The Perils of Bilateral Sovereign Debt*

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Abstract

We study the interaction between private and official sovereign debts. The emergence of new official lenders not bound by the Paris Club institutional framework has raised concerns about their implications for the terms and seniority structure of sovereign debt. We evaluate this view in a quantitative sovereign default model augmented by the presence of a large senior creditor with whom borrowing terms are negotiated. The dynamics of the bilateral surplus endogenously lead the government to overborrow in markets and expose itself more intensely to sovereign risk, creating welfare losses. The model also implies a simple test to assess the welfare implications of new forms of bilateral sovereign debt.

JEL Classification F34, F41, G15
Keywords Sovereign debt, debt dilution, bilateral bargaining, official debt

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Introduction

A large fraction of sovereign borrowing in emerging-market economies takes the form of official debt, including loans from other governments, regional development banks, or multilateral institutions such as the IMF and the World Bank. The past few decades have witnessed the rise of new sovereign creditors operating outside of the Paris Club framework and with ambitions to redesign the financial architecture of sovereign debt (Horn et al., 2021b; Gelpern et al., 2021). The claims to senior creditor status by these new lenders as well as the opaqueness of their borrowing terms have raised concerns about welfare implications for borrowing countries (Horn et al., 2021a, 2023).

This paper evaluates such concerns in the context of a quantitative sovereign debt and default model, augmented by the presence of a large lender who offers an alternative source of funds. Relative to creditors in international capital markets, the large lender possesses a superior enforcement technology, which supports its claim to senior creditor status. In our baseline setup, we assume that borrowing terms with the large creditor are determined through bargaining, which gives a critical role to the dynamics of the bilateral relationship and its surplus.

We focus on the interaction between the market and the large lender as two possible sources of funds. While the availability of bilateral loans from the large lender affects the government's behavior in debt markets, outcomes in debt markets influence threat points in the bilateral negotiation. The interest rate charged by the large lender is therefore constrained by implicit competition from debt markets. But when default risk pushes up yields on marketable debt, the large lender is also able to charge a premium. Because there is lower or no default risk on this loan, such a premium only reflects the borrower's outside options.

The baseline model yields two main results: welfare losses and relational overborrowing. While bilateral loans can and are often used on the equilibrium path to avoid costly defaults, the borrowing country is worse off when the large lender is present. One reason for this is that the possibility of borrowing from the large lender while excluded from markets raises the value of default, which increases the default frequency and lowers debt prices. But there is another, more fundamental reason. Even imposing the constraint that bilateral loans are unavailable during default, welfare for the government is still hurt by the presence of the large lender due to a "relational overborrowing" effect. Borrowing terms with the large lender are determined by splitting the bilateral surplus. This surplus is greatest when sovereign risk is present and the government is paying high spreads on its debt, which is when the large lender is most needed. Consequently, when it expects the government to face high spreads in the future, the large lender values the relationship more, and is willing to invest in it by lending more cheaply. This endogenous elasticity of bilateral loan terms to indebtedness in markets acts as a countervailing force to the market discipline of spreads upon large issuances of debt. The presence of the large lender then leads the government to take on more debt in markets and to delever more slowly. The result is an increase in the default frequency and therefore in spreads, which ultimately create welfare losses.

The dynamics and welfare effects we describe result from three critical assumptions regarding the large creditor and the funding it offers. Compared to markets, we assume that it is more difficult (or impossible) to default on the large creditor, that its loans are of shorter maturity, and that the terms of borrowing result from bilateral bargaining rather than explicit competition and a zero-profit condition. The prime example of this are the Central Bank swap lines that Horn et al. (2021b) identify as one of the main forms under which official lending, largely from China, has returned to the fore since the 2000s.

Other forms of bilateral debt share these seniority and duration characteristics, including notably IMF programs and certain lines and repo facilities with large central banks such as the Fed or the ECB. In these cases, however, borrowing terms are fixed in advance by institutional frameworks such as the IMF surcharges policy (IMF, 2024). The Fed's liquidity lines typically involve a spread of 25bps over policy rates (Bahaj and Reis, 2023) and are reported in real time on the FRB New York's website. We capture these in an extension of the model in which we replace the bargaining protocol by fixed rules for determining borrowing terms. The extension allows us to ask questions about optimal design of these facilities and also sheds light on the dynamics underlying our main results.

When the interest rate of the bilateral loan does not respond aggressively to indebtedness in debt markets, the relational overborrowing effect is muted or disappears. In this case, the fact that the large lender can help avoid defaults on marketable debt becomes the dominating force, and the equilibrium features lower default frequencies, better market financing terms, and welfare gains for the government.

A key quantity in the model is the government bargaining power relative to the large lender. When the government can make take-it-or-leave-it offers (full bargaining power), the large lender simply provides nondefaultable loans at the risk-free rate, recovering the model of Hatchondo, Martinez, and Onder (2017). In this case, the government's welfare is also higher relative to the equilibrium without the large lender. In our preferred calibration, however, such gains quickly dissipate as the lender's bargaining power grows.

In the baseline model we assume that the large lender is purely motivated by profits. In fact, it shares the objectives, risk attitudes, and intertemporal preferences of the competitive creditors who lend in debt markets. We take this assumption to focus on the pure effect of market structure, but discuss in the context of the extension what to expect if the large lender had other motivations. However, the feedback from debt levels to the bilateral surplus which gives rise to the relational overborrowing effect will be present unless the large lender has a strong motivation to avoid default on the government's marketable debts. In this sense, our main results appear robust to a much more realistic description of the large lender in a specific application.

Quantitatively, the model shows how bilateral loans that are small relative to the stock of marketable debt can still have an important impact on outcomes in sovereign debt markets. The difference in maturities between bilateral loans and marketable debt is critical in generating this result. The longer maturity of debt means that the debt service coming due in a particular period is of the same order of magnitude as the amount coming due on the bilateral loan. As a result, changes in the interest rate of the bilateral loan have an impact on the current-period budget constraint of similar magnitude to changes in the interest rate on marketable debt. In an extension, we show that with short-term market debt the relational overborrowing effect is again largely muted. In reality, bilateral loans such as swap lines are typically of a much shorter duration than marketable debt.

