The Perils of Bilateral Sovereign Debt

Francisco Roldán
IMF

César Sosa-Padilla
Notre Dame & NBER

XXII Ridge Forum
Montevideo, October 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 ▸ IDS data
  - … with claims to seniority and sometimes **opaque** terms

> **Questions**
> · How does the presence of a large senior lender affect sovereign debt markets?
> · What are its welfare implications for borrowing governments?

- 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 ▶ IDS data
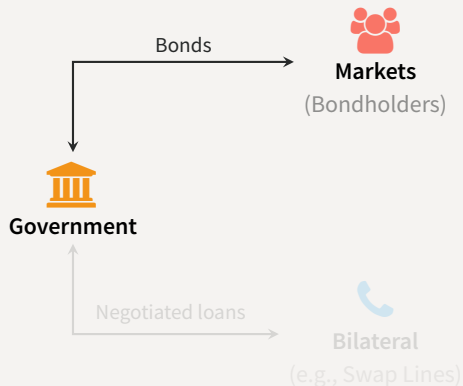 - … with claims to seniority and sometimes **opaque** terms

Questions
· How does the presence of a large senior lender affect sovereign debt markets?
· What are its welfare implications for borrowing governments?

Quantitative sovereign debt model with

- Competitive creditors in private markets
- Large bilateral lender
  1. Superior enforcement
     [de-facto seniority]
  2. Bargained terms
     [price and quantity]
  3. Short-maturity loans

- Prime example: Central Bank **swap** lines
  (Horn et al., 2021)

- Focus on the **interaction** between both funding sources

Bonds

Markets
(Bondholders)

Government

Negotiated loans

Bilateral
(e.g., Swap Lines)

Quantitative sovereign debt model with
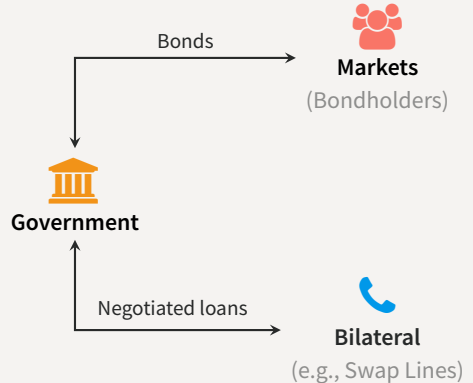
- Competitive creditors in private markets
- Large bilateral lender
  1. Superior enforcement
     [de-facto seniority]
  2. Bargained terms
     [price and quantity]
  3. Short-maturity loans

- Prime example: Central Bank **swap** lines
  (Horn et al., 2021)

- Focus on the interaction between both funding sources

Bonds → **Markets** (Bondholders)

Government

Negotiated loans → **Bilateral** (e.g., Swap Lines)

Quantitative sovereign debt model with

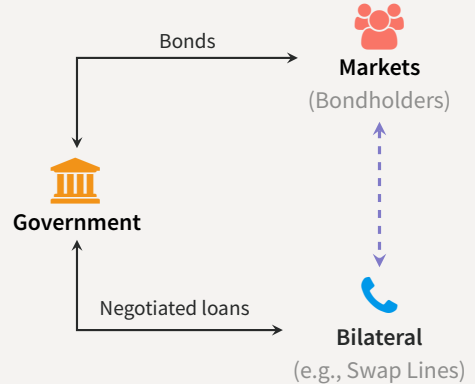- Competitive creditors in private markets
- Large bilateral lender
  1. Superior enforcement
     [de-facto seniority]
  2. Bargained terms
     [price and quantity]
  3. Short-maturity loans

- Prime example: Central Bank **swap** lines
  (Horn et al., 2021)

- Focus on the **interaction** between both funding sources

Markets
(Bondholders)

Bonds

Government

Negotiated loans

Bilateral
(e.g., Swap Lines)

Main findings

- Bilateral loans have significant effects on equilibrium outcomes
  - … provide funding when other sources dry up (e.g. because of default risk)
  - … can also incentivize more **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 due to elasticity of bilateral terms to market debt
  - … remains present in a model without bargaining
  - … model with exogenous bilateral terms useful for **optimal design**

Main findings

- Bilateral loans have significant effects on equilibrium outcomes
  - … provide funding when other sources dry up (e.g. because of default risk)
  - … can also incentivize more **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 due to elasticity of bilateral terms to market debt
  - … 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 & Önder 2017), senior debt with conditionality (Boz 2011, Fink & Scholl 2016), bailout agencies (Corsetti, Guimarães & 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

