

Central Bank Swap Lines as Bilateral Sovereign Debt

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XXVI Workshop in International Economics and Finance
September 2024

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Uses of Swap Lines

- **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?

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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- 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, (collateralized) bilateral loans, IMF programs...

The Dangers of Borrowing through Swap Lines

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); Bahaj, Fuchs, and Reis (2024)
- Sovereign debt/default with interactions from 'official' debt
 - ... Boz (2011), Hatchondo, Martinez, and Onder (2014), Arellano and Barreto (2023), Hatchondo, Martinez, and Sosa-Padilla (2024), Liu, Liu, and Yue (2024)

Model

Environment

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**


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

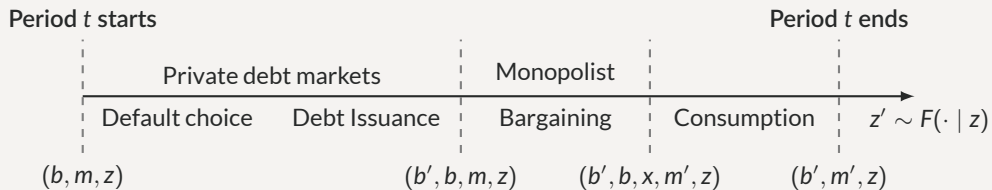
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Timeline of events



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

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

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

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Bargaining: intuition

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- When $\mathbb{E} [h(b', m', z') - h(b', 0, z')]$ is high: monopolist willing to lend at low rates

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- If default risk is low, not much role for monopolist
- 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

Calibration

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

	Parameter	Value
Sovereign's discount factor	β	0.9504
Sovereign's risk aversion	γ	2
Preference shock scale parameter	χ	0.02
Lender's bargaining power	θ	0.5
Risk-free interest rate	r	0.01
Duration of debt	ρ	0.05
Income autocorrelation coefficient	ρ_z	0.9484
Standard deviation of y_t	σ_z	0.02
Reentry probability	ψ	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?

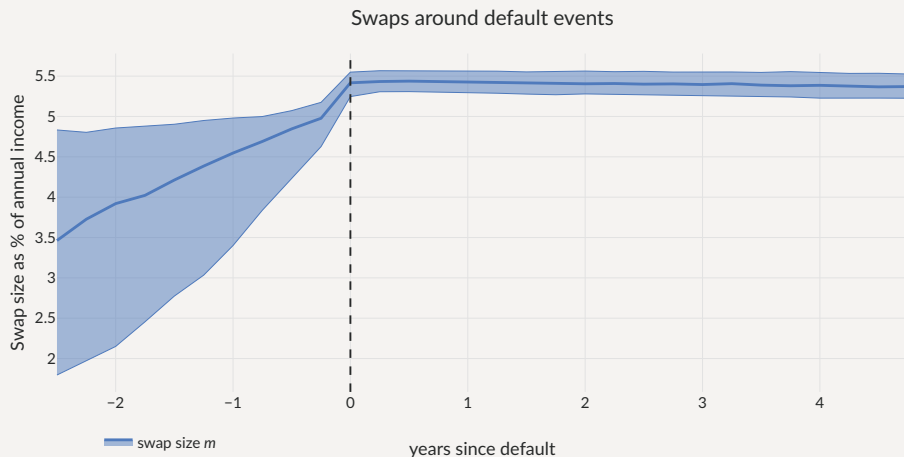
	No swap	Unrestricted, $\theta = 0.25$	Unrestricted, $\theta = 0.5$
Avg spread (bps)	804	1,841	2,396
Std spread (bps)	470	1,099	1,541
$\sigma(c)/\sigma(y)$ (%)	111	111	110
Debt to GDP (%)	21.4	20.8	20.2
Swap to GDP (%)	0	3.74	3.32
Corr. swap & spreads (%)	–	53.8	62.2
Default frequency (%)	6.53	13	14.7
Welfare gains (rep)	–	-0.082%	-0.41%

When is the Swap Used?

