Central Bank Swap Lines as Bilateral Sovereign Debt

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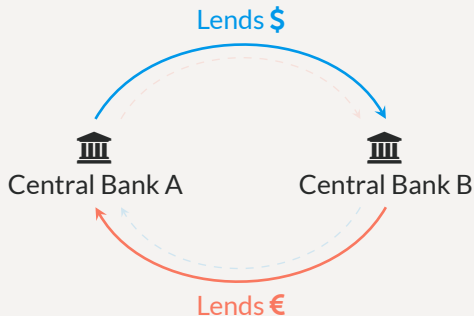
Swaps are symmetric currency exchanges

- 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

Lends $

Central Bank A   Central Bank B

Lends €

- Symmetric swaps (AE-AE) potentially very different from asymmetric ones (AE-EM)
  ... Symmetric swaps better understood, growing number of *asymmetric* ones

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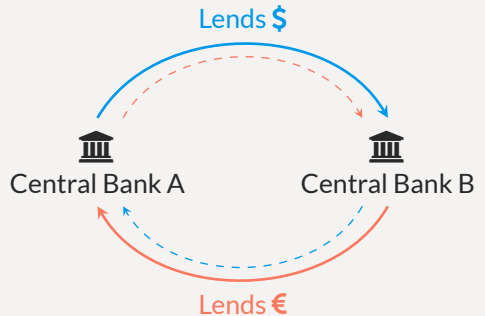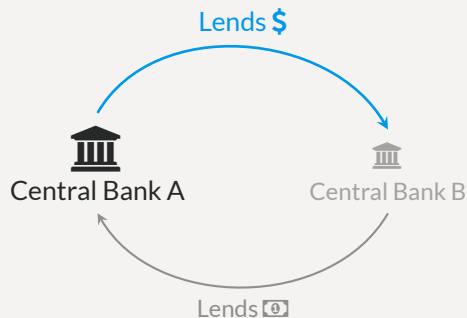
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Lends 💵

**which can be asymmetric
in practice**

· The Fed doesn't really want
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  … treats them more like collateral

· Mexican authorities may need
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  … more similar to borrowed reserves

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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)	Bilateral loan (swap line)
· Defaultable	· Non-defaulteable (Central Bank)
· Many different lenders	· No coordination issues
· Interest rate (spreads) mainly reflects default risk	· Can be used to curb default risk
	· Interest rate?

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How do Central Bank Swap Lines interact with Sovereign Debt?

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
    - Availability of swaps in default:
        - … raises the value of default
        - … which increases the default frequency
        - … and worsens borrowing terms in bond markets
    - Without restricting swaps in default, welfare losses for the government

- Swap lines worsen the debt dilution problem

Literature

- 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

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

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

Environment

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Bargaining stage with monopolist

