# The Perils of Bilateral Sovereign Debt*

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**Abstract**

We study the use, terms, and desirability of central bank swap lines for sovereign borrowing. We find that swaps, a type of bilateral debt, interact strongly with borrowing terms on international capital markets. The high frequency at which swaps can be renegotiated makes their interest rate reflect outside options and market power. We highlight how swaps create an overborrowing incentive similar to debt dilution. This happens through a weakening the threat of autarky which typically sustains sovereign borrowing but also dynamically through the incentives created by the bilateral relationship. Our model is consistent with the prevailing pattern of sovereign borrowing primarily occurring through bond markets, with swap lines serving as a "first line of defense" when debt repayment becomes difficult. Moreover, we identify significant welfare effects associated with having access to swaps.

**JEL Classification** F34, F41, G15
**Keywords** Sovereign debt, debt dilution, bilateral bargaining, Central Bank swap lines

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# Introduction

Central Bank swap lines have gained prominence after the global financial crisis and the Covid-19 pandemic. The number of outstanding bilateral swap lines reached 91 in 2020, from only a few in the early 2000s (Perks et al., 2021). Contracted amounts are also large: Perks et al. (2021) document that bilateral swap lines amounted to US$ 1.9 trillion, or about 10% of worldwide gross international reserves by end-2020. So far, swap lines have been understood as precautionary instruments, supporting the Central Bank's lender-of-last-resort function with global banks in advanced economies (Bahaj and Reis, 2021; Cesa-Bianchi et al., 2022). The identities of countries drawing from swap lines have also shifted, from a few advanced economies to emerging and frontier market economies, some of which have limited or no access to international capital markets (Perks et al., 2021; Horn et al., 2023). Finally, the usage of these instruments has shifted, from standing facilities designed to fend off adverse equilibria, similarly to deposit insurance, to drawn instruments potentially raising debt-sustainability questions.

In this paper, we study the role of Central Bank swap lines as alternative borrowing vehicles for sovereigns. We ask which circumstances create incentives for countries to use swap lines when private debt markets are also available. Finally, we investigate the relation between the terms of the swap and those offered by private creditors.

We consider a standard model of sovereign default with long-term debt (Leland, 1998; Hatchondo and Martinez, 2009; Arellano and Ramanarayanan, 2012), augmented with the presence of a monopolist with which it is possible to negotiate a bilateral loan (the swap line). While it is possible to default on private bonds as in other models, the costs of defaulting on the swap line are assumed to be prohibitive for the Central bank. This assumpion reflects the fact that countries have defaulted on private debts while keeping swap lines (and other Central Bank obligations) insulated. This suggests that, at least, defaulting on a Central Bank foreign liability might be more costly than defaulting on the debt. There are other reasons for this assumption: reputation and credibility are central to Central bankers' jobs; renegotiation of rollover terms with only one counterparty is much simpler than with a multitude of bondholders; and finally, most swap lines involve a small country borrowing from a larger one which could enforce punishments in case of default. In reality, no defaults on swap lines have been observed so far.

In our model, both instances of borrowing interact. Outcomes in private markets influence the threat points in the bilateral negotiation. At the same time, while the monopolist tries to extract surplus from the borrower by raising interest rates, it is constrained by implicit competition from private markets. However, when default risk pushes up interest rates in private markets, the monopolist is able to follow suit and charge a premium on the bilateral loan. But because there is no default risk on this loan, such a premium only reflects the borrower's (lack of) outside options.

We find that the borrowing government resorts to bilateral loans sparsely and at times when default risk is present. Furthermore, by allowing consumption smoothing (and borrowing) in default, the possibility of bilateral debt raises the value, and hence the frequency, of default. In our parametrization, this leads to welfare losses for the borrowing government. A version of our model in which drawing on the swap during default is limited decreases these welfare losses but does not eliminate them, unless the bargaining power of the lender is small. Finally, we find that with short-term debt the swap can be welfare-improving, which highlights the interaction of debt dilution with the availability of bilateral loans.

**Discussion of the Literature** To be added.

**Layout** The rest of the paper is structured as follows. Section 2 introduces our model, starting with the case in which only bilateral loans are available. Section 3 describes the main model with both types of debt coexisting, while Section 4 analyzes its equilibrium. Finally, Section 5 concludes.