▶ Limited

▶ More

- Swaps shoot up before *and during* defaults



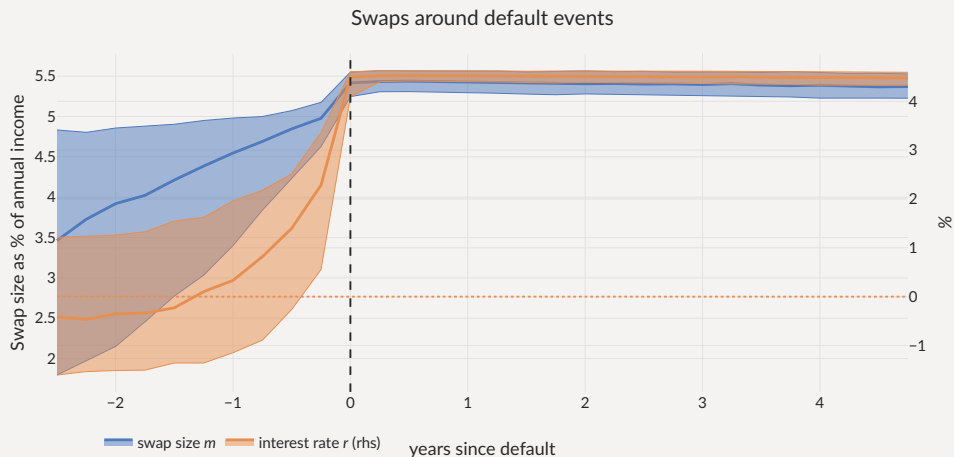
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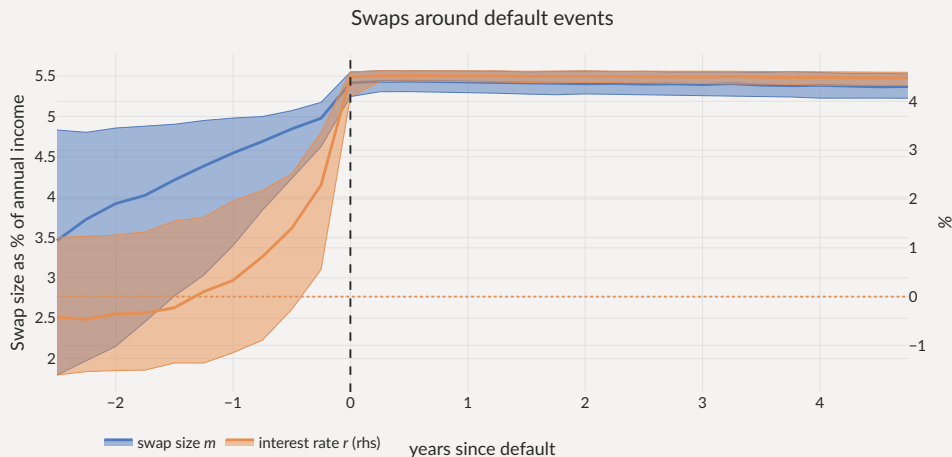
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Limiting swaps in default

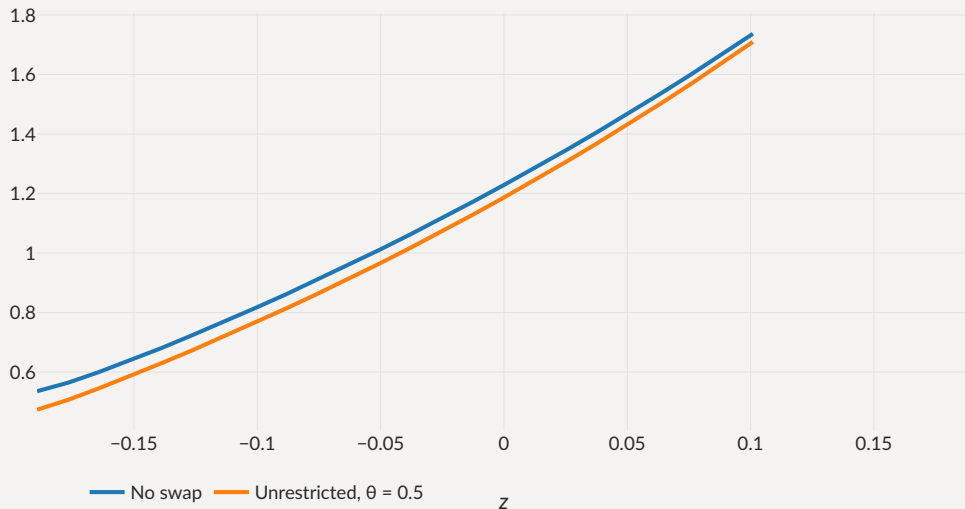
- Limited: entire swap must be repaid while in default $\Gamma(m) = 0$

	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

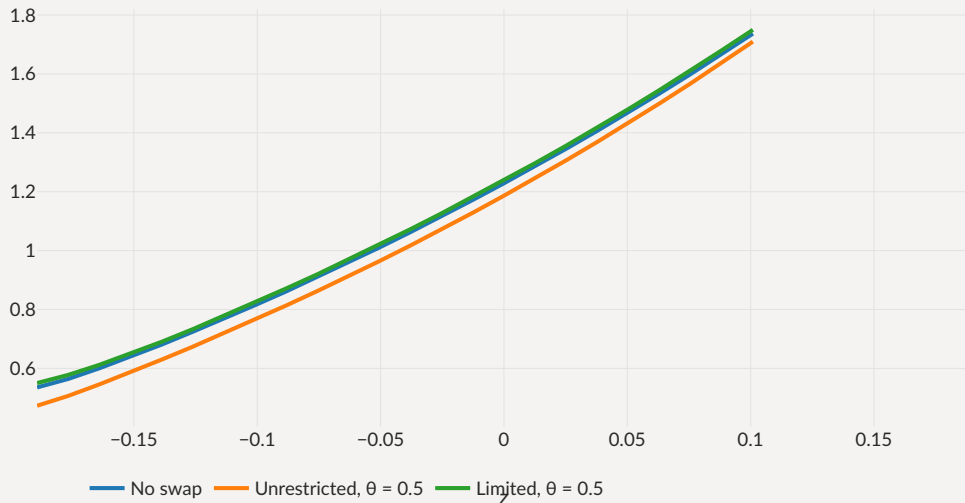
Debt levels at which $\mathcal{P}(b,m,z)$ crosses 50%



