The Perils of Bilateral Sovereign Debt

Francisco Roldán
IMF

César Sosa-Padilla
Notre Dame & NBER

May 2025

Official Sovereign Debt

- A large share of sovereign borrowing takes the form of official debt
  - … Multilaterals, development banks, other governments

- Emergence of new bilateral creditors **outside** the Paris Club
  - … with claims to seniority and sometimes **opaque** terms

Questions

- How does the presence of a large official lender affect sovereign debt markets?
- What are the welfare implications for borrowing governments?

Official Sovereign Debt

- A large share of sovereign borrowing takes the form of official debt
  - … Multilaterals, development banks, other governments

- Emergence of new bilateral creditors **outside** the Paris Club
  - … with claims to seniority and sometimes **opaque** terms

Questions

- How does the presence of a large official lender affect sovereign debt markets?
- What are the welfare implications for borrowing governments?

Evaluating Large Official Creditors

Quantitative sovereign debt model with

- Competitive creditors in private markets (bondholders)
- Large bilateral lender
  1. Superior enforcement technology
  2. Bargained borrowing terms (price and quantity)
  3. Short-maturity loans

- Prime example: Central Bank swap lines (Horn et al., 2021), also deposits, IMF programs…

- Focus on the **interaction** between both funding sources
  - … presence of bilateral lender affects government behavior in debt markets
  - … outcomes in debt markets affect threat points in bargaining

Relational Overborrowing

Main findings

- Bilateral loans small relative to debt but significant effects
  - … provide funding when other sources dry up (e.g. because of default risk)
  - … can also increase **risk-taking**
- Bilateral loans induce **relational overborrowing**
  - Surplus requires spreads – spreads require risk
- Welfare losses from presence of bilateral creditor (for realistic bargaining weights)

- Relational overborrowing explained by elasticity of bilateral terms to market spreads
  - … remains present in a model without bargaining
  - … model with exogenous bilateral terms useful for **optimal design**

Relational Overborrowing

Main findings

- Bilateral loans small relative to debt but significant effects
  - … provide funding when other sources dry up (e.g. because of default risk)
  - … can also increase **risk-taking**
- Bilateral loans induce **relational overborrowing**
  - Surplus requires spreads – spreads require risk
- Welfare losses from presence of bilateral creditor (for realistic bargaining weights)

- Relational overborrowing explained by elasticity of bilateral terms to market spreads
  - … remains present in a model without bargaining
  - … model with exogenous bilateral terms useful for **optimal design**

Literature

- Sovereign debt/default with interactions from ‘official’ debt
  - … senior debt (Hatchondo, Martinez, & Onder 2017), senior debt with conditionality (Boz 2011, Fink & Scholl 2016), bailout agencies (Corsetti, Guimaraes & Roubini 2006, Kirsch & Rühmkorf 2017, Roch & Uhlig 2018), official debt (Arellano & Barreto 2024, Liu, Liu, & Yue 2025)

- Data on new official creditors
  - … Horn, Reinhart & Trebesch 2021a, 2021b, Gelpern et al. 2021, Horn, Parks, Reinhart & Trebesch 2023

- Central Bank swap lines
  - … among advanced economies (Bahaj & Reis 2021, Cesa-Bianchi, Eguren-Martin, & Ferrero 2022), data for emerging-market borrowers (Perks, Rao, Shin, & Tokuoka 2021)

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

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

- **Should expect**
  - … Implicit interest rate r to vary over time
  - … Interest rate to reflect market power
  - … Interest rate to reflect outside options

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

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

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

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

- Lender surplus

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

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

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 (borrower) surplus

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

- Lender surplus

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

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

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 (borrower) surplus

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

- Lender surplus

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

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

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 (borrower) surplus

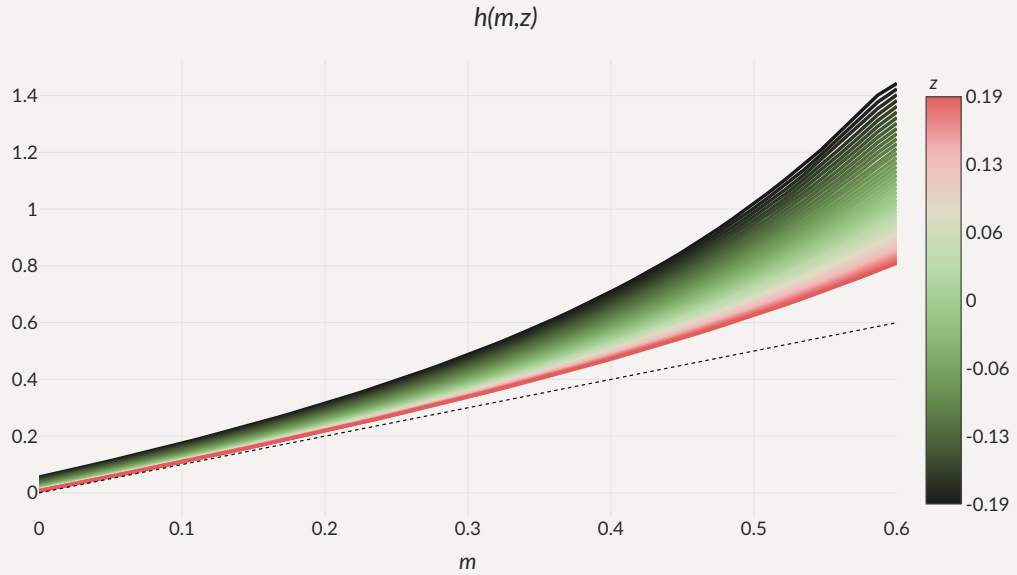
$$\mathcal{B}(x, m, m', z) = \underbrace{u(y(z) + x) + \beta \mathbb{E}\left[v(m', z') \mid z\right]}_{\text{agreement: receive } x\text{, owe } m'} - \underbrace{\left(u(y(z) - m) + \beta \mathbb{E}\left[v(0, z') \mid z\right]\right)}_{\text{threat point: repay } m\text{, clean slate}}$$

