

# Central Bank Swap Lines as Bilateral Sovereign Debt

---

Francisco Roldán  
IMF

César Sosa-Padilla  
Notre Dame & NBER

XXVI Workshop in International Economics and Finance  
September 2024

The views expressed herein are those of the authors and should not be attributed to the IMF,  
its Executive Board, or its management.

# 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?

# 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?

# 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?

# 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?

# 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

# 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

# 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



- 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, 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

# 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

# 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

- 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**


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

# Environment

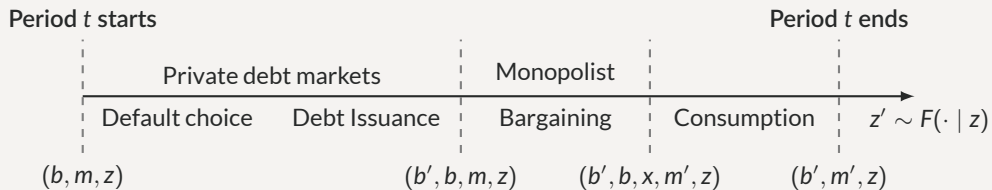
The government of a small open economy borrows from a monopolist and from markets

- 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**


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



# 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

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

## 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

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

# 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

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

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

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

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

# 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

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

same sdf as markets

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

# 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

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

- Government's surplus

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

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

# Bargaining: intuition

## Lender's surplus

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

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

## Government's surplus

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

- 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



## Lender's surplus

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

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

## Government's surplus

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

- 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

## Quantitative Effects of Swap Lines

---

# Calibration

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

	Parameter	Value
Sovereign's discount factor	$\beta$	0.9504
Sovereign's risk aversion	$\gamma$	2
Preference shock scale parameter	$\chi$	0.02
Lender's bargaining power	$\theta$	0.5
Risk-free interest rate	$r$	0.01
Duration of debt	$\rho$	0.05
Income autocorrelation coefficient	$\rho_z$	0.9484
Standard deviation of $y_t$	$\sigma_z$	0.02
Reentry probability	$\psi$	0.0385
Default cost: linear	$d_0$	-0.24
Default cost: quadratic	$d_1$	0.3

# Calibration

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

	Parameter	Value
Sovereign's discount factor	$\beta$	0.9504
Sovereign's risk aversion	$\gamma$	2
Preference shock scale parameter	$\chi$	0.02
Lender's bargaining power	$\theta$	0.5
Risk-free interest rate	$r$	0.01
Duration of debt	$\rho$	0.05
Income autocorrelation coefficient	$\rho_z$	0.9484
Standard deviation of $y_t$	$\sigma_z$	0.02
Reentry probability	$\psi$	0.0385
Default cost: linear	$d_0$	-0.24
Default cost: quadratic	$d_1$	0.3

## How do swaps affect equilibrium?

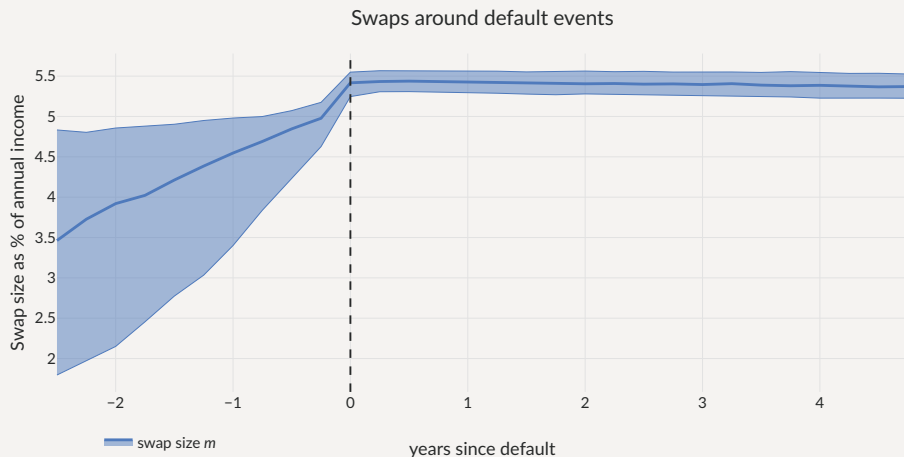
	No swap	Unrestricted, $\theta = 0.25$	Unrestricted, $\theta = 0.5$
Avg spread (bps)	804	1,841	2,396
Std spread (bps)	470	1,099	1,541
$\sigma(c)/\sigma(y)$ (%)	111	111	110
Debt to GDP (%)	21.4	20.8	20.2
Swap to GDP (%)	0	3.74	3.32
Corr. swap & spreads (%)	–	53.8	62.2
Default frequency (%)	6.53	13	14.7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

