Sovereign Debt and Grace Periods[1]

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Abstract

Grace periods are included in 83% of sovereign debt, and all concessional loans—comprising 73% of the total—feature grace periods. To understand grace periods, we first estimate their effects using local projections and then develop a quantitative model. Our findings suggest that while grace periods enhance household welfare by lowering default risk and improving market completeness, they also lead to higher long-run non-contingent debt and increased spreads.

Keywords: Sovereign debt, default, concessional loans, grace period, stigma premium
JEL Codes: E44, F34

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1 Introduction

Grace periods, which refer to periods during which the borrower is not required to make repayments, are a standard feature of sovereign debt, as 83% of sovereign debt has an average grace period of 5 years. Concessional loans, both bilateral and multilateral, are also highly common in low- and lower-middle-income countries, sometimes representing more than 80% of total lending; however, they make up only a small share in high-income countries (see Figure 1). These loans generally offer substantial grace periods up to 10 years, lower interest rates compared to private debt, and seniority over private creditors (see Table 1).

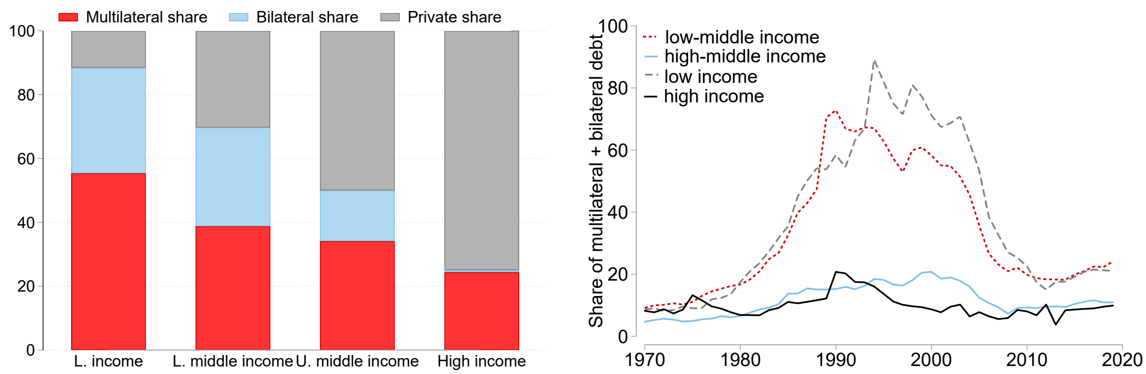


Figure 1: Share of multilateral, bilateral and private debt. Source: World Bank.

We have three main contributions: first, we document the nature of grace periods in sovereign borrowing and the prevalence of concessional loans. Second, we develop a framework that incorporates grace periods and concessional loans, along with non-contingent government debt, into a quantitative sovereign default model. Third, we estimate the effects of grace periods and concessional loans using local projections and use these estimates to validate the model.

Our documentation on grace periods and concessional loans highlight key features that a quantitative model should possess to enhance our understanding of sovereign debt. First, the model must allow for default as an equilibrium outcome. Second, it should incorporate at least two asset types in the government's budget: long-term non-contingent debt and long-term concessional loans. Third, the model needs to reflect the common use of grace periods in sovereign borrowing. Fourth, it should replicate the primary patterns observed in the data following the introduction of a new asset class, specifically concessional loans and grace periods. Towards this objective, we build a model of a small open economy that receives a stochastic income stream of a single tradable good. The government's objective is to maximize the expected utility of private agents. We follow the timing of Eaton and Gersovitz (1981). Decisions are made sequentially: in each period, the government first determines whether to default on its non-contingent private bond and then decides how much to borrow. A government in default incurs an income cost, is temporarily excluded from issuing non-contingent bonds, and loses access to concessional loans. Concessional loans are available only during financial distress episodes when the government faces a shock that increases its gross financing needs. These concessional loans include grace periods, during which payments are suspended for some periods, including in cases of default and exclusion. In later sections, we relax some of these assumptions to further explore the model's mechanisms.

A key trade-off emerges with the inclusion of grace periods in sovereign debt contracts. On one hand, grace periods offer temporary relief during adverse income shocks, thereby enhancing market completeness and easing liquidity constraints when the economy faces persistent downturns. On the other hand, in models of long-term debt, grace periods can exacerbate the debt dilution problem—a situation in which new debt issuance diminishes the value of existing debt, potentially increasing borrowing costs. By postponing repayments, grace periods may incentivize higher borrowing, elevating the risk of future dilution. As such, the desirability of grace periods becomes a quantitative question: do the liquidity benefits during crises outweigh the potential costs associated with increased debt dilution?

To validate our model findings, we compare the interest rate and CDS responses following Flexible Credit Line (FCL) and swap line establishments for a panel of countries to assess the effect of having access to concessional loans and the grace periods therein. FCLs and swap lines are essentially similar arrangements. They are mainly provided to economies that are otherwise financially sound but experiencing a stress episode. The major difference we explore in our study is that swap lines do not entail grace periods, while FCLs include 3¼–5 years of grace periods. This enables us to disentangle the effects of including grace periods for our identification. We find that within the first year after a country gains access to these lines, swap lines produce a more pronounced and more persistent reduction in sovereign spreads compared to FCLs.

Turning to our quantitative results, we demonstrate that concessional loans, when structured to remain available exclusively during risk-on episodes, can contribute to lower spreads over the long run. This effect is achieved by avoiding grace periods and maintaining short-term maturities, which prevents additional debt dilution while still enhancing market completeness.

For model validation, we use the transition dynamics of the model, where we analyze an unanticipated announcement that the government would have access to concessional loans with varying degrees of grace periods. Our results are in line with our empirical findings. We find that the introduction of concessional loans mitigates default risk and spreads, which maps to the decline in CDS and EMBI results in our empirical counterpart. Additionally, we show that the decline in default and spreads is more pronounced when grace periods are eliminated, again in line with our empirical estimates.

