

# Central Bank Swap Lines as Bilateral Sovereign Debt

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June 2024

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its Executive Board, or its management.

# Symmetric and Asymmetric 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)

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How do swap lines interact with 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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# The Dangers of Borrowing through Swap Lines

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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 (2023)

Model

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# Environment

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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**


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

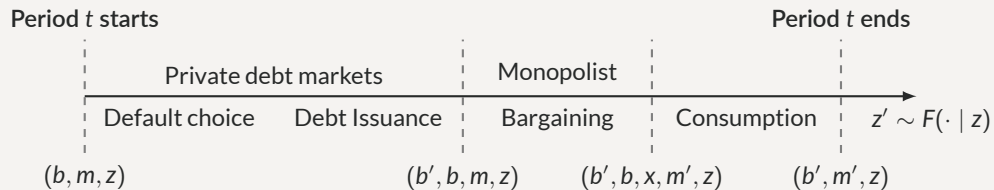
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# Timeline of events





## 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

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

$$m' = m'(b', b, m, z)$$

$$b'' = b'(b', m', z')$$

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same sdf as monopolist

## Bargaining stage with monopolist

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

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

↖ Lender surplus
↖ Government surplus

- Lender's surplus

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

- Government's surplus

$$\begin{aligned} \mathcal{B}_R(b', b, x, m, m', z) = & \underbrace{u(y(z) + B(b', b, m, z) + x) + \beta \mathbb{E}[v(b', m', z') | z]}_{\text{agreement}} \\ & - \underbrace{(u(y(z) + B(b', b, m, z) - m) + \beta \mathbb{E}[v(b', 0, z') | z])}_{\text{threat point}} \end{aligned}$$

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## Quantitative Effects of Swap Lines

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# Calibration

- 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?

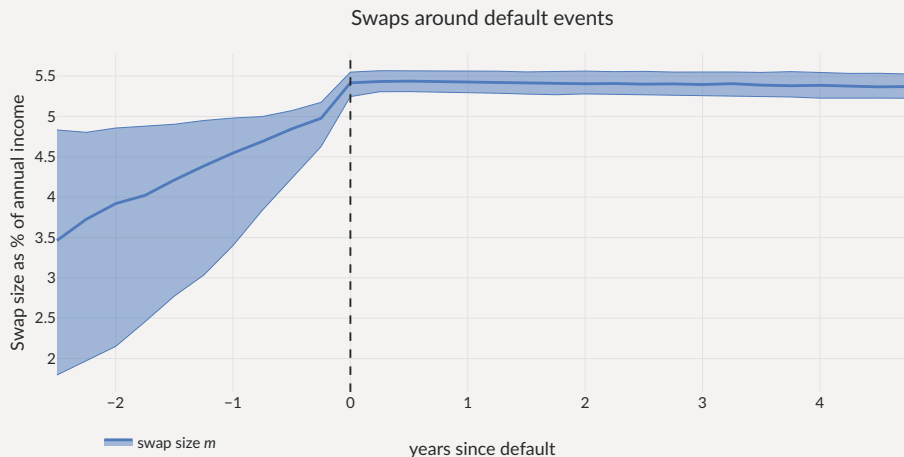
	No swap	Unrestricted, $\theta = 0.25$	Unrestricted, $\theta = 0.5$
Avg spread (bps)	804	1841	2396
Std spread (bps)	470	1099	1541
$\sigma(c)/\sigma(y)$ (%)	111	111	110
Debt to GDP (%)	21.4	20.8	20.2
Swap to GDP (%)	0	3.74	3.32
Corr. swap & spreads (%)	–	53.8	62.2
Default frequency (%)	6.53	13.0	14.7
Welfare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