# When is the Swap Used?

▶ Limited

▶ More

- Swaps shoot up before *and during* defaults



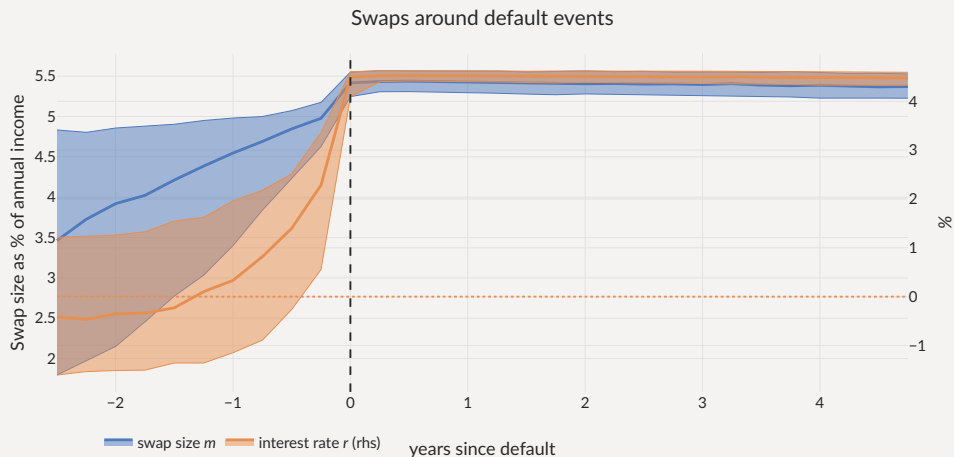
- Also consider **Limited** versions:  $m' \leq \Gamma(m)$  while in default

# When is the Swap Used?

▶ Limited

▶ More

- Swaps shoot up before *and during* defaults



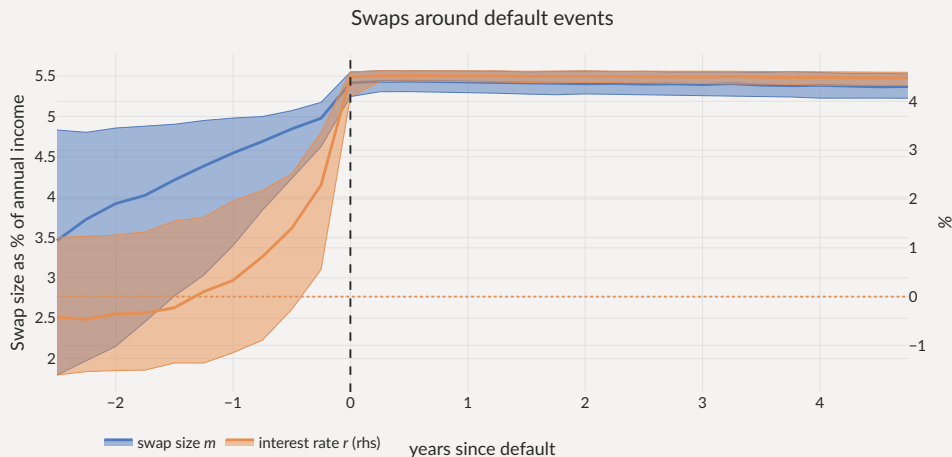
- Also consider **Limited** versions:  $m' \leq \Gamma(m)$  while in default

# 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



## Limiting swaps in default

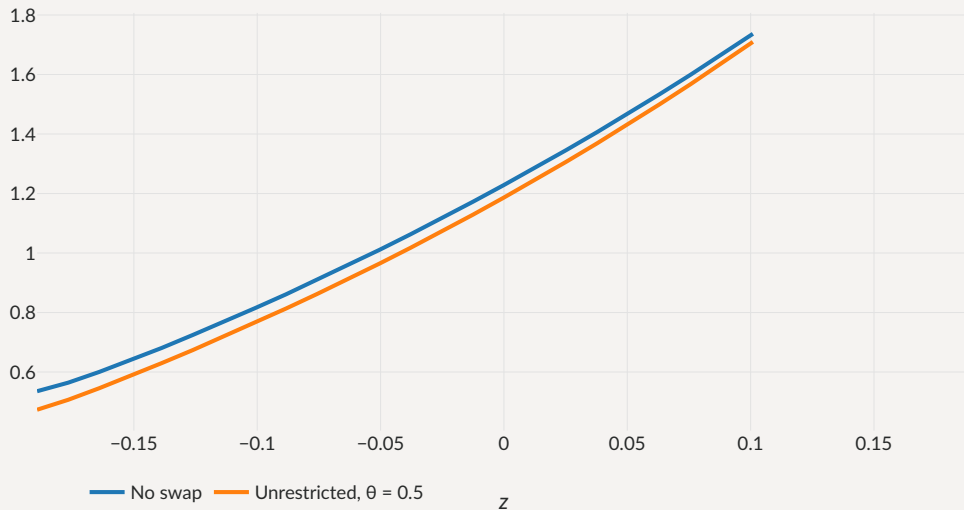
- Limited: entire swap must be repaid while in default  $\Gamma(m) = 0$