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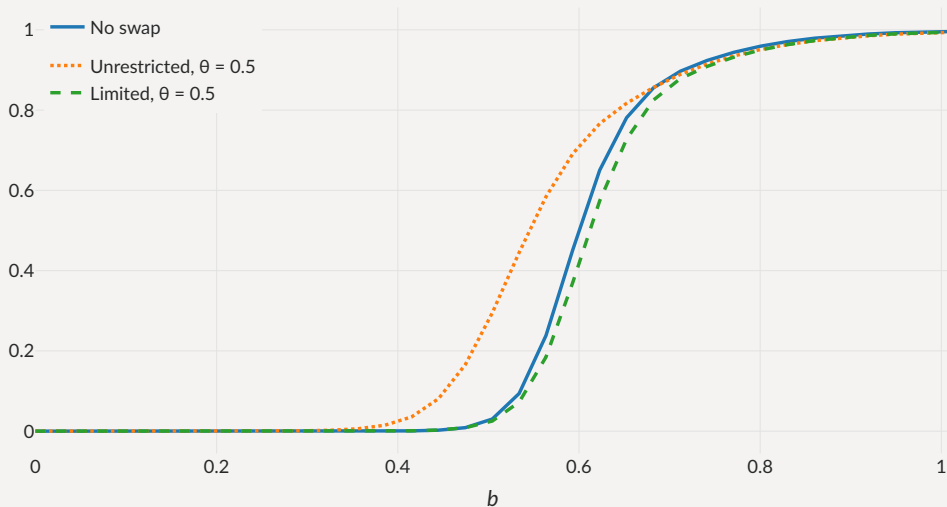
Debt levels at which $\mathcal{P}(b,m,z)$ crosses 50%