- Lender surplus

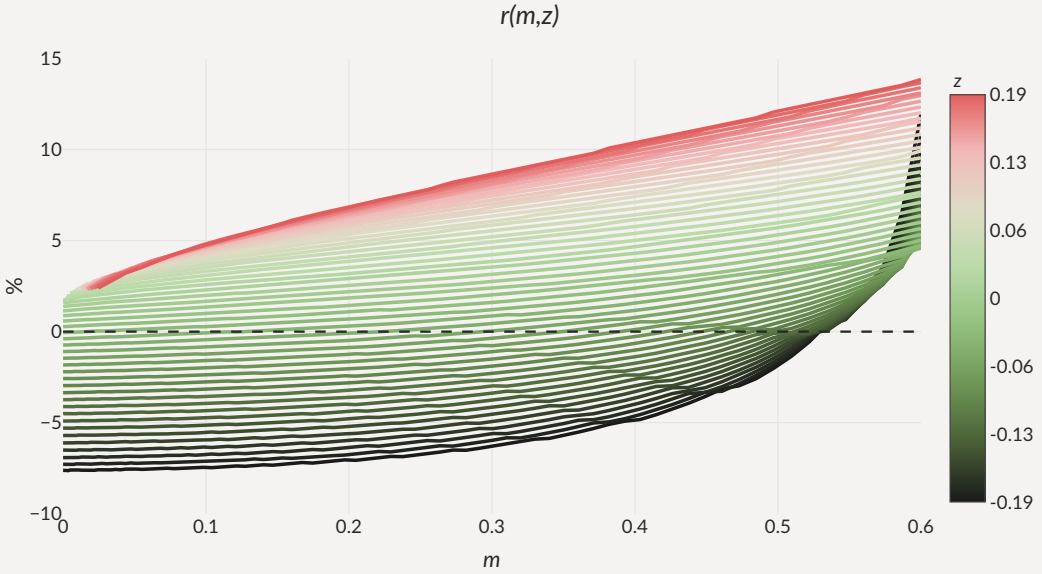
$$\mathcal{L}(x, m, m', z) = \underbrace{a - x + \beta_L \mathbb{E}\left[h(m', z') \mid z\right]}_{\text{agreement}} - \underbrace{\left(a + m + \beta_L \mathbb{E}\left[h(0, z') \mid z\right]\right)}_{\text{threat point}}$$

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

Monopolist Terms: Lender's Value Function



Monopolist Terms: Implicit Interest Rate



Monopolist Terms: Takeaways

key requirement:
threat point value decreasing in m

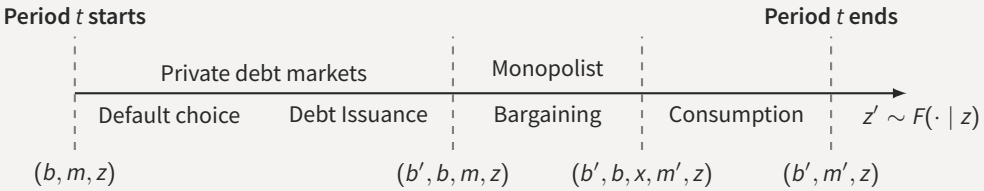
The threat point is less 'credible' when m is large

- 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 $\kappa, (1-\rho)\kappa, \ldots (1-\rho)^{s-1}\kappa$
- 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

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

Borrowing from Markets

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

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

Borrowing from Markets

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

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

same sdf as monopolist

Bargaining Stage with Monopolist

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

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

Government surplus

Lender surplus

- Lender's surplus

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

- Government's surplus

$$\mathcal{B}_R(b', b, x, m, m', z) = \underbrace{u\big(y(z) + B(b', b, m, z) + x\big) + \beta \mathbb{E}\left[v(b', m', z') \mid z\right]}_{\text{agreement}}$$
$$- \underbrace{\big(u\big(y(z) + B(b', b, m, z) - m\big) + \beta \mathbb{E}\left[v(b', 0, z') \mid z\right]\big)}_{\text{threat point}}$$

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

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's surplus

same sdf as markets

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

- Government's surplus

$$\mathcal{B}_R(b', b, x, m, m', z) = \underbrace{u\big(y(z) + B(b', b, m, z) + x\big) + \beta \mathbb{E}\left[v(b', m', z') \mid z\right]}_{\text{agreement}}$$

$$- \underbrace{\big(u\big(y(z) + B(b', b, m, z) - m\big) + \beta \mathbb{E}\left[v(b', 0, z') \mid z\right]\big)}_{\text{threat point}}$$