	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

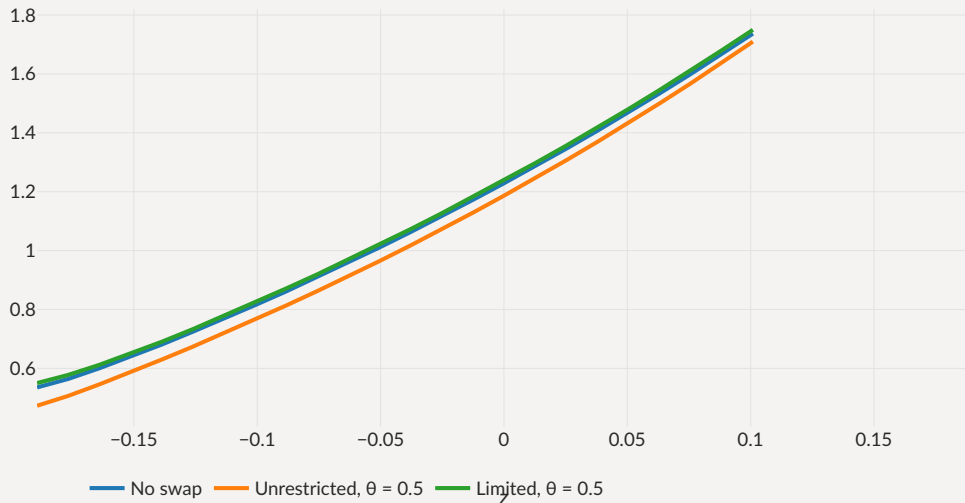
Debt levels at which  $\mathcal{P}(b,m,z)$  crosses 50%



## Default Barriers with Swaps

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

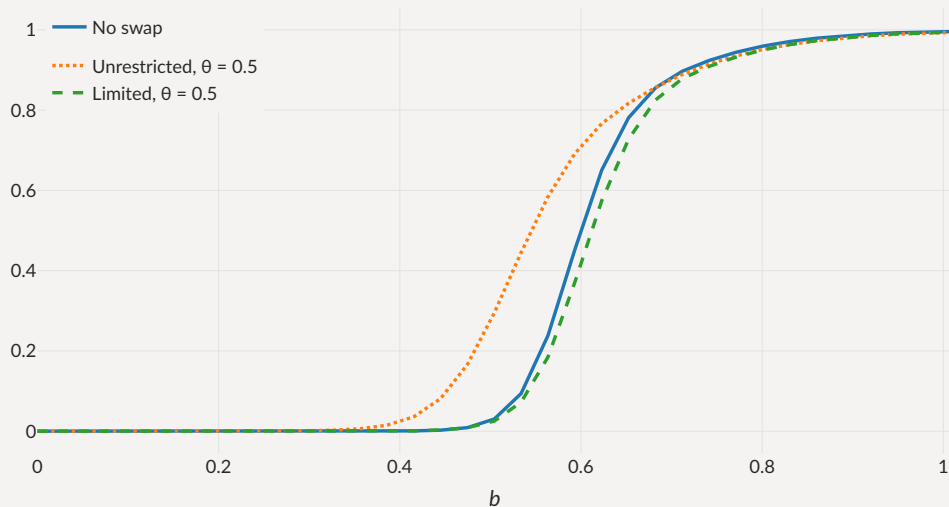
Debt levels at which  $\mathcal{P}(b,m,z)$  crosses 50%



# Debt Tolerance with Swaps

- Unrestricted: default more often, Limited: marginal impact

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



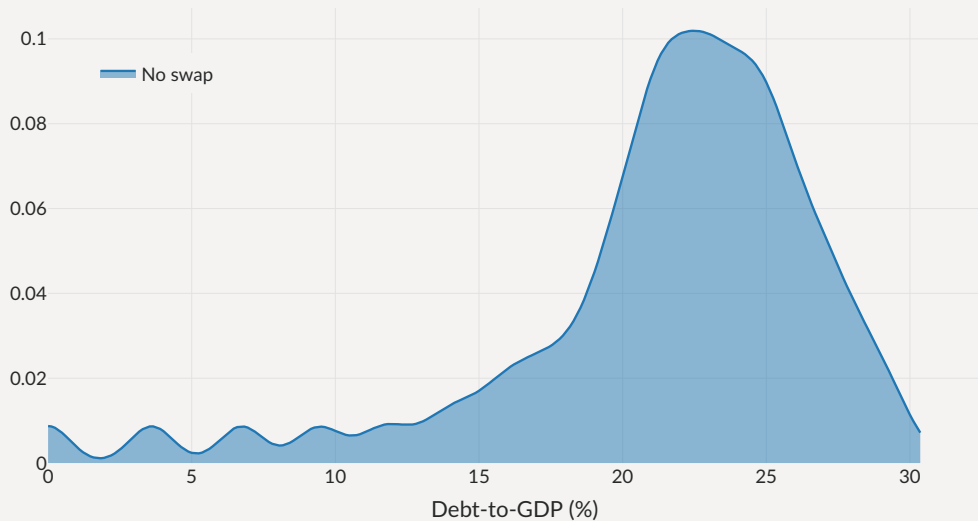
If **Limited** swaps help repay the debt,