We also find that prohibiting debt payment suspensions during default acts as a *disciplining device* for the government, yielding stronger quantitative effects. The intuition behind this is that if the government is required to meet its obligations from concessional loans after default, the cost of defaulting becomes more pronounced. This, in turn, enables the government to sustain a higher level of non-contingent debt at lower spreads in equilibrium.

However, the government's ability to maintain higher debt levels when concessional loans are in place may conflict with policymakers' preferences, a concern that has been publicly raised. Moreover, the significant increase in government indebtedness following large fiscal stimulus plans in the euro area has brought discussions of new fiscal rules to the forefront of policy debates, especially within the context of debt sustainability. To address this issue and align with existing proposals, concessional loans could be used as a financing tool to help sovereigns deleverage their debt to achieve the 60 percent debt-to-GDP ratio, a common policy goal aligned with the Maastricht rule.[1] We analyze a scenario in which the sovereign exchanges its defaultable debt with existing bondholders and uses concessional loan proceeds to finance this exchange using a net present value preserving (voluntary) debt exchange framework as in Hatchondo et al. (2014). Our results show that such an exchange almost eliminates default risk and debt spreads, though it also increases consumption volatility, as debt brakes limit the government's ability to smooth adverse income shocks. With debt reduction to sustainable levels becoming a key policy focus following significant fiscal stimulus across the euro area, concessional loans, along with voluntary debt exchanges and debt brakes, can be instrumental in maintaining financial stability.

We intentionally consider Portugal for our policy exercise for two main reasons: (i) we want to investigate the effects of grace periods and concessional loans. Thus, we selected a country with little concessional debt to analyze the effects of introducing an

[1] Debt brakes are institutional fiscal rules designed to limit government borrowing and ensure fiscal discipline. These rules, implemented in several countries—most notably Switzerland and Germany—are intended to constrain public debt levels and promote sustainable public finances.

additional debt instrument with grace periods, enabling a clearer understanding of each ingredient in the model. (ii) To align with our empirical analysis, which utilizes Flexible Credit Lines, Precautionary Credit Lines, and swap lines for identification—all established with economies that have strong economic and financial fundamentals but are potentially vulnerable to external shocks. To this end, concessional loans are calibrated to be capped at 10% of annual GDP, which is nearly equal to the country's average annual gross financing needs in recent years. Our findings suggest that in response to country-specific income shocks, concessional loans amounting to 10% of GDP, with a grace period of 10 years, on average, mitigate the widening of sovereign spreads by 120 basis points and halve the default risk upon their initial introduction.

A natural question arises: if concessional loans are so beneficial, why haven't they been widely utilized despite being available for some time in the euro area? We attribute this to a political *stigma premium* (see Reinhart and Trebesch (2016)). Our calculations suggest that the stigma premium can be as high as 25%. In other words, the perceived cost of using concessional loans would need to reach 25% to explain their lack of use. This high premium is primarily due to the long grace periods associated with concessional loans. Without grace periods, we find that a stigma premium of just 5% would suffice to discourage their use entirely.

Related Literature. This paper contributes to the body of substantial research on quantitative sovereign debt including the works of Eaton and Gersovitz (1981), Aguiar and Gopinath (2006), and Arellano (2008). An important feature of our framework is the inclusion of long-term debt for both non-contingent debt and concessional loans. Previous research emphasizes the significance of long-term debt as a modeling choice for non-contingent contracts, as highlighted by Hatchondo and Martinez (2009), Chatterjee and Eyigungor (2012), and Arellano and Ramanarayanan (2012). Notably, Hatchondo et al. (2016) demonstrate that debt dilution under long-term debt can significantly impact welfare, with its elimination potentially generating substantial welfare gains. Additionally, Aguiar et al. (2019) argue that, in the absence of income risk fluctuations, sovereigns should actively manage short-term debt while remaining passive with long-term debt. Our study departs from this literature by incorporating grace periods into this framework. Unlike Aguiar et al. (2019), we show that when income risk fluctuations are considered, sovereigns actively manage long-term debt as well—engaging in activities such as buybacks or new issuance—highlighting the nuanced interaction between income risk and debt management strategies. Influential studies, including Boz (2011), Fink and Scholl (2016), Hatchondo et al. (2017), Önder (2022), and Arellano and Barreto (2024) have examined concessional loan like instruments within a quantitative default framework. The latter study also document the prevalence of concessional loan like instruments and investigate them in a partial default. Again, all these influential studies are abstracted from incorporating grace periods and long-term maturity nature of concessional loans. Our framework highlights concessional loans' broader implications for consumption, debt dynamics, and overall welfare. Our findings propose that concessional loans could yield long-run welfare gains if designed to be accessible only during risk-on episodes and structured as short-term instruments. While grace periods enhance market completeness, they exacerbate the debt-dilution problem, leading to higher sovereign spreads in the long run.

The literature on optimal sovereign debt contracts is extensive, encompassing works such as Atkeson (1991), Thomas and Worrall (1994), Kehoe and Perri (2003), Dovis (2018), and Callegari et al. (2023). Our study diverges from this body of work by incorporating strategic default risk into the analysis. Nonetheless, we argue that a contract design characterized by the absence of grace periods, short-term maturity, and availability limited to risk-on episodes can lower long-term borrowing costs by improving market completeness.

The rest of the article proceeds as follows. Section 2 presents our stylized facts. In Section 3, we describe the model environment, while in Section 4, we provide model results with a number of counterfactual. We conclude the article in Section 5.

2 Empirical Analysis

2.1 Stylized facts: Grace periods, Concessional and Private External Debt 1970-2019

Table 1 presents a comparative summary of external sovereign debt characteristics—both concessional and private—for a panel of 108 countries spanning a range of income groups.[2] The analysis covers two periods: 1970–1999 and 2000–2019. For each country, we use data from the World Bank's *International Debt Statistics* on total external debt stocks and average loan terms for new external debt issuances.