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 loan m each period
  - … Involves a current transfer x and a new size m'
  - … Loan 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
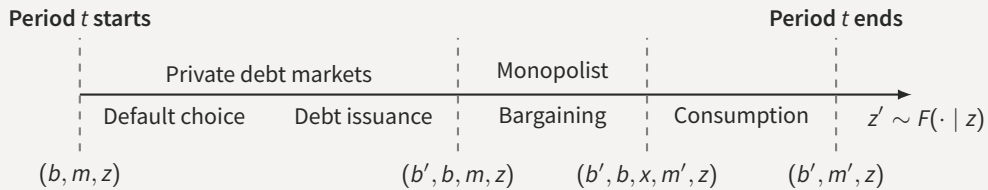 - … Interest rate to reflect outside options

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

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 loan m each period
  - … Involves a current transfer x and a new size m'
  - … Loan is non-defaultable $\implies$ Repaying m is the natural threat point

- **Should expect**
  $$x = \frac{1}{1+r}m' - m$$
  - … Implicit interest rate r to vary over time
  - … Interest rate to reflect market power
  - … Interest rate to reflect outside options

Period t starts   **Period t ends**

Private debt markets   Monopolist

Default choice   Debt issuance   Bargaining   Consumption $z' \sim F(\cdot \mid z)$

(b, m, z) (b', b, m, z) (b', b, x, m', z) (b', m', z)

- Debt is a geometrically-decaying coupon
    - ... for each unit,   get q,   pay $\kappa, (1-\delta)\kappa, \ldots (1-\delta)^{s-1}\kappa$
- Government enters first stage owing b in debt, m in loans, 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

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

- Debt is a geometrically-decaying coupon

  … for each unit, get q, pay $\kappa, (1-\delta)\kappa, \ldots (1-\delta)^{s-1}\kappa$

- Government enters first stage owing b in debt, m in loans, 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

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

- Debt is a geometrically-decaying coupon

  ... for each unit,   get q,   pay $\kappa, (1-\delta)\kappa, \ldots (1-\delta)^{s-1}\kappa$

- Government enters first stage owing b in debt, m in loans, 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

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

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

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

same sdf as monopolist

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

Government surplus

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

Lender surplus

- 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

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

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

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

8

- At state z, owing debt b bonds and m on the loan 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

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

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

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

- At state z, owing debt b bonds and m on the loan 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

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

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

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

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

- 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

9

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

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

- 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

- 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	δ	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

- 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	δ	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

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)	714	2,105	1,038
Std spread (bps)	399	1,331	612
$\sigma(c)/\sigma(y)$ (%)	113	109	113
Debt to GDP (%)	22.5	21.2	22.5
Loan to GDP (%)	0	3.02	1.06
Loan spread (bps)	–	-429	536
Corr. loan & spreads (%)	–	67.5	71.1
Default frequency (%)	5.72	13	7.72
Welfare gains (rep)	–	-0.43%	-0.2%

- Loans shoot up before *and during* defaults
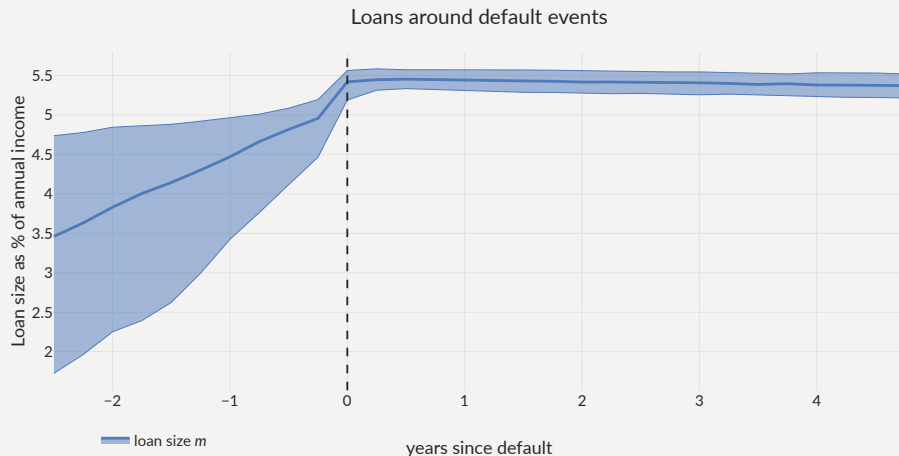
Loans around default events