## 2. 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 monopolist extracts surplus from the borrower: subsidized terms while debt accumulates, combined with high interest rates when the debt stock becomes large and the borrower attempts to delever.

We model a small open economy borrowing from a monopolist. Loans (the swap line) 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. 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 $\theta$ 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

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

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 expected profits.

## 2.1 *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

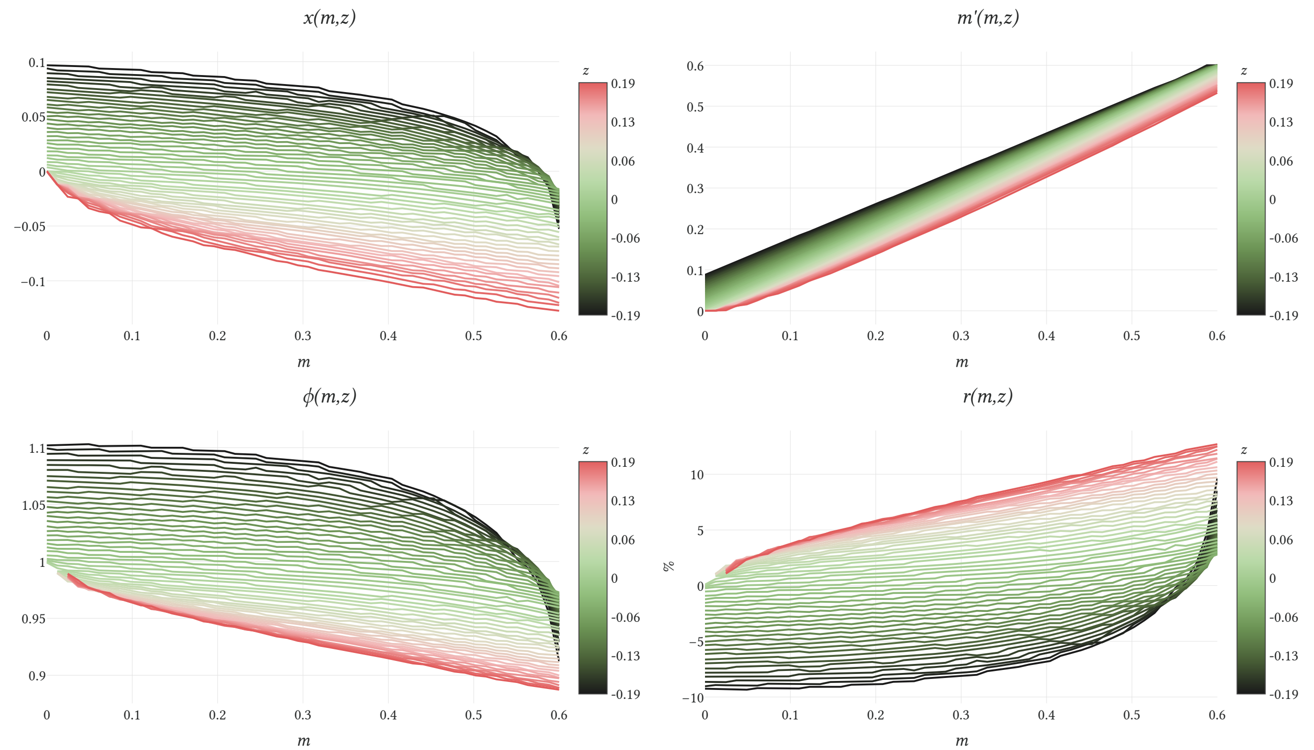


Figure 1: Monopolist's terms with $\theta = 0.5$

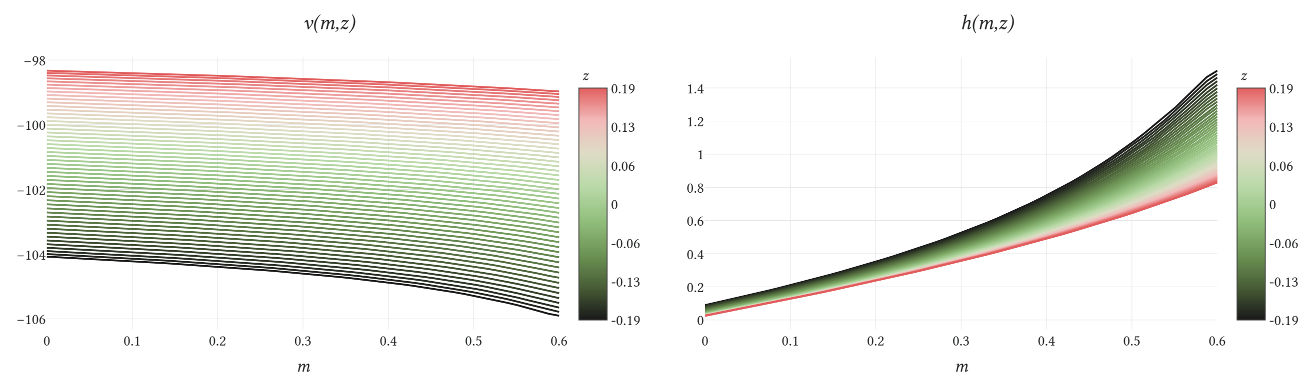


Figure 2: Value functions, $\theta = 0.5$

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 3: SIMULATED PATH, $\theta = 0.5$

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 $\beta_L^{-1}$ 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.

## 3. 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 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.

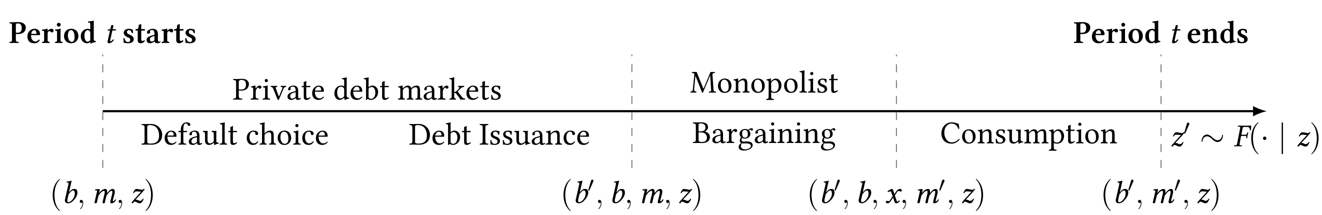


FIGURE 4: TIMELINE OF EVENTS WHILE NOT IN DEFAULT

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

$$v(b, m, z) = \chi \log \left( \exp(v_D(m, z)/\chi) + \exp(v_R(b, m, z)/\chi) \right)$$