- At income state z and loan m, solve

Government surplus

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

Lender surplus

- Government (borrower) surplus

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

- Lender surplus

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

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

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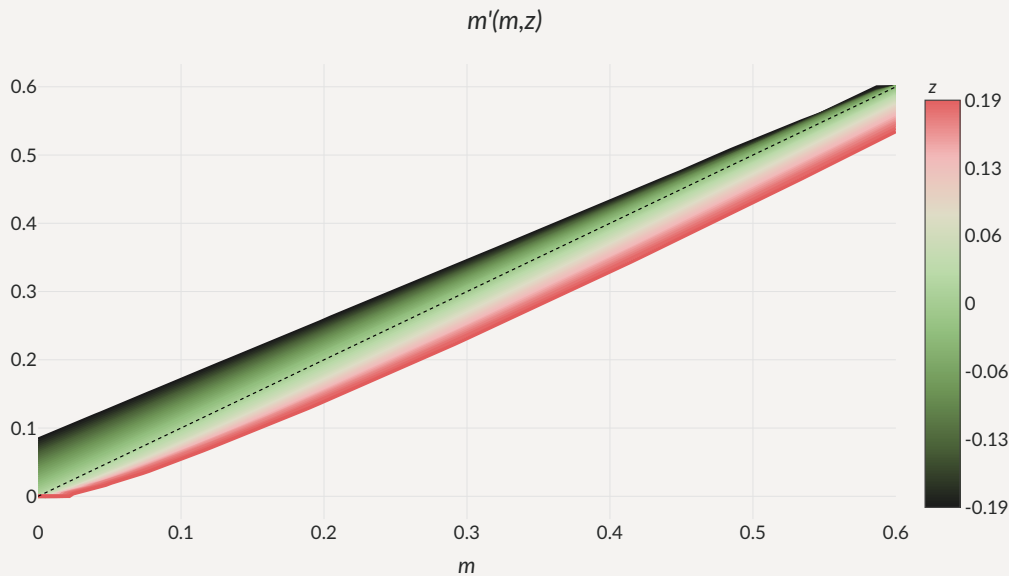
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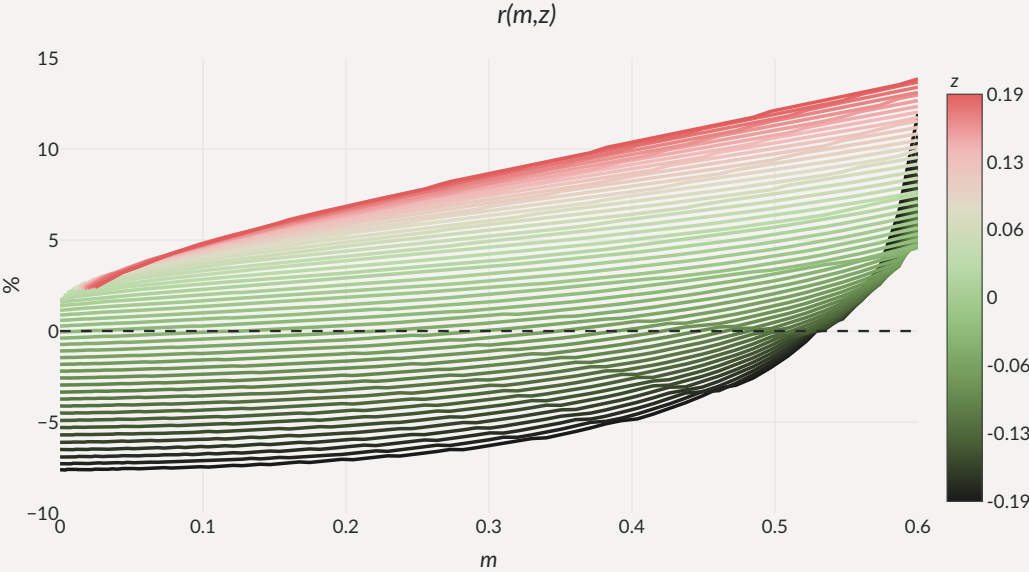
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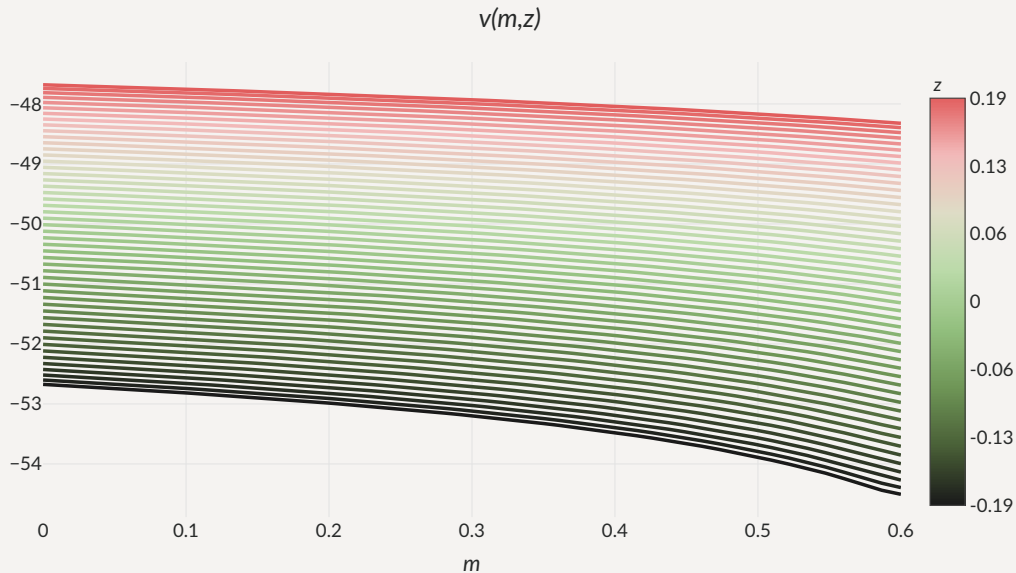- Value functions $v(m, z)$ and $h(m, z)$ encode expected outcomes of future rounds

