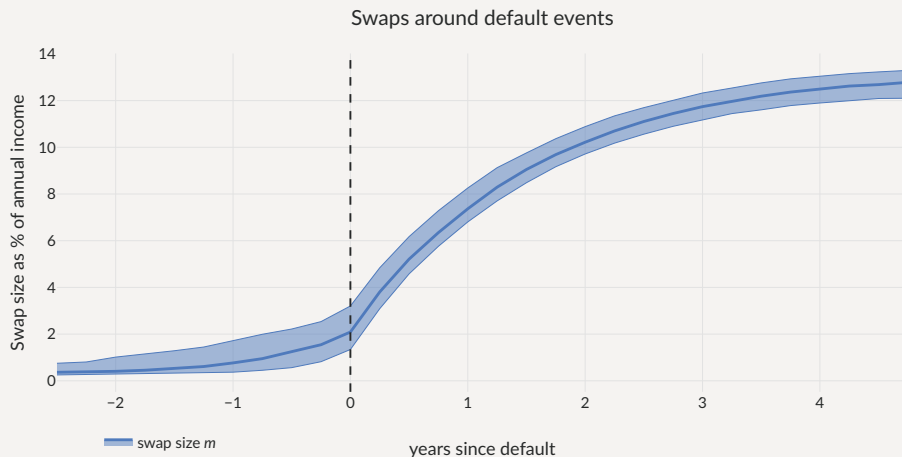
Both types of debt are clearly **substitutes**





# When is the Swap Used?

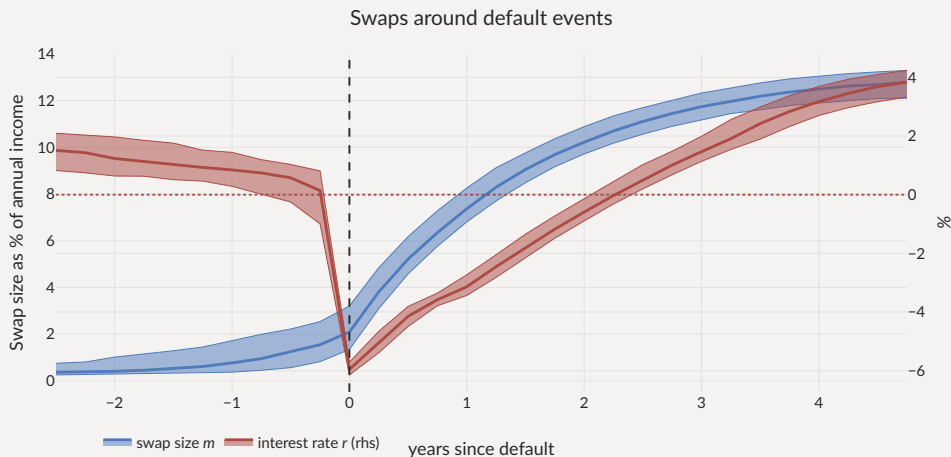
- In repayment, average swap = 0.42% of GDP with s.d. 0.71%
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- Also consider Limited version:  $m' \leq m$  while in default