---

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

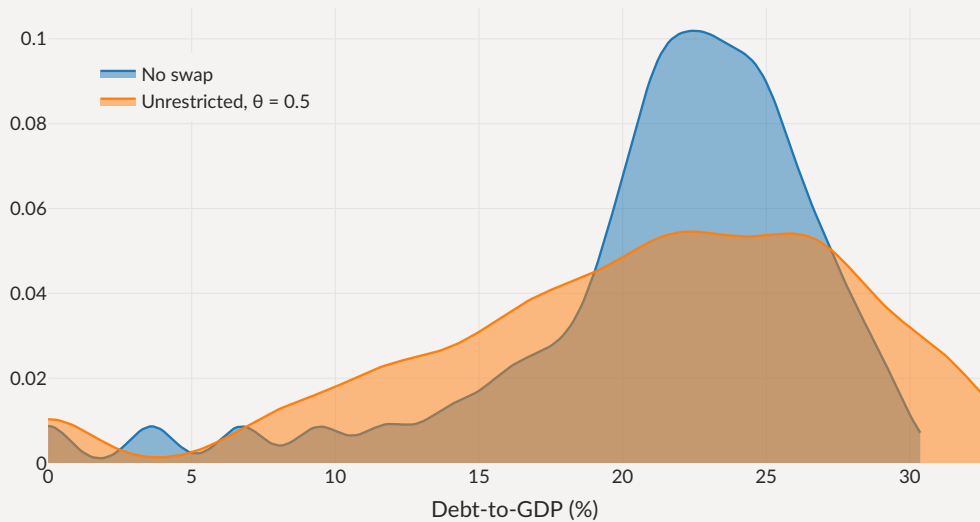
# Debt Levels with Swaps

Distribution of debt levels



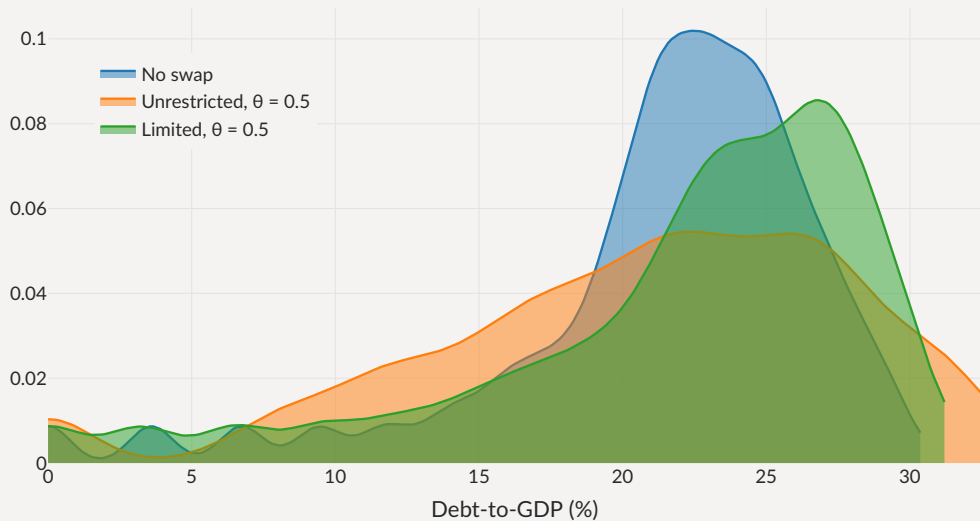
# Debt Levels with Swaps

Distribution of debt levels



# Debt Levels with Swaps

Distribution of debt levels





# 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
  - $b' \gg 0$

# 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
  - $b' \gg 0$

# 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
  - $b' \gg 0$

# 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
  - $b' \gg 0$