Debt Tolerance with Swaps

- Unrestricted: default more often, Limited: marginal impact

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

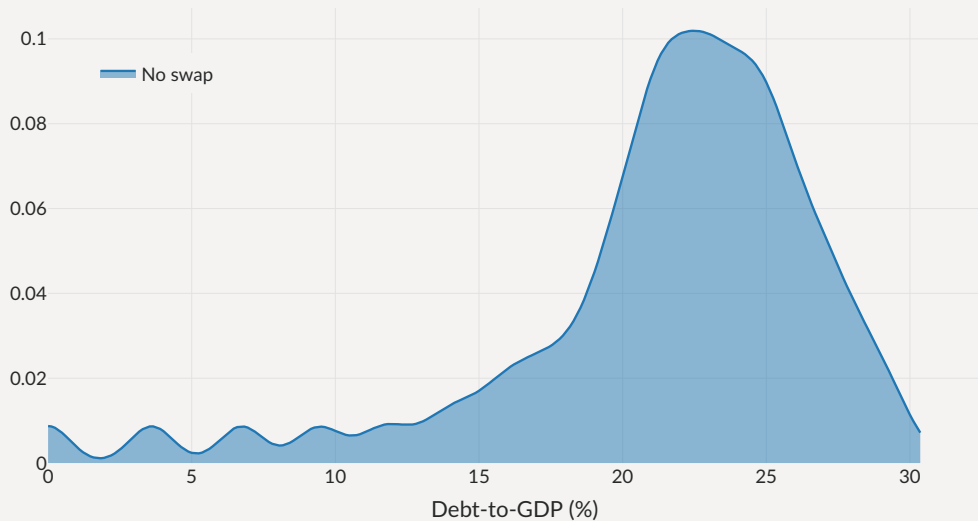


If **Limited** swaps help repay the debt,

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

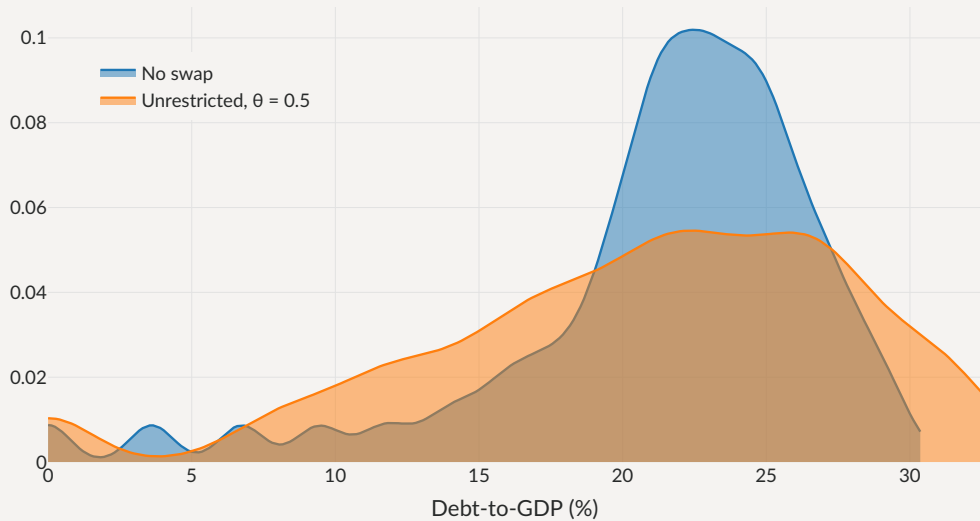
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Distribution of debt levels



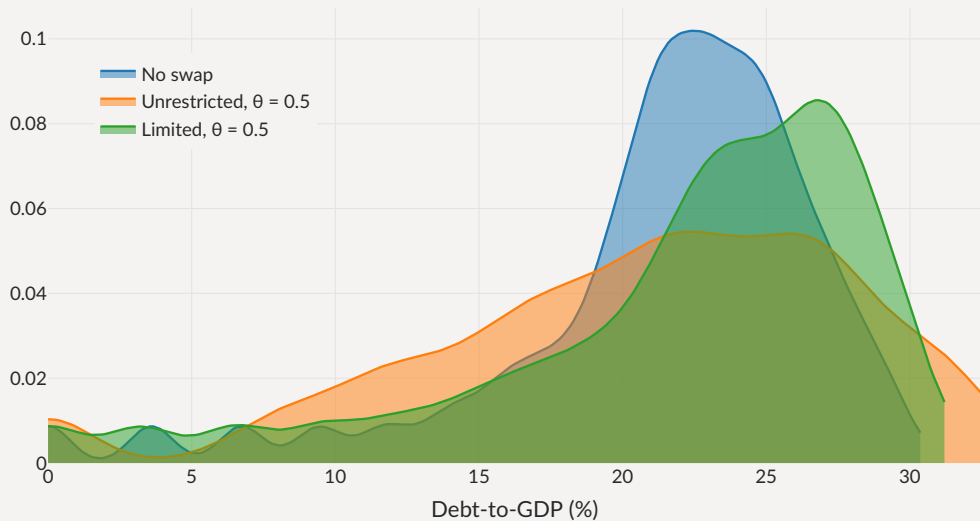
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Relational overborrowing

Surplus

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

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- Low rates when $\mathbb{E} [h(b', m', z') - h(b', 0, z')] \gg 0$ (e.g. when $> m'$)
- High rates when $m - B(b', b, m, z) \gg 0$
- Lender surplus today $\mathbb{E} [h(b', m', z') - h(b', 0, z')]$ is high ($> m'$) when
 - high rates in the future
 - $m' \gg B(b'', b', m', z')$
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Relational overborrowing

Surplus

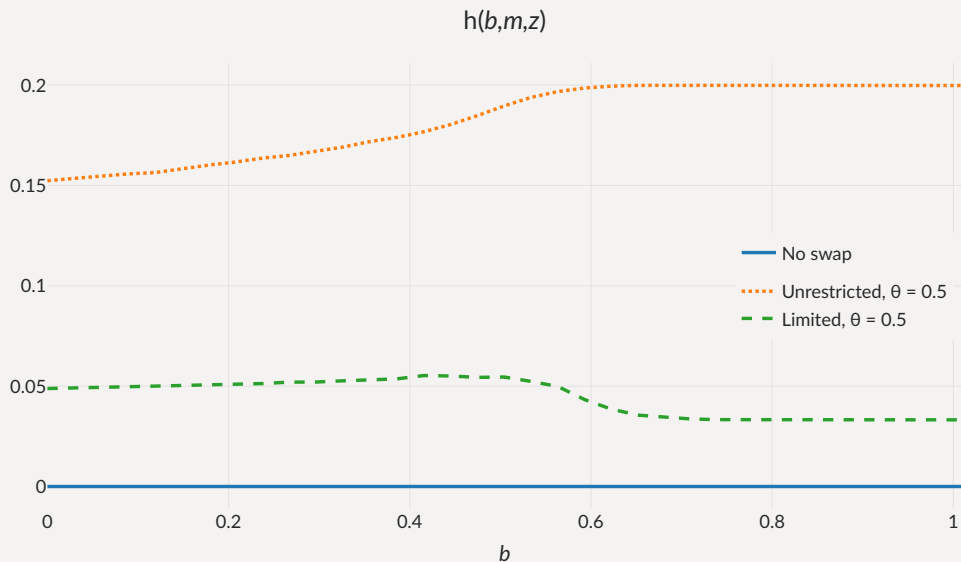
$$\mathcal{L}_R(b', x, m, m', z) = (a - x + \beta_L \mathbb{E}[h(b', m', z') | z]) - (a + m + \beta_L \mathbb{E}[h(b', 0, z') | z])$$