# When is the Swap Used?

▶ Limited

▶ More

- Swaps shoot up before *and during* defaults



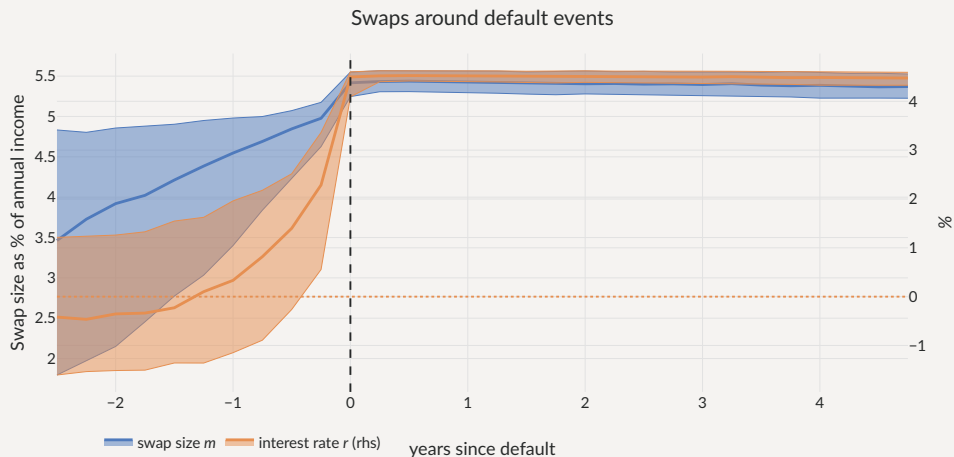
- Also consider **Limited** versions:  $m' \leq \Gamma(m)$  while in default

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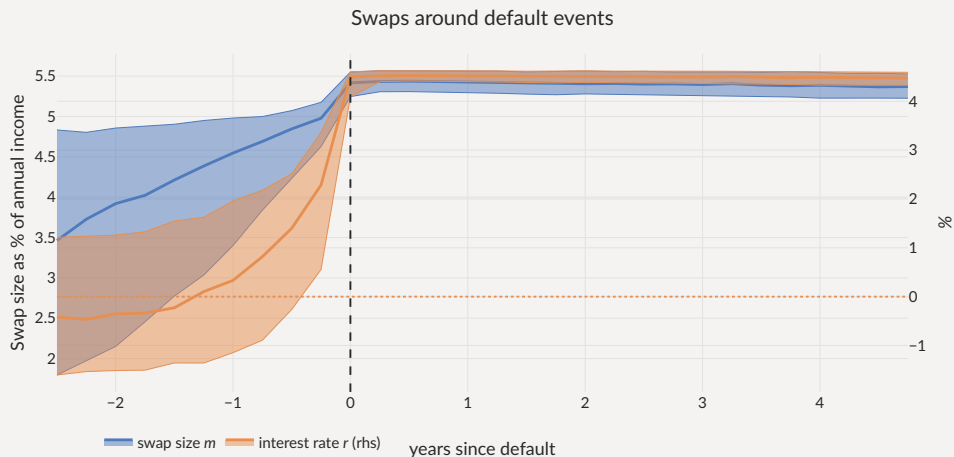
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- Also consider **Limited** versions:  $m' \leq \Gamma(m)$  while in default