$$\mathcal{P}(b, m, z) = \frac{\exp(v_D(m, z)/\chi)}{\exp(v_D(m, z)/\chi) + \exp(v_R(b, m, z)/\chi)}$$

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 $b'$

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

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

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

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

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

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

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

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

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 $\psi$. 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

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

## 4. 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.

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

Table 1: Baseline parameter values

| | Parameter | Value |
|---|---|---|
| Sovereign's discount factor | $\beta$ | 0.9504 |
| Sovereign's risk aversion | $\gamma$ | 2 |
| Preference shock scale parameter | $\chi$ | 0.025 |
| 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 |

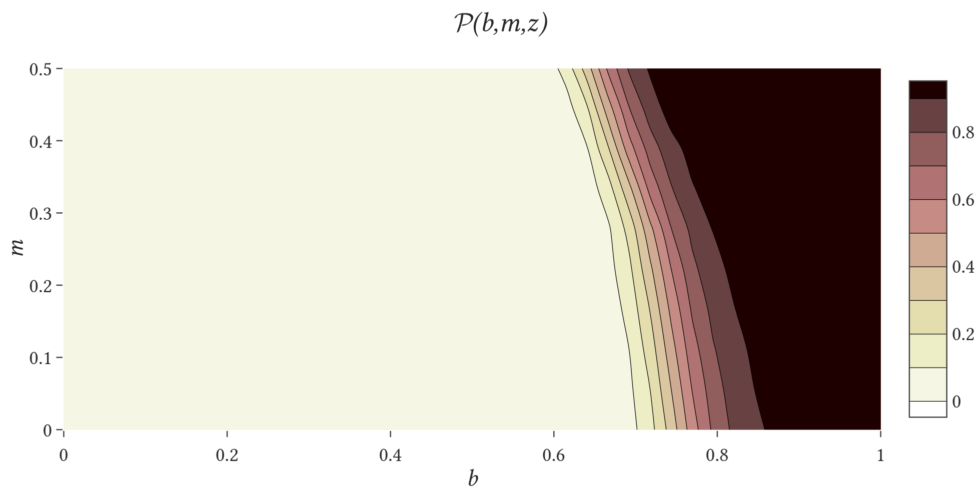


FIGURE 5: DEFAULT PROBABILITY

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 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