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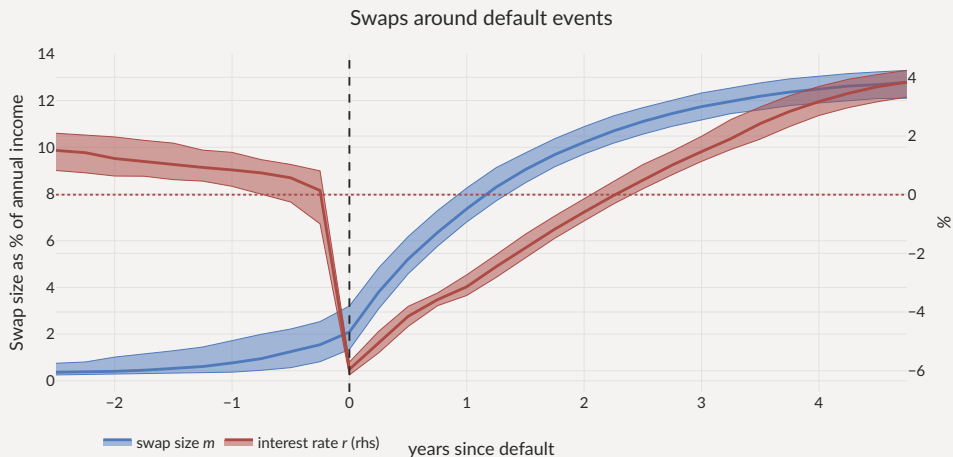
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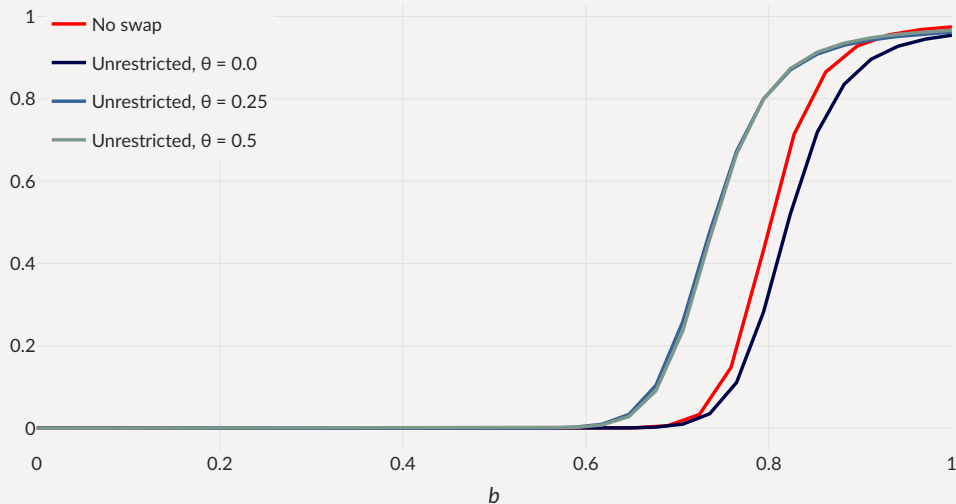


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# Debt Tolerance with Swaps

Repay less often when swaps present. More often with Limited

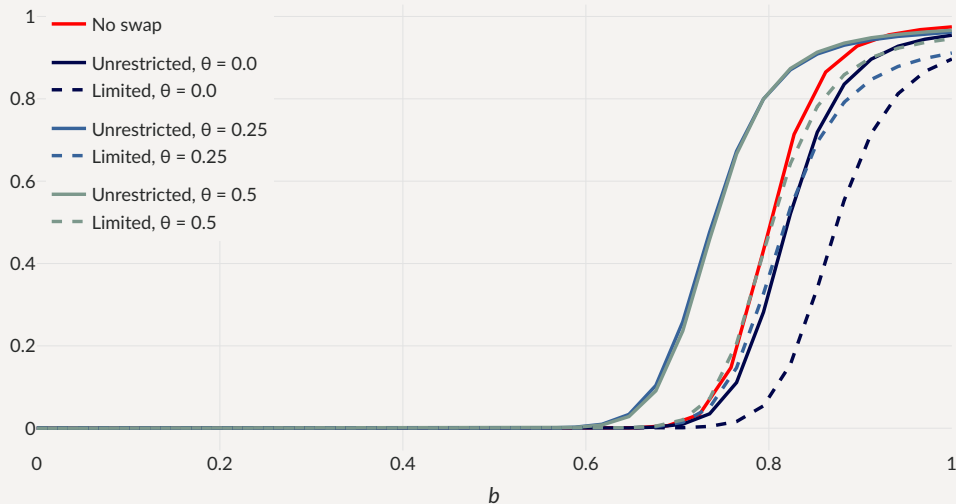
Default Probability  $\mathcal{P}(b, m, z)$