For the purposes of our descriptive analysis, we define external debt stocks as the total stock of Public and Publicly Guaranteed (PPG) debt owed to both official and private creditors, measured in current U.S. dollars.

Official external debt consists primarily of concessional loans extended by multilateral institutions—such as the International Monetary Fund (IMF), World Bank, and regional development banks (e.g., AfDB, IDB, ADB)—as well as bilateral loans from sovereign

[2] Table A1 (Appendix Appendix A) shows a similar analysis across the entire 1970-2019 period

governments and their agencies, including Paris Club members and countries such as China. These loans are typically issued on concessional terms and frequently include grace periods of three to five years prior to the commencement of principal repayment. For example, Ecuador's oil-backed bilateral loans from China during the 2010s included a four-year grace period, while IMF facilities such as the Extended Fund Facility commonly incorporate repayment deferrals of similar duration. Grace periods are a standard feature of multinational lending agreements (see International Monetary Fund (2024a), International Monetary Fund (2024b)).

In contrast, private external debt comprises PPG loans from commercial banks (e.g., JP-Morgan, HSBC, BNP Paribas), other private creditors (including manufacturers, exporters, and export credit agencies), and both publicly issued and privately placed bonds. Among these, syndicated bank loans are notable for often including grace periods designed to delay repayment during periods of macroeconomic adjustment. A prominent example is Argentina's 2018 IMF-supported syndicated loan package, which featured a three-year grace period on principal repayment.

To further distinguish debt across repayment structures, we classify external debt with grace periods as the sum of concessional debt and debt from commercial banks—two categories that incorporate repayment deferrals. External debt without grace periods includes bonds, which are typically issued absent such provisions. This classification reflects standard lending practices and provides a useful framework for analyzing variation in the terms of sovereign borrowing. The data includes an item, "loans from other private creditors," which we could not precisely identify. Although sizable, we categorized them under the no-grace-period category. Thus, the overall grace period numbers we report can be considered a lower bound.

Panel A documents changes in the composition of sovereign external debt across time for different creditor types, and grace period features. The table reports average shares of external debt for two periods—1970–1999 (pre-2000) and 2000–2019 (post-2000)—disaggregated by official and private creditor sources. Columns (1)–(3) present the shares of debt owed to official creditors, classified as multilateral institutions, bilateral creditors excluding China, and bilateral creditors including China. Columns (4)–(6) report the shares of debt owed to private creditors, including commercial banks, bonds, and other private lenders excluding those based in China. Column (7) shows the share of private external debt originating from Chinese creditors. Finally, columns (8) and (9) distinguish between debt instruments with grace periods—comprising concessional loans and loans from commercial banks—and those without grace periods, which include bonds and loans from other private creditors.

Table 1: External Debt Composition and Loan Terms by Creditor Type and Period (1970-1999 and 2000-2019)

Panel A: External Debt Composition (% External Debt)

Country group	Official Creditors						Private Creditors								With Grace Periods?			
	Multilateral (1)		Bilateral (2)		China (3)		Commercial Banks (4)		Bonds (5)		Other Creditors (6)		China (7)		Yes (8)		No (9)	
	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000
Low Income	62.0	39.1	27.9	43.7	6.0	4.7	2.0	2.8	0.7	0.2	1.5	9.4	0.3	0.0	97.9	90.4	2.1	9.6
Low Mid. Income	44.4	29.3	29.2	46.1	7.9	1.5	5.7	9.9	10.1	2.8	2.6	10.4	0.6	0.0	87.2	86.8	12.8	13.2
Upper Mid. Income	33.2	24.6	20.4	31.8	2.5	1.3	9.9	21.7	30.9	8.4	3.0	12.2	0.2	0.0	66.1	79.4	33.9	20.6
High Income	21.0	17.3	6.2	20.9	0.1	0.0	9.2	37.6	63.3	17.8	0.3	6.4	0.0	0.0	36.4	75.8	63.6	24.2
Emerging Market	32.1	24.0	21.3	33.7	2.4	0.9	9.8	21.5	31.5	8.4	2.8	11.4	0.2	0.0	65.7	80.2	34.3	19.8
All	44.4	29.9	25.0	39.5	5.2	2.3	6.3	13.2	16.8	4.7	2.4	10.4	0.3	0.0	80.9	84.8	19.1	15.2

Panel B: Loan Characteristics of New External Debt Issuances

Country group	New Concessional Loans												New Loans					
	All Creditors						China						Private Creditors					
	Grace periods (years) (1)		Maturity (years) (2)		Interest Rate (%) (3)		Grace periods (years) (4)		Maturity (years) (5)		Interest Rate (%) (6)		Grace periods (years) (7)		Maturity (years) (8)		Interest Rate (%) (9)	
	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000	Pre 2000	Post 2000
Low Income	7.6	8.4	31.0	33.1	1.3	2.1	7.6	9.3	19.5	19.0	1.4	0.4	4.4	2.2	2.9	7.1	12.7	8.7
Low Mid. Income	6.6	7.5	25.1	26.7	2.1	3.9	5.9	9.6	17.5	19.8	2.3	1.5	6.2	3.0	4.3	7.8	12.0	9.7
Upper Mid. Income	5.4	5.4	18.9	19.7	2.8	5.9	4.7	6.1	15.0	16.5	3.0	2.7	8.3	3.3	5.2	8.4	12.5	9.5
High Income	4.8	5.0	16.2	17.1	3.6	7.0	7.0		30.0		3.0		12.3	4.2	5.1	8.6	13.4	8.6
Emerging Market	5.5	5.6	19.3	20.5	2.8	5.8	4.6	6.5	14.9	16.8	3.0	3.1	8.6	3.5	5.1	8.3	12.4	9.6
All	6.4	6.9	24.1	25.7	2.2	4.2	6.0	8.7	17.4	18.8	2.3	1.4	7.4	3.0	4.6	7.9	12.4	9.4