The model implies a simple heuristic for determining whether a particular type of bilateral debt is likely to be beneficial to the government. The welfare effects of bilateral loans are determined by the elasticity of their terms to indebtedness on the *market* segment. If bilateral loans become cheaper when market debts are high, the relational overborrowing effect is likely to be present. Conversely, if bilateral loans are cheaper when market debts are low, they are more likely to support debt sustainability. These forces act in addition to better-known effects operating through the value of default, as emphasized for example in the Lending Into Arrears policies of the IMF (2022).

Discussion of the Literature To be added.

Boz (2011); Dellas and Niepelt (2016); Fink and Scholl (2016); Hatchondo, Martinez, and Onder (2017); Kirsch and Rühmkorf (2017); Dovis and Kirpalani (2023); Arellano and Barreto (2025); Liu, Liu, and Yue (2025)

Perks et al. (2021); Bahaj and Reis (2021, 2023); Cesa-Bianchi et al. (2022)

Layout The rest of the paper is structured as follows. Section 2 provides some data and evidence regarding official and marketable debts in emerging markets. Section 3 then introduces our model, starting with the case in which only bilateral loans are available. Section 4 describes the main model with both types of debt coexisting, while Section 5 analyzes its equilibrium, and Section 6 describes the extension with fixed rules for the terms of bilateral loans. Finally, Section 7 concludes.

2. Data

3. Model with bilateral loans only

We begin our analysis by studying a simple model in which only bilateral loans are possible. This first model serves to clarify the dynamics of bilateral lending and the strategy through which the large lender extracts surplus from the borrower: subsidized terms while debt accumulates, combined with high interest rates when the debt stock becomes large and the borrower reduces leverage.

We model a small open economy borrowing from a monopolist. The economy receives an endowment stream $y(z)$ where the state z follows an AR(1) process. Loans are short-term and therefore effectively continuously renegotiated. At the start of t, let $v(m,z)$ represent the value attained by the government (or sovereign, or borrower) at income state z and owing m to the monopolist. The lender similarly attains a value $h(m,z)$.

At the beginning of period t, borrower and lender negotiate over the terms of the loan. In the absence of default, payment of the full amount m extinguishes any debts and serves as a natural threat point. We use a simple Nash bargaining framework and set θ as the lender's bargaining power. The outcome of this negotiation is a transfer x and a new loan size m' which solve

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

where $\mathcal{L}$ and $\mathcal{B}$ represent the lender and borrower's surplus functions. It will be useful to keep track of the implicit interest rate of the loan r satisfying $x = \frac{1}{1+r}m' - m$.

After negotiations are concluded and transfers settled, consumption takes place. The lender finances the transfer x with a constant endowment a and thus consumes $c_L = a - x$. Conversely, the borrower receives the transfer so $c = y(z) + x$. Under risk neutral preferences for the lender,

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

and similarly

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

where β_L and β are the discount factors of the lender and borrower, respectively. The borrower's utility function u is increasing and concave.

Notice that the choice of m' only involves continuation values v and h, while the choice of x only involves flow payoffs. Given a choice of m', the first-order condition for x is

$$\mathcal{B}(x,m,m',z)\theta = \mathcal{L}(x,m,m',z)u'(y(z)+x)(1-\theta)$$

Given the solution $x(m,z)$, $m'(m,z)$ to (1), the value functions satisfy

$$\begin{aligned} v(m,z) &= u(y(z) + x(m,z)) + \beta \mathbb{E}\left[v(m'(m,z), z') \mid z\right] \\ h(m,z) &= a - x(m,z) + \beta_L \mathbb{E}\left[h(m'(m,z), z') \mid z\right] \end{aligned} \tag{2}$$

Finally, we normalize $a = 0$, which allows us to interpret $h(m,z)$ as the expected present discounted value of transfers along the equilibrium path, or the lender's total expected profits.

3.1 *Equilibrium with bilateral loans only*

We solve the model with bilateral loans only at a parametrization that illustrates the forces at play. We choose $\theta = 0.5$ so the surplus is split equally between borrower and lender; we also set $\beta = \beta_L$ to isolate consumption smoothing and bargaining from the initial indebtedness that would result if the borrower was relatively impatient, which in sovereign debt models tends to be the relevant case.

Figure 1 summarizes the terms of the new loan for each level of income z and initial loan size m. Unsurprisingly, the borrower economy delevers in high-income states and receives positive transfers in low-income ones. The monopolist makes intense use of the interest rate to extract surplus. When both debt and income are low, the monopolist offers subsidized and even negative rates. The benefit of incurring this cost is to induce high levels of debt, which make the borrower's threat point more costly to exercise. Once the loan size is large, repaying it in full becomes difficult and the monoplist is able to charge much higher interest rates, even going above 10% (for a discount rate of about 2%) in the higher income states.

Figure 2 shows the value functions v and h for borrower and lender. As indebtedness m increases, the borrower's threat point becomes less credible, which allows the lender to charge higher interest rates and create more surplus. This effect creates convexity in the lender's profits and, hence, in the value function h.

Convexity in the lender's value function implies endogenously risk-loving behavior. In equilibrium, the lender gambles for debt overhang. Subsidizing the loan in order to induce high indebtedness only pays off if the borrower's income takes a long time to revert. If the borrower receives a favorable income shock quickly, the loan is repaid before the monopolist has had an opportunity to raise rates and collect profits.

Figure 3 shows a simulation path, which further clarifies the lender's strategy. The swap is subsidized on the way up and, once debt has accumulated, the interest rate can increase to extract profits from the borrower. The borrower government anticipates these dynamics: the relationship between the initial subsidy and the expected high rates later on is disciplined by an implicit participation constraint (or a literal one when $\theta = 1$).