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

- Low rates when $\mathbb{E}[h(b', m', z') - h(b', 0, z')] \gg 0$ (e.g. when $> m'$)
- High rates when $m - B(b', b, m, z) \gg 0$
- Lender surplus today $\mathbb{E}[h(b', m', z') - h(b', 0, z')]$ is high ($> m'$) when
 - high rates in the future
 - $m' \gg B(b'', b', m', z')$
 - $q(b'', b', m', z')$ is low
 - $b' \gg 0$

Monopolist's profits

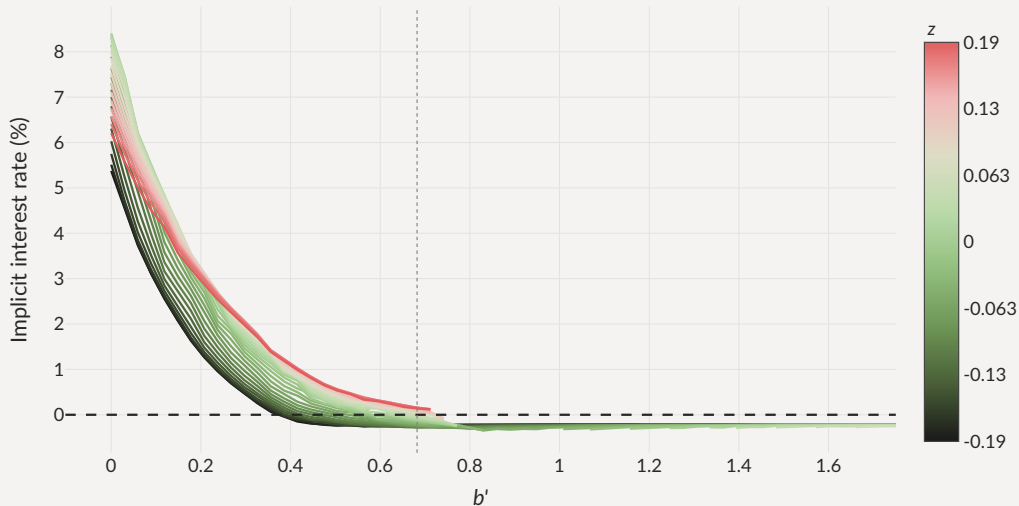
Monopolist's profits **increasing** in debt (cond. on repayment) – surplus requires spreads



Risk-taking incentives

Surplus on swap requires spreads: relationship creates **incentives** for risk taking

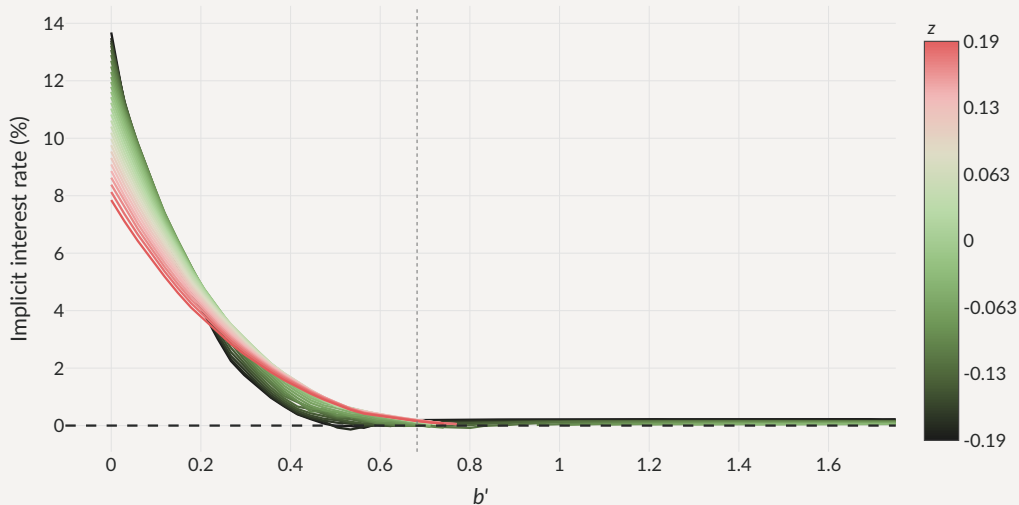
Interest rate on the swap (Unrestricted)