## Limiting swaps in default

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

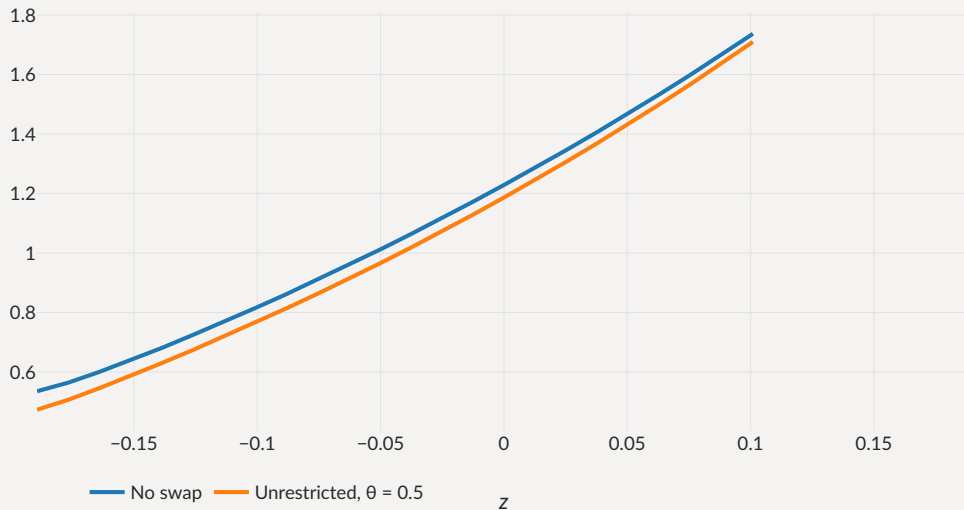
	No swap	Unrestricted, $\theta = 0.5$	Limited, $\theta = 0.5$
Avg spread (bps)	804	2396	1216
Std spread (bps)	470	1541	779
$\sigma(c)/\sigma(y)$ (%)	111	110	113
Debt to GDP (%)	21.4	20.2	21.7
Swap to GDP (%)	0	3.32	1.05
Corr. swap & spreads (%)	-	62.2	69.4
Default frequency (%)	6.53	14.7	9.34
Welfare gains (rep)	-	-0.41%	-0.084%



## Default Barriers with Swaps

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

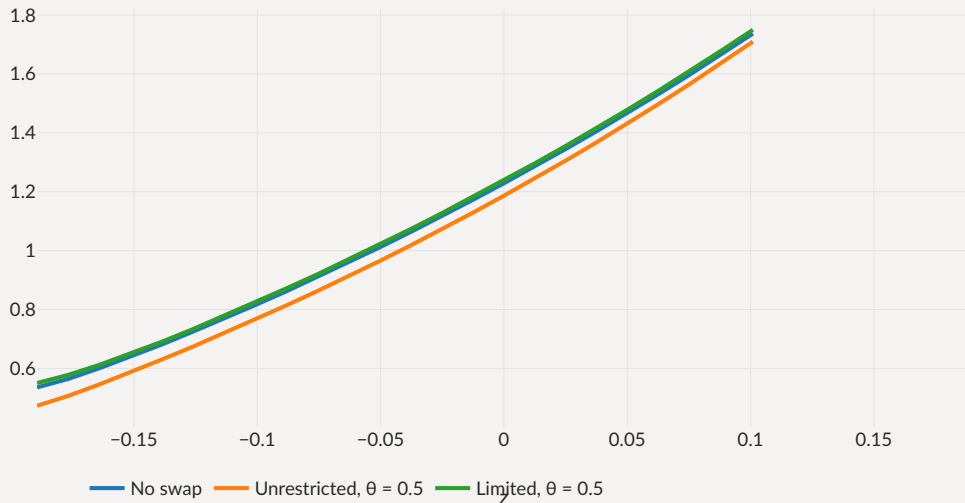
Debt levels at which  $\mathcal{P}(b,m,z)$  crosses 50%



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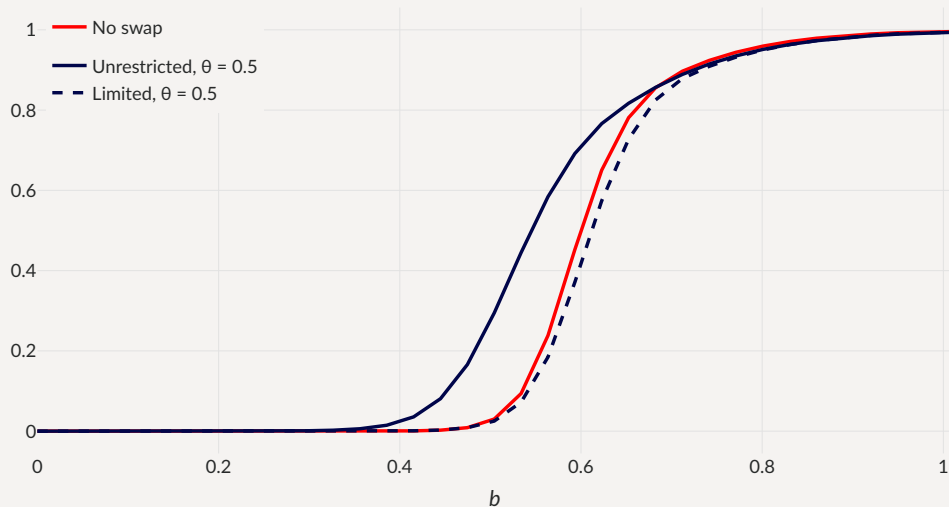
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# Debt Tolerance with Swaps