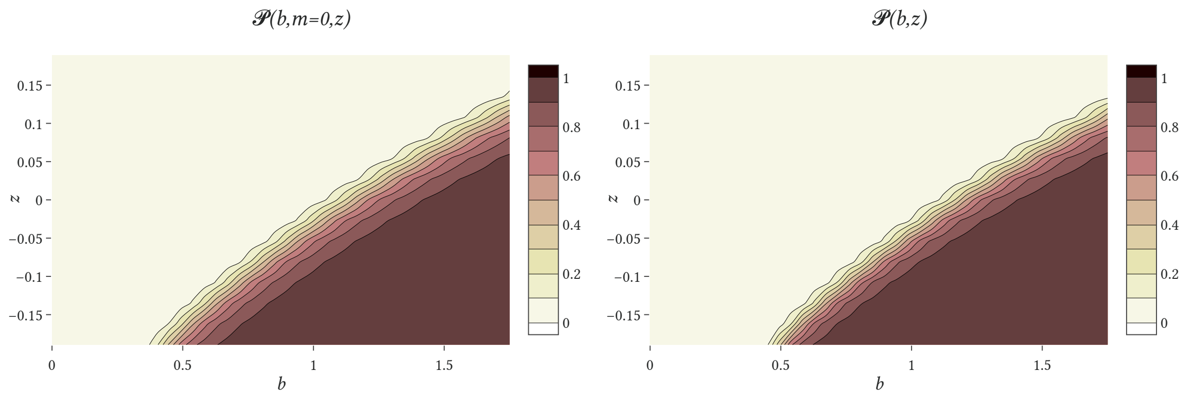


FIGURE 6: DEFAULT PROBABILITY AT $m = 0$ WITH (LEFT) AND WITHOUT (RIGHT) SWAPS

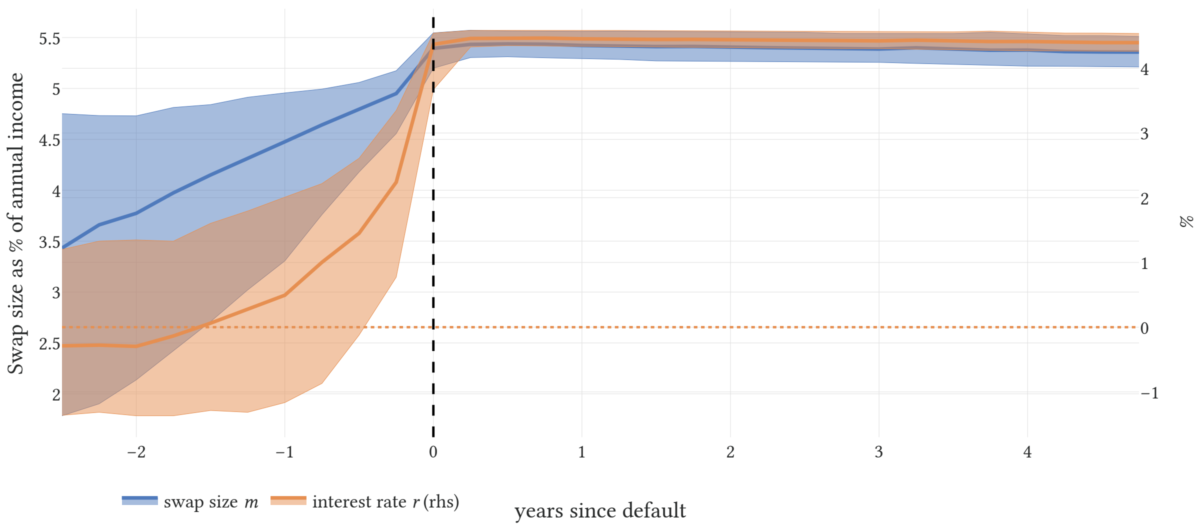


FIGURE 7: SWAPS AROUND DEFAULT EVENTS

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.