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

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's surplus

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

- Government's surplus

$$\mathcal{B}_R(b', b, x, m, m', z) = \underbrace{u\big(y(z) + B(b', b, m, z) + x\big) + \beta \mathbb{E}\left[v(b', m', z') \mid z\right]}_{\text{agreement}} - \underbrace{\left(u\big(y(z) + B(b', b, m, z) - m\big) + \beta \mathbb{E}\left[v(b', 0, z') \mid z\right]\right)}_{\text{threat point}}$$

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

Bargaining: Intuition

Lender's surplus

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

- Low rates when value of relationship $\mathbb{E}\left[h(b', m', z') - h(b', 0, z')\right]$ is high

Government's surplus

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

- If default risk is low, not much role for monopolist
- Revenues from debt issuance $B(b', b, m, z)$ modulate the value of the threat point
  - … When $m - B(b', b, m, z)$ is large: government willing to borrow at high rates

Bargaining: Intuition

Lender's surplus

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

- Low rates when value of relationship $\mathbb{E}\left[h(b', m', z') - h(b', 0, z')\right]$ is high

Government's surplus

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

- If default risk is low, not much role for monopolist
- Revenues from debt issuance $B(b', b, m, z)$ modulate the value of the threat point
  - … When $m - B(b', b, m, z)$ is large: government willing to borrow at high rates

Quantitative Effects of Bilateral Loans

Calibration

- Calibrate to Argentina with only market (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

Calibration

- Calibrate to Argentina with only market (as in Roch & Roldán, 2023)

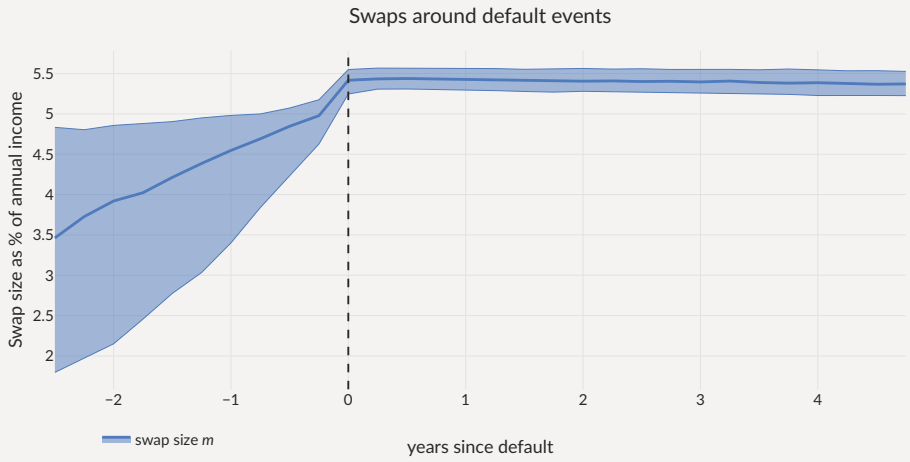
	Parameter	Value
Sovereign's discount factor	β	0.9504
Sovereign's risk aversion	γ	2
Preference shock scale parameter	χ	0.02
Lender's bargaining power	θ	0.5
Risk-free interest rate	r	0.01
Duration of debt	ρ	0.05
Income autocorrelation coefficient	ρ_z	0.9484
Standard deviation of y_t	σ_z	0.02
Reentry probability	ψ	0.0385
Default cost: linear	d_0	-0.24
Default cost: quadratic	d_1	0.3

How Do Bilateral Loans Affect Equilibrium?

	Only market	**Both,** $\theta = 0.25$	**Both,** $\theta = 0.5$
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
Loan to GDP (%)	0	3.74	3.32
Corr. loan & spreads (%)	–	53.8	62.2
Default frequency (%)	6.53	13.0	14.7
Welfare gains (rep)	–	-0.082%	-0.41%

When Is the Loan Used?

- Loans shoot up before *and during* defaults

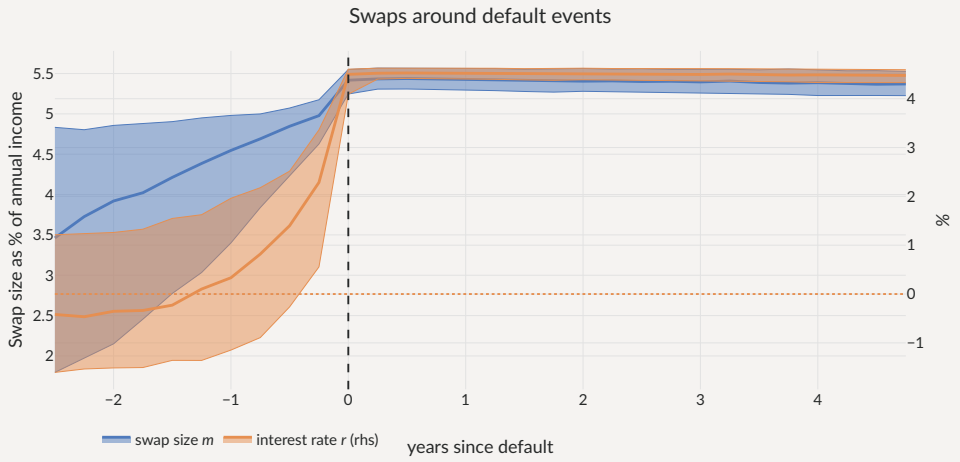


- Also consider Limited versions: $m' \leq \Gamma(m)$ while in default

When Is the Loan Used?