# Relational overborrowing

## Surplus

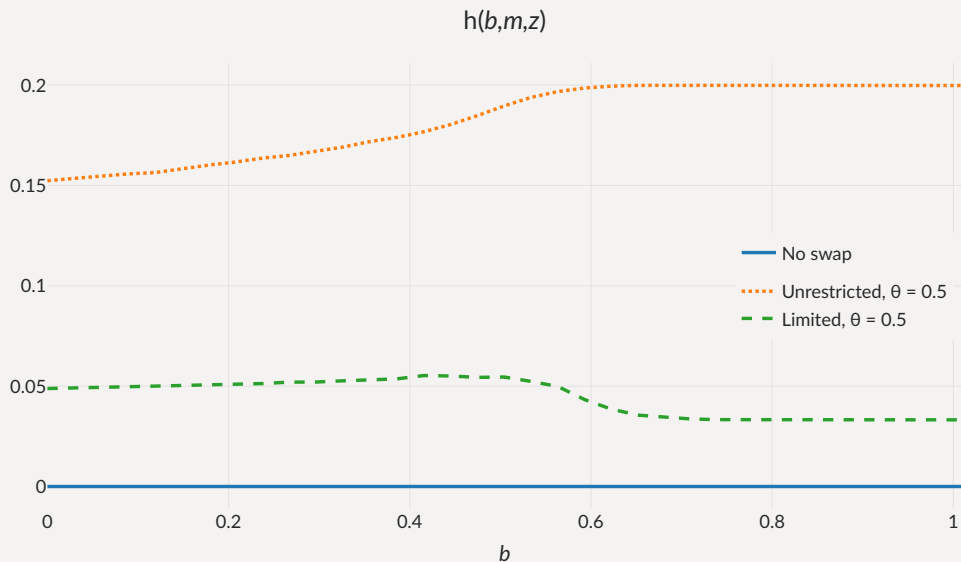
$$\mathcal{L}_R(b', x, m, m', z) = (a - x + \beta_L \mathbb{E} [h(b', m', z') | z]) - (a + m + \beta_L \mathbb{E} [h(b', 0, z') | z])$$

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

- 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

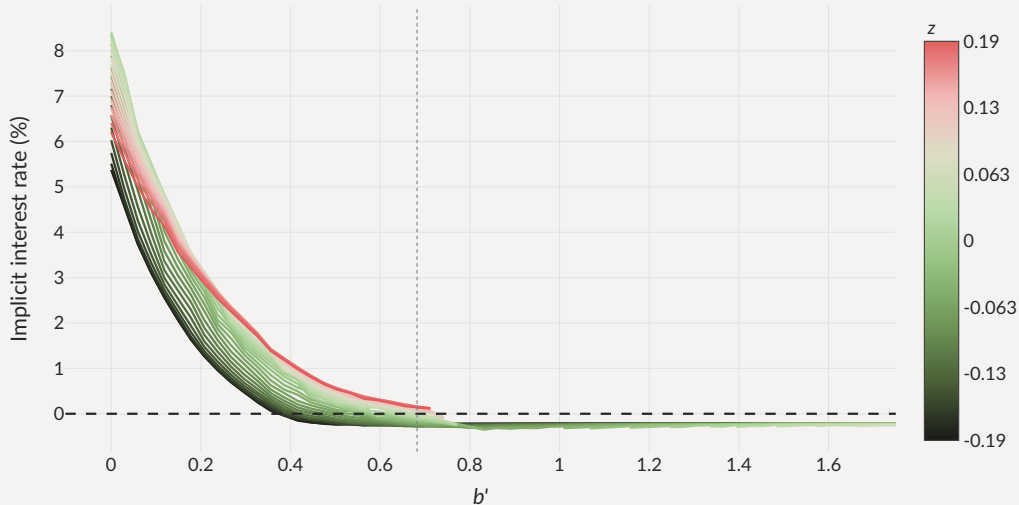
Monopolist's profits **increasing** in debt (cond. on repayment) – surplus requires spreads



# Risk-taking incentives

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

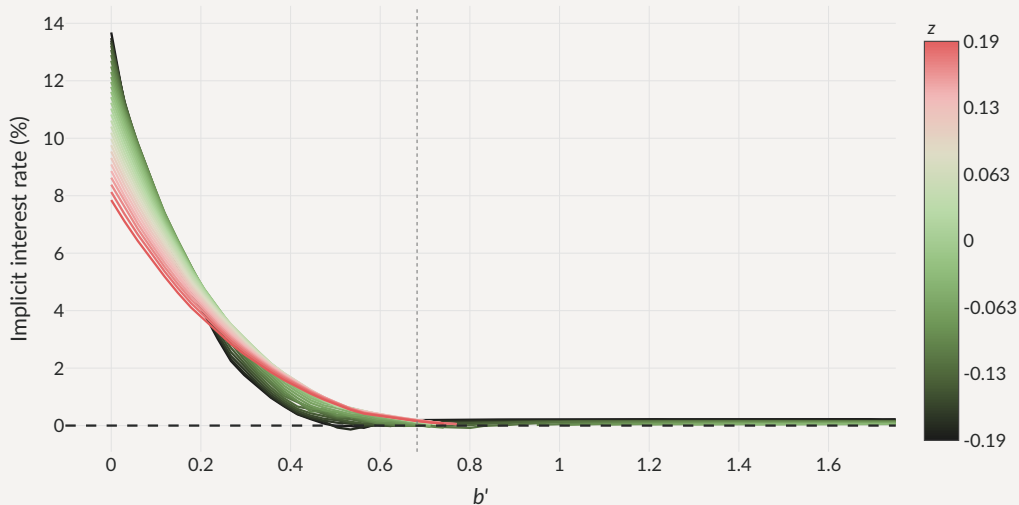
Interest rate on the swap (Unrestricted)