Risk-taking incentives

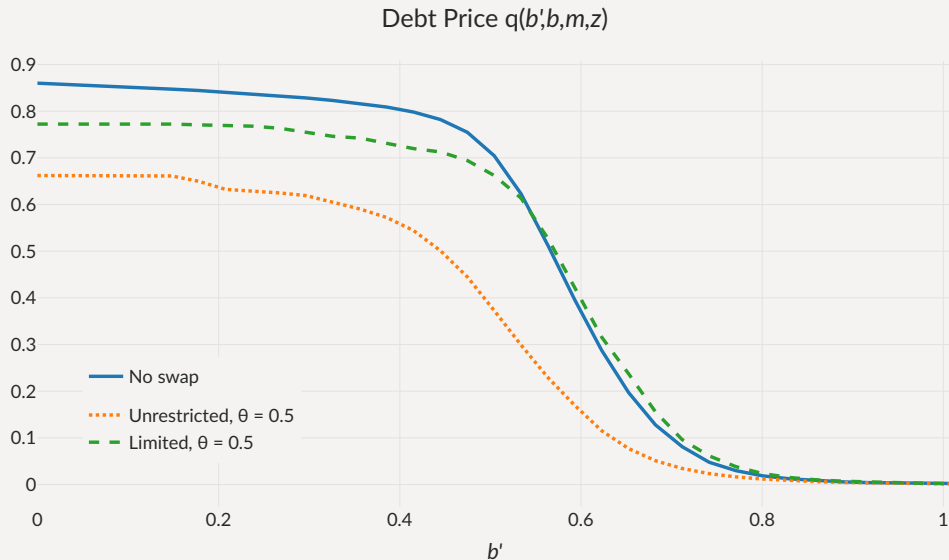
Surplus on swap requires spreads: relationship creates **incentives** for risk taking

Interest rate on the swap (Limited)



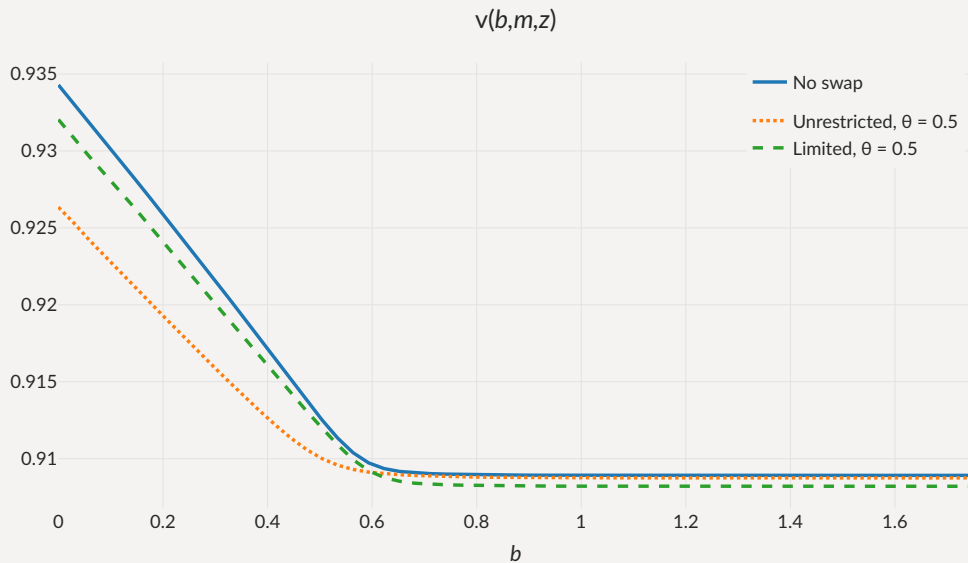
Debt Prices with Swaps

Equilibrium dynamics worsen prices: [relational overborrowing](#) similar to debt dilution