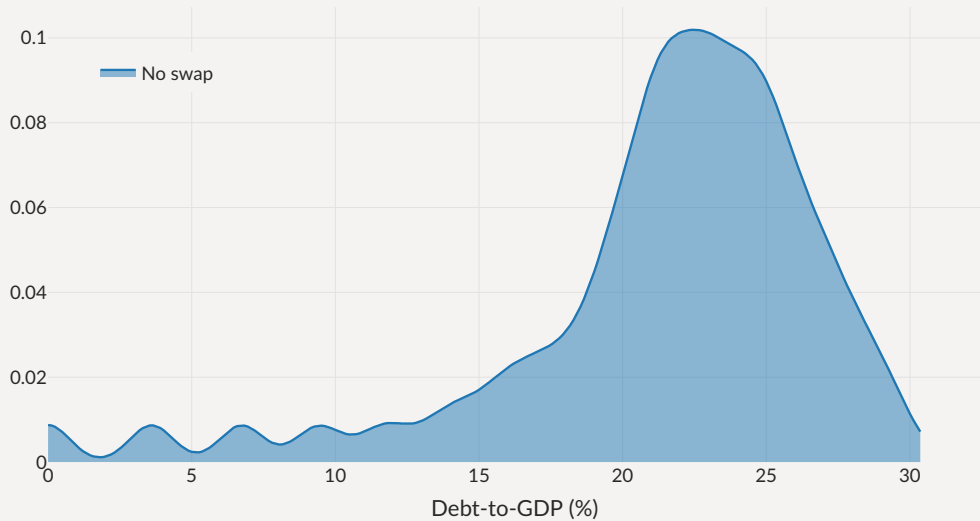
- Unrestricted: default more often, Limited: marginal impact

