

Central Bank Swap Lines as Bilateral Sovereign Debt

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Symmetric and Asymmetric 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)

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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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 create overborrowing incentives 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

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**


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

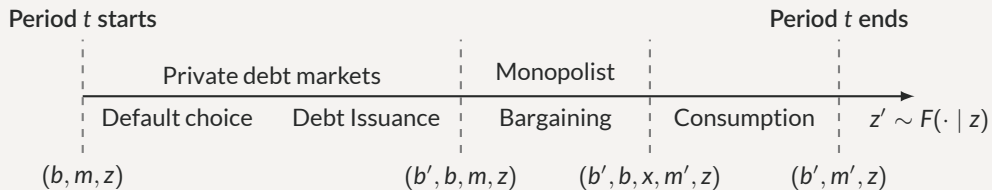
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Timeline of events



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 income state z , owing debt b and having issued b' at price q

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

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

Default state

- In default,

$$v_D(m, z) = u \left(y(z) - \underbrace{\phi(y(z))}_{\text{default cost}} + \underbrace{x_D(m, z)}_{\text{swap transfer}} \right) + \beta \mathbb{E} [\psi v(0, m'_D, z') + (1 - \psi) v_D(m'_D, z') \mid z]$$

- Negotiate $x_D(m, z)$ and $m'_D(m, z)$ with common knowledge of **default** status
- Bargaining in default not **disciplined** by market
 - ... similar to model with monopolist only: gambling for debt overhang
 - ... extra dimension of gambling for delayed reentry

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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?

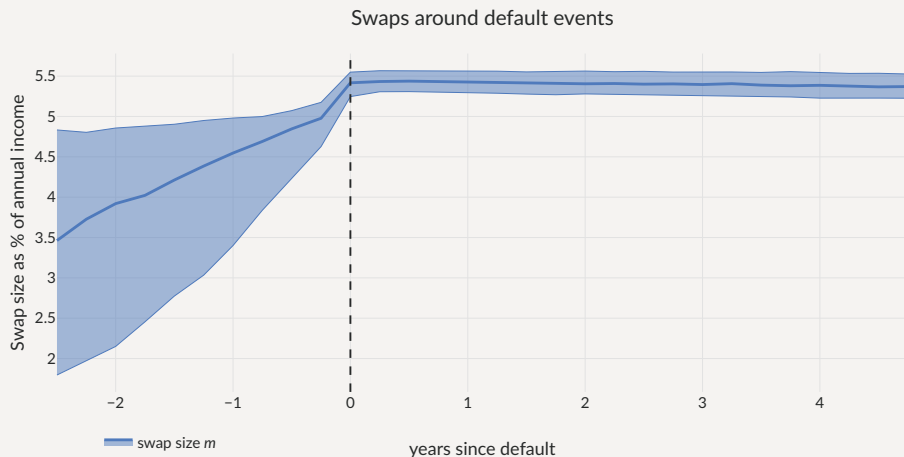
	No swap	Unrestricted, $\theta = 0.25$	Unrestricted, $\theta = 0.5$
Avg spread (bps)	804	1841	2396
Std spread (bps)	470	1099	1541
$\sigma(c)/\sigma(y)$ (%)	111	111	110
Debt to GDP (%)	21.4	20.8	20.2
Swap to GDP (%)	0	3.74	3.32
Corr. swap & spreads (%)	–	53.8	62.2
Default frequency (%)	6.53	13.0	14.7
Welfare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

When is the Swap Used?