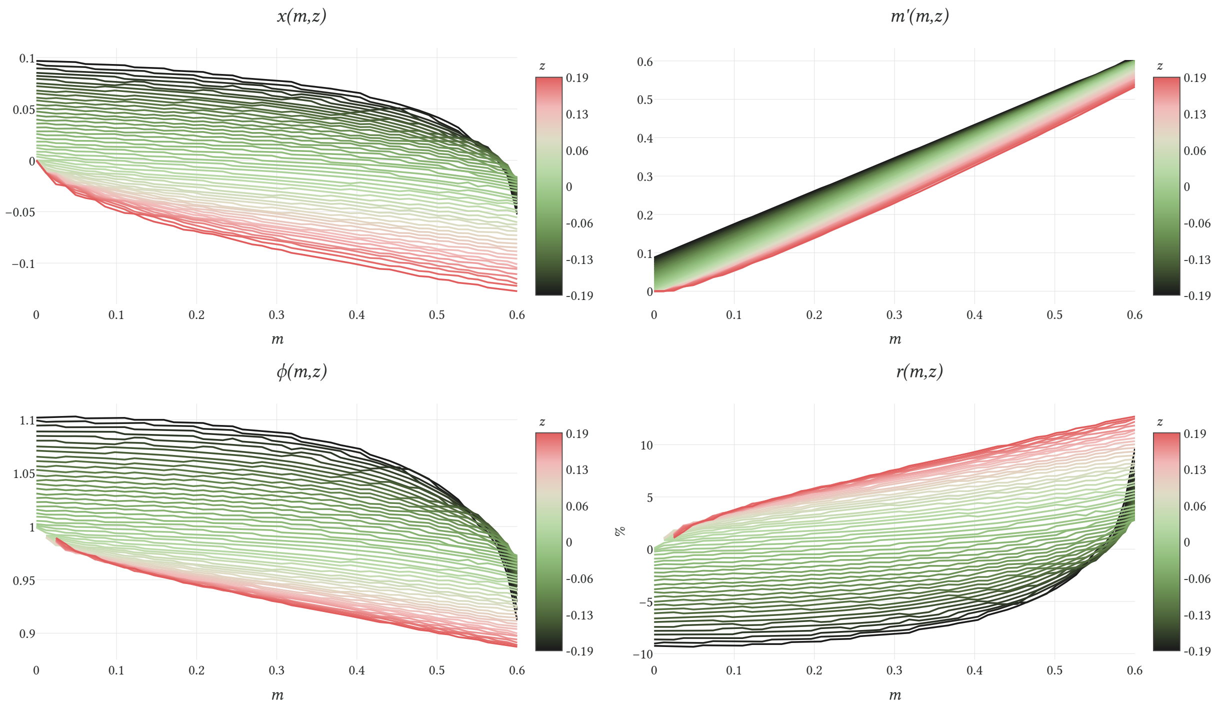

FIGURE 1: MONOPOLIST'S TERMS WITH $\theta = 0.5$

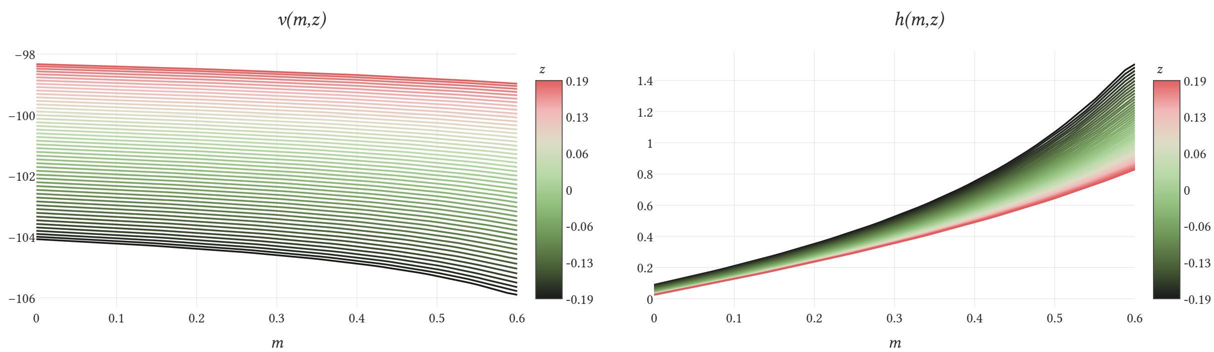

FIGURE 2: VALUE FUNCTIONS, $\theta = 0.5$

Figure 14 in the Appendix, which simulates a model with $\theta = 0$, shows that when the borrower holds all the bargaining power, it is able to borrow at rate β_L^{-1} at all times. Because rates do not go up once the loan is large, they cannot be negative when it is still small. This effectively recovers an income fluctuations problem at the risk-free rate without default.

4. MODEL WITH DEFAULTABLE DEBT AND SWAPS

In this section we present the full version of our model, in which the borrowing government has access to the monopolist as well as a competitive fringe of lenders. Default on the debt b held

FIGURE 3: SIMULATED PATH, $\theta = 0.5$

by competitive lenders is possible, subject to standard output costs of default. However, for the same reasons as before, bilateral loans m cannot be defaulted on.

A period takes place as follows.

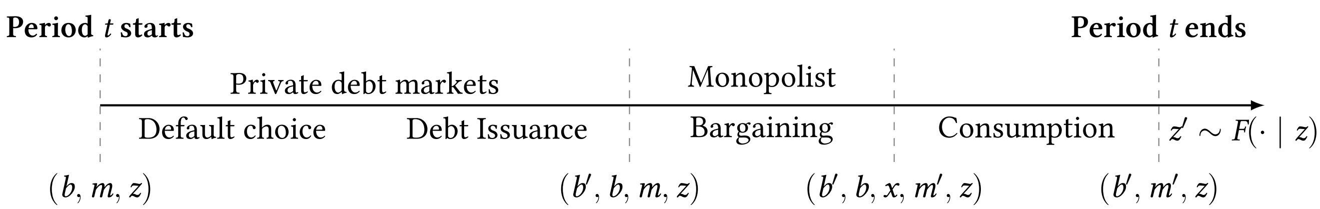

FIGURE 4: TIMELINE OF EVENTS WHILE NOT IN DEFAULT

At the start of t, the government owes m to the monopolist, b to the fringe, and observes the exogenous state z. Additionally, the economy can be in default ($\zeta = 1$) or in repayment ($\zeta = 0$). Let $v(b, m, z)$ and $h(b, m, z)$ represent the government's and the monopolist's value functions in case of repayment, and similarly $v_D(m, z)$ and $h_D(m, z)$ in case of default.