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

- Loans shoot up before *and during* defaults

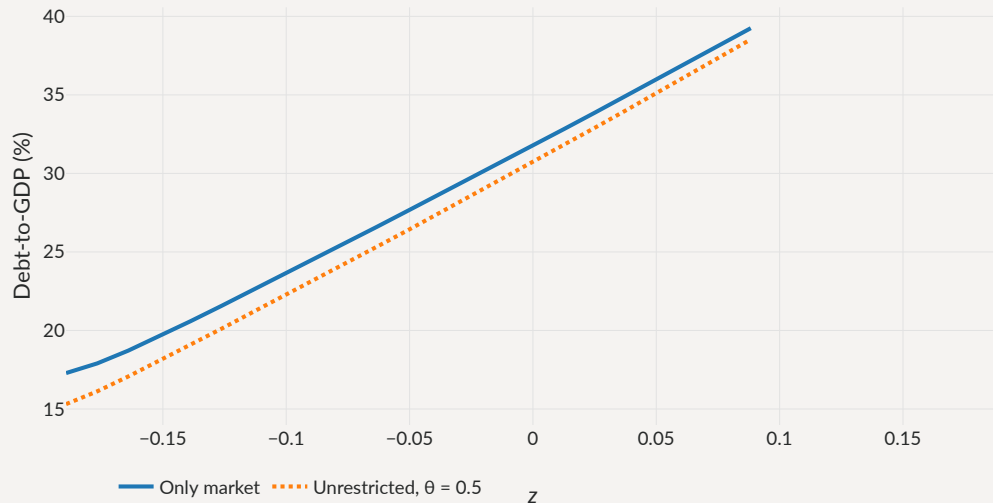Loans around default events

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

- Loans shoot up before *and during* defaults

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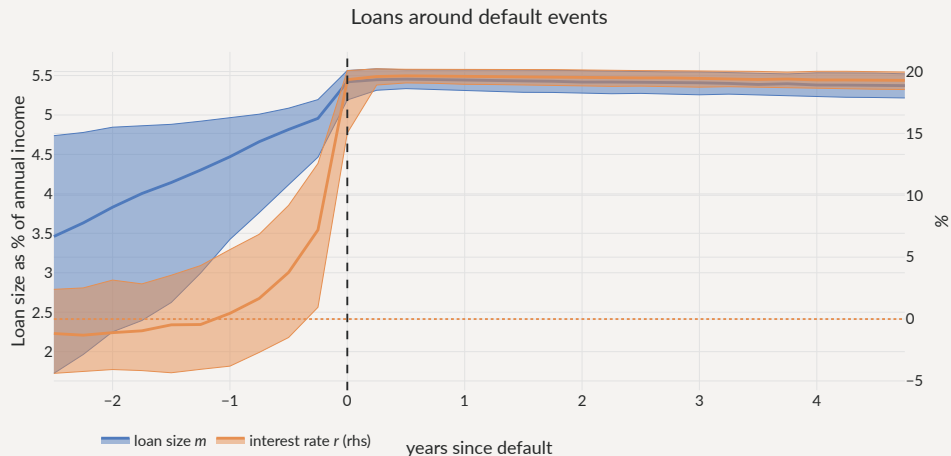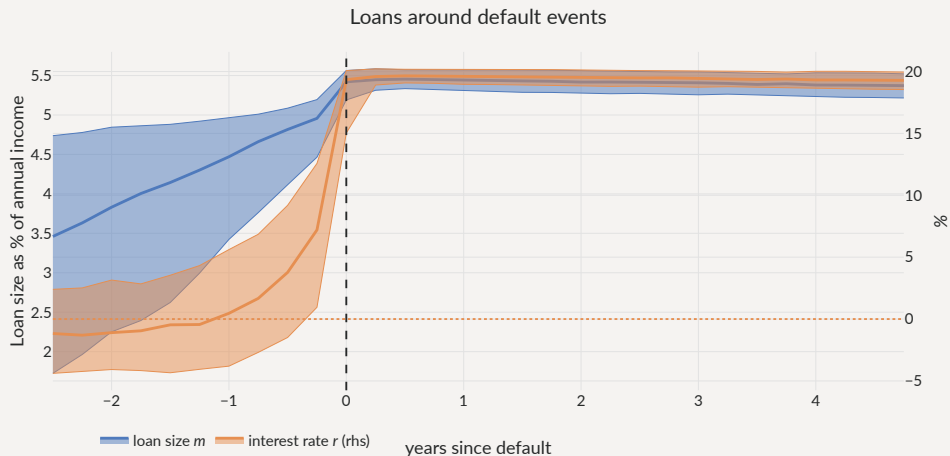
- Also consider Limited versions: $m' \leq \Gamma(m)$ while in default