▶ Limited

▶ More

- Swaps shoot up before *and during* defaults



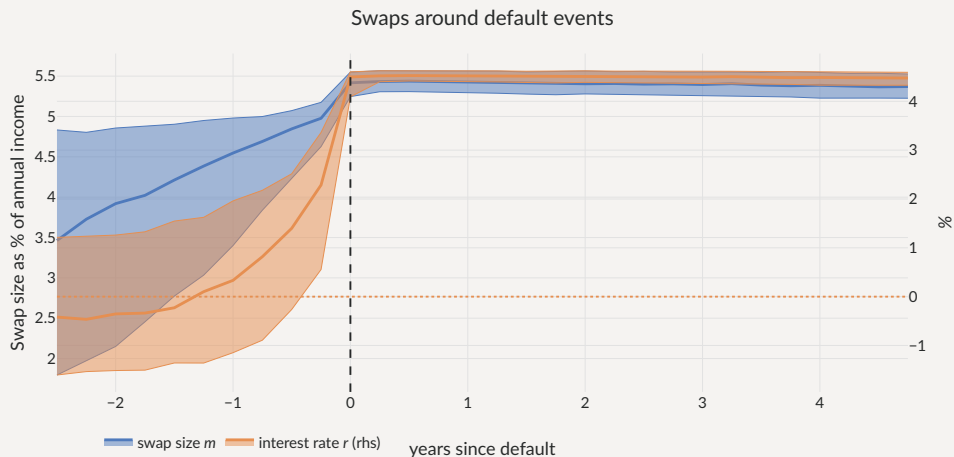
- Also consider **Limited** versions: $m' \leq \Gamma(m)$ while in default

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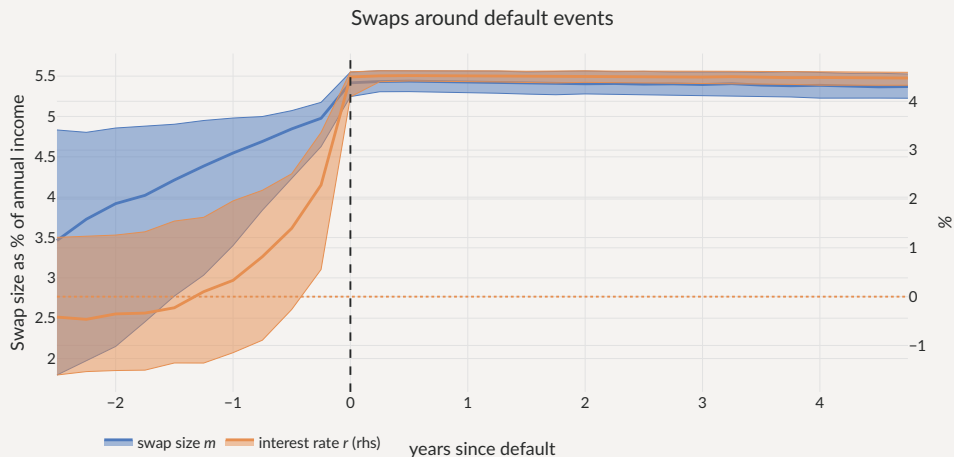
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Limiting swaps in default

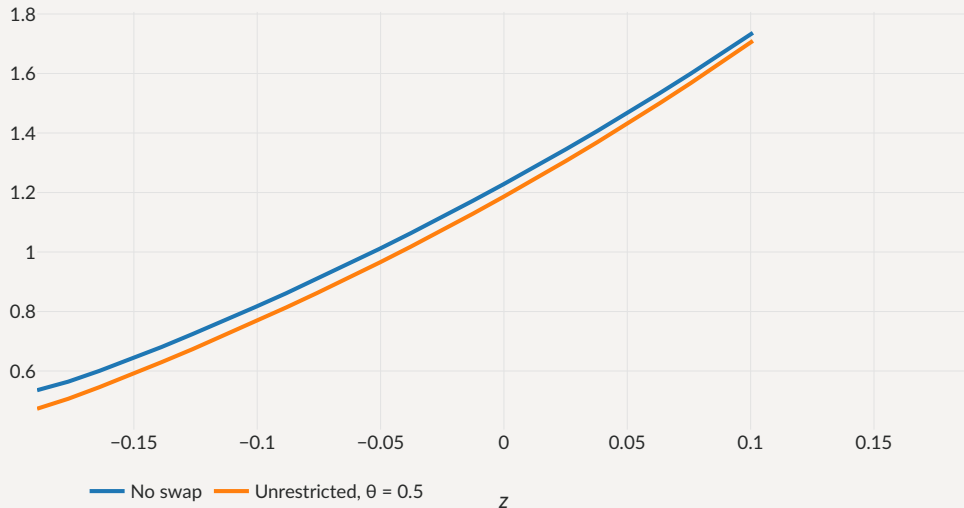
- Limited: entire swap must be repaid while in default $\Gamma(m) = 0$

