

# Central Bank Swap Lines as Bilateral Sovereign Debt

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St. Louis Fed brown bag seminar  
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# Uses of Swap Lines

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- **Swap** line: two lines of credit involving two central banks
  - ... Each makes available some of its own currency to the other, for a fixed term
  - ... Short-term arrangements (typically one year, typically renewed)
- Used to mainly involve **AEs** Fed-ECB-BoE-BoJ-SNB
  - ... to support lender-of-last-resort functions with multinational firms
- Large increase in bilateral swaps and loans involving **EMs** since early 2000s
  - ... for EM, swap resources are hard currency
  - ... for EM, swap can be used for financing BoP (or as borrowed reserves)
  - ... EMs borrowing from swap lines tend to use different counterparts

Question

How do swap lines interact with sovereign debt?

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# How do Central Bank Swap Lines Affect the Market Structure of Sovereign Debt?

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

## Tradeoff

- Borrowing with bonds
  - ... interest rate reflects **default** risk
- Borrowing from the swap line
  - ... interest rate and drawings **negotiated**

!! Defaulting on the debt does not mean defaulting on the swap

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# A New Landscape for Sovereign Borrowing

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- Swap lines are an *example* of a new type of sovereign borrowing arrangement
  - Short maturity but rolled over, with **renegotiation**
  - Difficult to **default** on — Central bank  $\neq$  Treasury
  - Cheaper than borrowing on the market
- Other examples: Central bank deposits, bilateral loans, IMF programs...

# Risk-taking Incentives and Relational Overborrowing

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## Main findings

- Swap drawings small relative to debt, but
  - Presence of swaps affects sovereign debt markets
    - ... can provide financing when other sources dry up
    - ... can increase risk-taking
- Lending around or in default maximizes surplus in swap negotiations
  - 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 induce relational overborrowing similar to the debt dilution problem
  - Surplus requires spreads — spreads require risk

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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 for EMs
  - ... Perks, Rao, Shin, and Tokuoka (2021); Horn, Parks, Reinhart, and Trebesch (2023)
- Sovereign debt/default with interactions from 'official' debt
  - ... Boz (2011), Hatchondo, Martinez, and Onder (2014), Arellano and Barreto (2024), Liu, Liu, and Yue (2025)

## Model

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The government of a small open economy borrows from a monopolist and from markets

- 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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## Warm-up: Bargaining with Monopolist Only

- 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

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

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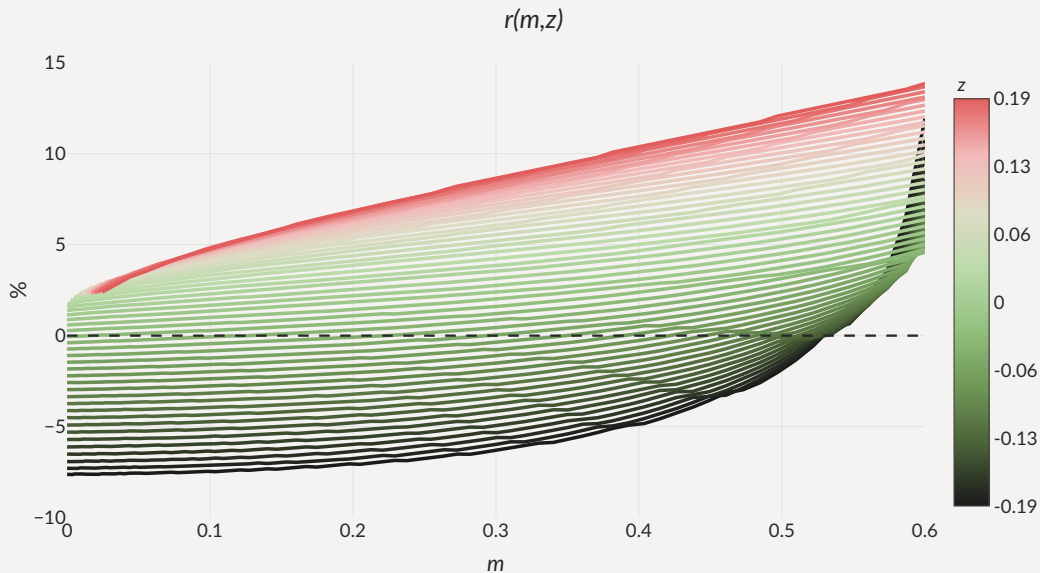
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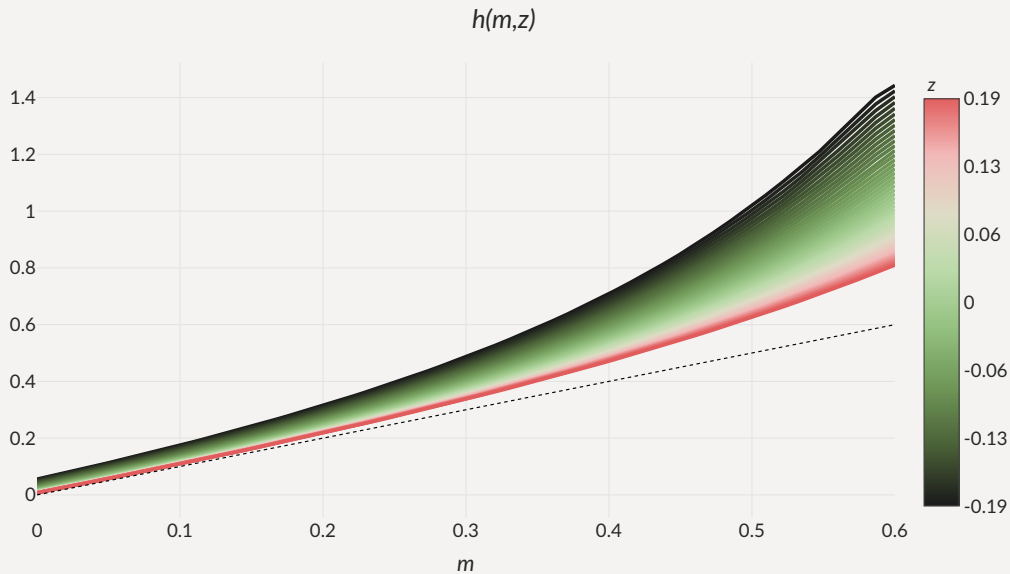
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## Monopolist Terms: Implicit Interest Rate



