The Perils of Bilateral Sovereign Debt

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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?

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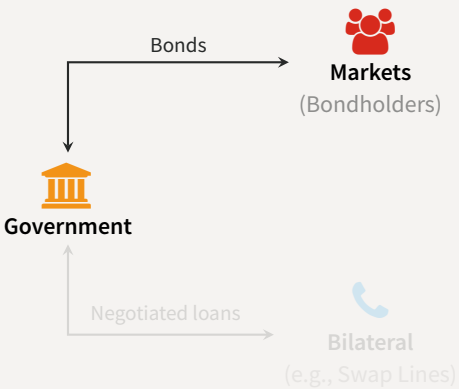
Evaluating Senior Official Creditors

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



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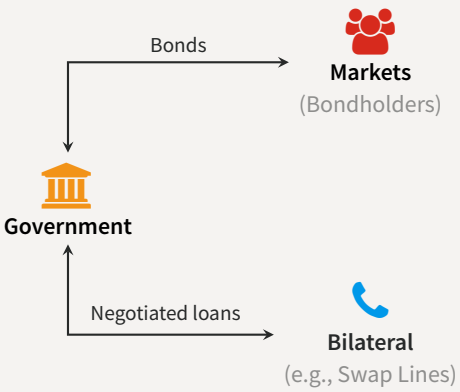

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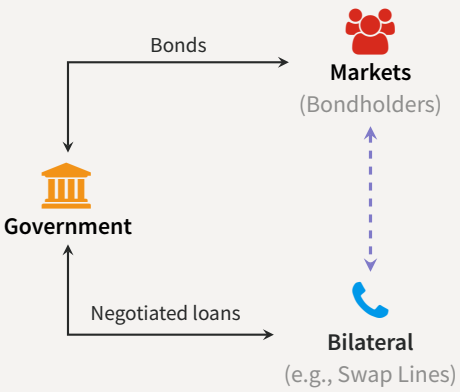

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Relational Overborrowing

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** ▼

- If the rate on bilateral loans is decreasing in *market* debt [cross-elasticity]
  - … government issues market debt more quickly, delevers more slowly
  - … spends longer in the risky region
  - … defaults more frequently
  - … welfare losses for the government

- Cross-elasticity can emerge endogenously from bargaining
  - … at plausible values for bargaining weights
  - … increased frequency of defaults dominates extra liquidity
  - … **relational overborrowing**

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Theory

Bargaining and the Cross-Elasticity

- Two periods $t \in \{0, 1\}$, endowment $y(z)$ at $t = 1$, would like to consume at both dates.
- Owe m to senior lender, just issued b' at price q in markets.
- Nash bargaining with weight θ for the lender solves

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

where

$$\mathcal{L}(m, x, m') = \underbrace{-x + \beta_L m'}_{\text{agreement}} - \underbrace{m}_{\text{threat point}}$$

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

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Bargaining and the Cross-Elasticity

- First-order conditions for bargaining problem

$$u'(qb' + x) = \frac{\theta}{1-\theta} \frac{\mathcal{B}(b', m, x, m')}{\mathcal{L}(m, x, m')}$$

$$u'(qb' + x) = \frac{\beta}{\beta_L} \mathbb{E}\left[u'\left(y(z) - m' - f(b')\right)\right]$$

- Can prove that

$$\frac{\partial x}{\partial q} \leq 0 \qquad \frac{\partial m'}{\partial q} \leq 0 \qquad \text{and} \qquad \frac{\partial r}{\partial q} \leq 0$$

- Intuition: large part of surplus comes from the term

$$u(qb' + x) - u(qb' - m)$$

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Debt Dilution with Undefaultable Loans