	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

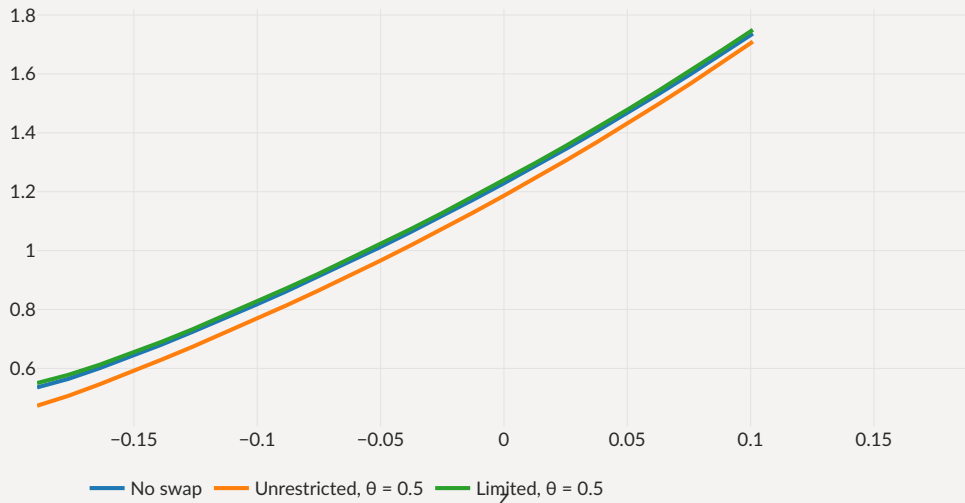
Debt levels at which $\mathcal{P}(b,m,z)$ crosses 50%



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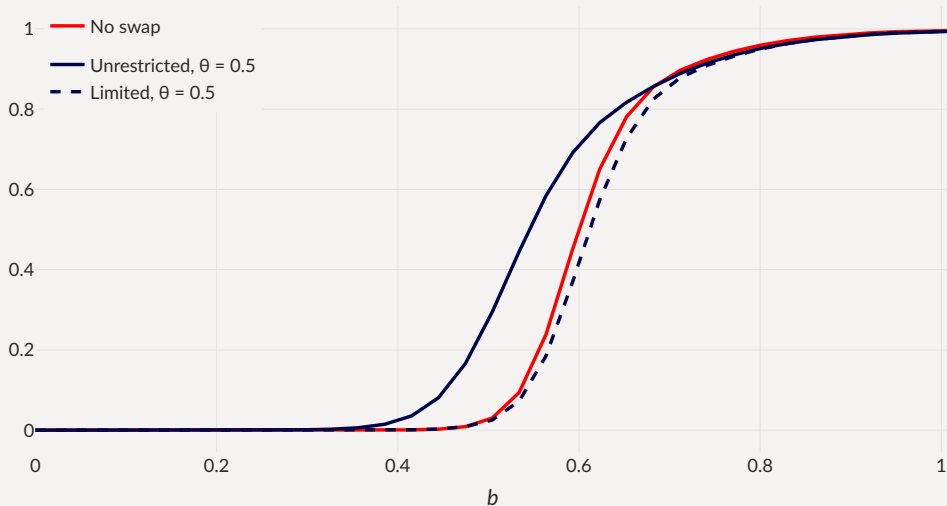
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Debt Tolerance with Swaps

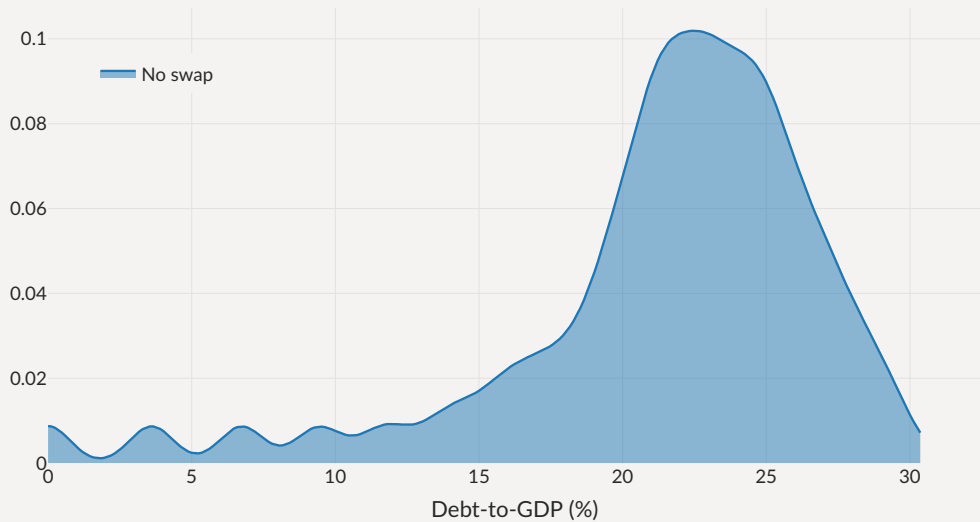
- Unrestricted: default more often, Limited: marginal impact