Private markets In the morning of t, first, the government decides default for the current period if it is in repayment.

$$v(b, m, z) = \max \{ v_R(b, m, z) + \varepsilon_R, v_D(m, z) + \varepsilon_D \} \tag{3}$$

where the ε's follow a Type 1 Extreme Value distribution, yielding closed forms for $v(b, m, z)$ and the ex-post default probability $\mathcal{P}(b, m, z)$

$$\begin{aligned} v(b, m, z) &= \chi \log\left(\exp(v_D(m, z)/\chi) + \exp(v_R(b, m, z)/\chi)\right) \\ \mathcal{P}(b, m, z) &= \frac{\exp(v_D(m, z)/\chi)}{\exp(v_D(m, z)/\chi) + \exp(v_R(b, m, z)/\chi)} \end{aligned}$$

If it is not in default, the government issues new debt b' to the fringe of lenders understanding the value of entering negotiations with the monopolist having issued debt b'

$$v_R(b, m, z) = \max_{b'} w_R(b', b, m, z) \tag{4}$$

where debt is a perpetuity of geometrically-decaying coupons as in Leland (1998), Hatchondo and Martinez (2009), or Arellano and Ramanarayanan (2012). A unit of debt issued at t promises to repay $\kappa(1-\delta)^{s-1}$ is period $t+s$, effectively making a unit issued at t a perfect substitute for $(1-\delta)$ units issued at $t-1$. We normalize $\kappa = r + \delta$ so that the price of debt equals 1 when the government repays with certainty.

The price faced by the borrower government reflects its lenders' expectations of repayment, discounted with a risk-neutral kernel

$$q(b', b, m, z) = \frac{1}{1+r}\mathbb{E}\left[\left(1 - 1_{\mathcal{D}}(b', g_m(b', b, m, z), z')\right)\left(\kappa + (1-\rho) q(b'', b', g_m(b', b, m, z), z')\right) \mid z\right] \tag{5}$$

where $1_{\mathcal{D}}(b, m, z)$ denotes the government's default policy as perceived by lenders, $b'' = g_b(b', g_m(b', b, m, z), z')$ is the expected debt issuance in the following period and $g_m(b', b, m, z)$ is the expected result of negotiations with the monopolist, to happen in the afternoon.

Bilateral loan In the afternoon of t, the government meets with the monopolist to negotiate the loan m. As before, the outcome of their negotiation is a transfer x and new loan size m' which solve the following Nash bargaining problem

$$\begin{gathered} \max_{m', x} \mathcal{L}_R(b', x, m, m', z)^{\theta}\, \mathcal{B}_R(b', b, x, m, m', z)^{1-\theta} \\ \text{or} \\ \max_{m', x} \mathcal{L}_D(x, m, m', z)^{\theta}\, \mathcal{B}_D(x, m, m', z)^{1-\theta} \end{gathered} \tag{6}$$

As before the monopolist's surplus is

$$\begin{aligned} \mathcal{L}_R(b', x, m, m', z) &= -x - m + \beta_L \mathbb{E}\left[h(b', m', z') - h(b', 0, z') \mid z\right] \\ \mathcal{L}_D(x, m, m', z) &= -x - m + \beta_L \mathbb{E}\left[\psi\left(h(0, m', z') - h(0, 0, z')\right) + (1-\psi)\left(h_D(m', z') - h_D(0, z')\right) \mid z\right] \end{aligned}$$

while the borrower's surplus now also reflects outcomes in debt markets

$$\begin{aligned}\mathcal{B}_R(b', b, x, m, m', z) &= u(y(z) + P(b', b, m, z) + x) - u(y(z) + P(b', b, m, z) - m) + \\ &\quad + \beta\mathbb{E}\left[v(b', m', z') - v(b', 0, z') \mid z\right] \\ \mathcal{B}_D(x, m, m', z) &= u(y_D(z) + x) - u(y_D(z) - m) + \\ &\quad + \beta\mathbb{E}\left[\psi\left(v(0, m', z') - v(0, 0, z')\right) + (1-\psi)\left(v_D(m', z') - v_D(0, z')\right) \mid z\right]\end{aligned}$$

where the function $y_D(z) = y(z) - \xi(z)$ is output in default and P summarizes net transfers from the competitive lenders received in the morning. We assume long-term debt in the form of standard geometrically-decaying coupons which yield $P(b', b, m, z) = q(b', b, m, z)(b' - (1-\rho)b) - \kappa b$. In default, opportunities to reaccess markets arrive with probability ψ. The bargaining problems yield new terms for the bilateral loan $x_R(b', b, m, z)$, $m'_R(b', b, m, z)$ and $x_D(m, z)$, $m'_D(m, z)$ in default and repayment.

After the negotiation is done and transfers settled, consumption takes place. The borrower's value functions for entering negotiations are given by

$$\begin{aligned}c_\zeta(b', b, m, z) &= y(z) + P(b', b, m, z) + x_\zeta(b', b, m, z) \\ w_R(b', b, m, z) &= u(c_R(b', b, m, z)) + \beta\mathbb{E}\left[v\left(b', m'_R(b', b, m, z), z'\right) \mid z\right] \\ w_D(m, z) = v_D(m, z) &= u(c_D(m, z)) + \beta\mathbb{E}\left[\psi v\left(0, m'_D(m, z), z'\right) + (1-\psi) v_D\left(m'_D(m, z), z'\right) \mid z\right]\end{aligned} \tag{7}$$

while for the monopolist we have

$$\begin{aligned}h(b, m, z) &= \mathcal{P}(b, m, z) h_D(m, z) + (1 - \mathcal{P}(b, m, z)) h_R(b'(b, m, z), b, m, z) \\ h_R(b', b, m, z) &= a - x_R(b', b, m, z) + \beta_L\mathbb{E}\left[h(b', m'_R(b', b, m, z), z') \mid z\right] \\ h_D(m, z) &= a - x_D(m, z) + \beta_L\mathbb{E}\left[\psi h(0, m'_D(m, z), z') + (1-\psi) h_D(m'_D(m, z), z') \mid z\right]\end{aligned} \tag{8}$$

5. Quantitative results

We parametrize our model at a quarterly frequency following standard strategies in the sovereign default literature (most parameters taken from the calibration to the 2001 Argentina default in Roch and Roldán, 2023). Table 1 summarizes our parametrization.