Swap Line Terms: Loan Dynamics

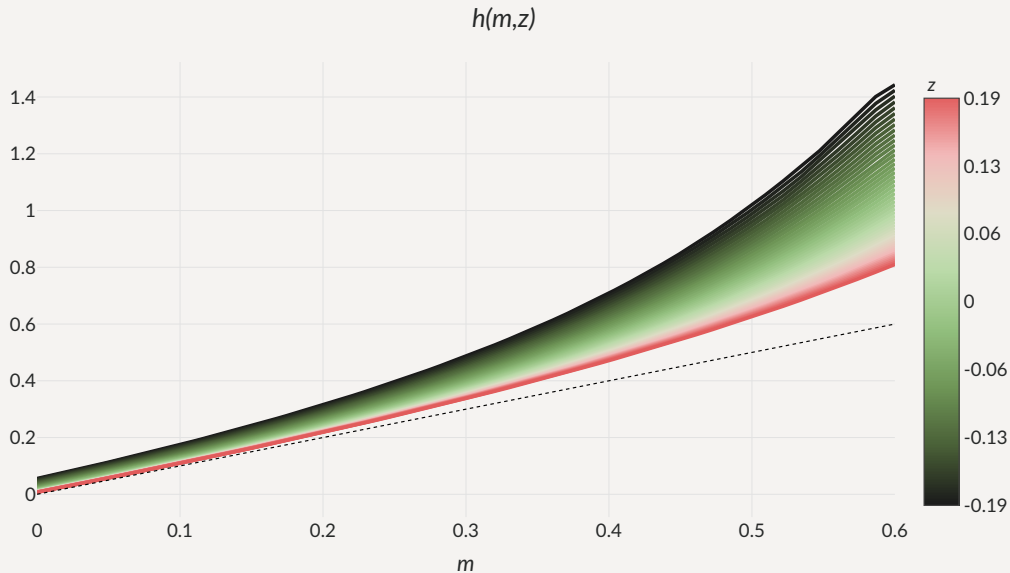$m'(m,z)$

Swap Line Terms: Implicit interest rate

$r(m,z)$

Swap Line Terms: Borrower's value function

v(m,z)

Swap Line Terms: Lender's value function

$h(m,z)$

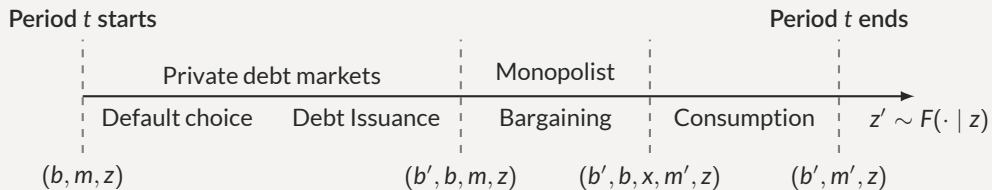The threat point is less 'credible' when m is large

key requirement:
threat point value decreasing in m

- 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'

Model with Swaps and Debt

Period t starts   **Period t ends**

	Private debt markets		Monopolist		

Default choice   Debt Issuance   Bargaining   Consumption $z' \sim F(\cdot \mid z)$

(b, m, z) (b', b, m, z) (b', b, x, m', z) (b', m', z)