Limited More

- Loans shoot up before *and during* defaults

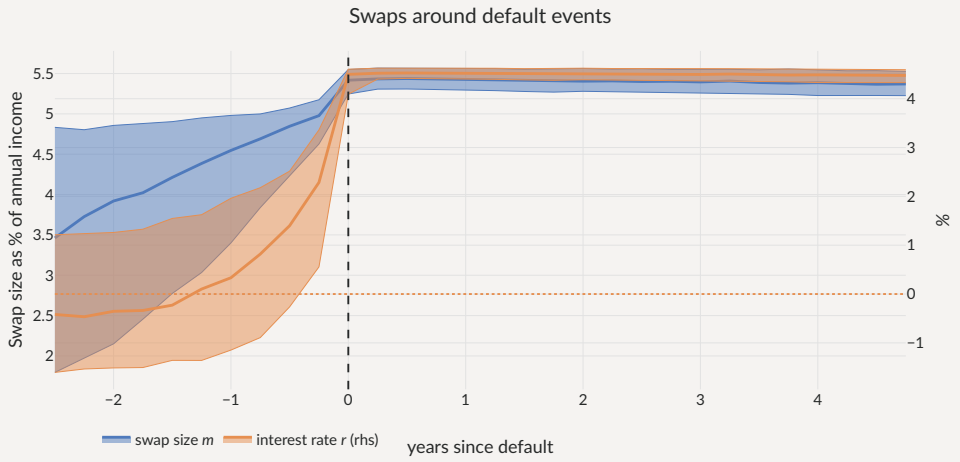


- Also consider Limited versions: $m' \leq \Gamma(m)$ while in default

When Is the Loan Used?

Limited More

- Loans shoot up before *and during* defaults



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

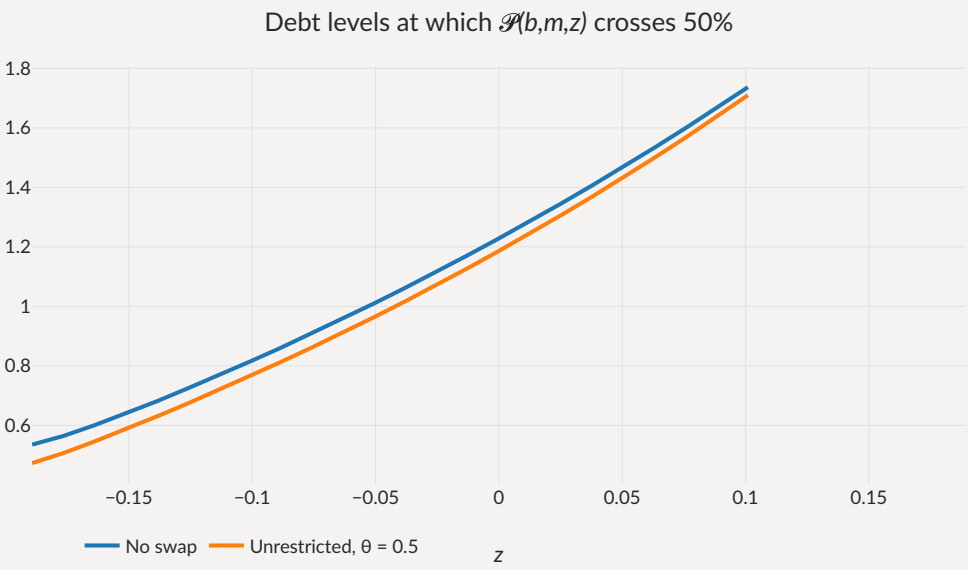
Limiting Loans in Default

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

	Only market	**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
Loan to GDP (%)	0	3.32	1.05
Corr. loan & spreads (%)	–	62.2	69.4
Default frequency (%)	6.53	14.7	9.34
Welfare gains (rep)	–	-0.41%	-0.084%