When both debt with private competitive lenders and swaps with the monopolist are available, they are clearly substitutes. For instance, Figure 5 shows that the default probability (for bonds) is increasing in both types of indebtedness, fixing income at its mean.

Figure 6 compares an economy with access to swaps but with current level $m = 0$, on the left, to an economy in which the swap is not available, on the right. It shows that the availability of swaps exacerbates sovereign risk by raising the option value of default: the economy with access to swaps defaults at lower levels of debt (or higher levels of income) than the one without them.

Table 1: Baseline parameter values

	Parameter	Value
Sovereign's discount factor	β	0.9504
Sovereign's risk aversion	γ	2
Preference shock scale parameter	χ	0.025
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

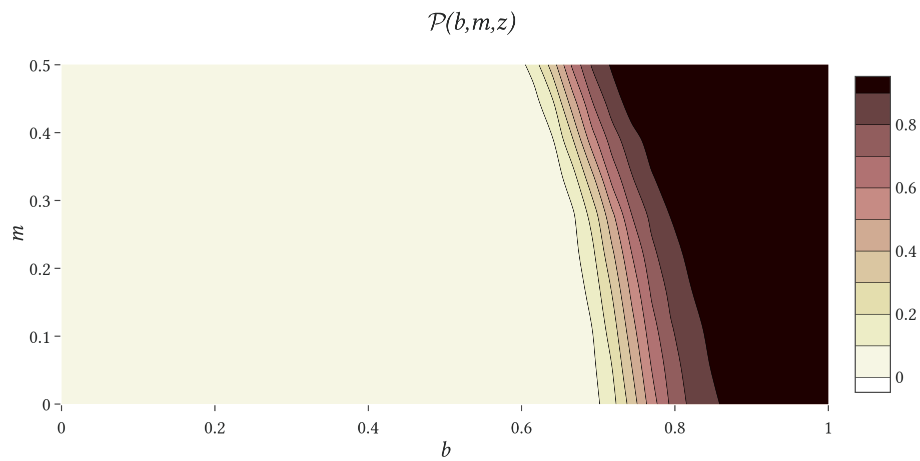

Figure 5: Default probability

Moreover, since the monopolist keeps a share of the surplus generated by the swap, the borrower economy is reluctant to borrow from it. In a typical simulation path, conditional on no default the amount drawn on the swap is 3.3% of annual income with a standard deviation of 1.6%. Figure 7 shows that this changes significantly around default events: the loan size m shoots up as soon as the default is declared. The monopolist heavily subsidizes this accumulation of debt on the swap line. As before, the monopolist provides negative interest rates at first, while debt on the swap line is increasing, to then raise them in default or close to it. In this case, the gamble for debt overhang has a twist: when the economy recovers market access, it immediately issues debt on the market to pay off the swap (see Figure 15 in the Appendix). The lender is then

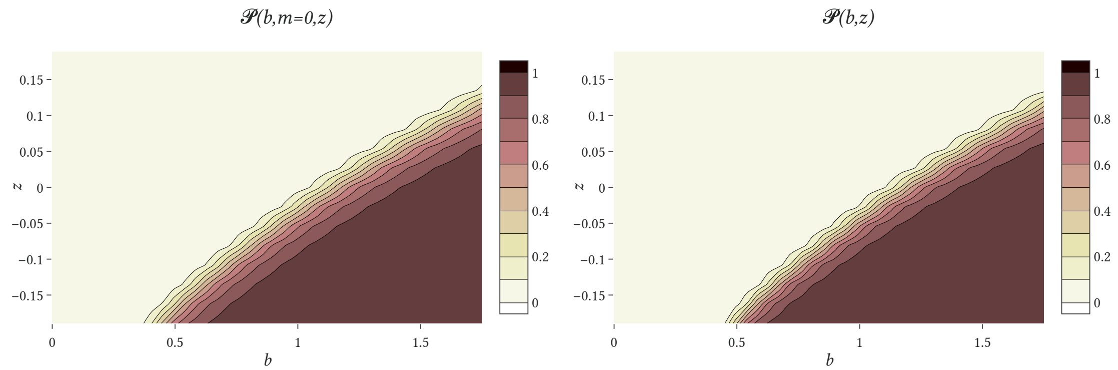

Figure 6: Default probability at $m = 0$ with (left) and without (right) swaps

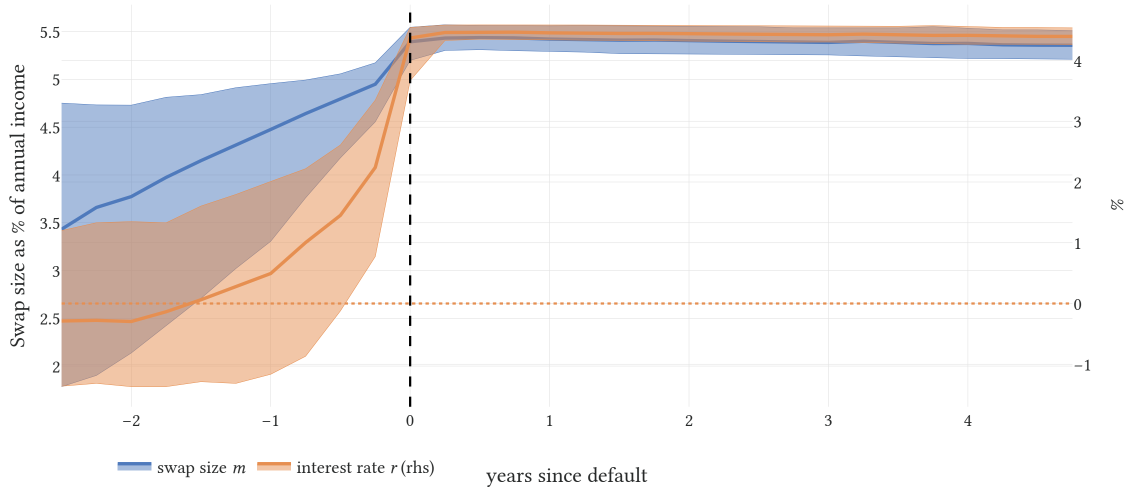

Figure 7: Swaps around default events

gambling that income will not revert and that the exclusion period will be long.