Default Barriers with Loans

- **Unrestricted**: default barrier moves inward,   **Limited**: marginal impact
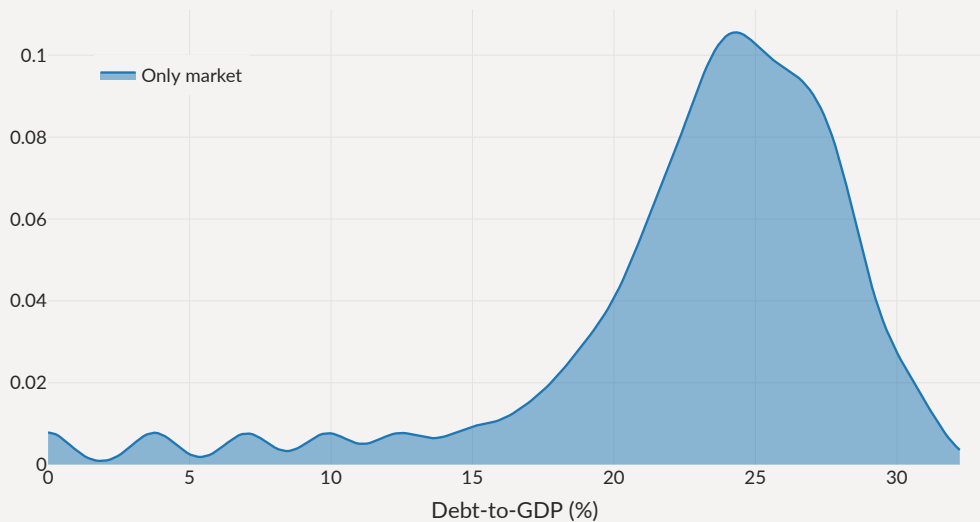
Debt levels at which $\mathcal{H}(b,m,z)$ crosses 50%

Legend: — Only market   ⋯⋯ Unrestricted, θ = 0.5

x-axis: z

y-axis: Debt-to-GDP (%)

Default Barriers with Loans

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

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

Only market ······ Unrestricted, θ = 0.5 ▬ ▬ Limited, θ = 0.5
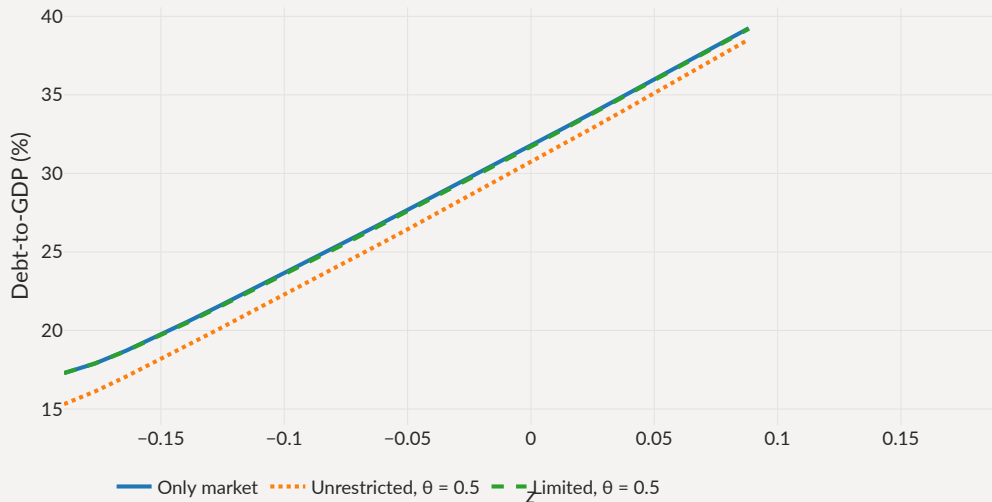
Why are there **more** defaults with loans?