Authors' calculations. The table shows several statistics on external debt averaged within countries of different income groups, Emerging Market countries, and across all countries. We employ annual aggregate data from the International Debt Statistics (World Bank) for 108 countries during 1970-2019. External debt stocks is the sum of Public and Publicly Guaranteed (PPG) loans from official and private creditors. We define external debt from official creditors as concessional debt. External debt from official creditors includes PPG loans from international organizations (multilateral) and loans from governments and their agencies (bilateral). Private creditors external debt captures PPG loans from private commercial banks, loans from other private financial institutions (other creditors), and bonds publicly issued or privately placed. We define grace loans as the sum of concessional external debt plus external debt from commercial banks. All data on external debt stocks is expressed in current U.S. dollars. Panel A reports average external debt composition for 1970–1999 (Pre-2000) and 2000–2019 (Post-2000). Columns (1)–(3) show shares from official sources (multilateral, bilateral ex. China, bilateral with China). Columns (4)–(7) show shares from private sources (banks, bonds, other creditors ex. China, China). Columns (8)–(9) report shares of debt with and without grace periods. Panel B documents three key loan characteristics: (i) grace period length (in years), (ii) loan maturity (in years), and (iii) interest rates (in %). Columns (1)–(6) present the statistics for new concessional loans, columns (7)–(9) are new borrowing from private creditors. Within the concessional category, columns (1)–(3) capture loans from official creditors globally, and columns (4)–(6) isolate concessional lending from Chinese official creditors.

Panel B documents changes in the structure and pricing of new sovereign external borrowing across time and creditor type. The analysis focuses on three key loan characteristics reported separately for the pre-2000 and post-2000 periods: (i) grace period length (in years), (ii) loan maturity (in years), and (iii) interest rates (in %). Columns (1)–(6) present summary statistics for new concessional loans, while columns (7)–(9) report corresponding values for new borrowing from private creditors. Within the concessional category, columns (1)–(3) capture loans from official creditors globally, and columns (4)–(6) isolate concessional lending from Chinese official creditors. This disaggregation facilitates a detailed comparison of how loan terms have evolved over time and how they vary by source of financing.

Several salient patterns emerge from Panel A. First, the composition of creditors has undergone meaningful shifts over time. Most notably, the share of external debt owed to multilateral institutions declined substantially across all country groups, falling from 44% in the pre-2000 period to less than 30% post-2000. This decline is particularly pronounced among low-income and lower-middle-income countries, where the share of multilateral debt dropped from 62% to 39% and from 44% to 29%, respectively. One potential explanation for this pattern is the stigma associated with borrowing from multilateral institutions—especially facilities such as the IMF's Extended Credit Facility and Extended Fund Facility—which may signal financial distress or require intrusive conditionality.

A comparable reduction is observed in bond-financed external debt. The average share of bonds in total external debt declined sharply among high-income countries, from 63% pre-2000 to just 18% post-2000. Similarly, for upper-middle-income countries and emerging market economies, bond reliance decreased from 30% to 8% over the same period.

Conversely, bilateral and commercial bank lending became increasingly prominent. Across all countries, the share of bilateral debt rose from 25% to 39%, while commercial bank lending increased from 6% to 13% between the pre- and post-2000 periods. This upward trend was most evident among upper-middle-income, high-income, and emerging market economies. For low- and lower-middle-income countries, the shift was concentrated primarily in bilateral lending, which appears to have partially offset the decline in multilateral financing.

A key consequence of the increasing prominence of bilateral and commercial lending has been the rise in the share of external debt with grace periods—debt instruments that include a delayed repayment structure. This category, encompassing both concessional and commercial loans with grace periods, remained the dominant form of sovereign external finance, accounting for an average of 81% of total external debt pre-2000 and rising slightly to 85% post-2000. While this pattern holds across income groups, the dynamics differ.

Among low- and lower-middle-income countries, debt with grace periods declined only modestly, remaining central to their financing portfolios. In contrast, high-income countries experienced a notable shift: the share of debt with grace periods more than doubled, from 36% pre-2000 to nearly 76% post-2000.

Finally, lending from China—both official bilateral and private—remains modest in aggregate terms, and its importance appears to have declined over time. Bilateral debt from China across all countries fell from 5% to 2% between the two periods, with the most marked decline observed in lower-middle-income countries (8% pre-2000 versus 1.5% post-2000). Lending from Chinese private creditors, already limited in scope, effectively disappeared in the post-2000 period, declining from 0.3% to zero.

Panel B presents further stylized facts regarding grace periods, maturities, and interest rates on new external debt issuances from both concessional and private creditors. First, our analysis reveals a sharp divergence in loan terms between concessional and private external lending. In the post-2000 period, private creditors extended loans with significantly shorter grace periods and maturities, coupled with higher interest rates. On average, private loans featured grace periods of just 3 years and interest rates near 8%, compared to 7 years and 4% for new concessional loans. These differences are particularly pronounced among lower-income and emerging market economies. For instance, in lower-middle-income countries, the average interest rate on private loans post-2000 was 9.7%—more than double the 3.9% rate on concessional loans.

Nonetheless, Chinese concessional lending exhibits distinct terms relative to other official creditors. In the post-2000 period, Chinese loans featured shorter grace periods (3 years), lower maturities (8 years), and higher interest rates (4.6%) than the average for multilateral and traditional bilateral concessional loans.

In terms of interest rate dynamics over time, we observe diverging trends across creditor types. Interest rates on new private loans declined modestly across most income groups between the pre- and post-2000 periods, likely reflecting improved global credit conditions. In contrast, interest rates on new concessional loans increased, particularly for upper-middle-income, high-income, and emerging market economies. For instance, the average interest rate on concessional loans to upper-middle-income countries rose from 2.8% to 5.9%, and from 3.6% to 7.0% for high-income countries. This shift suggests that official financing has become relatively more expensive for higher-income borrowers.