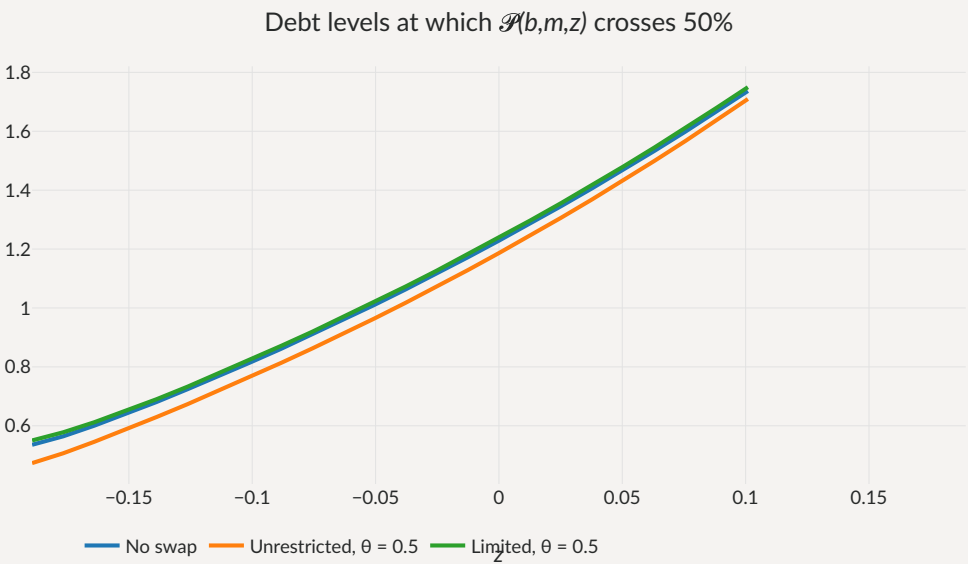
Default Barriers with Loans

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



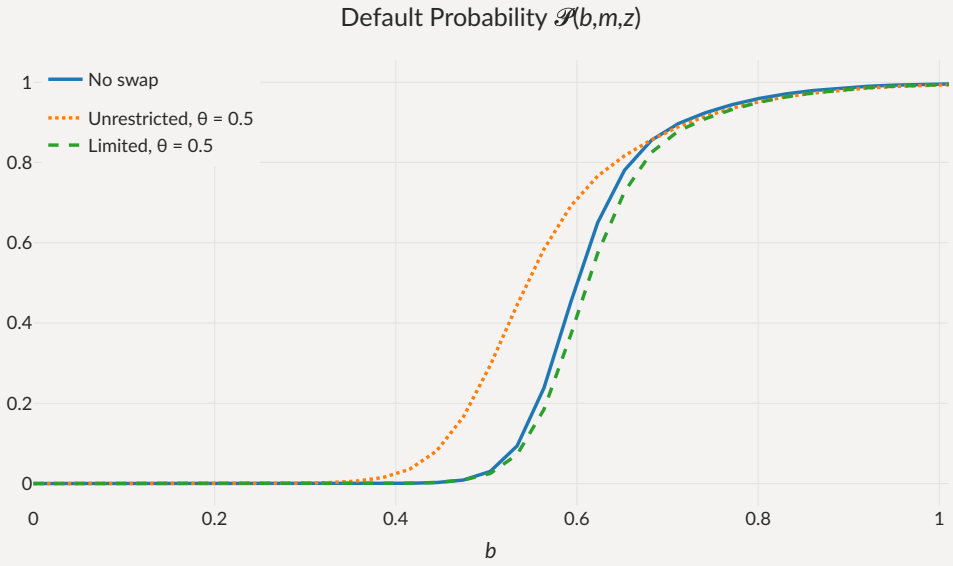
Default Barriers with Loans

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



Debt Tolerance with Loans

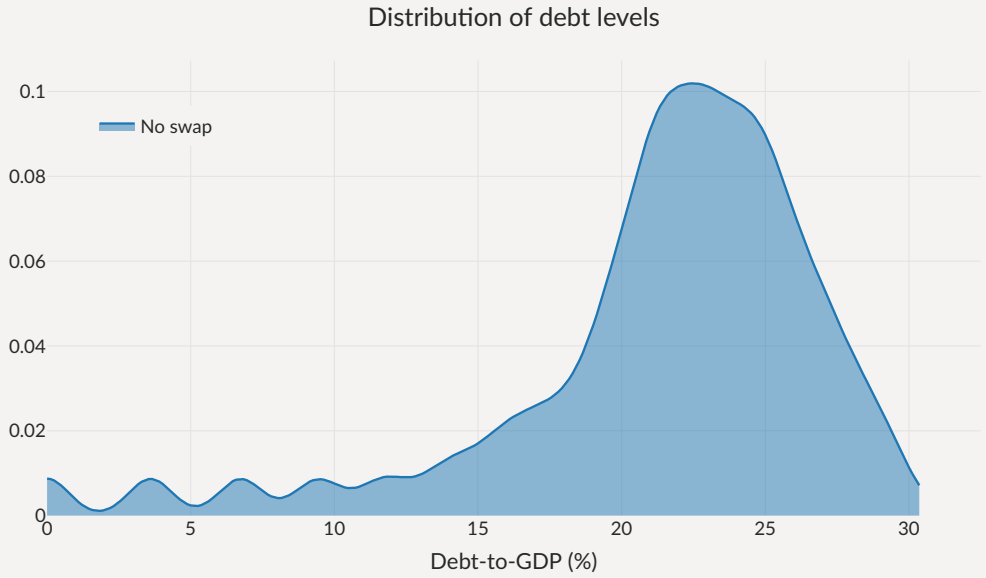
- **Unrestricted**: default more often, **Limited**: marginal impact



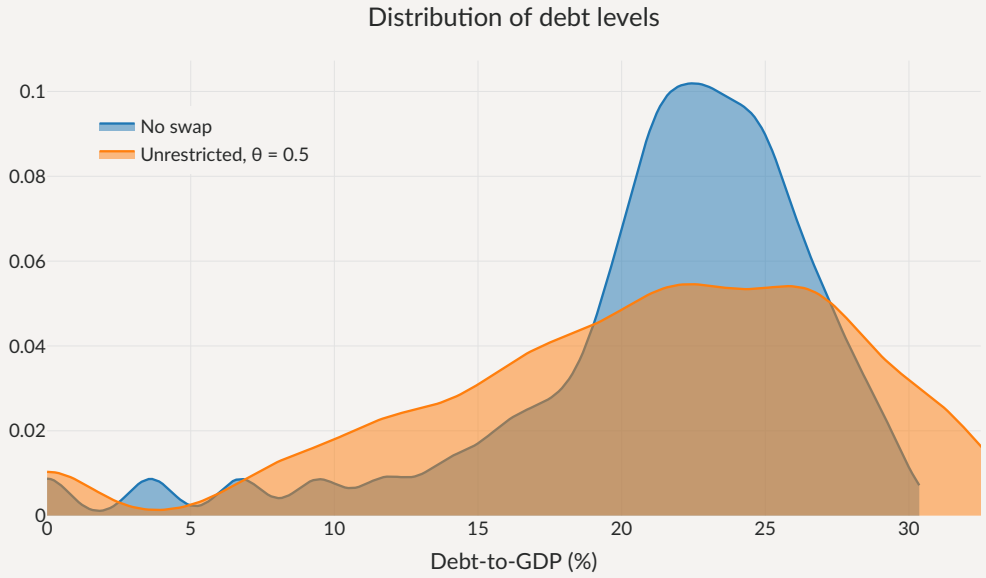
If **Limited** loans help repay the debt,

Why are there more defaults with loans?