Borrowing from markets

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

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

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

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

Bargaining stage

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

$$\mathcal{L}_R(b', x, m, m', z) = (a - x + \beta_L \mathbb{E}\left[h(b', m', z') \mid z\right]) - (a + m + \beta_L \mathbb{E}\left[h(b', 0, z') \mid z\right])$$
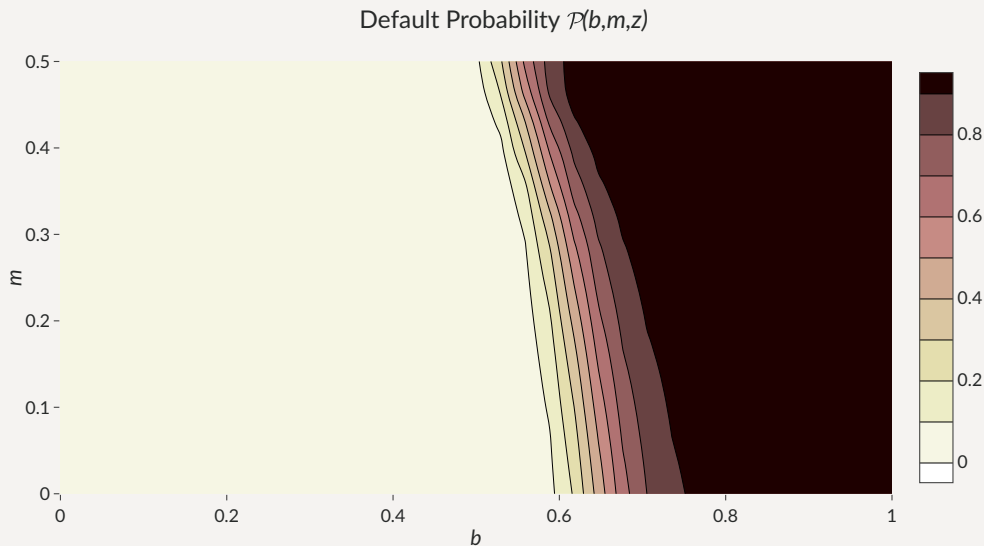
$$\mathcal{B}_R(b', b, x, m, m', z) = u\big(y(z) + B(b', b, m, z) + x\big) + \beta \mathbb{E}\left[v(b', m', z') \mid z\right]$$
$$- \big(u(y(z) + B(b', b, m, z) - m) + \beta \mathbb{E}\left[v(b', 0, z') \mid z\right]\big)$$

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

Quantitative Effects of Swap Lines

Default probability
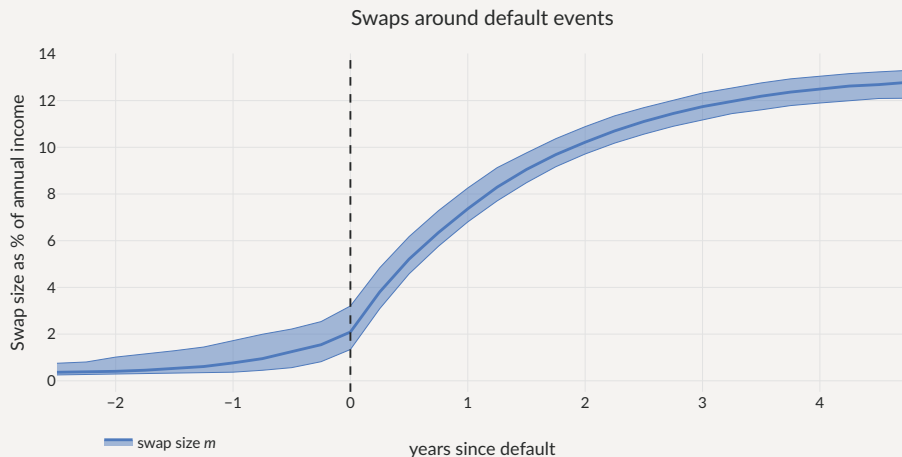
Both types of debt are clearly substitutes

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

When is the Swap Used?

- In repayment, average swap = 0.42% of GDP with s.d. 0.71%
- In default,
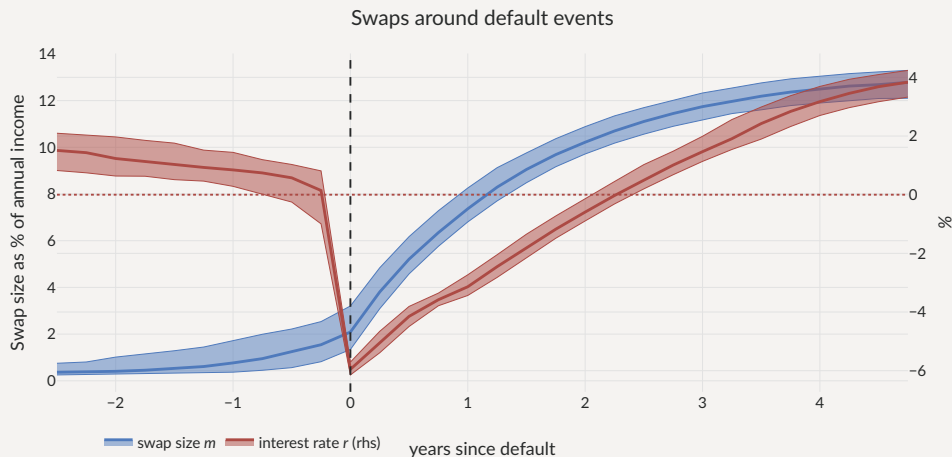
Swaps around default events