While most of the use of the bilateral loan m occurs during default, Figure 7 shows that default episodes are preceded by drawings on the swap in an effort to avoid or postpone default (Figure 7 does not show the defaults that were avoided as a consequence of swaps being possible).

The swap line affects the economy in two ways: on the one hand, it provides extra financing when default risk makes borrowing in private markets costly. But it also provides funds in default, which raises the value of being excluded from private markets and consequently spreads. To disentangle these effects, we consider a variant of the model in which the swap line is unavailable while the economy is excluded from private debt markets, in other words, a variant with the extra constraint that $m'_D(m, z) \leq 0$.

Table 2 presents some statistics from simulating the model without swaps, with swaps, and with swaps unavailable in default. All statistics except the relative volatility of consumption are computed conditional on repayment. The frequency of default is computed as the number of defaults per hundred years of access to markets. Finally, welfare gains are computed as the consumption equivalent of moving from the no-swap economy to one of the economies with swaps, starting from $m = 0$ but the same debt level and income, averaging over the ergodic distribution conditional on a repayment state.

Table 2: Business cycle statistics with swap lines

	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%

The table reveals that the presence of swaps dramatically increases the frequency of default, along with the level and volatility of spreads. The economy sustains a marginally lower debt level on average when swaps are available (in the Unrestricted variant).

In the version with Limited swaps in default, the usage of the swap line declines by more than a half, as repaying the swap after defaulting becomes even more costly. However, the swap is still mostly used when spreads are high, as shown by the high correlation between spreads and drawings on the swap. The Limited version still creates welfare losses for the economy, but these are about a third lower than in the Unrestricted case.

5.1 *Default probabilities and debt prices*

Figure 8 shows ex-post default probabilities as a function of the debt level in private markets b, when the bilateral loan $m = 0$, as a function of the lender's bargaining power θ. Solid lines, corresponding to the version of the model with unrestricted bilateral loans in default, show that default is more likely when bilateral loans are available, for almost all debt levels (except for the case of all the bargaining power for the borrower). In contrast, the models in which no extra funds can be obtained from the monopolist while in default (marked Limited) all display a lower default probability.

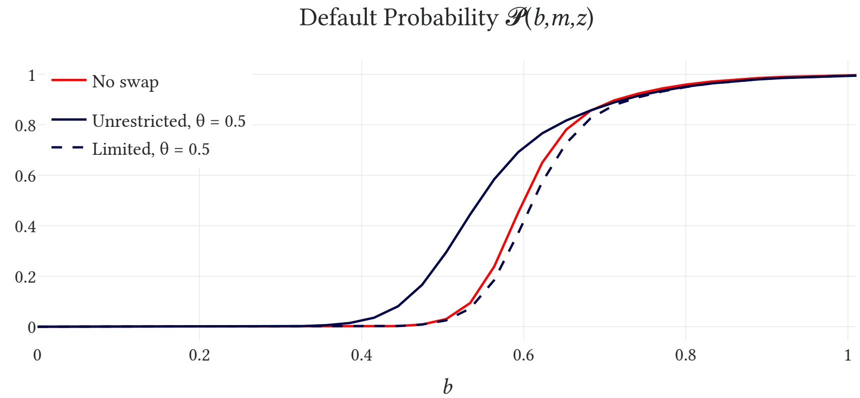

Figure 8: Default probability

Figure 8 highlights the negative impact of the swap line. In the Unrestricted version, swaps are available during default, which makes private debt repayment less attractive. The higher default probability translates into lower prices for debt, as shown in Figure 9. This effect mostly disappears in the Unavailable variant, when swaps are not available in default. However, as shown in Figure 9, prices remain lower in the Unavailable variant relative to the model without swaps. This means that even though the one-period-ahead default probability may not increase when swaps are introduced in the Unavailable variant, policies are altered in a way that creates more default risk later on. In other words, the option of swaps, even in the Unavailable variant, creates overborrowing by the government.

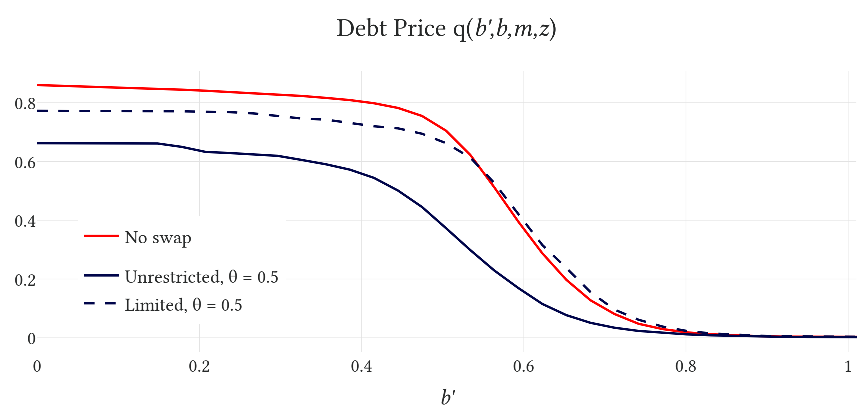

Figure 9: Debt prices

Figure 10 presents the ergodic distribution of the debt/GDP ratio in simulations of the three models, conditional on repayment. When swaps are available, in both variants, the economy spends longer in the region of the state space where default risk is large.