Issue long bonds b at $t = 0$, short bonds d and loans m at $t = 1$, repay at $t = 2$

$$c_0 = q(b,d)b \qquad c_1 = q(b,d)d + \phi(b,d,m)m \qquad c_2(z) = y(z) - m - \min\{h(z), b + d\}$$

with

$$q(b,d) = \mathbb{P}\left(b + d \leq h(z)\right) = p(b + d) \qquad \text{and} \qquad m \leq \bar{m}$$

to maximize $\sum_{t=0}^{2} \mathbb{E}\left[u(c_t)\right]$

Commitment: Choose d internalizing effect on initial prices

$$u'(c_0)\underbrace{p'(b+d)b}_{\text{past prices}} + u'(c_1)\Big(\underbrace{p(b+d)}_{\text{revenue}} + \underbrace{p'(b+d)d}_{\text{current prices}} + \underbrace{\phi'_d(b,d,m)m}_{\text{cross-elasticity}}\Big) = \mathbb{E}\left[u'(c_2)\right]$$

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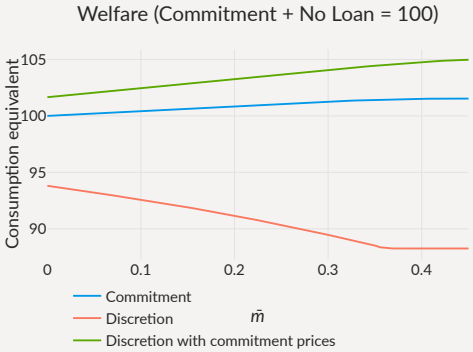
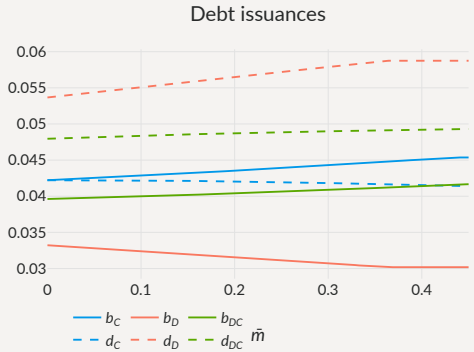
Debt Dilution with Undefaultable Loans and Cross-Elasticity

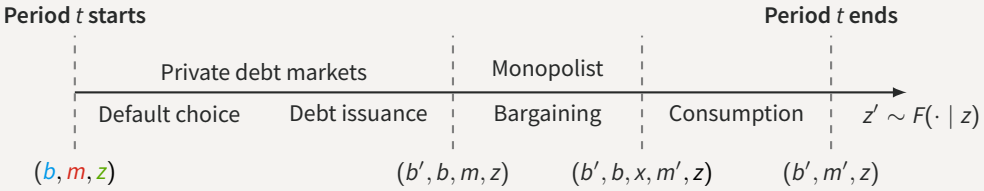




Quantitative Model

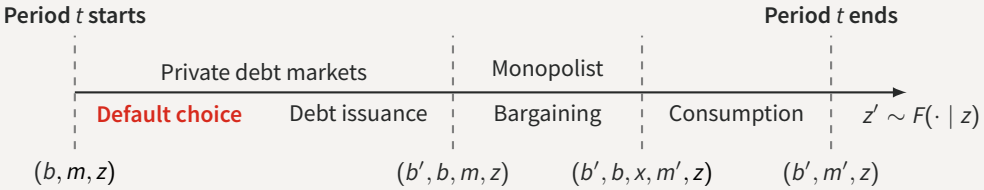
Timeline of Events

- Enter period t owing b to bondholders, m to monopolist, income $y(z)$



Timeline of Events

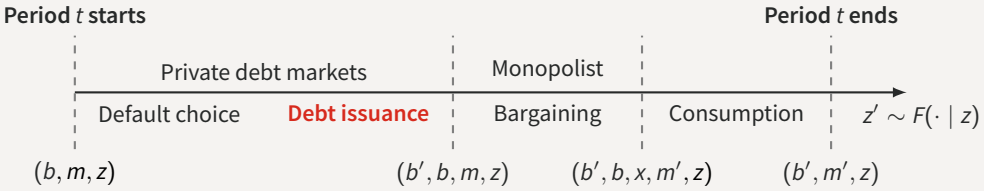
- Choose to repay or default the *market* debt subject to convex output costs



$$v(b, m, z) = \max \left\{ v_R(b, m, z) + \epsilon_R, v_D(m, z) + \epsilon_D \right\}$$