## Monopolist Terms: Lender's Value Function



# Monopolist Terms: Takeaways

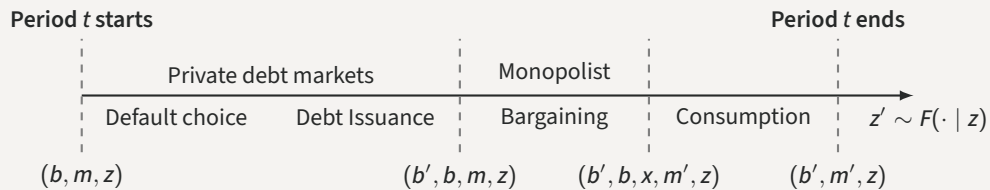
key requirement:

threat point value decreasing in  $m$

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'

# Timeline of Events





## Borrowing from Markets

- Debt is a geometrically-decaying coupon  
... for each unit, get  $q$ , 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

$$q(b', b, m, z) = \beta_L \mathbb{E} [(1 - 1_D(b', m', z')) (\kappa + (1 - \rho)q(b'', b', m', z')) \mid z]$$
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## Bargaining Stage with Monopolist

- At state  $z$ , owing debt  $b$  bonds and  $m$  on the swap and having issued  $b'$

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Lender surplus

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... When  $m - B(b', b, m, z)$  is large: government willing to borrow at high rates

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## Quantitative Effects of Swap Lines

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- Calibrate to Argentina without swaps (as in Roch & Roldán, 2023)

	Parameter	Value
Sovereign's discount factor	$\beta$	0.9504
Sovereign's risk aversion	$\gamma$	2
Preference shock scale parameter	$\chi$	0.02
Lender's bargaining power	$\theta$	0.5
Risk-free interest rate	$r$	0.01
Duration of debt	$\rho$	0.05
Income autocorrelation coefficient	$\rho_z$	0.9484
Standard deviation of $y_t$	$\sigma_z$	0.02
Reentry probability	$\psi$	0.0385
Default cost: linear	$d_0$	-0.24
Default cost: quadratic	$d_1$	0.3

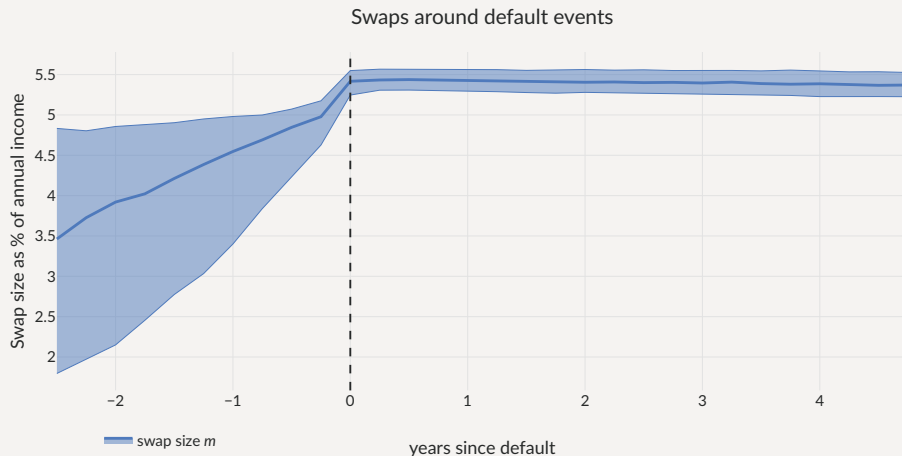
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## How Do Swaps Affect Equilibrium?