Grace periods on new concessional loans remained broadly stable over time, increasing only modestly from 6.4 years in the pre-2000 period to 6.9 years after 2000. In contrast, private lending saw a substantial reduction in grace periods across all income groups. As a result, the average grace period on private external debt declined from 7.4 years before 2000 to just 3 years in the post-2000 period.

Finally, there is evidence of a modest lengthening of loan maturities across both creditor types. For all countries combined, the average maturity on new concessional loans rose from 24.1 years to 25.7 years, while private loans increased from 17.4 to 18.8 years.

2.2 Assessing Market Responses to IMF Credit Lines and Central Bank Swaps

As previously discussed, private creditors typically extend credit under less favorable terms, offering significantly shorter grace periods and maturities, alongside higher interest rates. This stylized fact raises the question of whether access to official concessional credit—characterized by longer maturities and grace periods—affects how private markets assess sovereign risk. Specifically, we aim to empirically evaluate whether the introduction of concessional loan arrangements alters private creditors' perceptions of default risk, thereby influencing the terms of new private lending. To this end, we examine the dynamic response of sovereign interest rate spreads to announcements of two distinct credit arrangements: IMF Flexible Credit Lines (FCL), which include substantial grace periods, and U.S. Federal Reserve central bank swap agreements, which do not. This analysis will help disentangle the effect of attaching grace periods to multilateral loans, a topic we primarily explore in our quantitative section.

We estimate the dynamic effects of FCL and swap line announcements on sovereign risk premia using a local projection approach, following Jordà (2005). Sovereign spreads are measured using both the Credit Default Swap (CDS) premium and the EMBI+ index. We begin by presenting results for a panel of upper-middle- and high-income emerging market economies that had access to either facility between 2008 and 2015.[3] We then provide a detailed case study of Mexico—an important emerging market that benefited from both FCL arrangements and Federal Reserve swap lines.

For country i in month t, let $Y_{i,t}$ denote the monthly average value of either the CDS premium or EMBI+ spread. We then estimate the following equation:

$$Y_{i,t+h} = \alpha + \lambda_i + \lambda_t + \beta_h \text{FCL}_{i,t} + \delta_h \text{SWAP}_{i,t} + \sum_{j=1}^{6} \rho_{j,h} Y_{i,t-j} + \sum_{j=1}^{k} \omega_{j,h} \Delta X_{t-j} + \varepsilon_{i,t+h}. \quad (1)$$

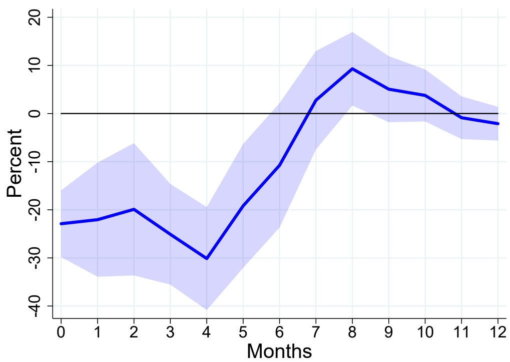
[3]We exclude high-income advanced economies with access to swap lines, such as the United Kingdom and Australia, as their sovereign risk dynamics may differ systematically from those of the emerging markets that constitute the majority of our sample.

Here, $\text{FCL}_{i,t}$ and $\text{SWAP}_{i,t}$ are indicator variables equal to one in the month of an FCL or swap announcement, respectively. Specification (1) includes up to six lags of the dependent variable, as well as country and year fixed effects (λ_i, λ_t). In addition, we control for global financial conditions, including six lags for the VIX monthly change (in CDS regressions) and two lags in the composite EMBI+ index monthly change (in EMBI+ regressions).

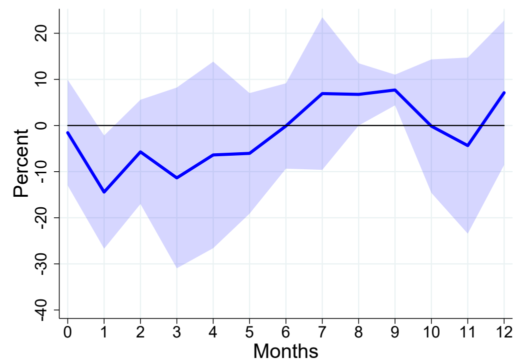
Our identification strategy exploits the shared and distinct characteristics of FCLs and swap lines. On the one hand, both arrangements are considerably less costly than borrowing from private external markets and are available exclusively to countries with sound macroeconomic fundamentals. On the other hand, the two instruments differ along a key contractual dimension: repayment structure. FCLs are medium-term arrangements (initially one to two years, renewable) that include grace periods ranging from 3.25 to 5 years, while swap lines are short-term facilities—typically maturing in 90 days—and do not feature grace periods. The shared eligibility criteria help mitigate concerns about selection bias, allowing us to interpret differences in market reactions as primarily driven by variation in contractual design rather than unobserved fundamentals. Moreoever, the comparison between FCLs and swap lines offers a natural setting to assess how concessional lending terms affect private borrowing costs.

The estimated impulse responses up to 12 months following an FCL or swap announcement are presented in Figure 2. At the time of introduction (month 0), point estimates indicate a sizable decline in sovereign spreads: the CDS premium falls by 22.89 percentage points following an FCL announcement and by 10.66 percentage points following a swap announcement. For the EMBI+ index, the corresponding estimates although smaller and not stistically significant are still negative equal to -1.5 and -6.3 percentage points, respectively. These results suggest that, on impact, FCls announcements generate a slightly stronger negative response of private sovereign spreads than swaps.