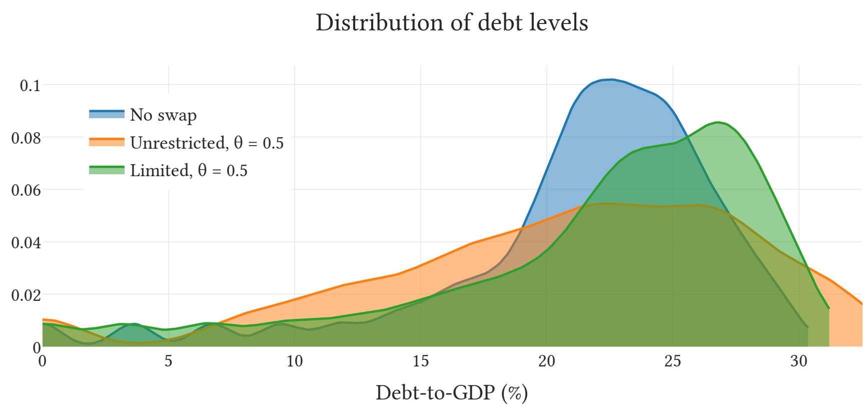

FIGURE 10: DISTRIBUTION OF DEBT LEVELS

5.2 *Dynamics with swaps*

In the model with swaps, the government issues debt in a riskier manner and spends more time in the regions where default risk is likely. Figure 11 plots the monopolist's value (or profit) function (8) as a function of debt, as always at $m = 0$.

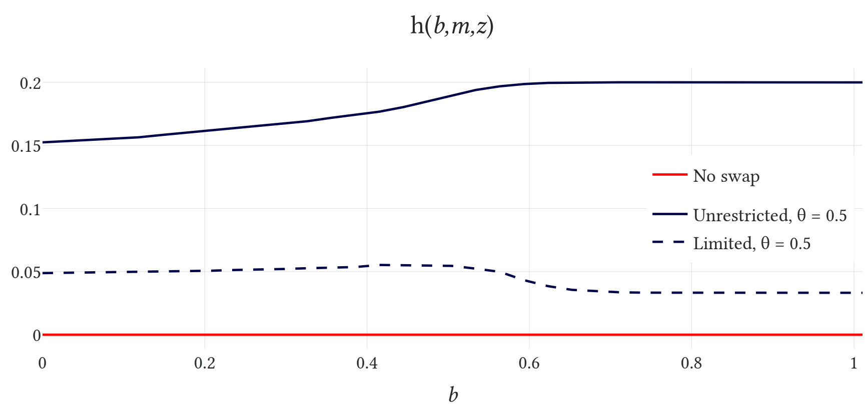

FIGURE 11: MONOPOLIST'S PROFITS

In the version with Unrestricted swaps (when they can be used during default), the monopolist's profits increase at debt levels for which default is likely, while they decrease in the variant with swaps Unavailable during default. More importantly, in the region to the left, where debt is not enough to trigger a significant default probability in the short run, the monopolist's profits are still increasing in debt. The reason this happens is that gains from trade are maximized when spreads on debt open up.

When the government has a safe level of debt and pays low spreads, there is little for the monopolist to offer that private markets do not already provide at a competitive price. But when default risk drives up spreads, the monopolist can give a transfer from the swap line, which is undefaultable, and charge an interest rate between the risk-free rate and the rate that the government is paying on its debt.

This creates a force towards issuing debt away from the 'safe' zone and to issue at positive spreads. Figure 12 shows the terms at which the monopolist offers transfers under the swap line for given choices of debt issuance b'.

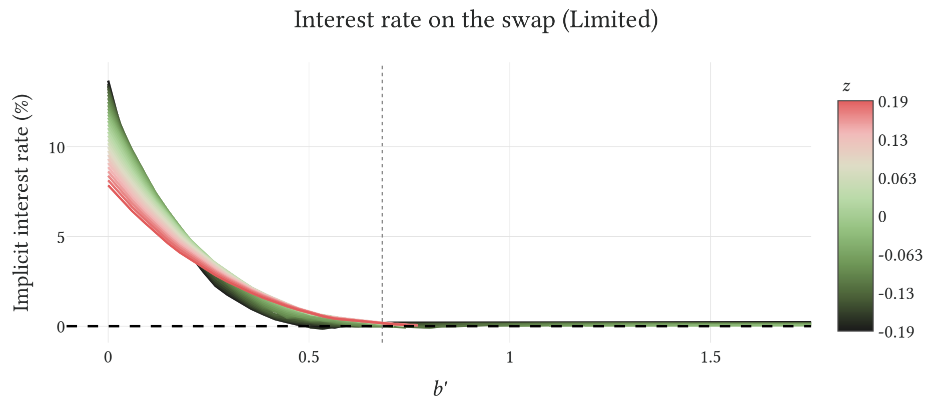

FIGURE 12: INTEREST RATE ON THE SWAP

When the government has already chosen a safe debt level, there are little profits to be made in the following period. Moreover, choosing a low level of debt today means less consumption, which makes drawing on the swap more tempting for the government. For both reasons, the monopolist charges a high rate when the government has chosen to delever its debt and a lower one when it is exposing itself to sovereign risk.

5.3 *Welfare effects of swap lines*

The forces discussed above combine to produce welfare effects of swap lines. Figure 13 shows the government's value function as a function of debt b when drawings from the swap $m = 0$. The government prefers swaps to be Unavailable during default, except of course when a default in the current period is very likely.

Figure 16 in the Appendix confirms this intuition about debt dilution. In particular, it shows that with short-term debt there are welfare gains for the variant where swaps are Unavailable during default. The Unrestricted variant produces very small welfare losses in this case.

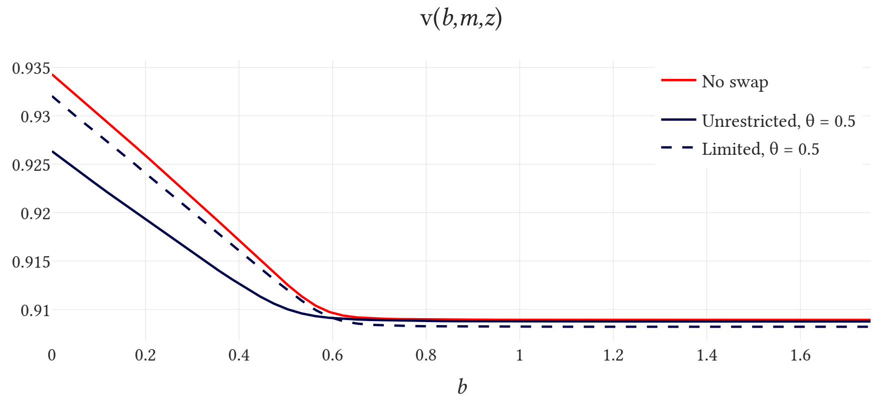

Figure 13: Value functions

6. Programming the large lender

7. Concluding remarks

To investigate the interaction between marketable and bilateral debts, we develop a model of sovereign debt in which the government can borrow from a large lender (or monopolist) as well as from a competitive fringe of creditors. We find that both sources of funds are linked by strong interactions, even when quantitatively the amounts borrowed from the large lender remain an order of magnitude smaller than market debts.