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



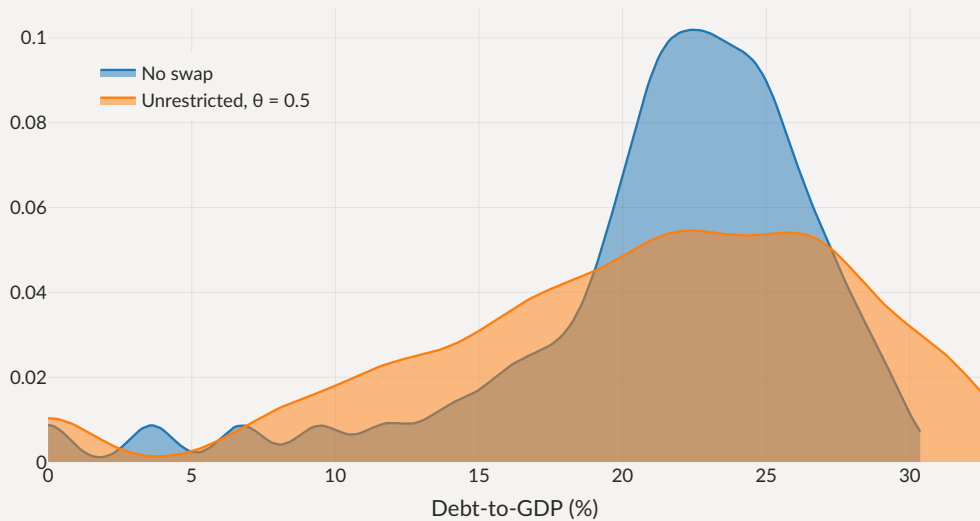
# Debt Levels with Swaps

Distribution of debt levels



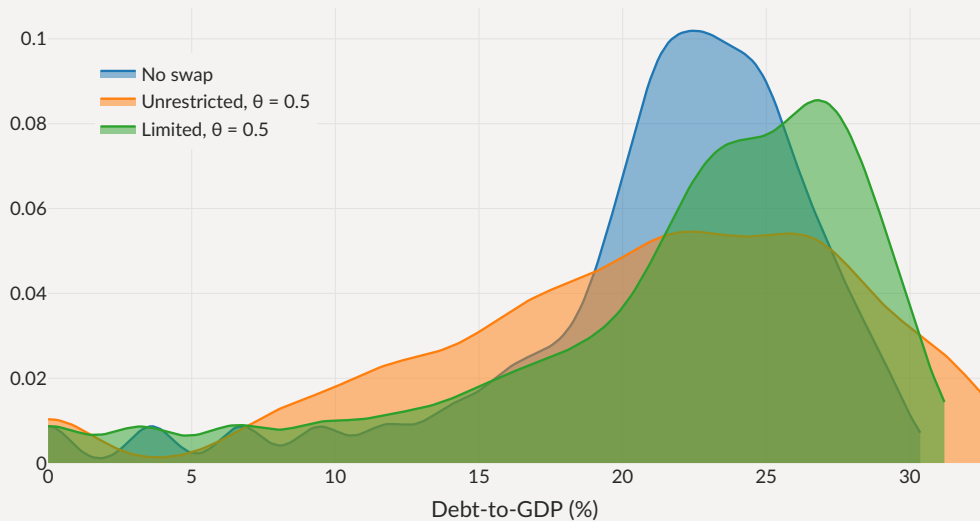