Timeline of Events

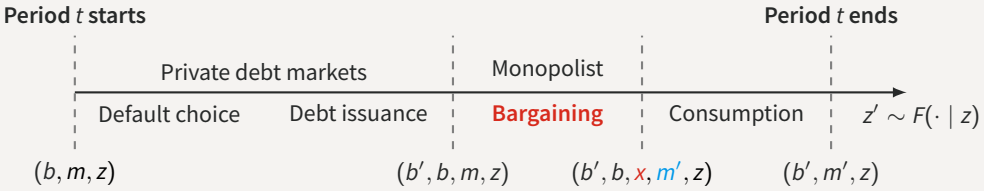
- If repaid, issue new (long-term) debt b' in markets at price q [coupon rate κ, maturity $1/\delta$]



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

Timeline of Events

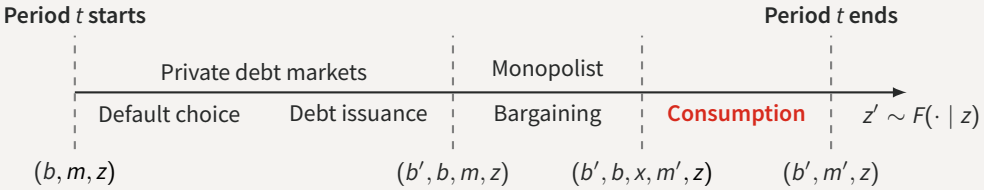
- Meet with senior lender, decide any transfers x and new/remaining balance m'



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

Timeline of Events

- Consume output plus revenues from debt issuance plus transfers minus debt service



$$c_R = y(z) + q(b', b, m, z)(b' - (1 - \delta)b) + x_R(b', b, m, z) - \kappa b$$
$$c_D = y(z) - h(z) + x_D(m, z); \qquad x_D(m, z) \leq \Gamma(m)$$

Exogenous Bilateral Terms

Programming the Large Lender: Possible Rules

- Explore interest rate rules of the form

$$r(b', m') = \max\{r^\star, \alpha_0 + \alpha_b b' + \alpha_m m'\}$$

- Two versions

Size-dependent
$\alpha_0 > 0, \alpha_b = 0, \alpha_m > 0$

Risk-inducing
$\alpha_0 > 0, \alpha_b < 0, \alpha_m \geq 0$

- First-order condition for bonds

$$u'(c)\left(q + \frac{\partial q}{\partial b'} i + \frac{1}{1+r_b}\frac{\partial m'}{\partial b'} + \frac{\partial \frac{1}{1+r_b}}{\partial b'} m'\right) = \beta \mathbb{E}\left[v_b(b', m', z') + v_m(b', m', z')\frac{\partial m'}{\partial b'} \mid z\right]$$

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Equilibrium with Exogenous Rules

- 'Only market' standard calibration to Argentina 1993-2001

	Only market	Size dependent r	Risk inducing r
Avg spread (bps)	714	623	921
Std spread (bps)	399	315	552
$\sigma(c)/\sigma(y)$ (%)	113	115	115
Debt to GDP (%)	22.5	23.5	22.8
Loan to GDP (%)	0	0.71	0.972
Loan spread (bps)	–	682	1,264
Corr. loan & spreads (%)	–	62.5	48.1
Default frequency (%)	5.72	5.13	6.92
Welfare gains (rep)	–	0.21%	-0.079%