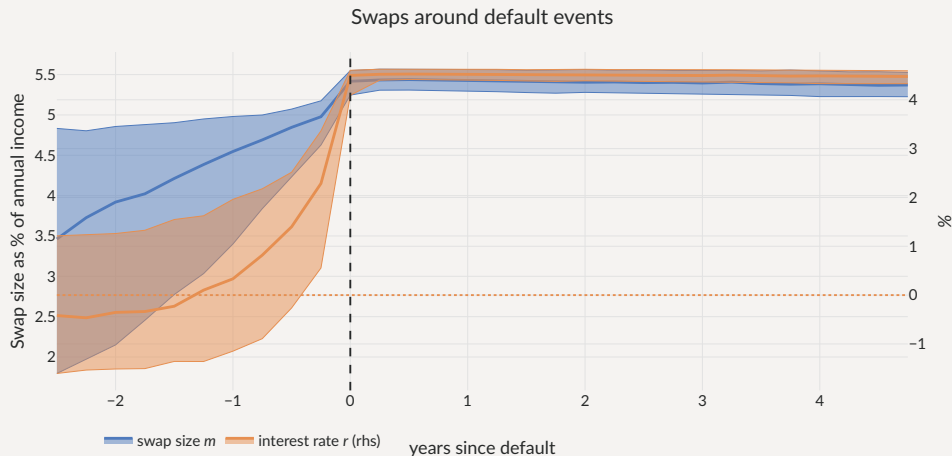
	No swap	Unrestricted, $\theta = 0.25$	Unrestricted, $\theta = 0.5$
Avg spread (bps)	804	1841	2396
Std spread (bps)	470	1099	1541
$\sigma(c)/\sigma(y)$ (%)	111	111	110
Debt to GDP (%)	21.4	20.8	20.2
Swap to GDP (%)	0	3.74	3.32
Corr. swap & spreads (%)	–	53.8	62.2
Default frequency (%)	6.53	13.0	14.7
Welfare gains (rep)	–	-0.082%	-0.41%

- Swaps shoot up before *and during* defaults



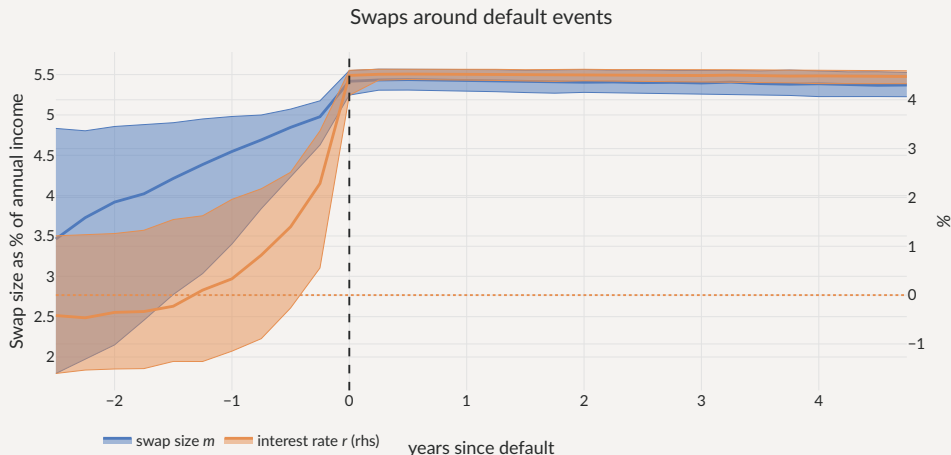
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## Limiting Swaps in Default

- **Limited:** entire swap must be repaid while in default  $\Gamma(m) = 0$

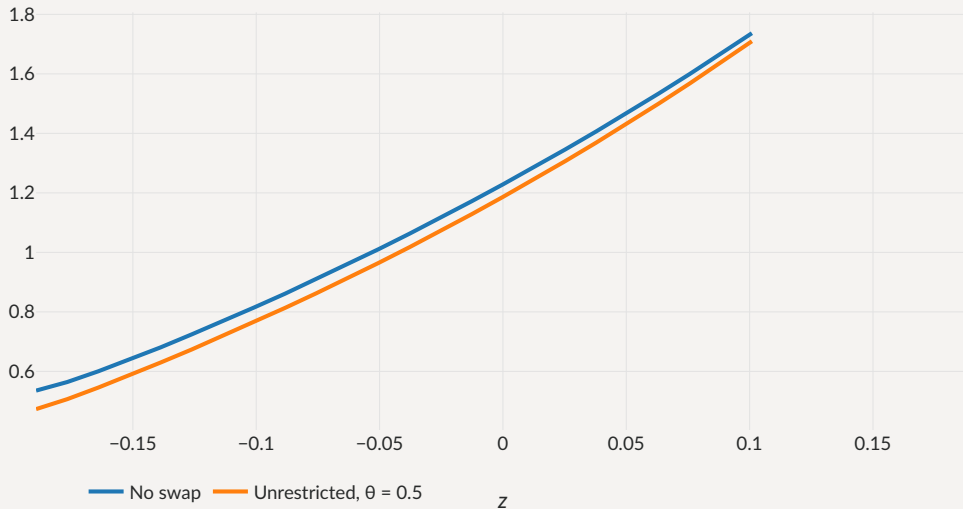
	No swap	Unrestricted, $\theta = 0.5$	Limited, $\theta = 0.5$
Avg spread (bps)	804	2,396	1,216
Std spread (bps)	470	1,541	779
$\sigma(c)/\sigma(y)$ (%)	111	110	113
Debt to GDP (%)	21.4	20.2	21.7
Swap to GDP (%)	0	3.32	1.05
Corr. swap & spreads (%)	–	62.2	69.4
Default frequency (%)	6.53	14.7	9.34
Welfare gains (rep)	–	-0.41%	-0.084%