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



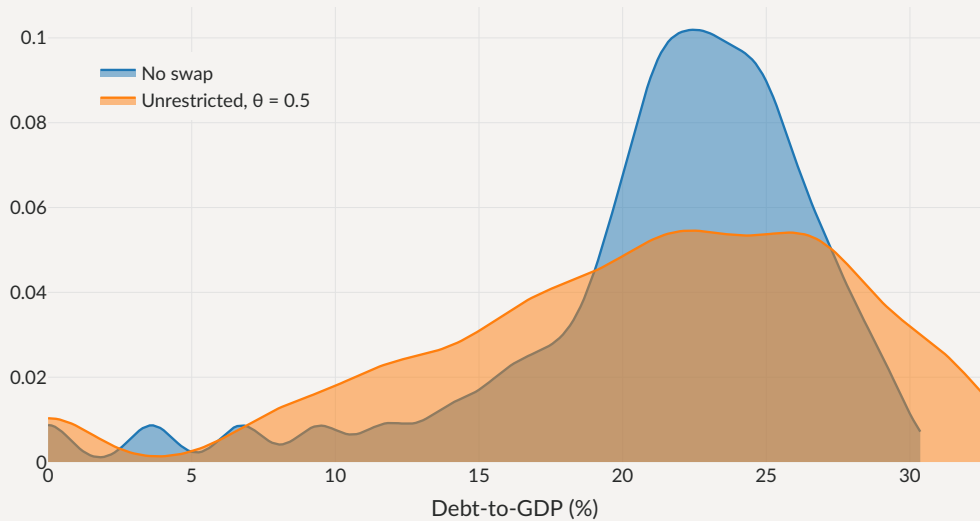
Debt Levels with Swaps

Distribution of debt levels



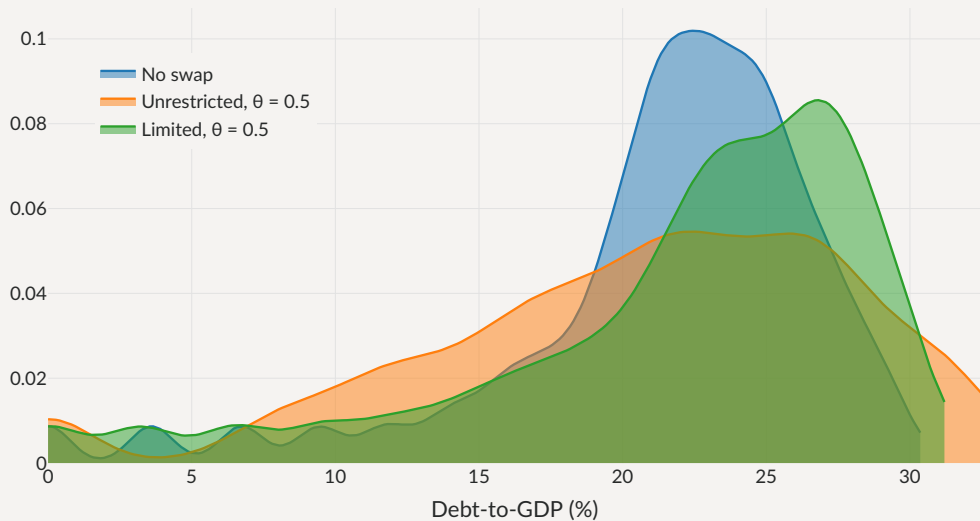