Equilibrium with Exogenous Rules

- Default rates: ↓ with size dependent ↑ with risk-inducing

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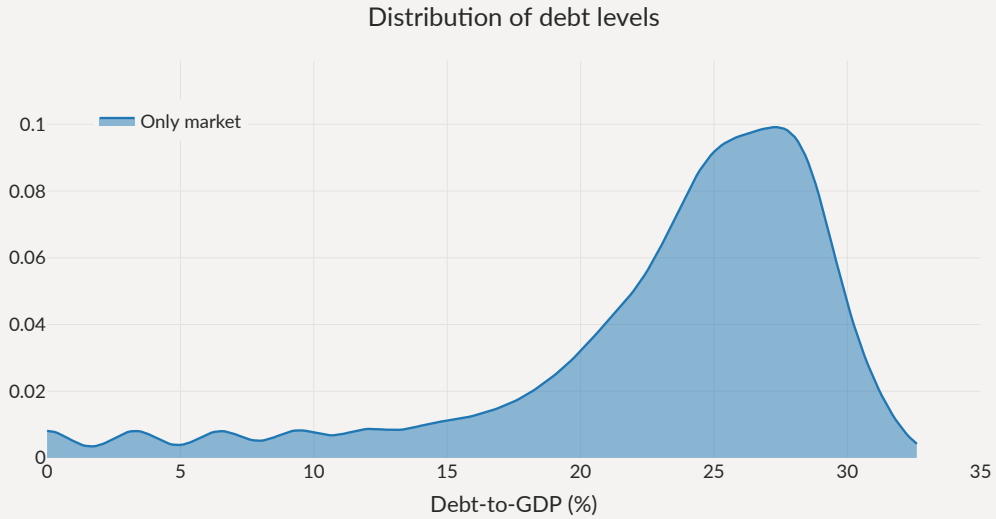
Default barriers with Exogenous Bilateral Rules

Debt Levels with Exogenous Bilateral Rules



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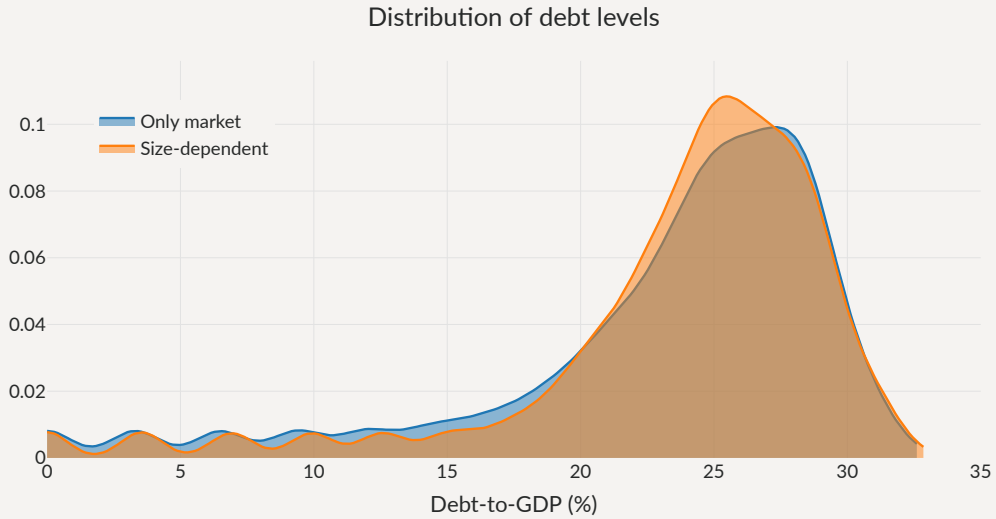