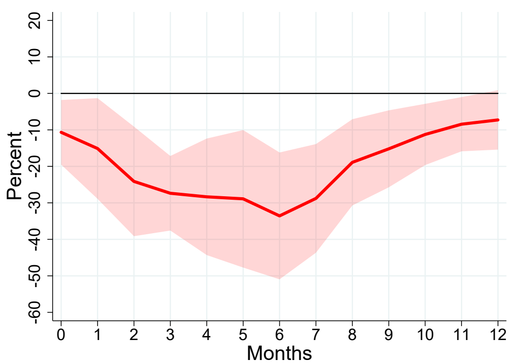
However, the persistence of the effects differs by instrument. For CDS spreads, the impact of FCL announcements becomes statistically insignificant by month 6, whereas the effect of swap announcements remains significant up to a year of the announcement. For EMBI+ spreads, the contrast is more pronounced: swap announcements generate persistent declines on privates sovereign spreads and this negative impact grows slightly and reamin significance up to 12 months after the initial annoucemnte, while the influence of FCL announcements is only statistically significant one month after the initial announcement, but besides this remains statistically insignificant close to zero (except on month 9 where seems to be an increase in EMBI+ spread).



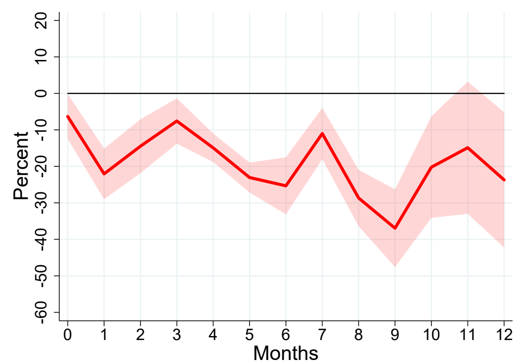
(a) CDS: FCL Announcement



(b) EMBI+: FCL Announcement



(c) CDS: SWAP Announcement



(d) EMBI+: SWAP Announcement

Figure 2: FCL and SWAP Announcements: Panel Countries (2008m1–2015m12)

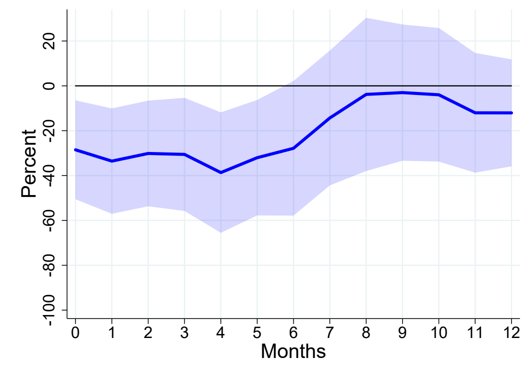
Conditional on statistical significance, the post-introduction impact tends to be stronger for swaps than for FCLs. For CDS spreads, FCL announcements are associated with declines up to 35 percentage points (month 4), while the corresponding range for swap announcements is between 10 and 35 percentage points, with larger persistence. For EMBI+ spreads, the decline following FCL announcements ranges achieves its maximum on 15 percentage points (month 1), whereas swap announcements produce reductions between 20 and 40 percentage points over the following months.

As a robustness check, we re-estimate the local projections for Mexico—the only country in the panel to receive both an FCL and a swap line:

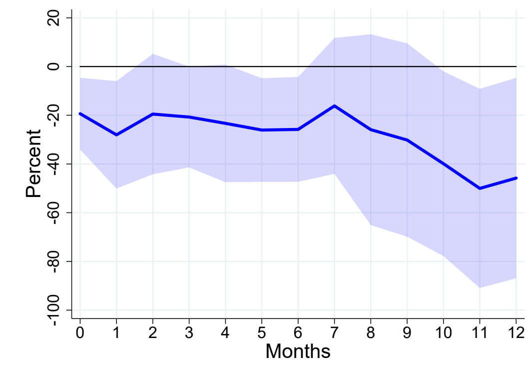
$$Y_{t+h} = \alpha + \beta_h \mathrm{FCL}_t + \delta_h \mathrm{SWAP}_t + \sum_{j=1}^{q} \rho_{j,h} Y_{t-j} + \varepsilon_{t+h}. \tag{2}$$

Equation (2) includes one lag ($q = 1$) in the CDS regressions and two lags ($q = 2$) in the EMBI+ regressions.

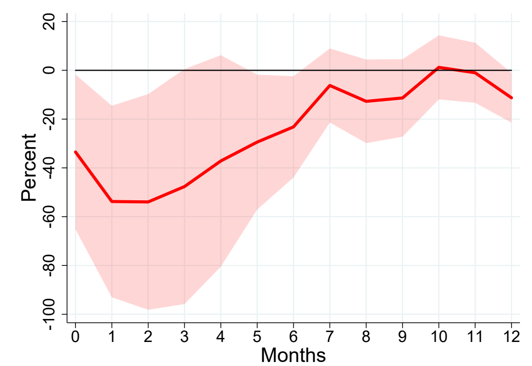
The local projection estimates for Mexico are presented in Figure 3. The results echo those from our panel data: the effects of swap announcements are stronger and more persistent than those of FCLs. CDS spreads decline by 20–60 basis points following swaps, compared to 20–40 basis points for FCLs. EMBI+ spreads drop by up to 90 basis points after swaps, exceeding the 20–50 basis point range for FCLs.



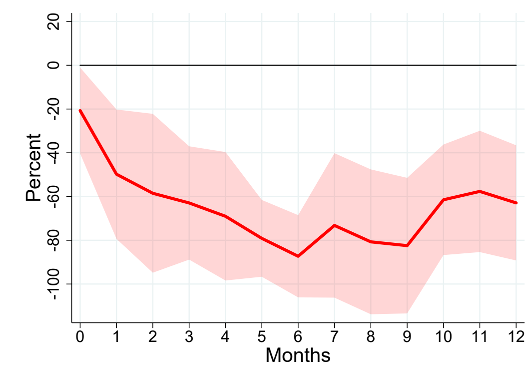
(a) CDS: FCL Announcement



(b) EMBI+: FCL Announcement



(c) CDS: SWAP Announcement



(d) EMBI+: SWAP Announcement

Figure 3: FCL and SWAP Announcements: Mexico

Overall, within the first year after announcement, swap lines—despite their short maturity and absence of grace periods—produce a more pronounced and more persistent reduction in sovereign spreads compared to FCLs. Taken together, our evidence suggests that concessional loans improve borrowing conditions from private creditors. However, the benefits appear larger for facilities with shorter maturities and no grace periods. As we show next, this finding is consistent with the implications of our quantitative model of sovereign default with concessional lending.