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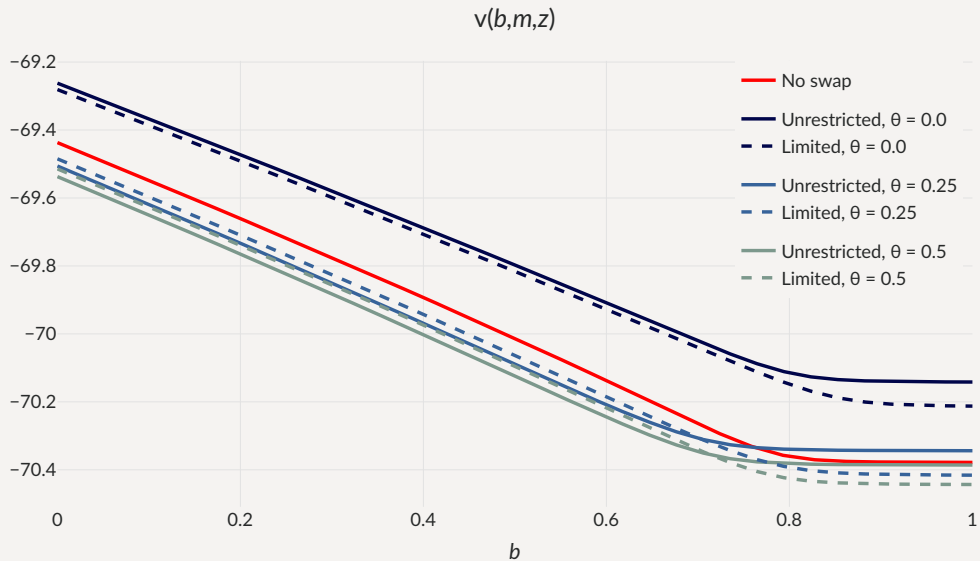
# Debt Prices with Swaps

Limited: more likely to repay but lower **prices** → Tell-tale sign of **debt dilution**



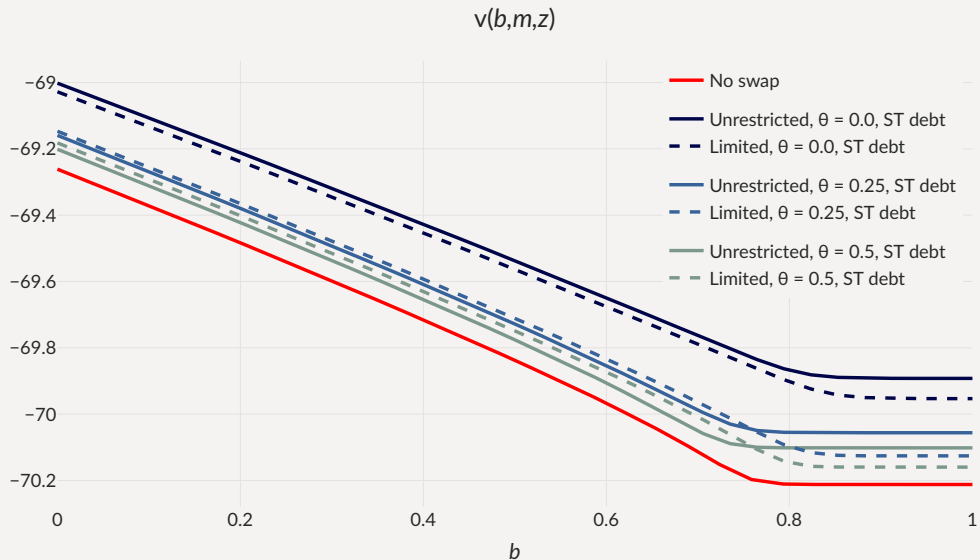
# Welfare effects of swap lines

with interior bargaining power, Limited  $\succcurlyeq$  Unrestricted, but...



# Welfare effects of swap lines – Debt dilution

Solving model with **short-term debt**: gains of swaps





## Concluding remarks

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- Simple model with monopolist/fringe structure
- Strong interaction between two markets for sovereign debt
  - ... even if swaps are not used intensely on the equilibrium path
- Market power crucial in model
  - ... how to discipline in model?
  - ... how to affect in reality?
- Large welfare effects, policy challenges
  - How to limit their use during defaults?
  - Strengthen debt dilution – more gains from fiscal rules, state-contingent debt?



# When is the Swap Used?

- Further conditioning on default events lasting exactly two years