## Default Barriers with Swaps

- **Unrestricted:** default barrier moves inward, **Limited:** marginal impact

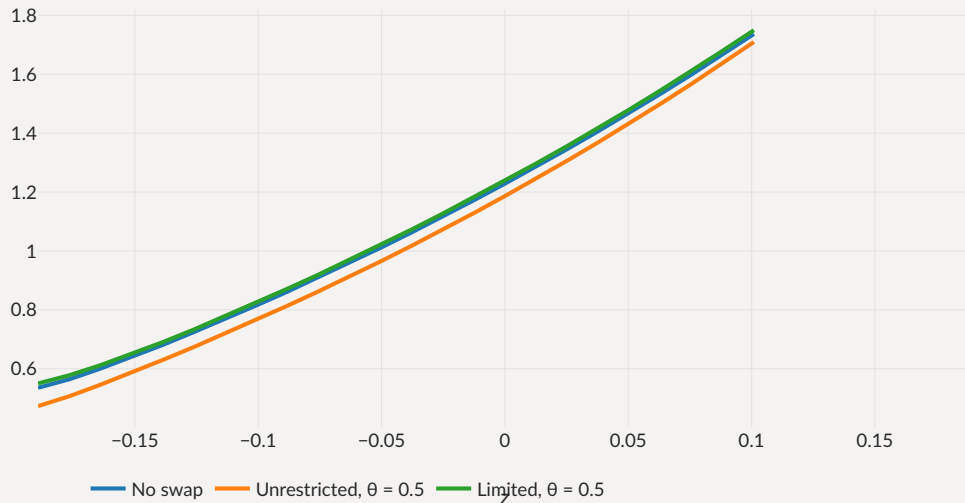
Debt levels at which  $\mathcal{P}(b,m,z)$  crosses 50%



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- **Unrestricted:** default barrier moves inward, **Limited:** marginal impact

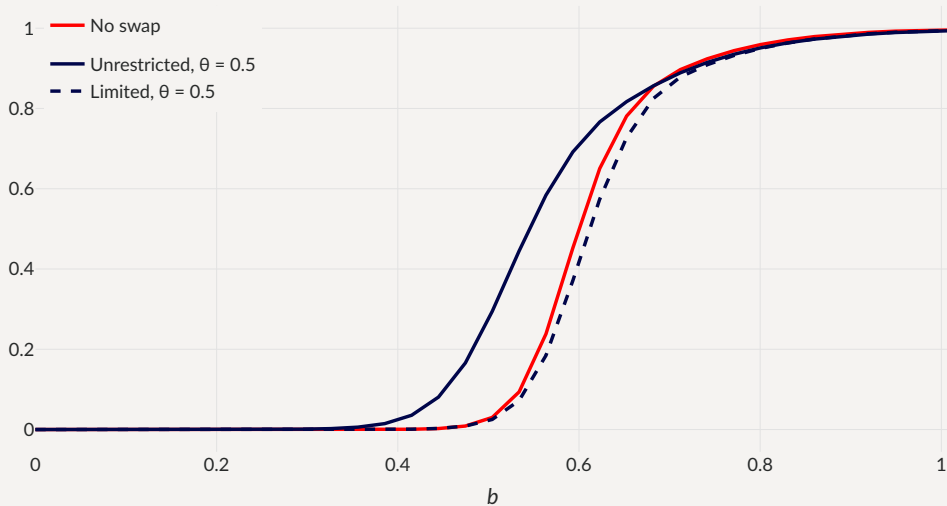
Debt levels at which  $\mathcal{P}(b,m,z)$  crosses 50%