One limitation for our local projection estimates is that pools together all FCL and swap announcements across countries and time. While this approach leverages rich variation, it may understate the effect of initial program announcements if later arrangements are partially or fully anticipated by markets (e.g., due to the renewal of prior agreements). To address this concern, we shift focus to the effects of first-time FCL and swap announcements, which are arguably more informative and less subject to anticipation.

Specifically, we estimate their impact on private sovereign borrowing costs using a difference-in-differences (DID) approach focused on Mexico, leveraging its unique sequencing of FCL and swap announcements—April 17 and April 22, 2009, respectively. The five-day gap enables separate identification of each effect using daily data.[4] We find that spreads began adjusting as early as the FCL announcement, but swap lines appear to have driven the bulk of the response. Details of the DID methodology and results are reported in Appendix C.

3 The Quantitative Model

Our empirical findings suggest that the following are desirable properties of a quantitative model designed to improve our understanding of sovereign debt. First, the model should generate default in equilibrium. Second, the model should at least accommodate two assets in its budget balances: long-term non-contingent debt and long-term concessional loans. Third, the model should account for the prevalence of grace periods in sovereign debt issuance. Fourth, a successful model should capture the main dynamics observed in the data following the inception of a new asset class, namely concessional loans in the model. With this in mind, we provide a framework in which the government has the ability to issue non-contingent private bonds that do not entail grace periods (as in the data) and access concessional loans with grace periods. In what follows, we provide the details of such a model.

[4] A staggered DID design using the panel of countries is not feasible due to limited cross-sectional treatment variation. In the CDS sample, only Mexico received an FCL, while variation across other countries pertains solely to swap announcements. Conversely, in the EMBI+ sample, only FCL announcements are observed. As a result, panel-based DID estimates would reflect country-specific shock for Mexico rather than average treatment effects across multiple treated units.

3.1 Environment

The model assumes that the government lacks commitment to future decisions regarding default and borrowing. The analysis focuses primarily on achieving a Markov-perfect equilibrium. In simple terms, this means that in each period, the government's default and borrowing strategies are determined only by payoff-relevant state variables.

In each period, the sequence of events unfolds as follows. First, the economy undergoes an endowment shock and a local expenditure shock and then decides whether to repay. Subsequently, after observing these shocks, the government makes decisions about debt default and borrowing, subject to constraints influenced by its default choice.

The economy's endowment of the single tradable good is represented by $y \in Y \subset \mathbb{R}_{++}$. The endowment process follows

$$\log(y_t) = (1-\rho)\,\mu + \rho \log(y_{t-1}) + \varepsilon_t,$$

with $|\rho| < 1$, and $\varepsilon_t \sim N\left(0, \sigma_\varepsilon^2\right)$.

Following Hatchondo et al. (2024), government expenditures denoted as e_t may take a low or a high value: $e_t \in \{e_L, e_H\}$, and it evolves according to a Markov process. During normal times, e_t equals e_L, while e_t becomes e_H during a local shock, with $e_H > e_L$. Specifically, a local shock ℓ initiates with probability $\pi_{LH}(y) \in [0,1]$ and concludes with probability $\pi_{HL} \in [0,1]$. To account for the correlation between negative conditions in international capital markets and low domestic aggregate income (Calvo et al., 2006a; Calvo et al., 2006b), we model π_{LH} as a decreasing function of y, expressed as $\pi_{LH}(y) = \min\left\{\pi_0 exp^{-\pi_1 \log(y) - 0.5\pi_1^2\sigma_\varepsilon^2}, 1\right\}$.

Access to concessional loans granted automatically during a local shock and it expires when the shock is over.

Episodes of the grace period, denoted as $g \in \{g_S, g_N\}$, where g_S indicates being in a grace period and g_N indicates not being in one, follow a Markov process. In this process, a grace period begins with probability $\pi_{NS}(g) \in [0,1]$ and ends with probability $\pi_{SN} \in [0,1]$. If the government gains access to concessional loans in the current period, then the probability of transitioning to a grace period in the following period is $\pi_{NS}(g' = g_S \mid e = e_H) = 1$. This is consistent with the stylized fact presented earlier. During suspended payment periods, creditors earn a rate of return r_C.

Preferences of the government over private consumption are given by

$$\mathbb{E}_t \sum_{j=t}^{\infty} \beta^{j-t} u\left(c_j\right),$$

where $\mathbb{E}$ denotes the expectation operator, β denotes the subjective discount factor, and c_t represents consumption of private agents. The utility function is strictly increasing and concave.

Asset spaces: Two asset classes exist in the model. The first one is the standard long-term debt. As Hatchondo and Martinez (2009), we assume that a non-contingent bond issued in period t promises an infinite stream of coupons that decrease at a constant rate δ. In particular, a bond issued in period t promises to pay $\delta(1-\delta)^{j-1}$ units of the tradable good in period $t+j$, for all $j \geq 1$. Hence, non-contingent debt dynamics can be represented as follows:

$$b_{t+1} = (1-\delta)b_t + i_t,$$

where δb_t are the payments due in period t, and i_t is the number of non-contingent bonds issued in period t. As presented in our data section, bonds under private creditors do not entail grace periods.