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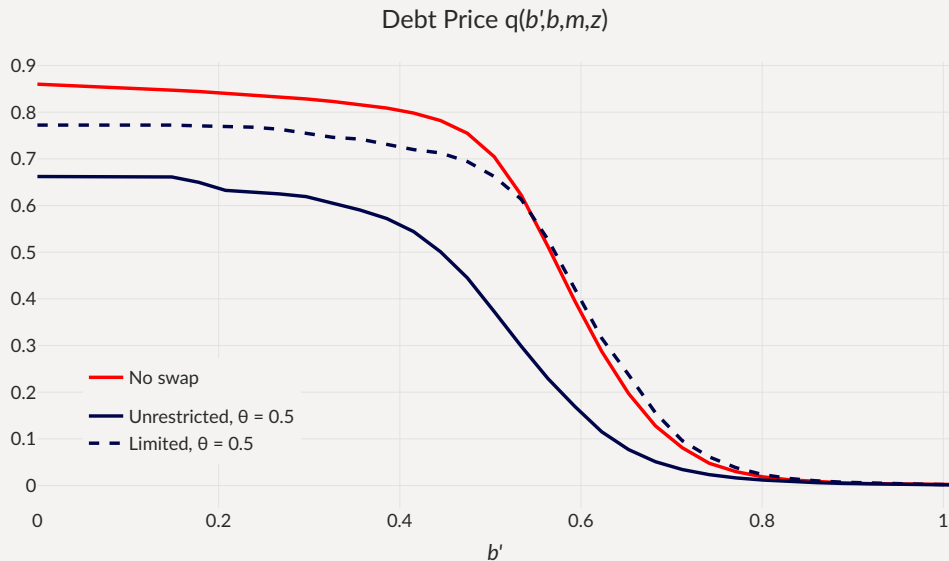
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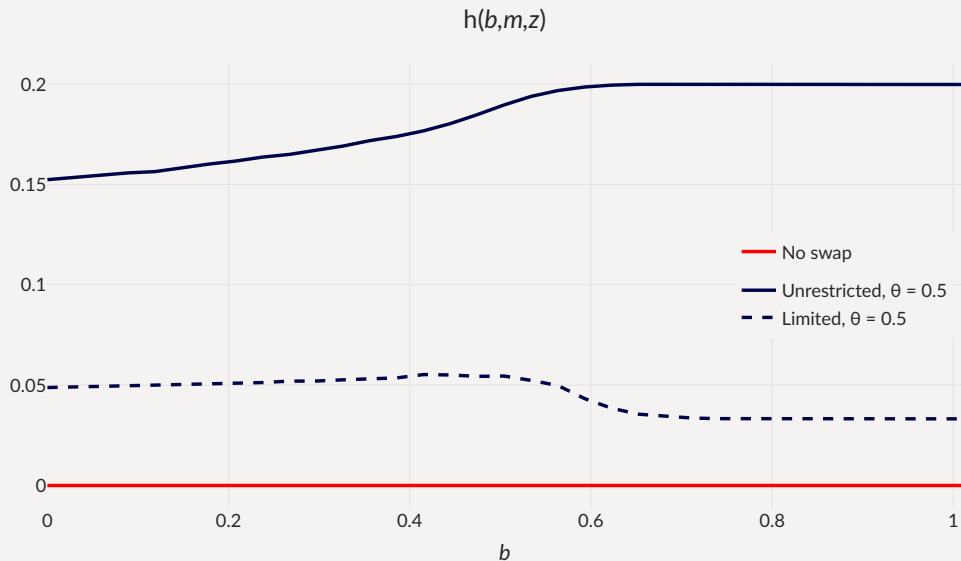
Debt Prices with Swaps