## 4.1 *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 $\theta$. 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 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

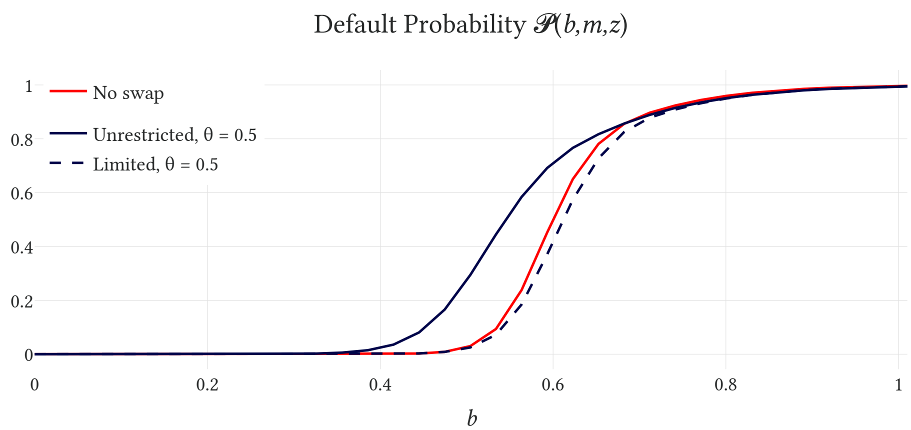


FIGURE 8: DEFAULT PROBABILITY

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.

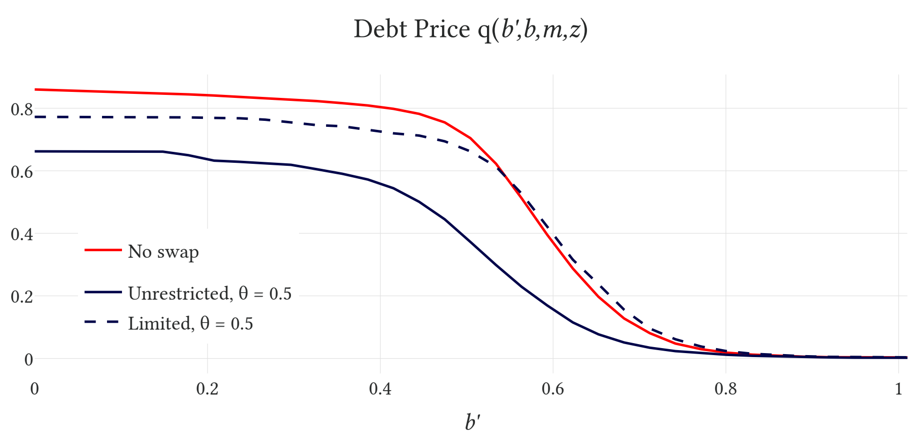


FIGURE 9: DEBT PRICES

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.