# Debt Tolerance with Swaps

- **Unrestricted:** default more often,    **Limited:** marginal impact

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



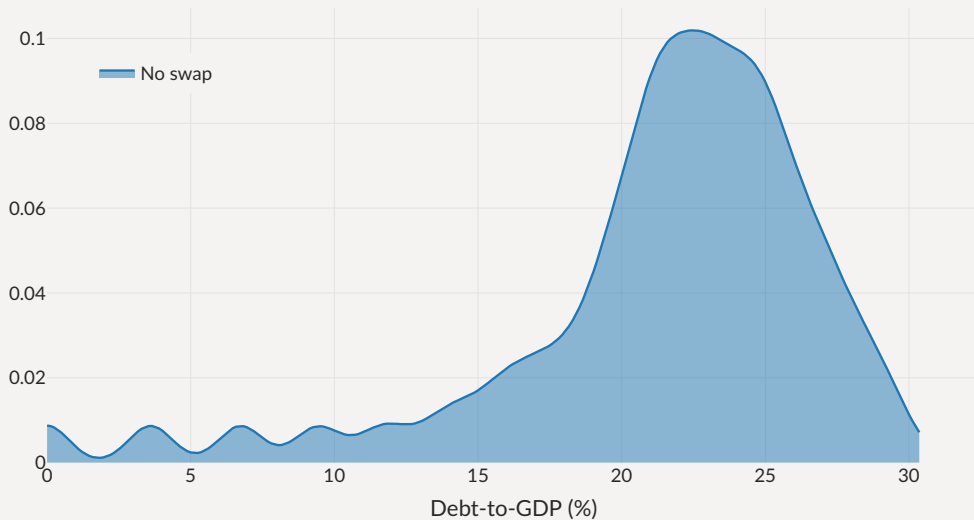
If **Limited** swaps help repay the debt,

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Why are there **more** defaults with swaps?