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



Monopolist's profits

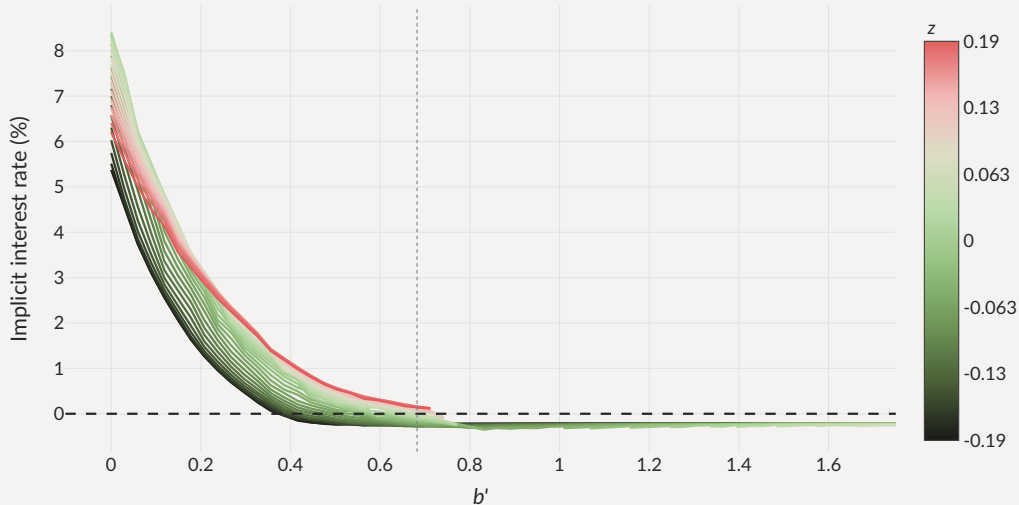
Monopolist's profits **increasing** in debt (cond. on repayment) – surplus requires spreads > 0



Risk-taking incentives

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

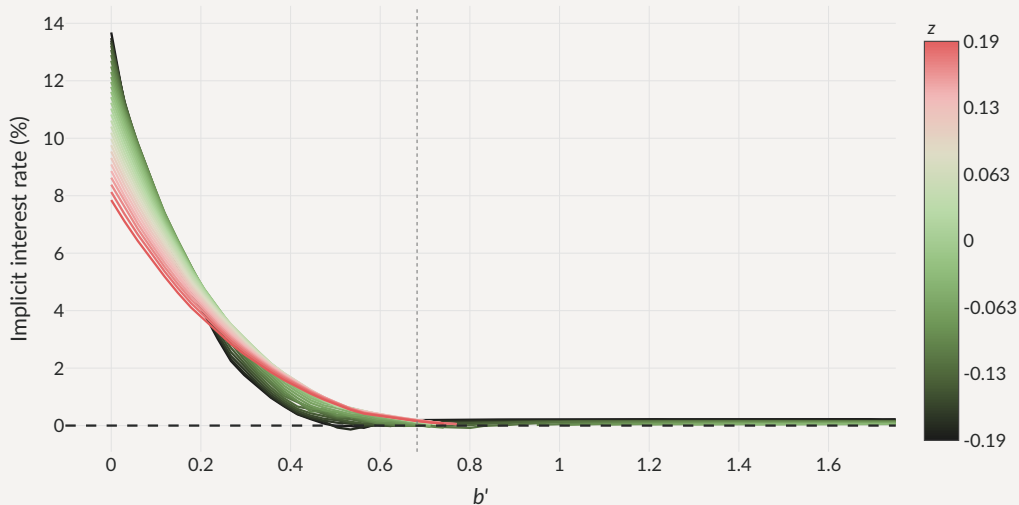
Interest rate on the swap (Unrestricted)