Debt Levels with Loans

Distribution of debt levels

Debt Levels with Loans
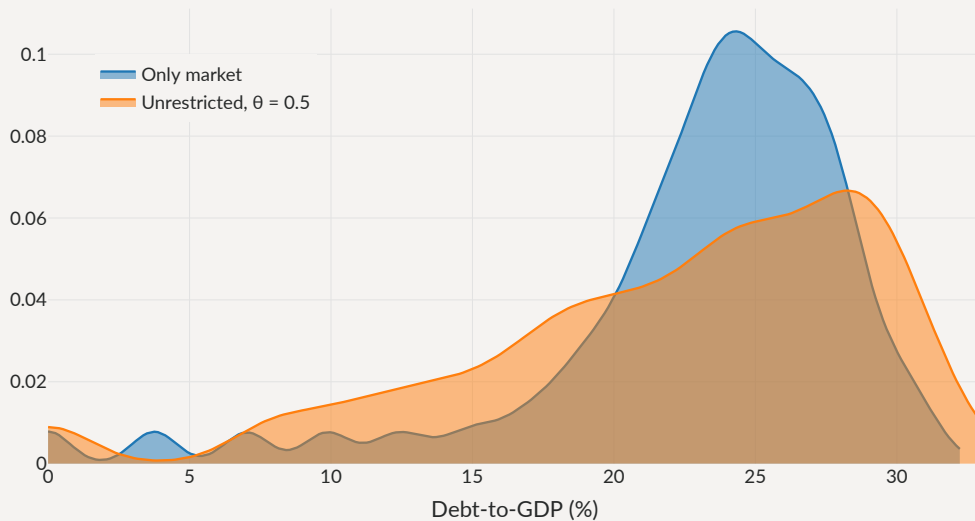
Distribution of debt levels

Distribution of debt levels

Government's surplus

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

- Revenues from debt issuance $B(b', b, m, z)$ modulate the value of the threat point
  - After large revenues (high q, high b'), gov't flush with cash, strong in bargaining
  - After bad issuance (low q or low b'), gov't weak in bargaining

- Strongly negative cross-elasticity of bilateral terms to market debt
  $\longrightarrow$ goes against market discipline of spreads

$$u'(c)\left(q + \frac{\partial q}{\partial b'}i + \frac{1}{1+r_b}\frac{\partial m'}{\partial b'} + \frac{\partial \frac{1}{1+r_b}}{\partial b'}m'\right) = \beta\mathbb{E}\left[u'(c)(1 - \mathbb{1}_{\mathcal{D}})\left(\kappa + (1-\delta)q' + \dots\right)\right]$$

Government's surplus

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

· Revenues from debt issuance $B(b', b, m, z)$ modulate the value of the threat point
   · After large revenues (high q, high b'), gov't flush with cash, strong in bargaining
   · After bad issuance (low q or low b'), gov't weak in bargaining

· Strongly negative cross-elasticity of bilateral terms to market debt
   $\longrightarrow$ goes against market discipline of spreads

$$u'(c) \left(q + \frac{\partial q}{\partial b'} i + \frac{1}{1 + r_b} \frac{\partial m'}{\partial b'} + \frac{\partial \frac{1}{1 + r_b}}{\partial b'} m' \right) = \beta \mathbb{E}\left[u'(c)(1 - \mathbb{1}_{\mathcal{D}})\left(\kappa + (1 - \delta)q' + \dots\right)\right]$$

Government's surplus

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

- Revenues from debt issuance $B(b', b, m, z)$ modulate the value of the threat point
  - After large revenues (high q, high b'), gov't flush with cash, strong in bargaining
  - After bad issuance (low q or low b'), gov't weak in bargaining