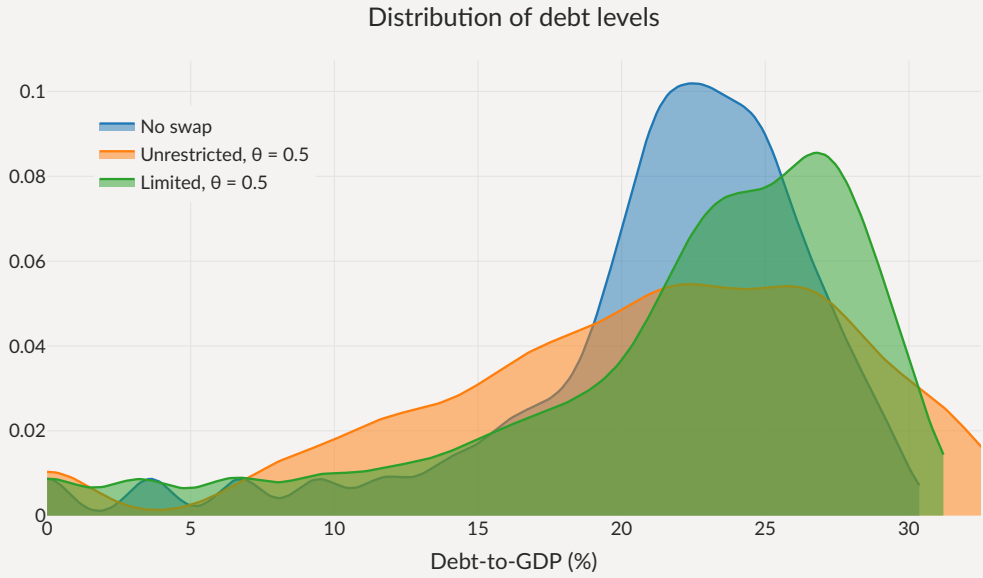
Debt Levels with Loans



Debt Levels with Loans

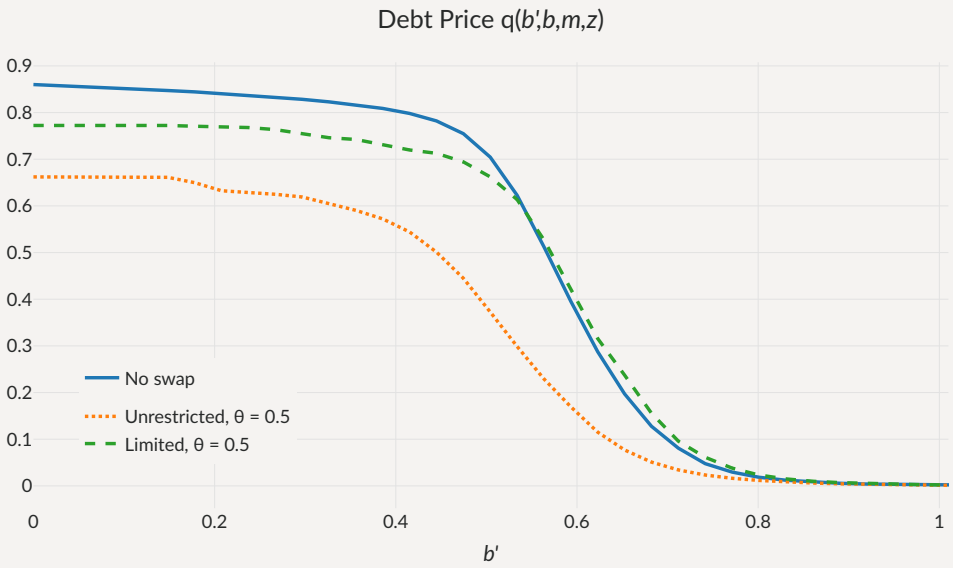


Debt Levels with Loans



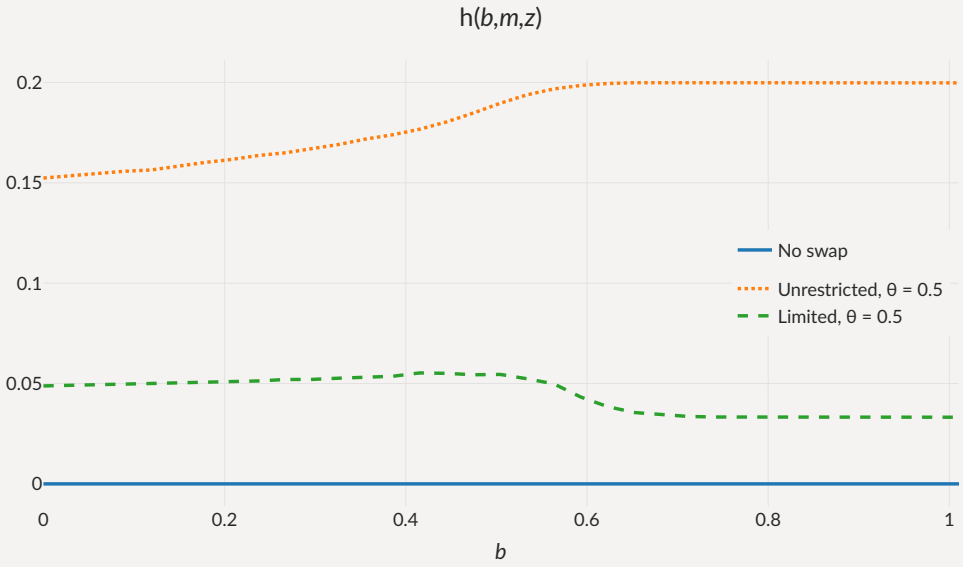
Debt Prices with Loans

Lower prices with same default rates: relational overborrowing similar to debt dilution