The model describes a 'relational overborrowing' effect which arises in the presence of the large lender, subject to three sufficient conditions. Relative to markets, loans from the large lender must be of shorter maturity, more costly to default, and with terms subject to negotiation. With these conditions, the interest rate on bilateral loans results endogenously increasing in indebtedness in markets, which incentivizes the government to overborrow and face more sovereign default risk.

Our results suggest that having more sources of indebtedness can be detrimental for the borrowing government. The price of bilateral debt can include large premia as a consequence of market power. Furthermore, while bilateral loans could in some cases help a government fend off default, they can also make it more likely: either through reducing the effective costs of default (when it is possible to borrow from the large lender while excluded from markets) or through the relational overborrowing effect.

The welfare impacts of the large lender's presence raise important policy questions and challenges. Limiting the use of bilateral debt during defaults is a clear welfare-enhancing policy in this model. Extending the maturity of bilateral loans would mute the incentivizing effect of their borrowing terms and could also disarm relational overborrowing. Because the relational overborrowing effect operates through increased default risk, the gains of fiscal rules which constrain market borrowing should be larger for countries with access to bilateral debts.

The model implies a simple test to gauge the likely effects of a new bilateral creditor or instrument. Bilateral loans whose interest rate is expected to be strongly decreasing in the amount (or spreads) of marketable debt will induce relational overborrowing and are thus likely to hurt welfare. More generally, it highlights the benefits of transparent rules for the terms of bilateral debts.

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A. More results

Figure 14 shows that when the borrower holds all the bargaining power, the swap interest rate is constant at β_L^{-1}.

Figure 14: Simulated path, $\theta = 0$

Figure 15 shows that, further conditioning on an exclusion period of 2 years, the economy issues debt in the market in order to pay off the swap as soon as it recovers market access.

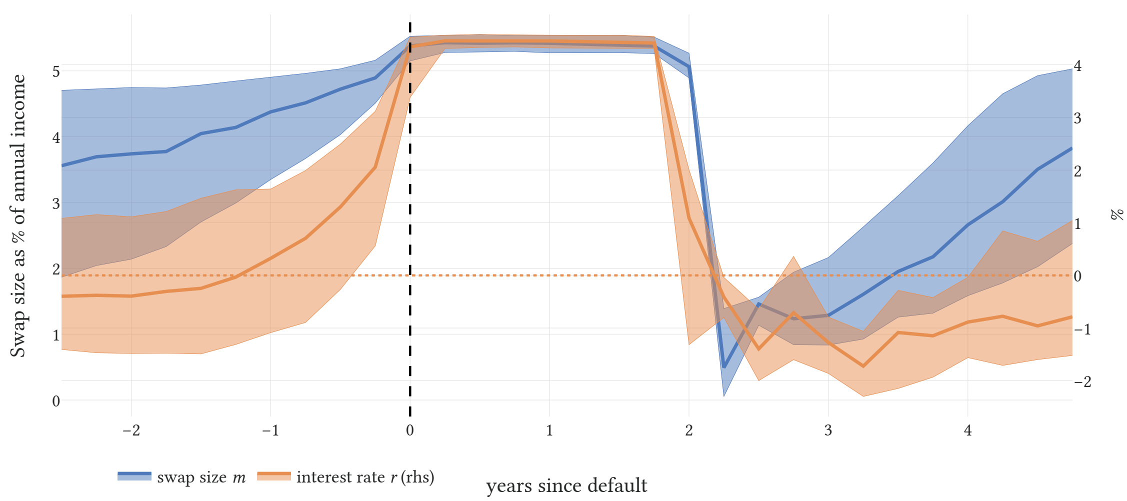

Figure 15: Swaps around default events

Figure 16 shows that, (*i*) with short-term debt, allowing the swap to be drawn while in default provides welfare gains and (*ii*) there are welfare gains from the swap for a larger range of values of the bargaining weight, in particular for $\theta \leq 0.3$.

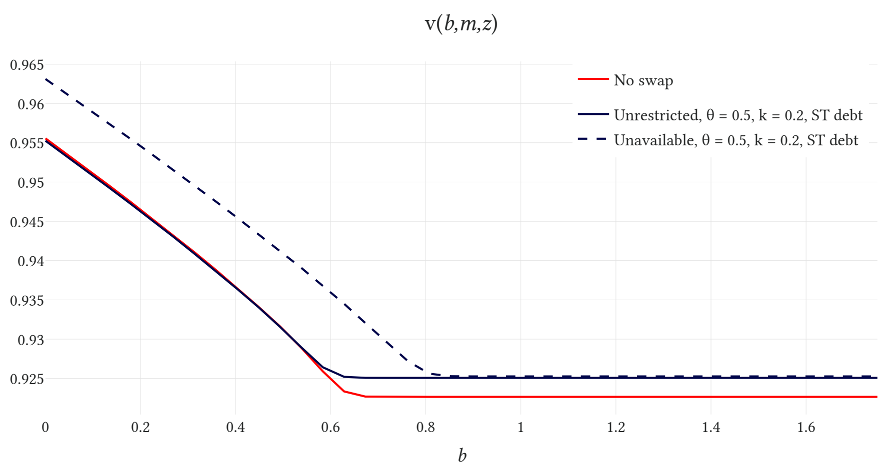

FIGURE 16: VALUE FUNCTIONS, SHORT-TERM DEBT