- Strongly negative cross-elasticity of bilateral terms to market debt
  $\longrightarrow$ goes against market discipline of spreads

$$u'(c)\left(q + \frac{\partial q}{\partial b'}i + \frac{1}{1+r_b}\frac{\partial m'}{\partial b'} + \frac{\partial \frac{1}{1+r_b}}{\partial b'}m'\right) = \beta \mathbb{E}\left[u'(c)(1 - \mathbb{1}_{\mathcal{D}})\left(\kappa + (1-\delta)q' + \dots\right)\right]$$
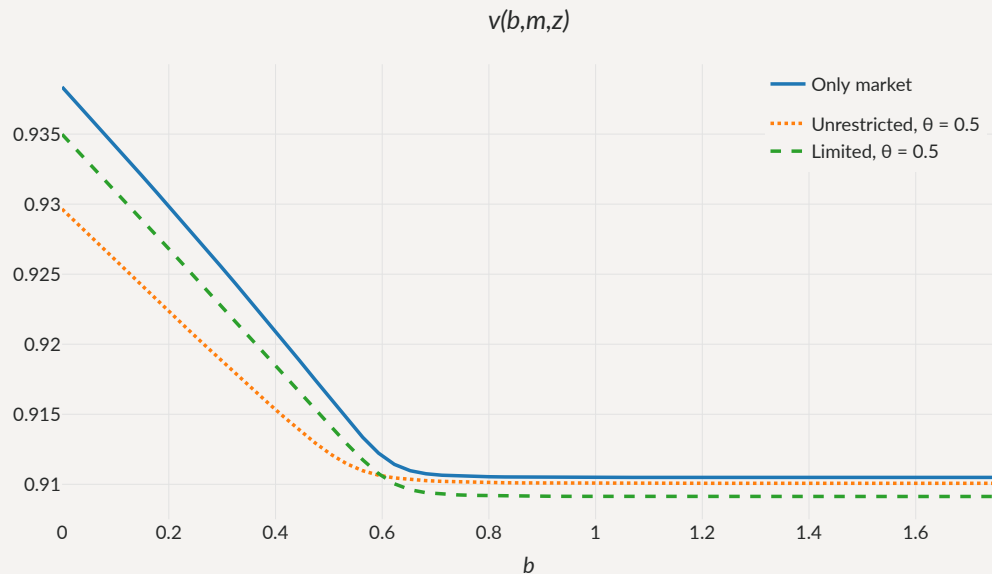
Surplus on loan requires spreads > 0: monopolist provides incentives for risk taking

Loan interest rate (Limited)
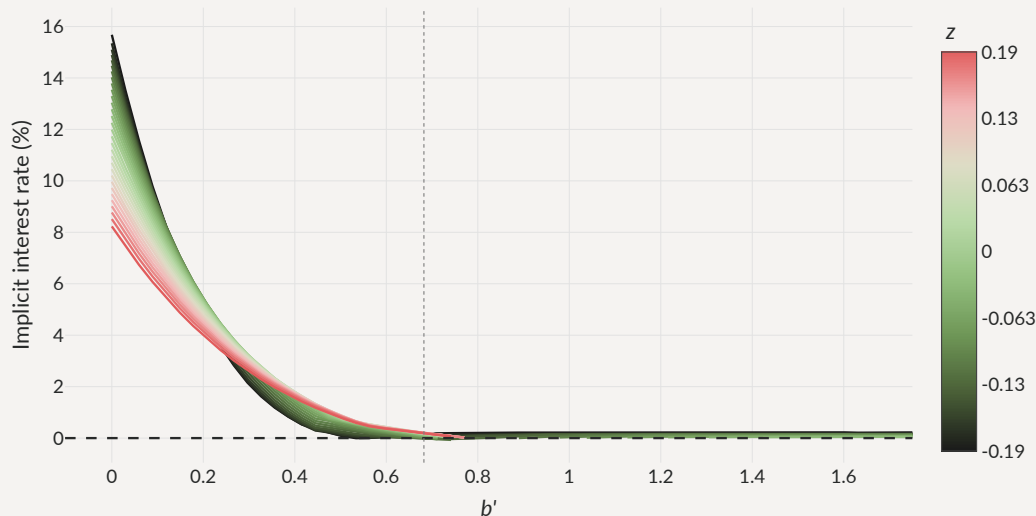
Limited $\succcurlyeq$ Unrestricted, but...

$$v(b,m,z)$$

Programming the Large Lender

- 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)	714	623	921	1,038
Std spread (bps)	399	315	552	612
$\sigma(c)/\sigma(y)$ (%)	113	115	115	113
Debt to GDP (%)	22.5	23.5	22.8	22.5
Loan to GDP (%)	0	0.71	0.972	1.06
Loan spread (bps)	–	682	1,264	536
Corr. loan & spreads (%)	–	62.5	48.1	71.1
Default frequency (%)	5.72	5.13	6.92	7.72
Welfare gains (rep)	–	0.21%	-0.079%	-0.2%