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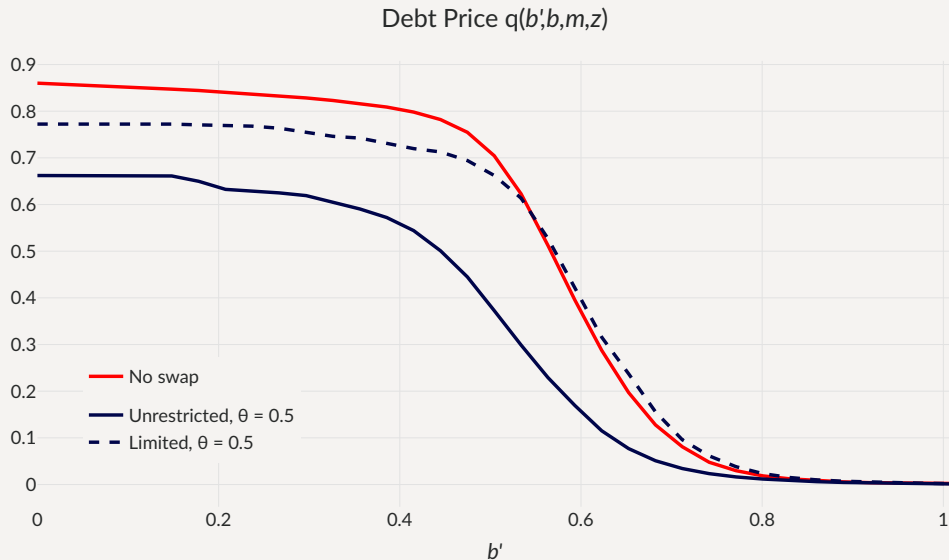
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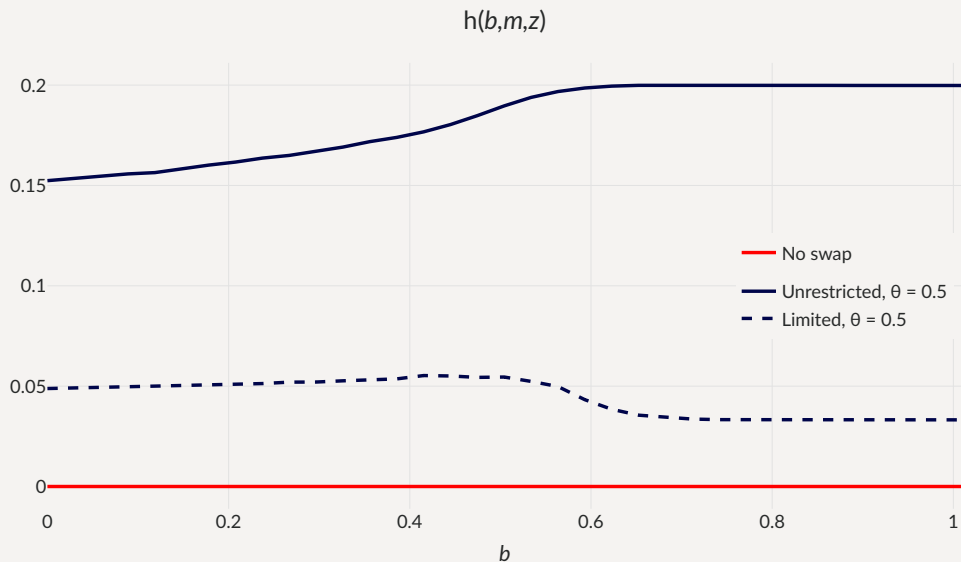
# Debt Prices with Swaps