# Risk-taking incentives

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

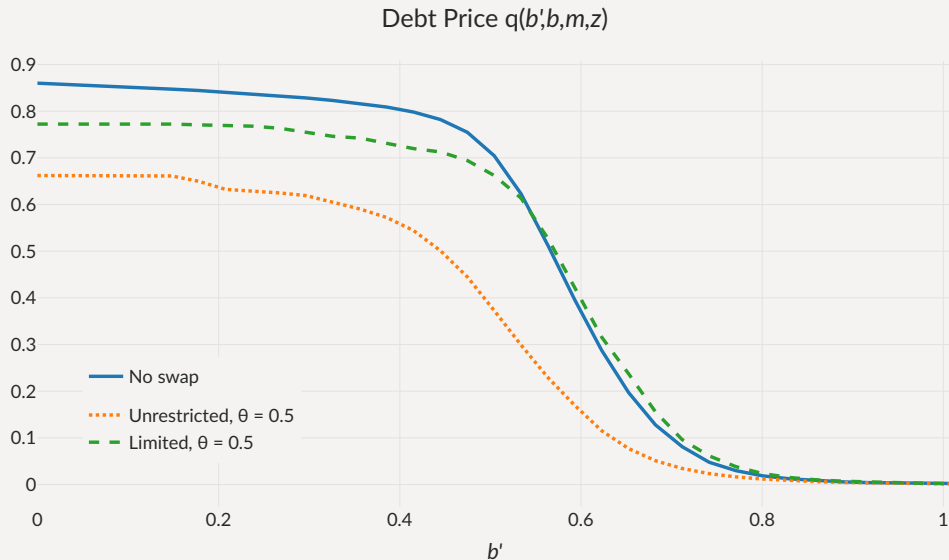
Interest rate on the swap (Limited)