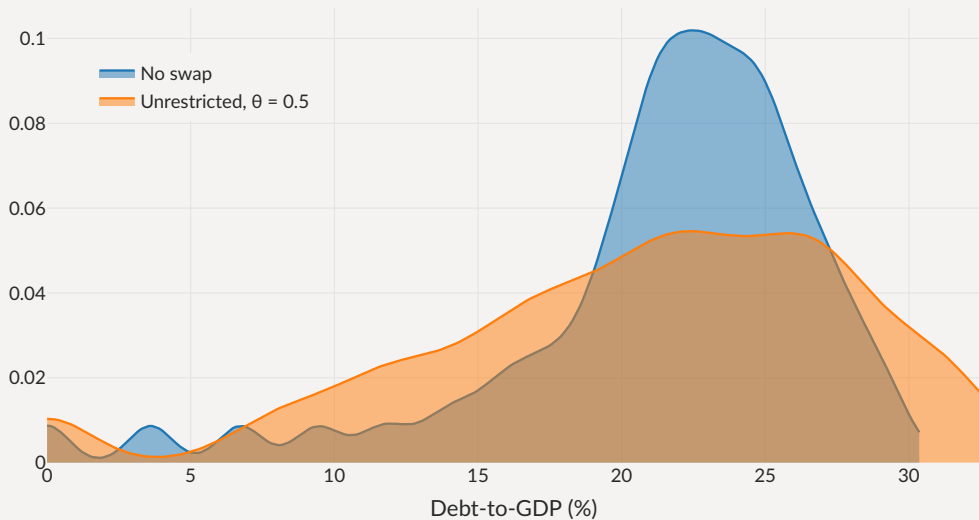
## Debt Levels with Swaps

Distribution of debt levels



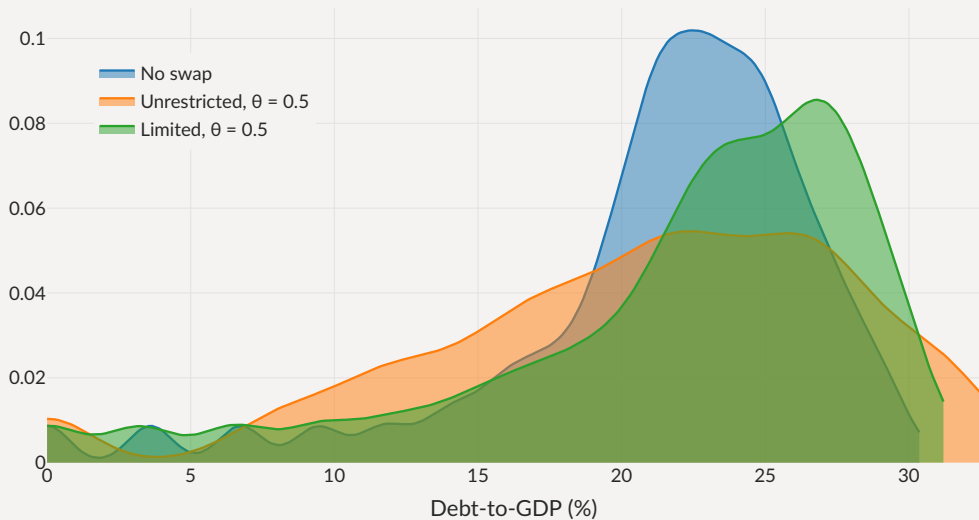
# Debt Levels with Swaps

Distribution of debt levels



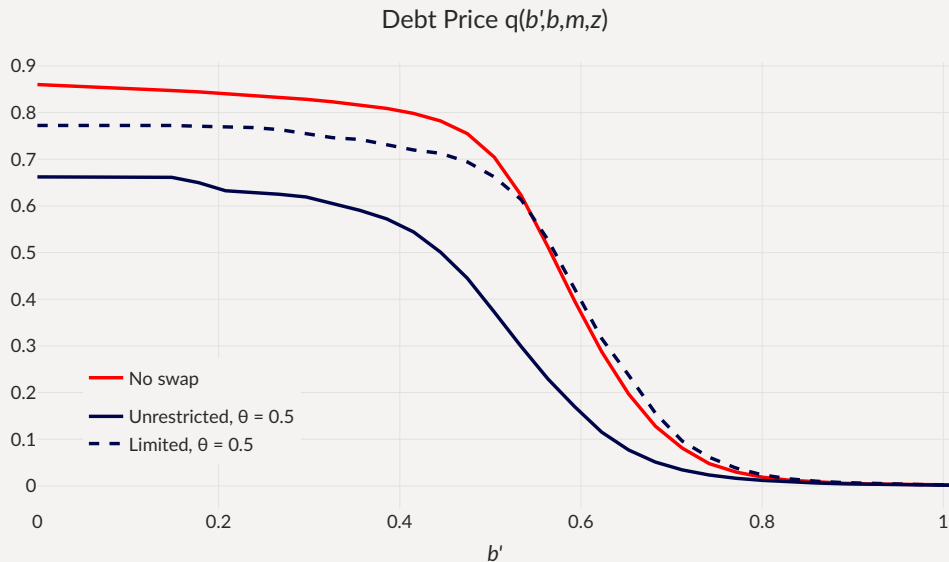
# Debt Levels with Swaps

Distribution of debt levels



## Debt Prices with Swaps

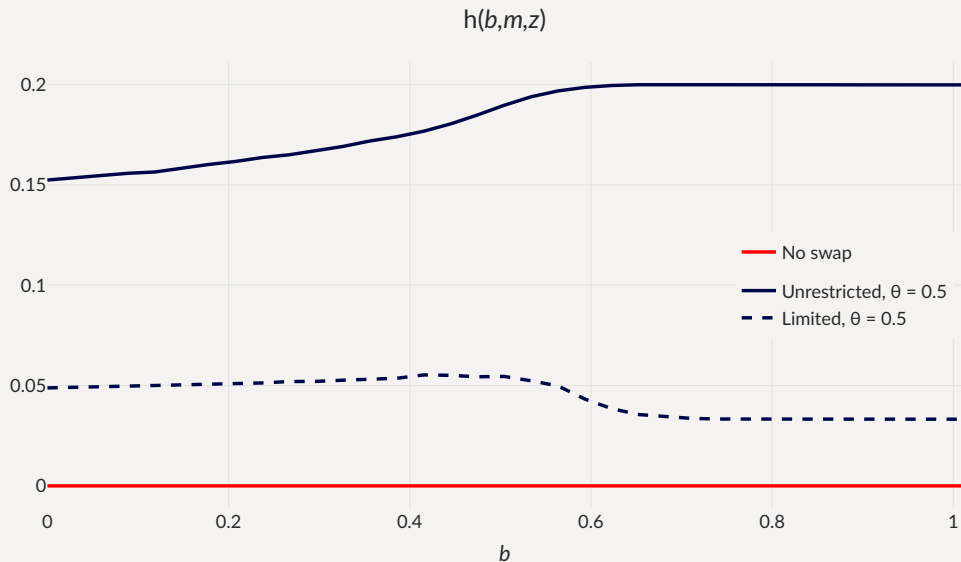
Lower prices with same default rates: [relational overborrowing](#) similar to debt dilution





# Monopolist's Profits

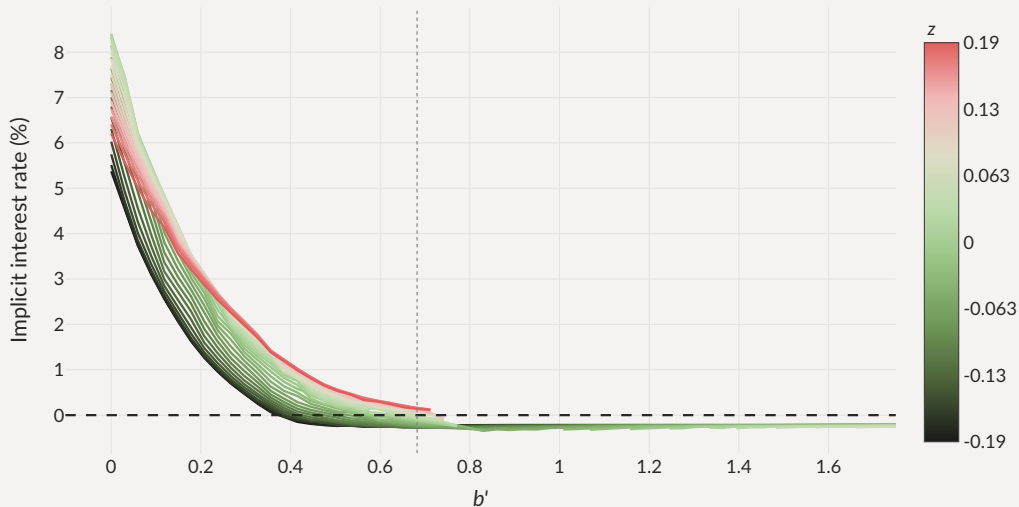
Monopolist's profits **increasing** in debt (cond. on repayment) – surplus requires spreads  $> 0$