swap size m

years since default
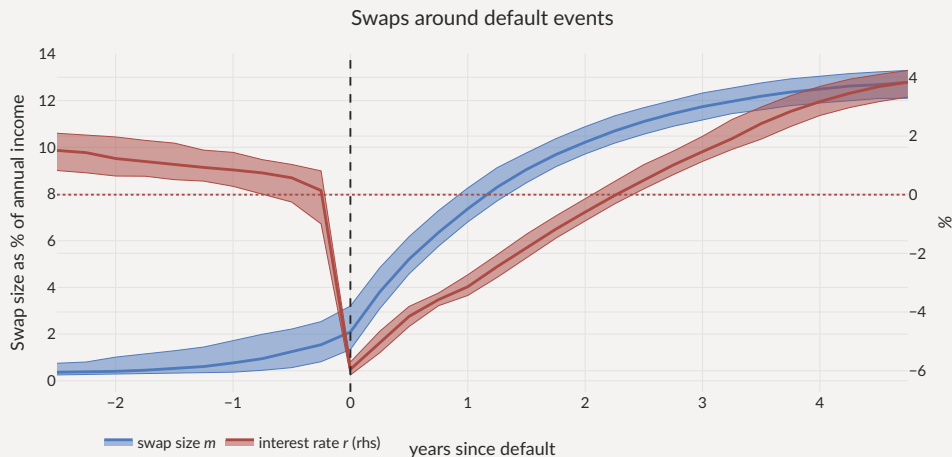
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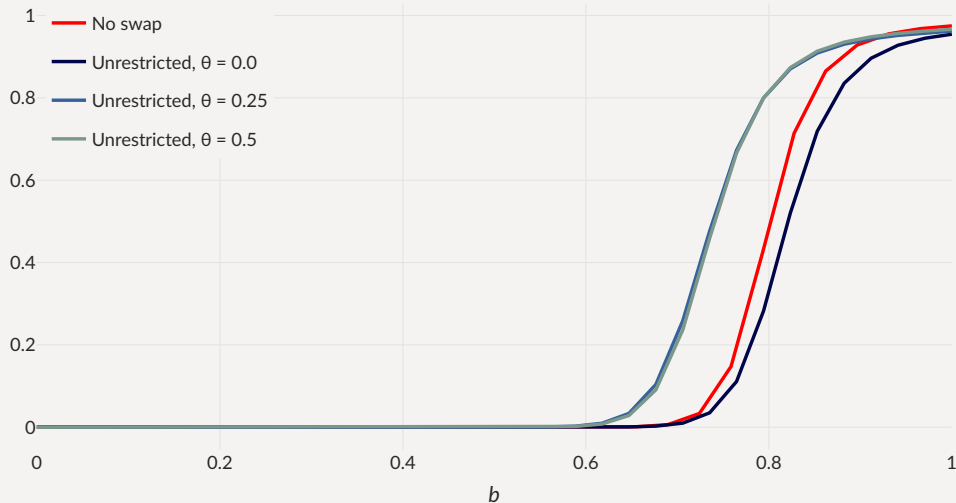*Legend: swap size m — interest rate r (rhs) — years since default*

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Debt Tolerance with Swaps

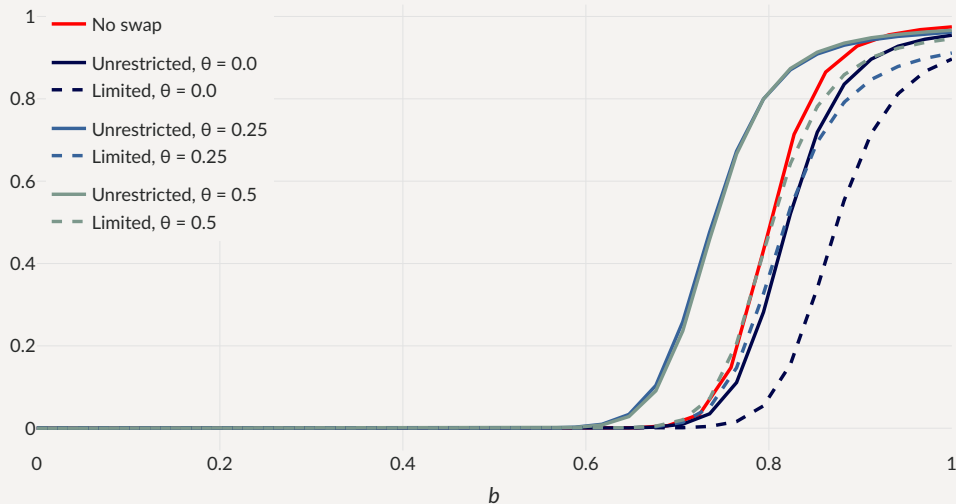**Repay less often when swaps present** (except when $\theta = 0$). More often with Limited