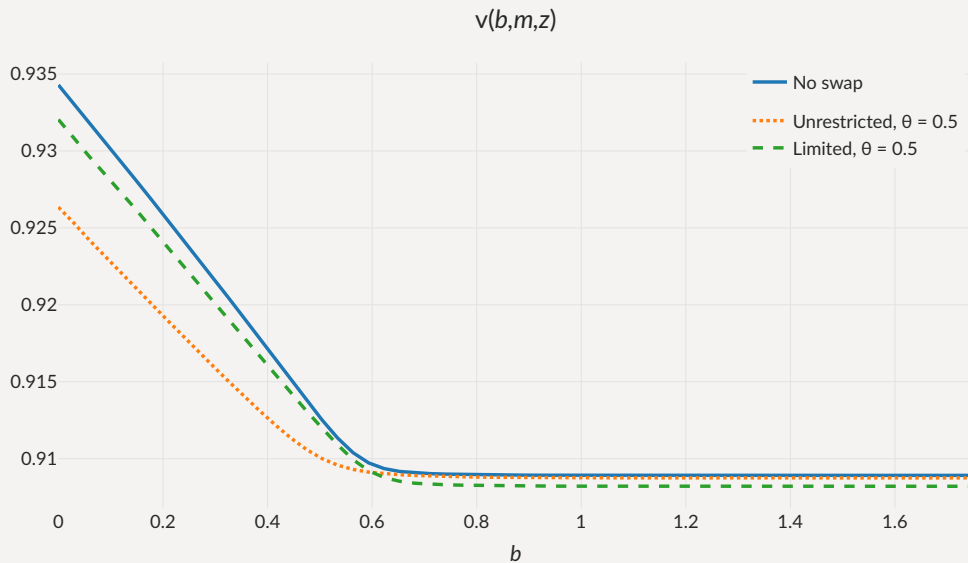
# Debt Prices with Swaps

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



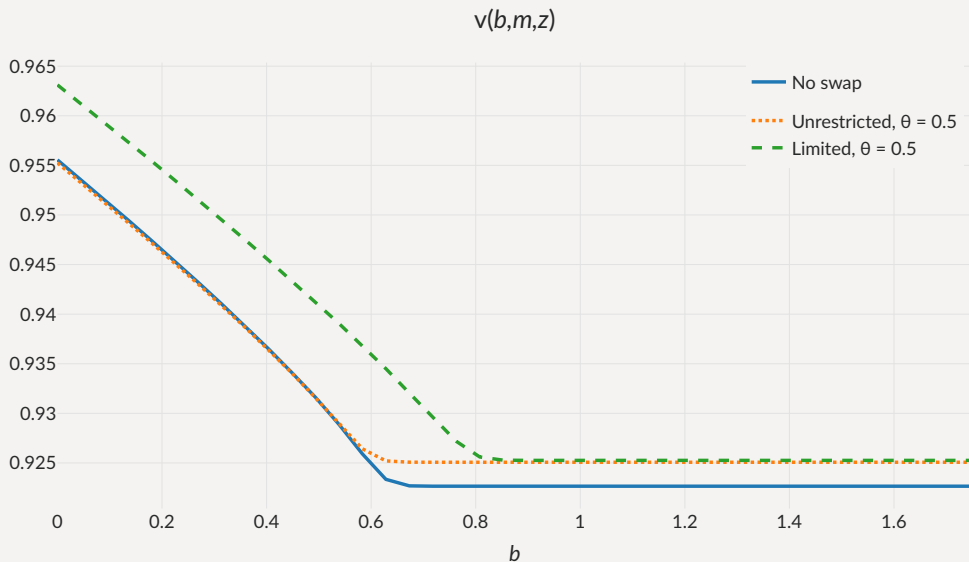
# Welfare effects of swap lines

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

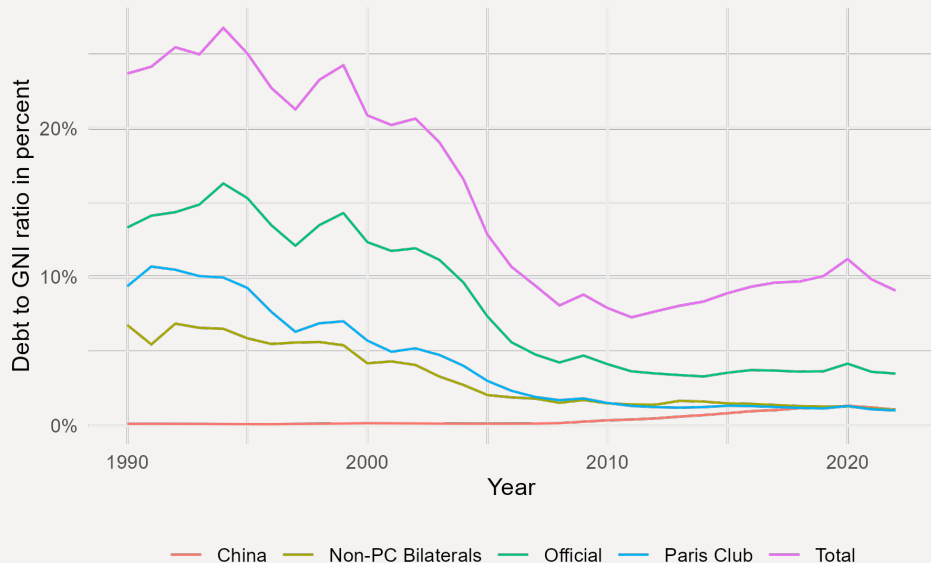
---

- 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
- 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?



*Scan to find the paper*

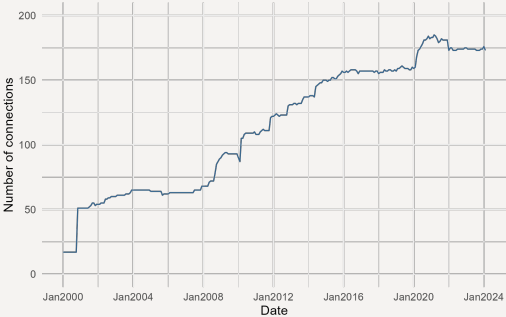
# Motivating Evidence: External debt to GNI (weighted)

[< Back](#)

Source: World Bank International Debt Statistics.