## 4.2 *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 $m = 0$.

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

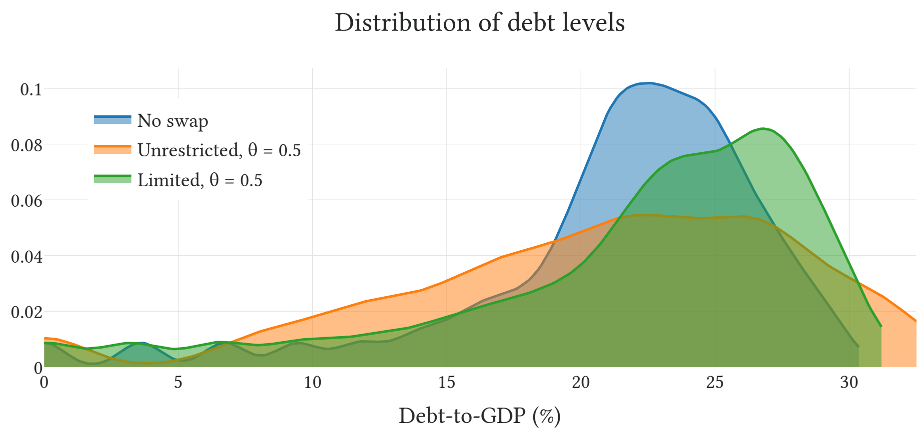


FIGURE 10: DISTRIBUTION OF DEBT LEVELS

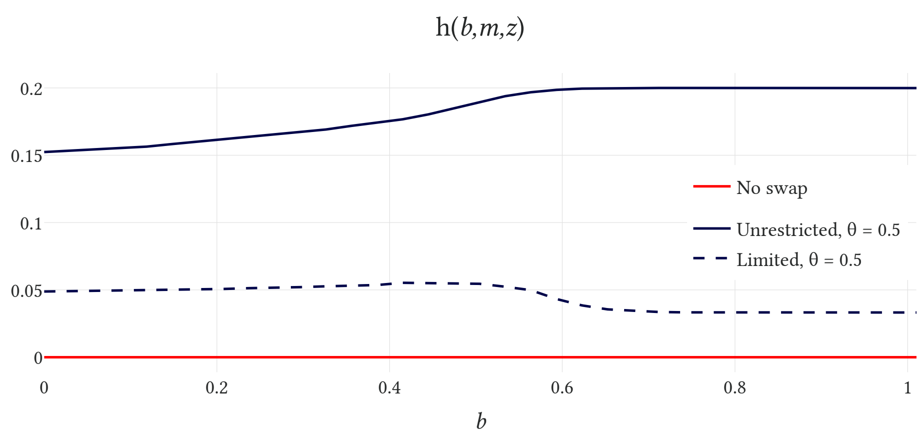


FIGURE 11: MONOPOLIST'S PROFITS

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 $b'$.

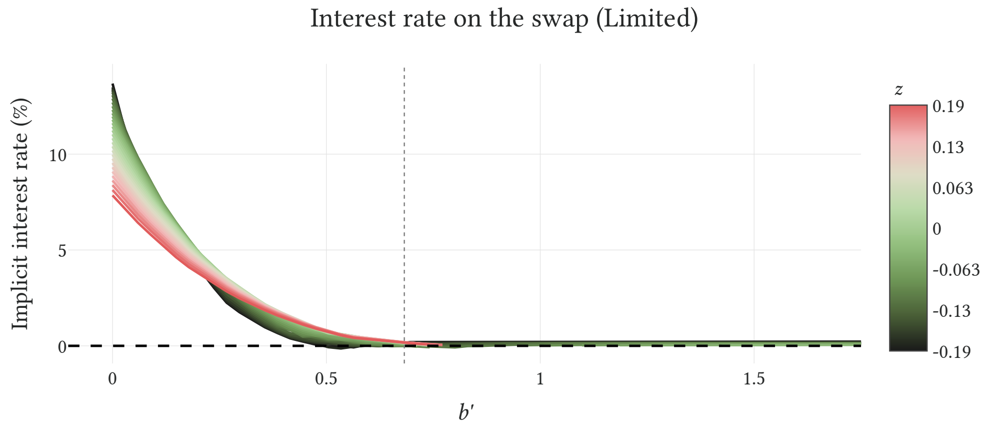


Figure 12: Interest rate on the swap

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.

## 4.3 *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.

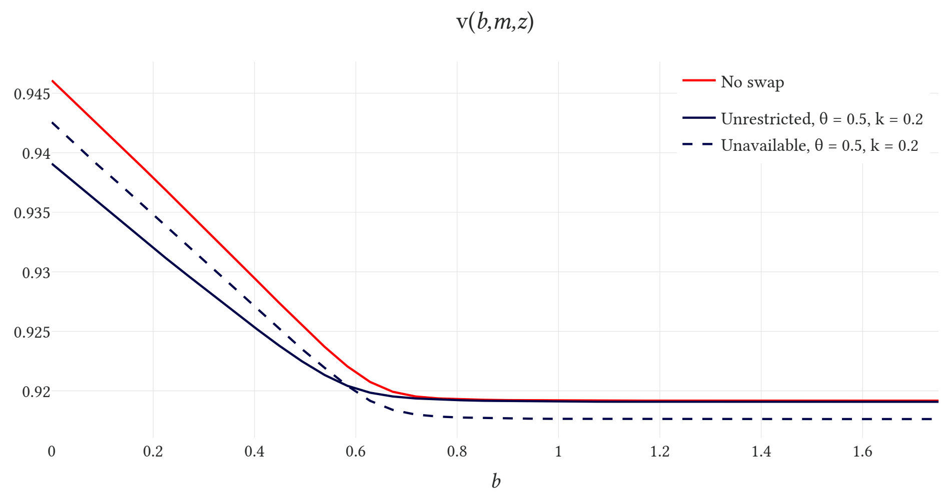


Figure 13: Value functions

## 5. Concluding remarks

Should drawn Central Bank swap lines be counted in public debt? We argue that swaps are a natural vehicle for sovereign borrowing when market access is limited, consistent with empirical observations over the past decade. Our model highlights the interaction between the terms of both types of debt and how the possibility of each affects the outside option (explicitly for bilateral loans and implicitly for private debt) of the other.