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  $> 0$

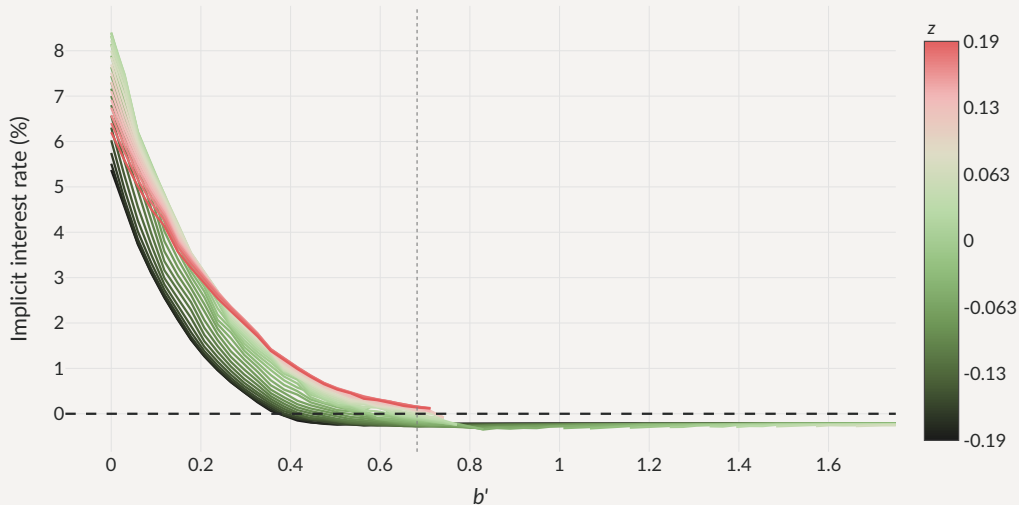




# Risk-taking incentives

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

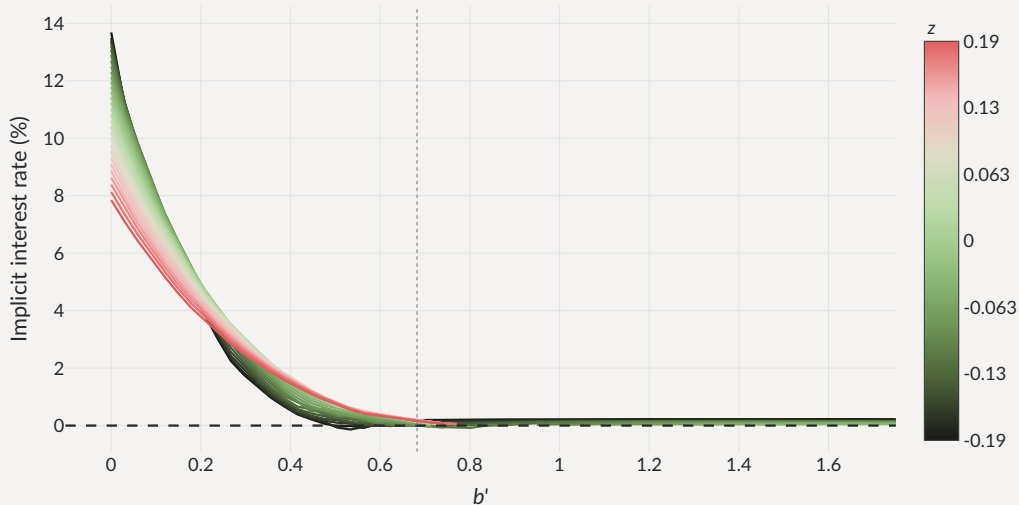
Interest rate on the swap (Unrestricted)



# Risk-taking incentives

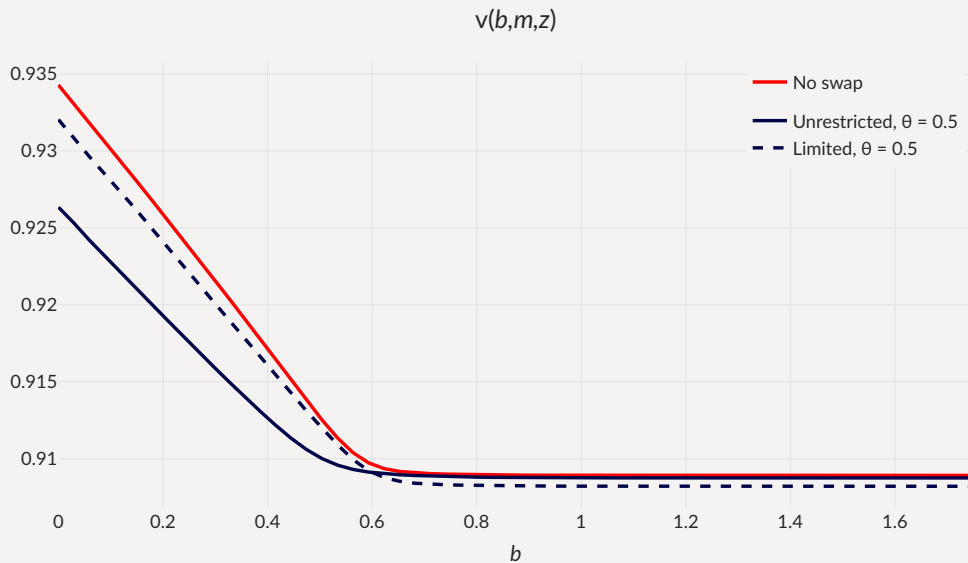
Surplus on swap requires spreads  $> 0$ : monopolist provides **incentives** for risk taking

Interest rate on the swap (Limited)