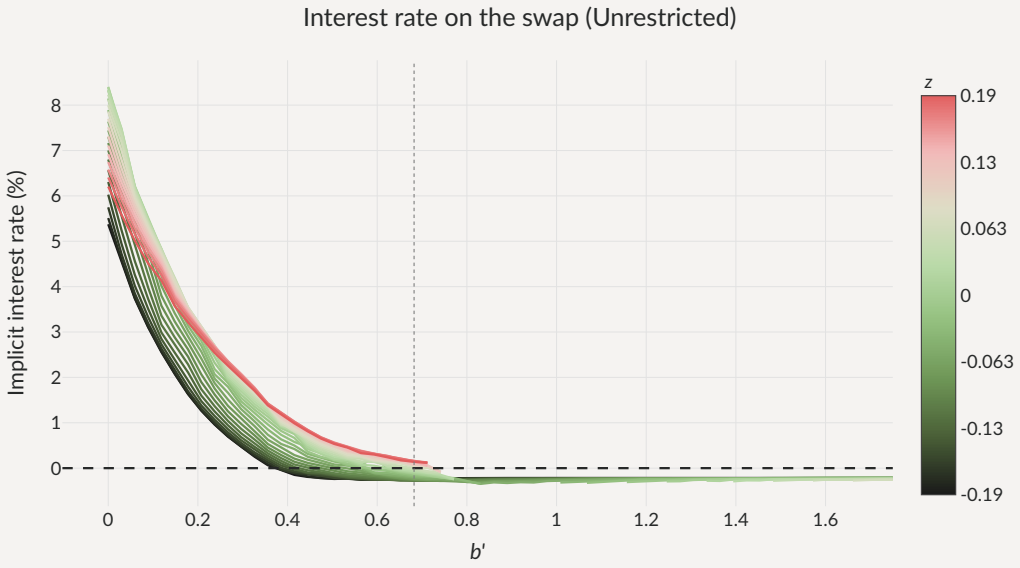
Monopolist's Profits

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



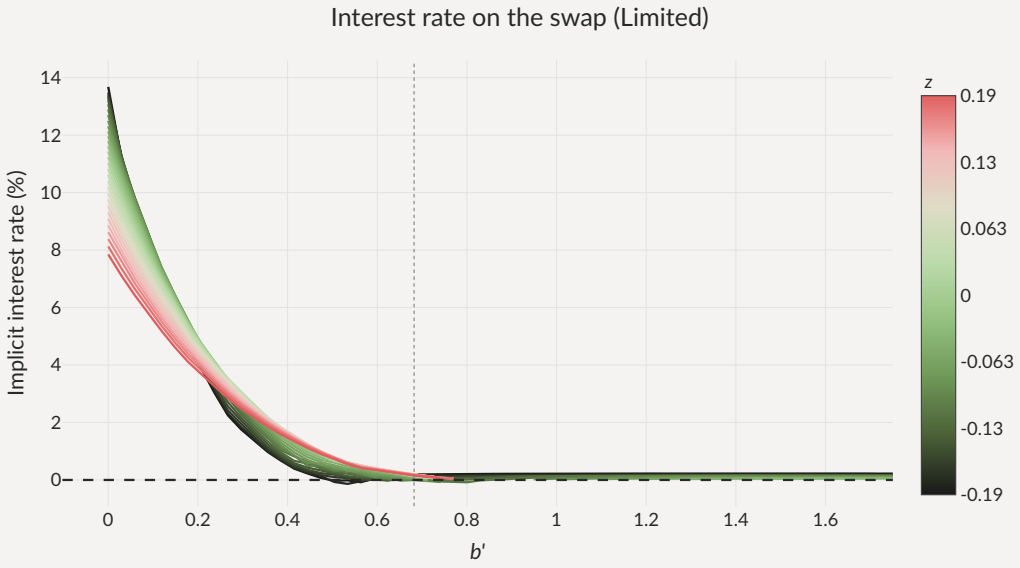
Risk-taking Incentives

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



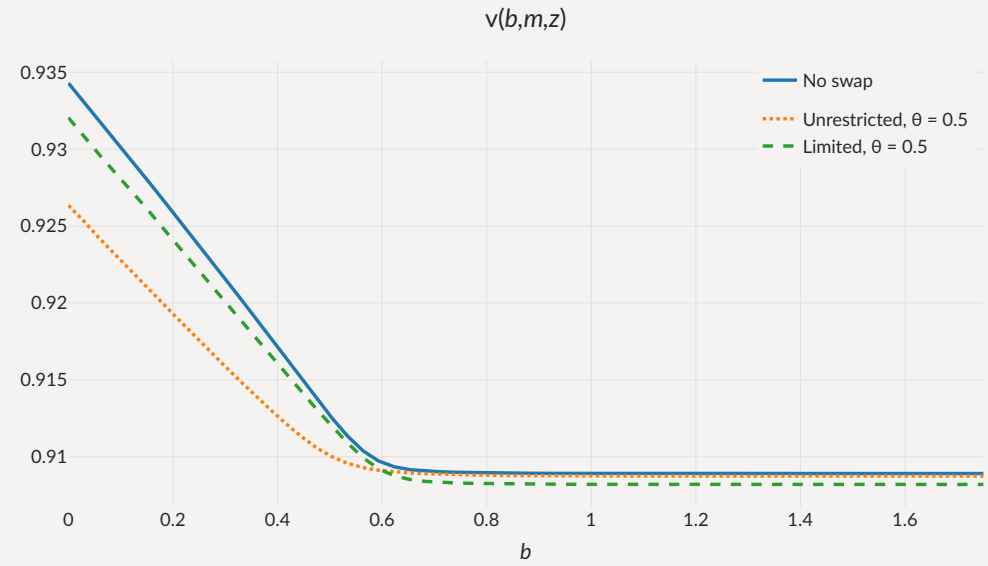
Risk-taking Incentives

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



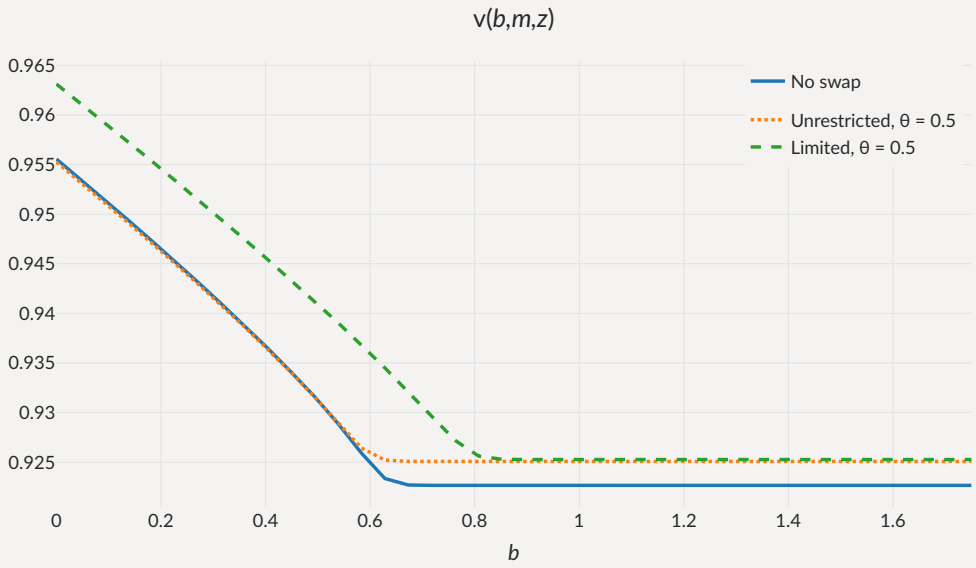
Welfare Effects of Bilateral Loans

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



Programming the Large Lender

Possible rules