Our results suggest that having more sources of indebtedness can be detrimental for the borrowing government. The price of swaps can include large premia as a consequence of market power. Furthermore, while swaps could in some cases help a government fend off default, they also make it more likely by allowing borrowing during the exclusion period, effectively diminishing the output costs of default which, in most models, sustain sovereign borrowing in the first place.

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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 $\beta_L^{-1}$.


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.

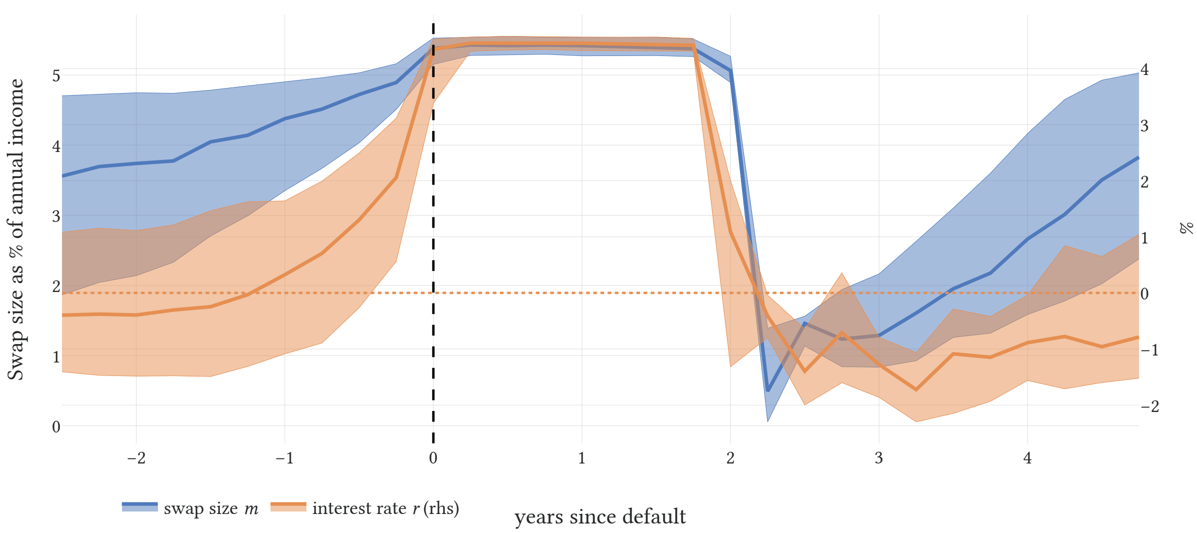


Figure 15: Swaps around default events

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 $\theta \leq 0.3$.

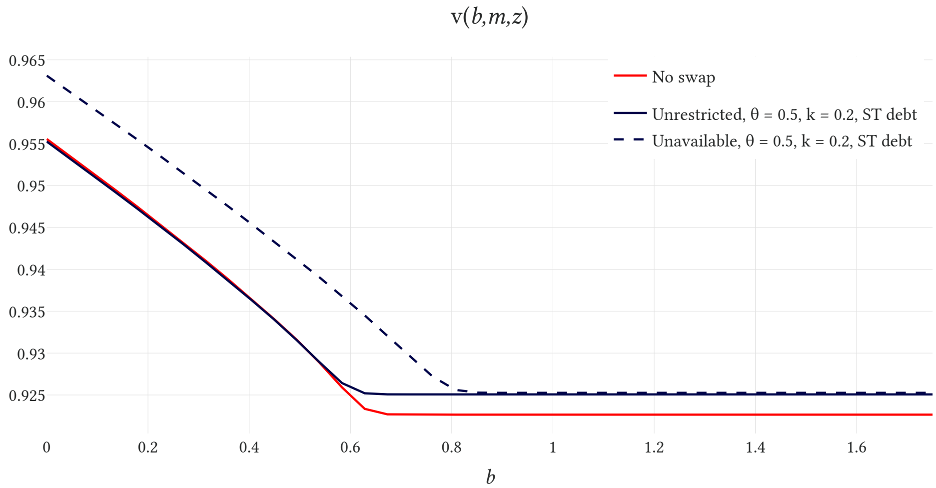


Figure 16: Value functions, short-term debt