# Motivating Evidence: Increase in `swaps connections'

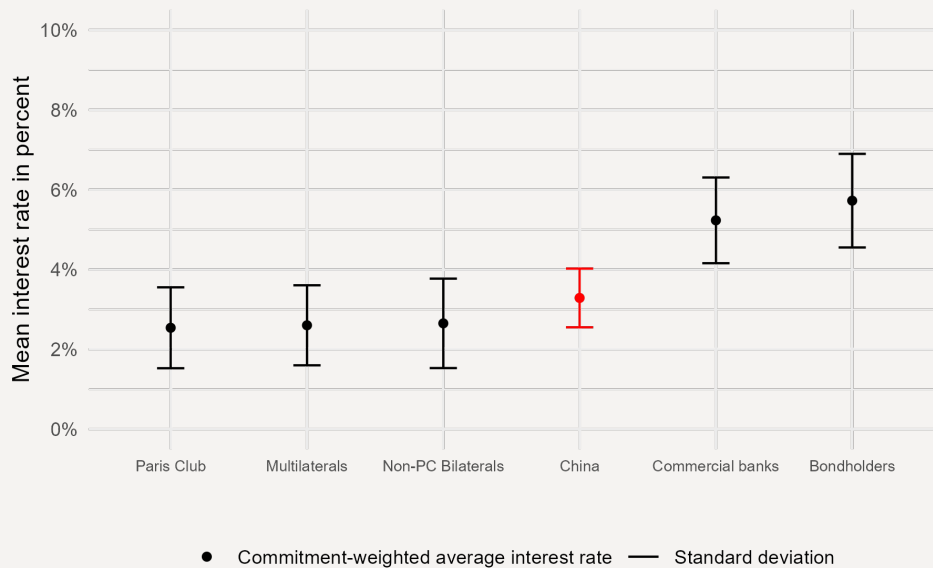


Source: Bahaj, Fuchs, and Reis (2024)



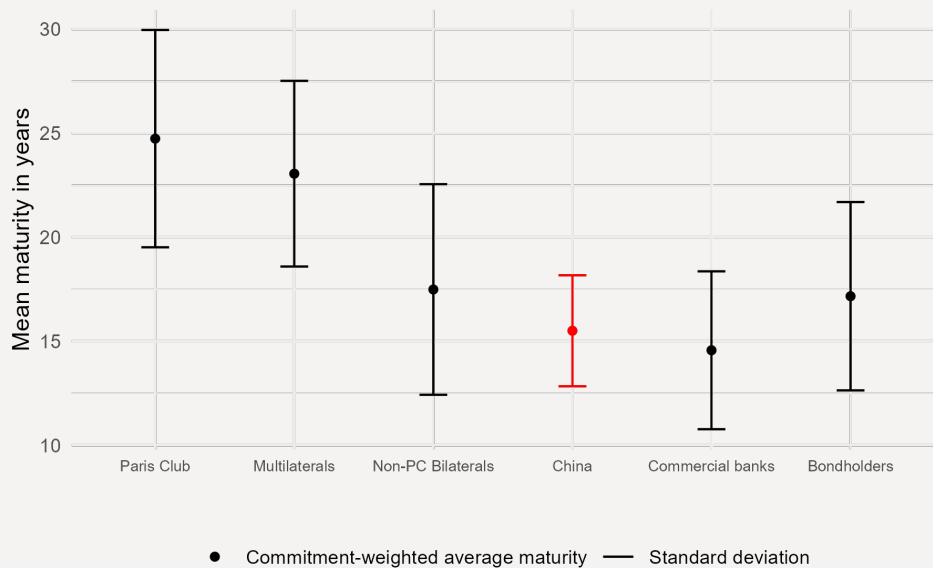
Source: Bahaj, Fuchs, and Reis (2024)

# Motivating Evidence: Average Interest Rates



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 <sup>2</sup>	0.825	0.777

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

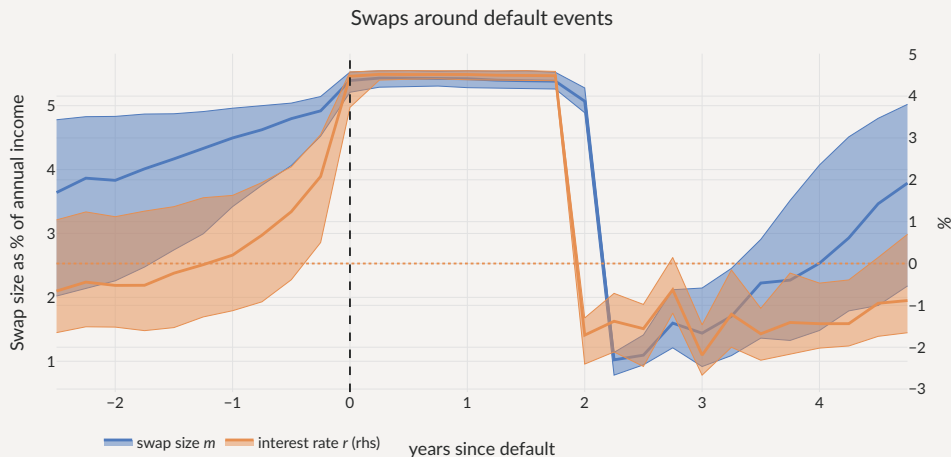
$$r_{i,t}^x = r_{i,t}^{\text{Bond Mkt}} + \gamma_i + \epsilon_{i,t}, \quad x \in \{\text{CHN, Paris Club}\}$$

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 <sup>2</sup>	0.825	0.777

\* p<0.1, \*\* p<0.05; \*\*\* p<0.01

# When is the Swap Used?

- Further conditioning on default events lasting exactly two years



# When is the Swap Used?

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