## Risk-taking Incentives

Surplus on swap requires spreads  $> 0$ : monopolist provides **incentives** for risk taking

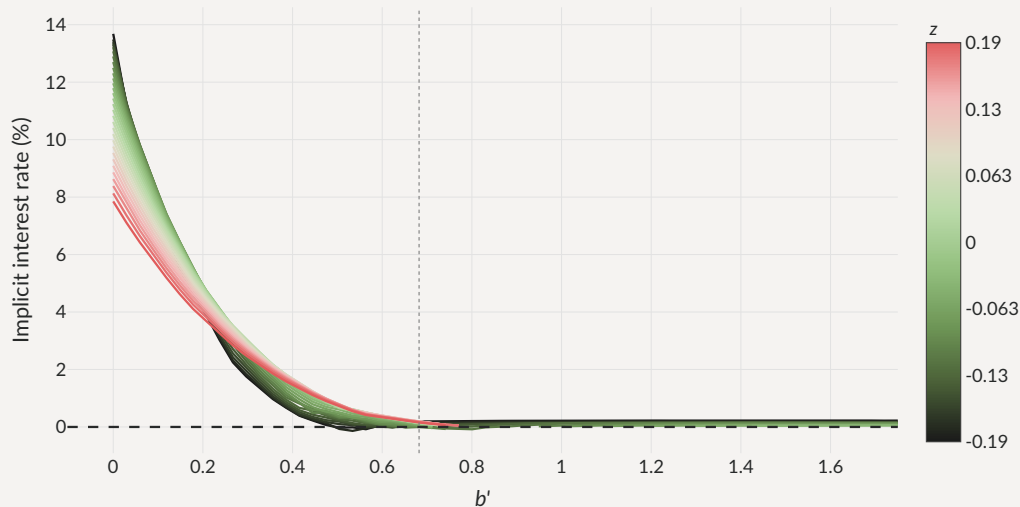
Interest rate on the swap (Unrestricted)



## Risk-taking Incentives

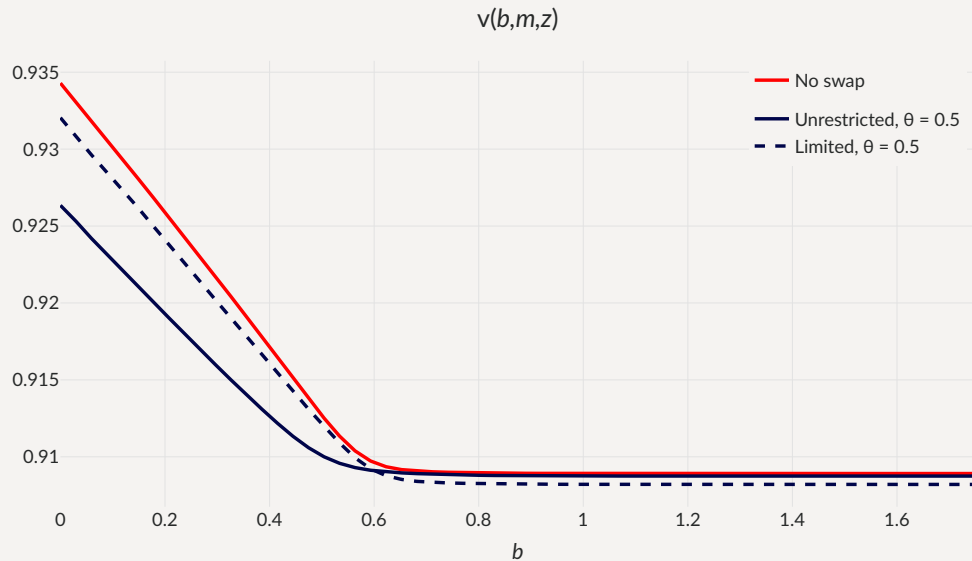
Surplus on swap requires spreads  $> 0$ : monopolist provides **incentives** for risk taking

Interest rate on the swap (Limited)