Default Probability $\mathcal{P}(b,m,z)$
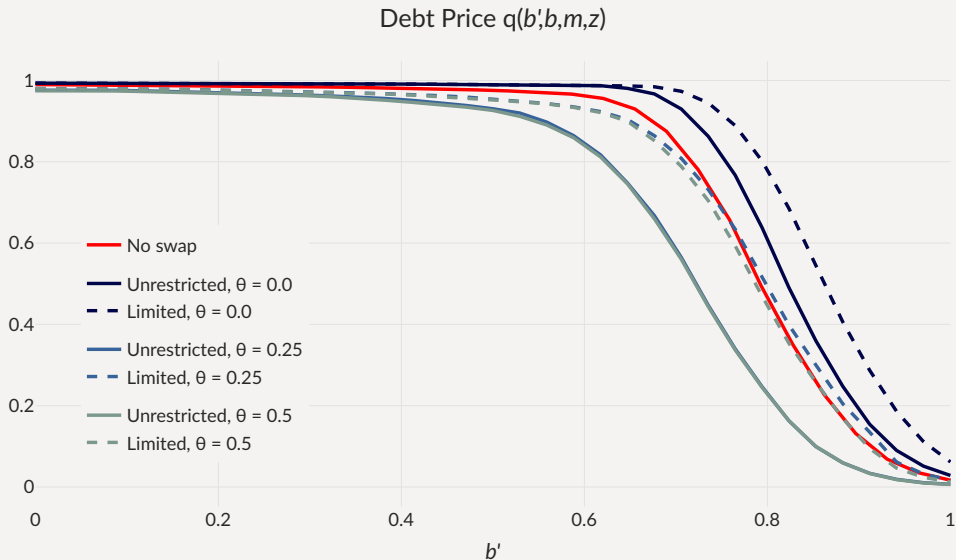
Debt Tolerance with Swaps

Repay less often when swaps present. More often with Limited

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

Legend:
- No swap
- Unrestricted, θ = 0.0
- Limited, θ = 0.0
- Unrestricted, θ = 0.25
- Limited, θ = 0.25
- Unrestricted, θ = 0.5
- Limited, θ = 0.5

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

Debt Price $q(b',b,m,z)$

Legend:
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- Unrestricted, $\theta = 0.25$
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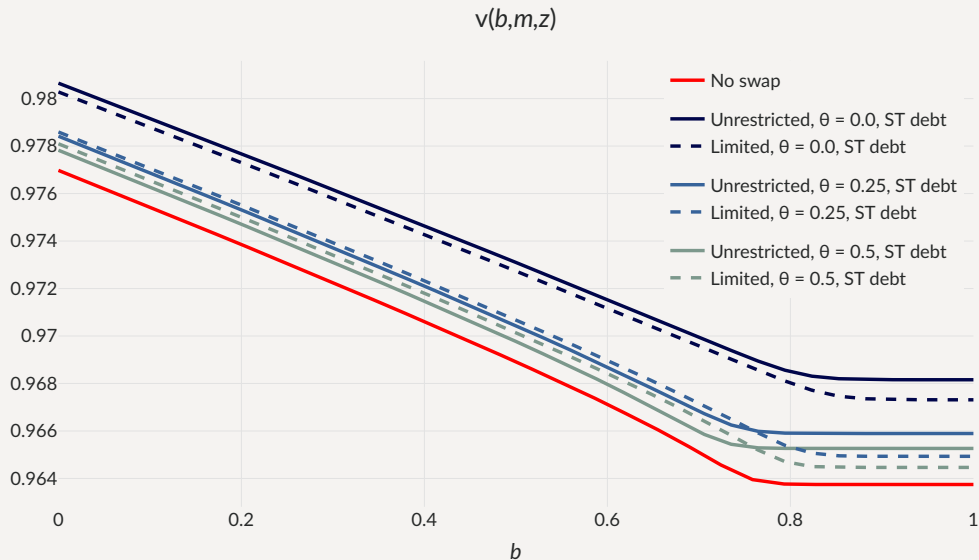# Welfare effects of swap lines