Concluding remarks

The Perils of Bilateral Sovereign Debt

- Simple model of borrowing from markets and a senior bilateral lender
    - … **Dangerous** when bilateral interest rate responds negatively to *market* debt
    - … Bargaining as an example of situation where cross-elasticity emerges

- Strong interaction between two markets for sovereign debt
    - … cross-elasticity induces risk-taking, more defaults, welfare losses
    - … even if bilateral loans are not used intensely on the equilibrium path

- Cross-elasticity constitutes a simple test to assess welfare gains of new instruments
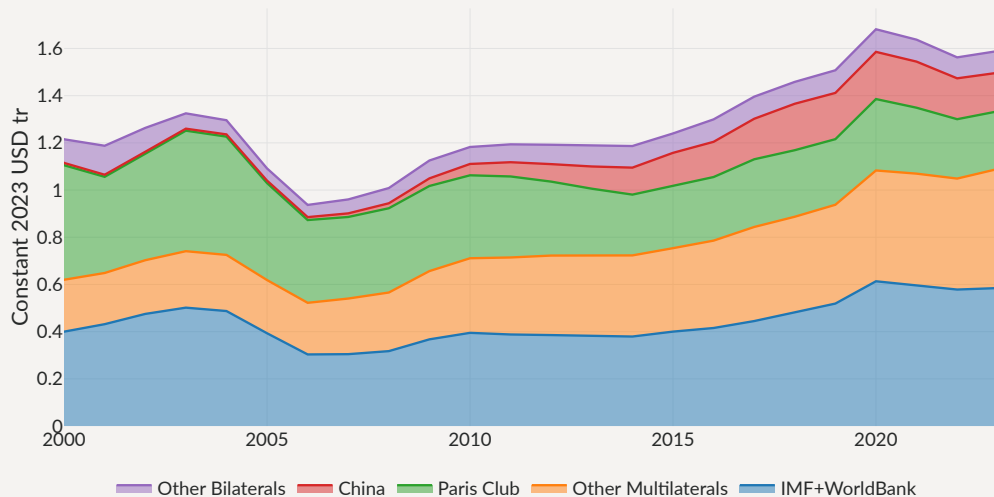   - … or a boost to the gains of fiscal rules, state-contingent debt…
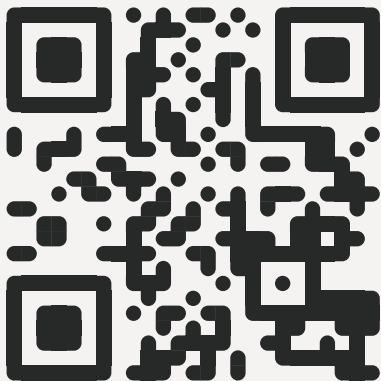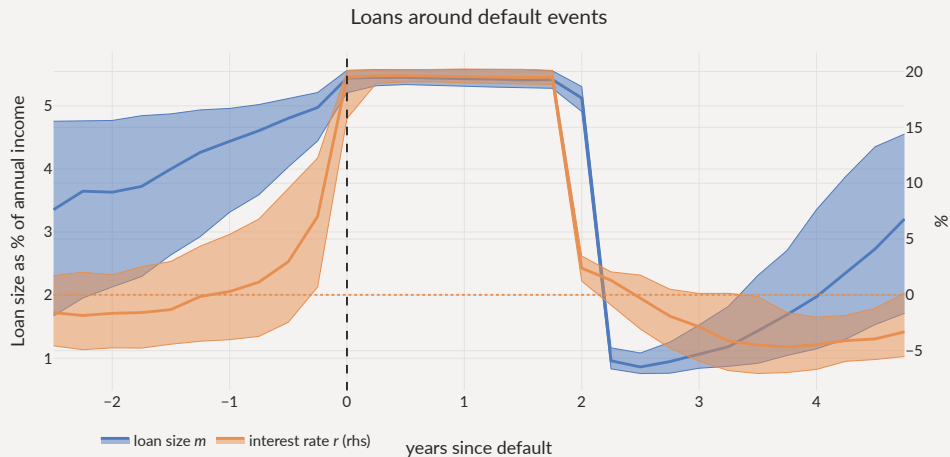
Scan to find the paper

Total Official Debt

- Further conditioning on default events lasting exactly two years

Loans around default events

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

Loans around default events

Loan drawings m' (Limited)