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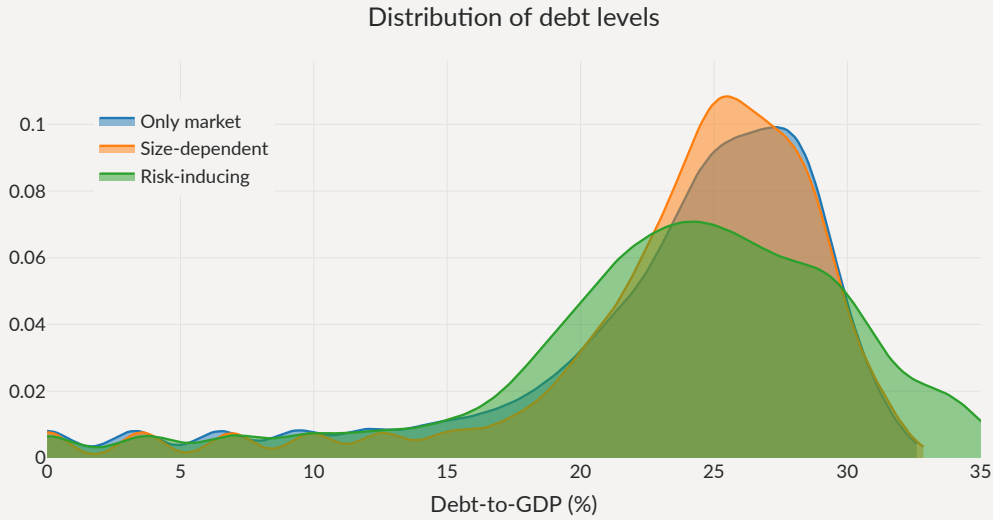

Endogenous Bargaining

Bargaining Stage with Monopolist

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

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

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

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

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

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same sdf as markets

- Government's surplus

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- Government's surplus

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Relational Overborrowing

Government's surplus

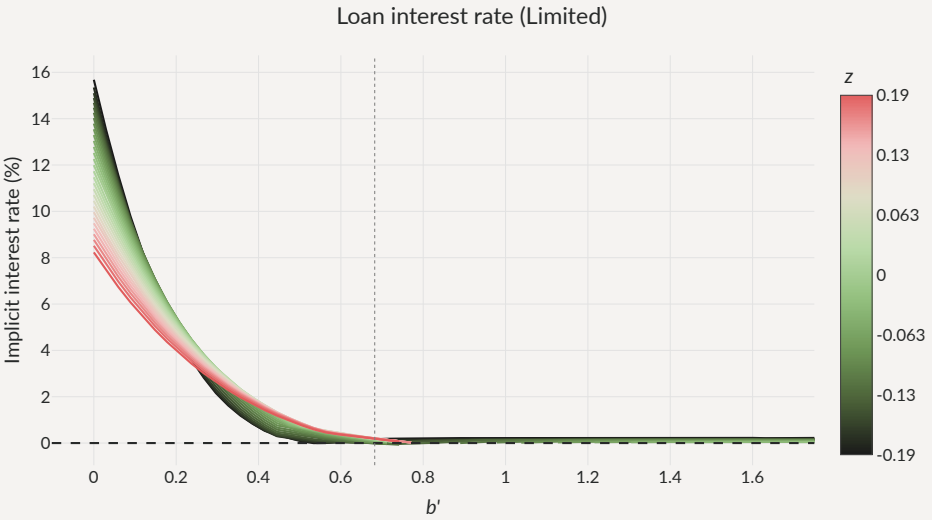
$$\mathcal{B}_R(b', b, x, m, m', z) = u\big(y(z) + B(b', b, m, z) + x\big) + \beta \mathbb{E}\left[v(b', m', z') \mid z\right]$$
$$- \big(u\big(y(z) + B(b', b, m, z) - m\big) + \beta \mathbb{E}\left[v(b', 0, z') \mid z\right]\big)$$