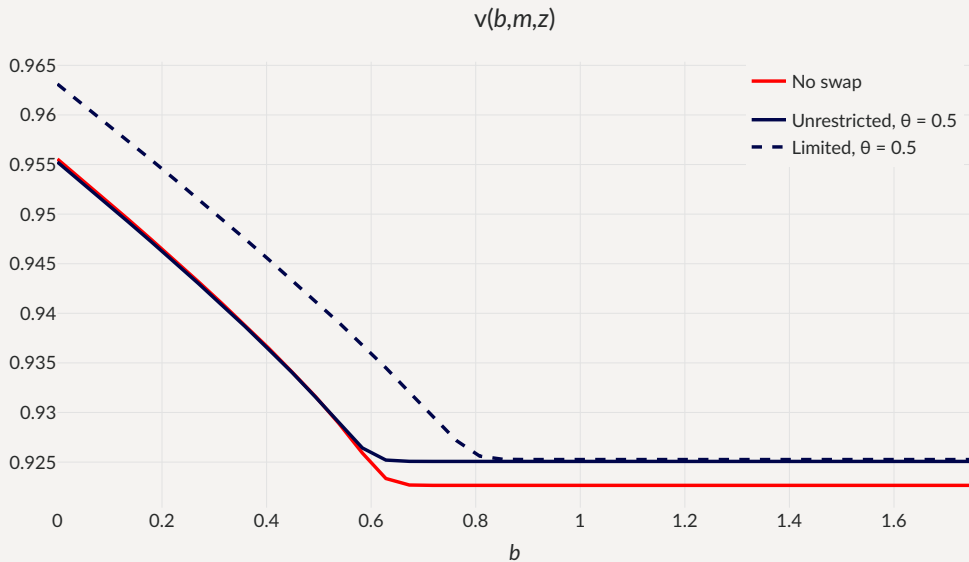
# Welfare Effects of Swap Lines

Limited  $\succcurlyeq$  Unrestricted, but...



## Welfare Effects of Swap Lines — Short-term Debt

Short-term debt: swaps beneficial – interest on the swap **small** wrt to *whole* debt stock



## Exogenous Terms for Bilateral Loan

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- Bargaining over bilateral terms endogenously leads to punishment for deleveraging
- Explore interest rate rules of the form

$$r(b', m') = \max\{r, \alpha_0 + \alpha_b b' + \alpha_m m'\}$$

- Two versions
  - Risk-inducing rule:  $\alpha_0 > 0, \alpha_b < 0, \alpha_m = 0$
  - Size-dependent (similar to surcharges):  $\alpha_0 > 0, \alpha_b = 0, \alpha_m > 0$

## Equilibrium with Exogenous Rules

	No swap	Size dependent $r$	Risk inducing $r$	Limited, $\theta = 0.5$
Avg spread (bps)	802	635	1,118	1,211
Std spread (bps)	454	241	1,051	753
$\sigma(c)/\sigma(y)$ (%)	112	120	118	113
Debt to GDP (%)	21.5	25.8	21.9	21.8
Swap to GDP (%)	0	2.32	1.37	1.05
Swap spread (bps)	–	836	2,267	408
Corr. swap & spreads (%)	–	50.2	43.6	70.1
Default frequency (%)	6.27	5.13	7.56	9.17
Welfare gains (rep)	–	0.61%	-0.094%	-0.084%



## Concluding remarks

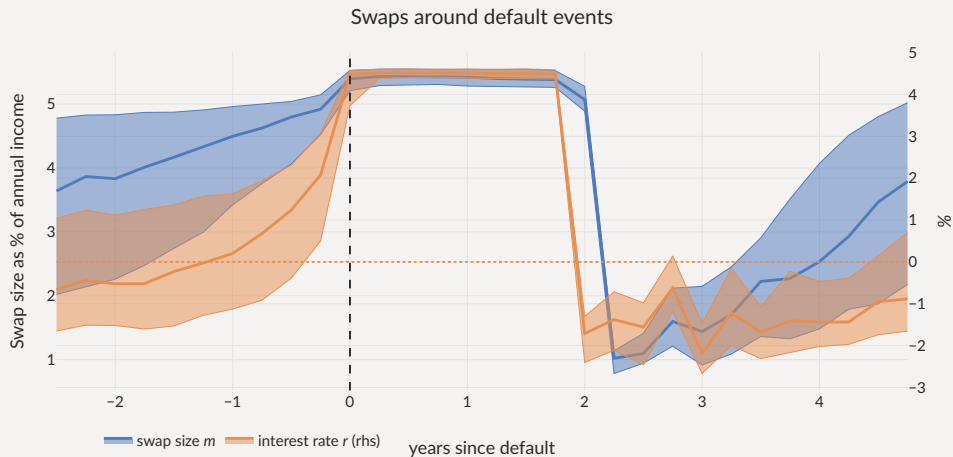
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# The Perils of Bilateral Sovereign Debt

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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?
  - Relational overborrowing – more gains from fiscal rules, state-contingent debt?
- Simple test to determine welfare gains of a new instrument

- Further conditioning on default events lasting exactly two years



# When is the Swap Used?

- With Limited:  $\Gamma(m) = m$