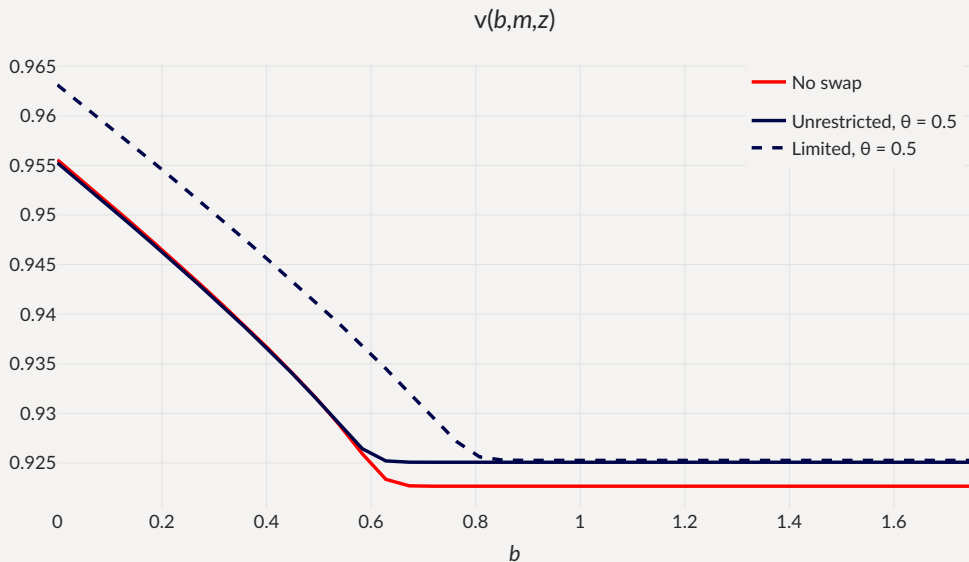
# Welfare effects of swap lines

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



## Welfare effects of swap lines – Short-term debt (cont'd)

	No swap, ST	Unrestricted, $\theta = 0.5$ , ST	Limited, $\theta = 0.5$ , ST
Avg spread (bps)	80.7	377	247
Std spread (bps)	110	373	197
$\sigma(c)/\sigma(y)$ (%)	129	130	138
Debt to GDP (%)	19.0	18.7	23.5
Swap to GDP (%)	0	3.13	3.65
Corr. swap & spreads (%)	–	54.9	50.3
Default frequency (%)	0.574	3.14	1.97
Welfare gains (rep)	–	-0.074%	0.8%

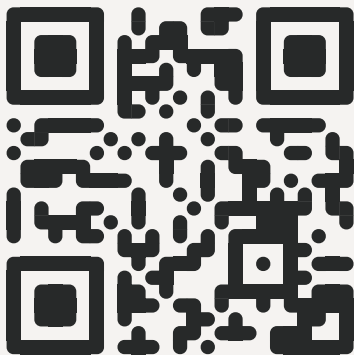
## Concluding remarks

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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?
  - Relational overborrowing – more gains from fiscal rules, state-contingent debt?

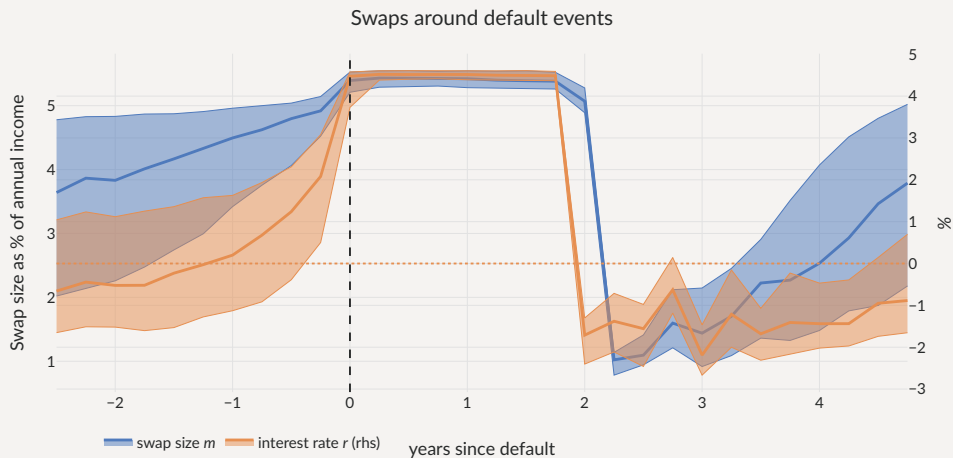


*Scan to find the paper*



# When is the Swap Used?

- Further conditioning on default events lasting exactly two years



# When is the Swap Used?

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