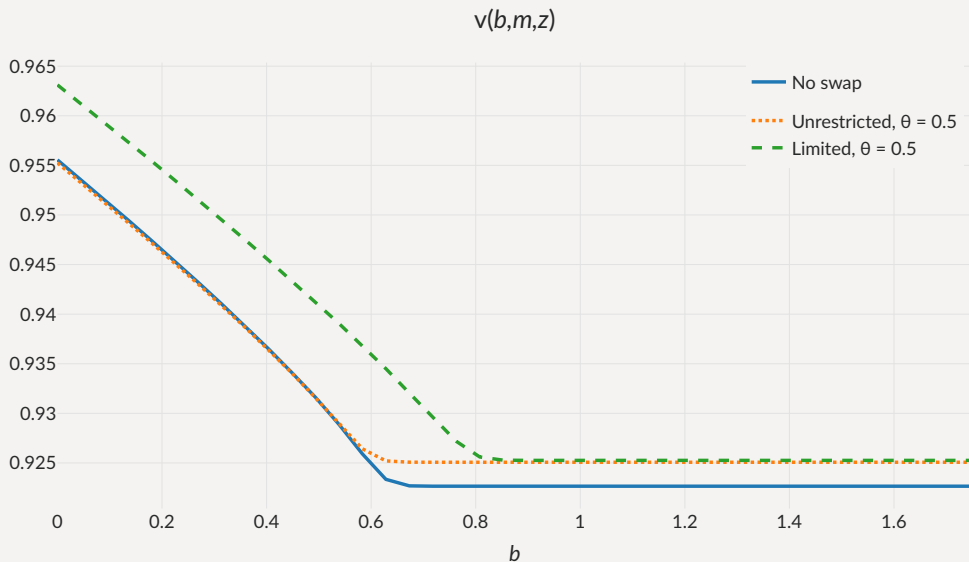
Welfare effects of swap lines

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	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

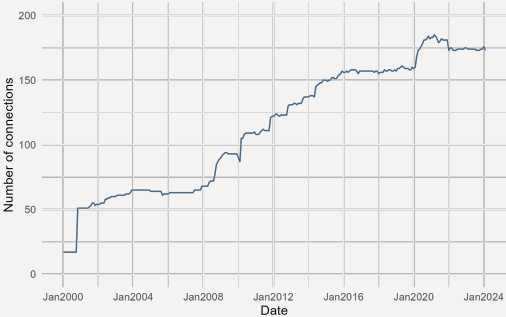
Concluding remarks

- 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
- Relational overborrowing
 - ... unintended consequence of maximizing surplus over time
 - ... arises as swap small relative to debt stock, large relative to debt service
- Large welfare effects, policy challenges
 - How to limit their use during defaults?
 - More gains from fiscal rules, state-contingent debt?
- Market power crucial in model
 - ... how to discipline in model, how to affect in reality?



Scan to find the paper

Motivating Evidence: Increase in `swaps connections'

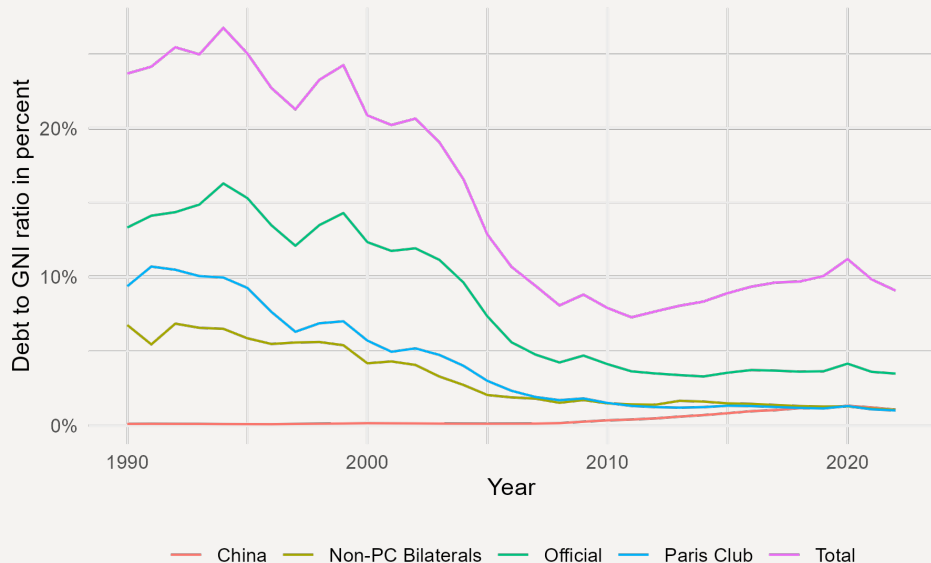


Source: Bahaj, Fuchs, and Reis (2024)



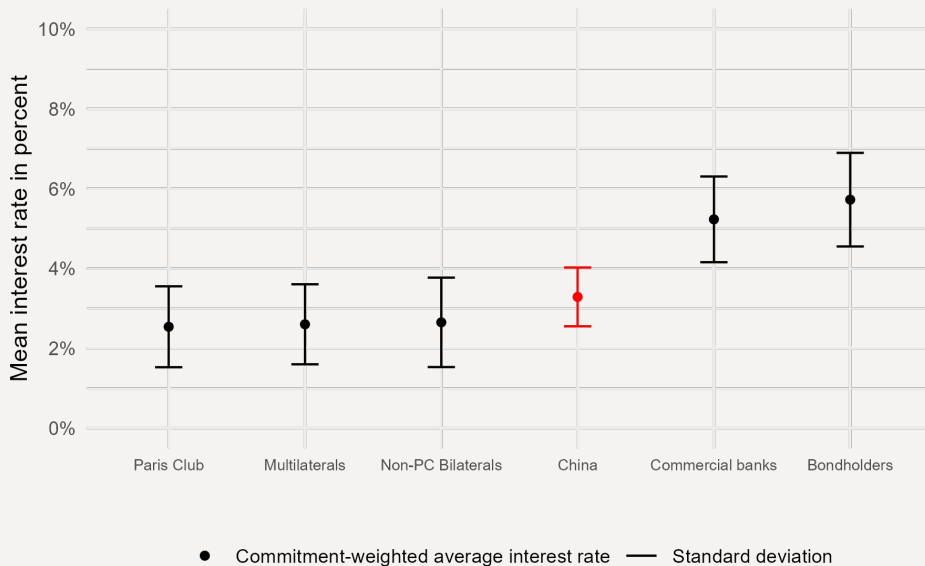
Source: Bahaj, Fuchs, and Reis (2024)