- 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

Risk-taking Incentives

Drawings

Threat point manipulation: increase market b' to reduce bilateral r

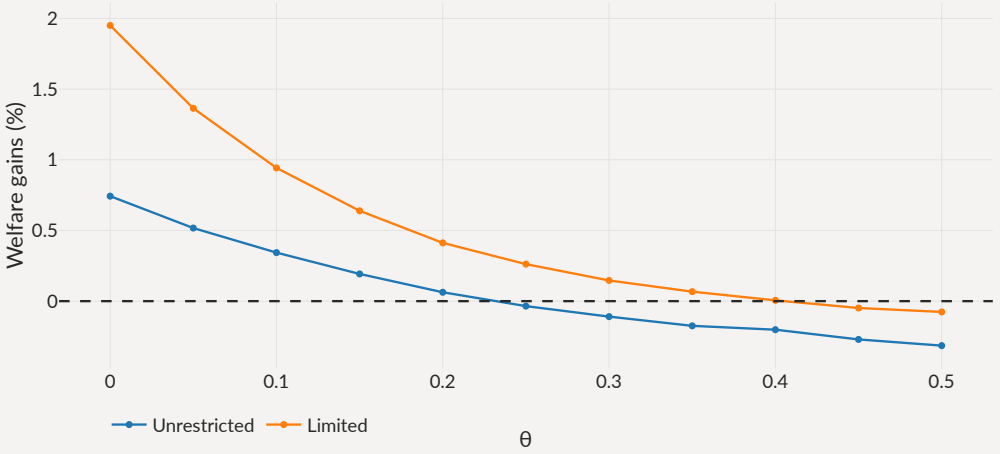


Limiting Loans in Default

- **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%

Bargaining Power and Welfare



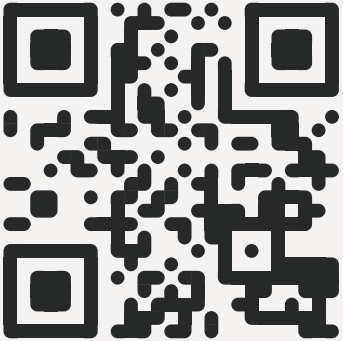
Concluding remarks

The Perils of Bilateral Sovereign Debt

- Simple model of borrowing from markets and a senior bilateral lender
  - … strong interaction between two markets for sovereign debt
  - … even if bilateral loans are **not** used intensely on the equilibrium path

- **Dangerous** when bilateral interest rate responds negatively to *market* debt
  - … cross-elasticity induces risk-taking, more defaults, welfare losses
  - … Bargaining as an example of situation where cross-elasticity emerges

- 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…



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A New Landscape for Official Sovereign Debt

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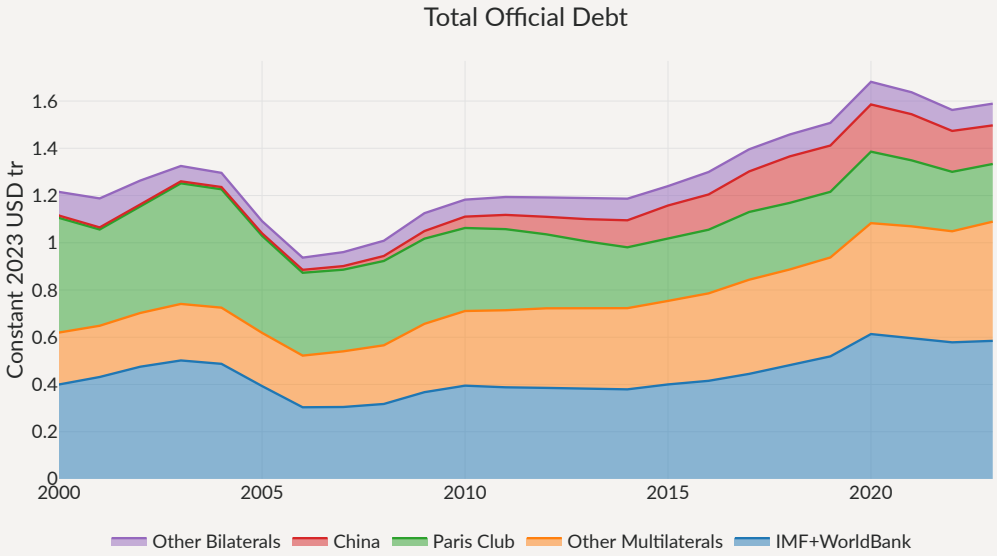

Risk-taking Incentives

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