- 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

	Only market	**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
Loan to GDP (%)	0	2.32	1.37	1.05
Loan spread (bps)	–	836	2,267	408
Corr. loan & 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

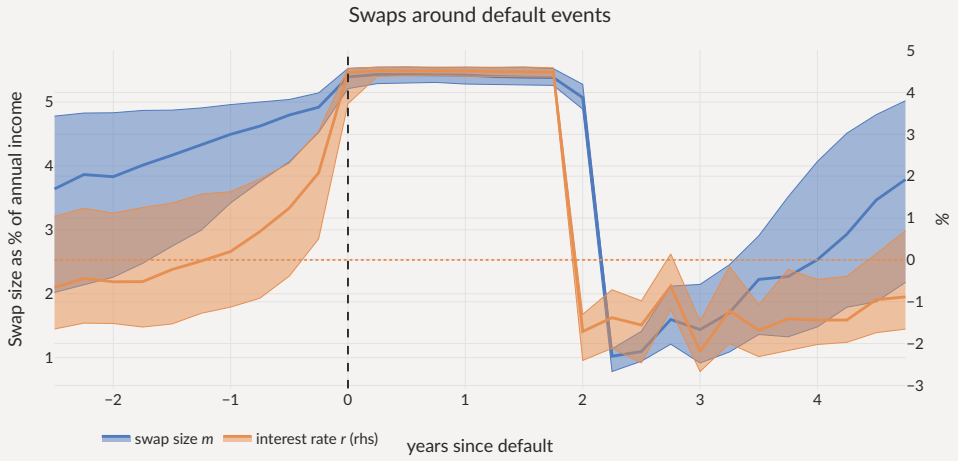
The Perils of Bilateral Sovereign Debt

- 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

When is the Swap Used?

Back

- Further conditioning on default events lasting exactly two years



When is the Swap Used?

Back

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