Motivating Evidence: External debt to GNI (weighted)

[< Back](#)

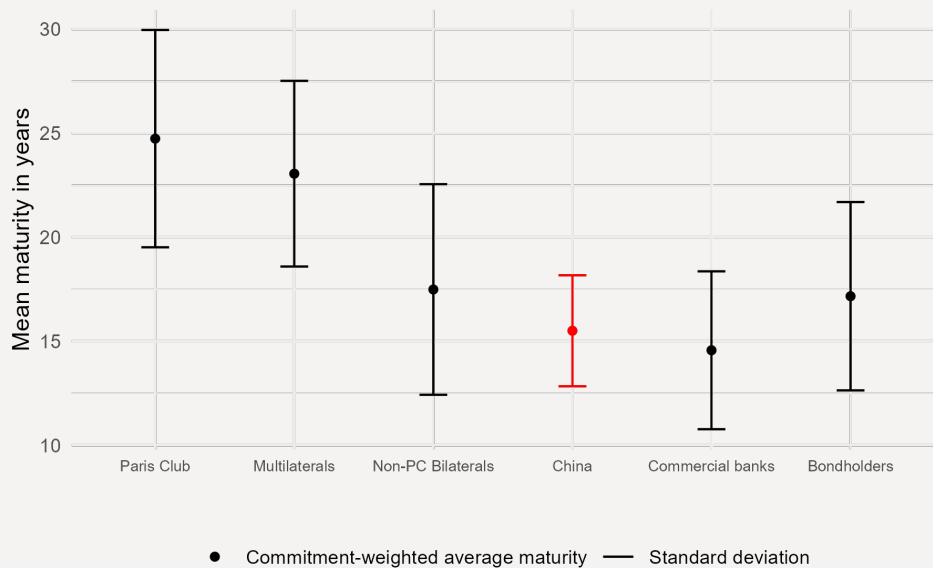
Source: World Bank International Debt Statistics.

Motivating Evidence: Average Interest Rates

[< Back](#)

Source: World Bank International Debt Statistics.

Motivating Evidence: Average Maturity



Source: World Bank International Debt Statistics.

$$r_{i,t}^x = r_{i,t}^{\text{Bond Mkt}} + \gamma_i + \epsilon_{i,t}, \quad x \in \{\text{CHN, Paris Club}\}$$

Dep. Variable	Interest on loans from:	
	China	Paris Club
$r^{\text{Bond Mkt}}$	0.140** (0.063)	0.380*** (0.033)
No. countries	52	70
Observations	200	682
Country FEs	Yes	Yes
Adjusted R ²	0.825	0.777

*p<0.1; **p<0.05; ***p<0.01

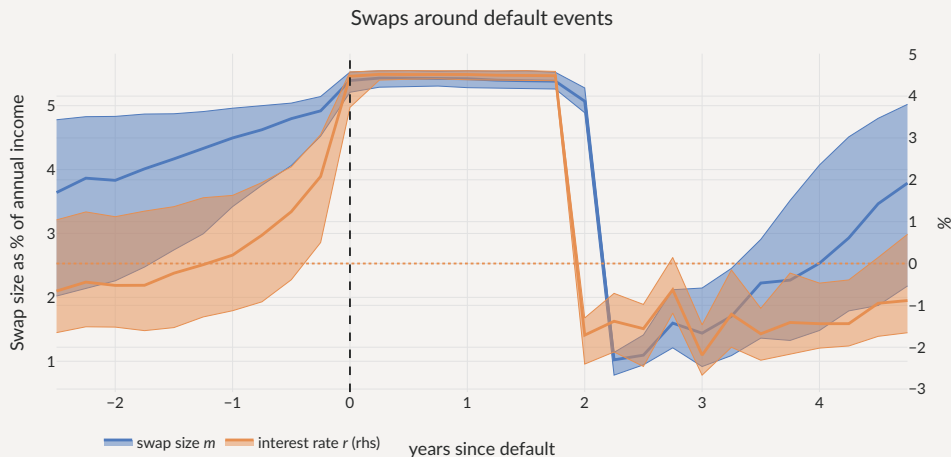
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When is the Swap Used?

- Further conditioning on default events lasting exactly two years



When is the Swap Used?

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