Risk-taking incentives

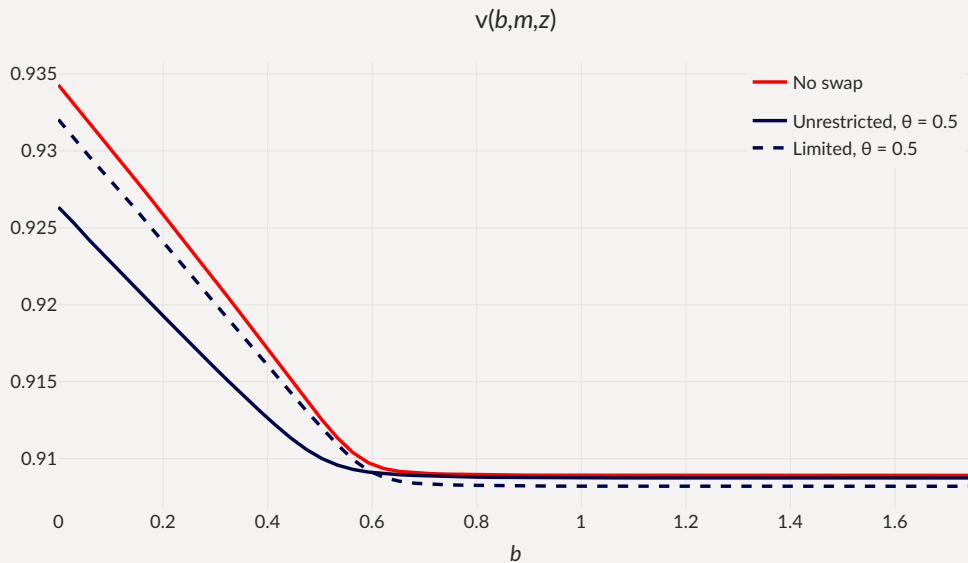
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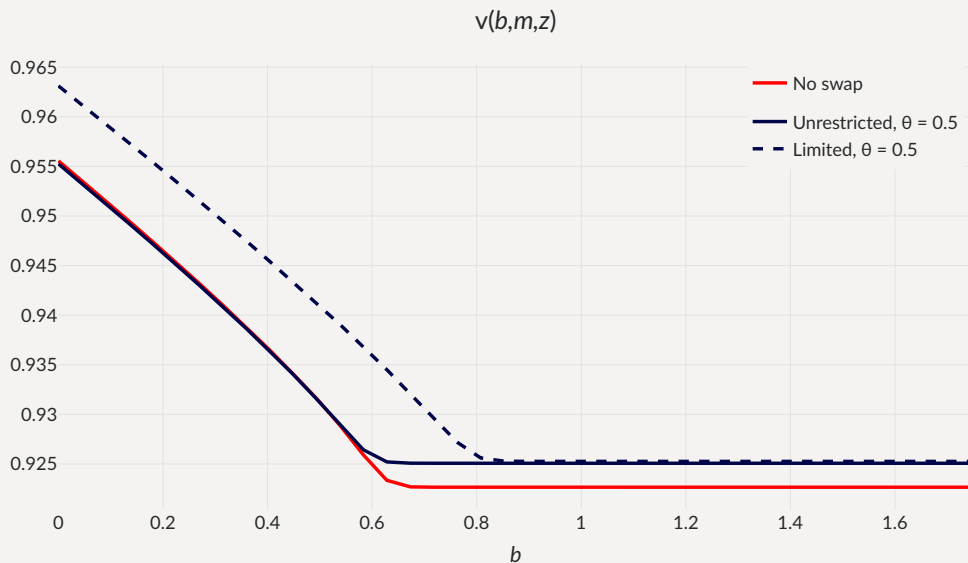
Welfare effects of swap lines

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%

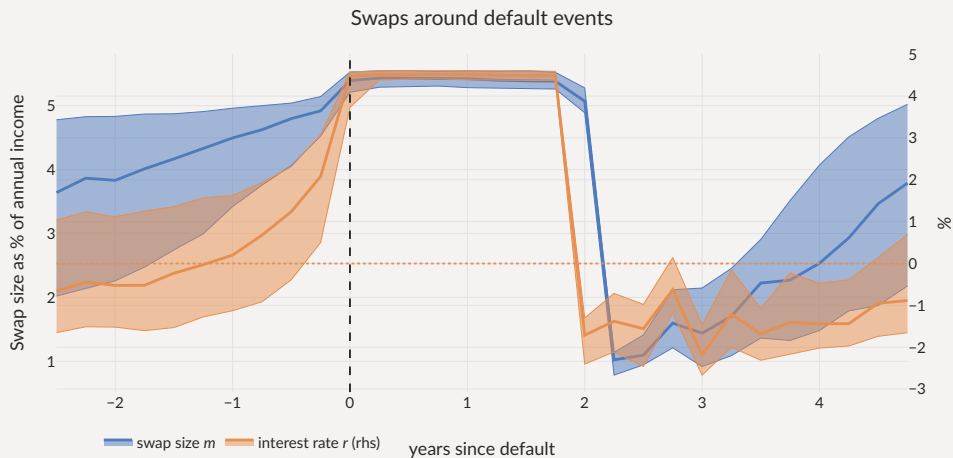
Concluding remarks

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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?

When is the Swap Used?

- Further conditioning on default events lasting exactly two years



When is the Swap Used?

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