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

$$v(b,m,z)$$
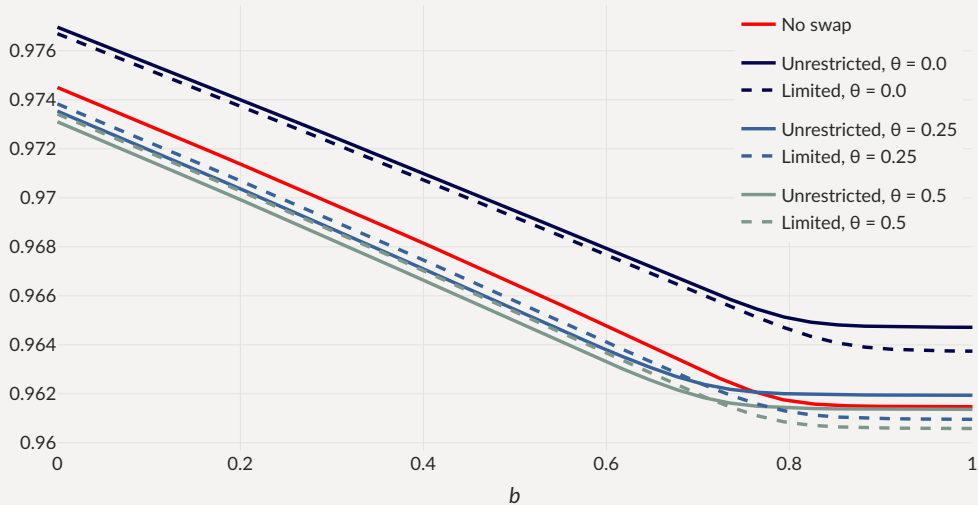
Welfare effects of swap lines — Debt dilution

Solving model with short-term debt: gains of swaps

$v(b,m,z)$

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- Limited, θ = 0.0, ST debt
- Unrestricted, θ = 0.25, ST debt
- Limited, θ = 0.25, ST debt
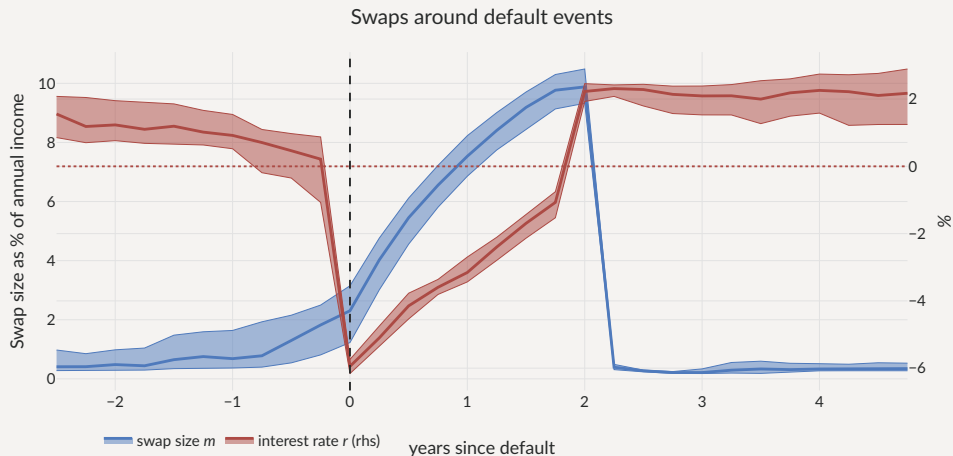- Unrestricted, θ = 0.5, ST debt
- Limited, θ = 0.5, ST debt

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?
  - Strengthened debt dilution – more gains from fiscal rules, state-contingent debt?

- Further conditioning on default events lasting exactly two years

Swaps around default events

- With Limited

Swaps around default events

Swap size as % of annual income

%

— swap size *m* — interest rate *r* (rhs)

years since default