Similar to non-contingent debt, concessional loans promise a continuous stream of coupons. These coupons represent periodic interest payments, and in this case, they decrease at a constant rate denoted by δ_C. The access to these lines is triggered when the sovereign faces a local shock ℓ and when the shock is over, the access expires. One key characteristic that sets these loans apart is the presence of grace periods. The payment to the concessional loans starts after a grace period. Grace periods refer to periods during which the borrower is not required to make repayments. This grace period starts after accessing to the concessional loans and extends for a specified number of periods after the access expires. In particular, expectations are computed such that whenever the government accesses to concessional loans, payments are suspended in the next period and then continues to be suspended for a stochastic number of periods.

If the sovereign has not defaulted and the payments of concessional loans are suspended while the government has access to them, then the budget constraint reads

$$c = y - (e = e_H) - \kappa b + q(b', b'_C, y, p, g)\left[b' - b(1-\delta)\right] + q_C\left(b'_C - \frac{b_C}{1+r_C}\right),$$

where q and q_C denote the price of non-contingent bonds and concessional loan, respectively. Following the literature, we assumed concessional loans to be non-defaultable and set it to equal to the risk free rate, $q_C = \frac{1}{1+r_C}$. Later on, we relax this assumption and introduce a premium. Note that the government expenditures e becomes e_H as the government can only access to these concessional loans when they are hit by local shocks. Next, $\kappa = \frac{r+\delta}{1+r}$ and $\kappa_C = \frac{r_C+\delta_C}{1+r_C}$ denote coupon payments of non-contingent debt and concessional loans, respectively. If payments accrued due to concessional loans are in a grace period while the sovereign cannot access to concessional loans, consumption is given by

$$c = y - (e = e_L) - \kappa b + q(b', b'_C, y, p, g)\left[b' - b(1-\delta)\right].$$

If the access to the concessional loans is not triggered and the payments are not suspended, then the consumption is given by

$$c = y - (e = e_L) - \kappa b - \kappa_C b_C + q(b', b'_C, y, p, g)\left[b' - b(1-\delta)\right].$$

Lastly, if the access to the concessional loans is triggered and the payments that are due from its previous concessional loan balances are not in a grace period, then the consumption reads

$$c = y - (e = e_H) - \kappa b - \kappa_C b_C + q(b', b'_C, y, p, g)\left[b' - b(1-\delta)\right] + q_C\left(b'_C - (1-\delta)b_C\right).$$

Defaults. In the event of government default, it encompasses both current and future debt obligations. This aligns with the observed behavior of defaulting governments and is a conventional assumption in the literature.[5] When a sovereign defaults, it is excluded from private debt markets for a stochastic period of time and faces an income cost of defaulting during its exclusion. Upon the government's re-entry, the government pays a fraction of its defaulted debt.

It is customary that the sovereign does not default on concessional loans as they have a seniority over private debt and keep their coupon payments as scheduled.

The budget constraint during defaults and exclusions is given by $c = y - e - \phi(y)$ if payments are suspended, and $c = y - e - \phi(y) - \kappa_C b_C$ if concessional loan payments are not suspended. The government does not have to make payments during exclusion if it overlaps with a grace period on the concessional loan contract.

3.2 Recursive Formulation

Let $s \equiv (y, \ell, g)$ denote the vector of exogenous states. Let V denote the value function of a government that is not currently in default. The function V satisfies the following

[5] A notable aspect in sovereign debt contracts is the inclusion of an acceleration clause and a cross-default clause. The acceleration clause empowers creditors to demand immediate repayment if the government defaults on a debt payment. Simultaneously, the cross-default clause stipulates that any default in a government obligation triggers a default in the contract containing that clause. These clauses imply that following a default event, future debt obligations transition into the category of current obligations.

functional equation:

$$V(b, b_C, s) = \max\left\{V^R(b, b_C, s), V^D(b, b_C, s)\right\}, \tag{3}$$

where the government's value of repaying is given by

$$V^R(b, b_C, s) = \max_{b' \geq 0,\, b'_C \geq 0,\, c \geq 0} \left\{u\,(c) + \beta \mathbb{E}_{(y'|y, \ell'|(y', \ell), g'|(\ell, g))} V(b', b'_C, s')\right\}, \tag{4}$$

subject to

$$\begin{aligned}
c &= y - e - \kappa b - [1 - \mathcal{I}(g)]\, \kappa_C b_C + q(b', b'_C, s) i + \mathcal{I}(\ell) q_C i_C, \\
i &= b' - b(1 - \delta), \\
i_C &= b'_C - [1 - \mathcal{I}(g)]\, b_C (1 - \delta_C) - \mathcal{I}(g) b_C (1 + r_C), \\
b'_C &= (1 - \mathcal{I}\,(g))\, b_C (1 - \delta_C) + \mathcal{I}(g) b_C (1 + r_C) \text{ if } \mathcal{I}(\ell) = 0, \qquad (5) \\
q(b', b'_C, s) &\geq \underline{q}\ \forall\, b' > b(1 - \delta),
\end{aligned}$$

where $\mathcal{I}(\ell)$ and $\mathcal{I}(g)$ are both indicator functions. $\mathcal{I}(\ell)$ becomes unity when the government is hit by a local shock and thus is allowed to borrow from multilateral institutions and equals 0 otherwise. Namely,

$$\mathcal{I}(\ell) = \begin{cases} 1 & \text{if } e = e_H, \\ 0 & \text{otherwise.} \end{cases}$$

$\mathcal{I}(g)$ activates during a grace period, indicating that payments are suspended, and becomes 0 otherwise. Equation (5) is the law of motion of concessional loans when the sovereign cannot access to them. Expectations, depicted in the right hand-side of equation (4), are computed such that whenever the government accesses to concessional loans, payments are suspended in the next period. That is, $\mathcal{I}(g') = 1$ if $\mathcal{I}(\ell) = 1$. When payments are suspended, it accrues interest rate at a rate r_C and the price of a concessional loan is given by a risk free rate $q_C = \frac{1}{1+r_C}$. The value of defaulting is given by:

$$\begin{aligned}
V^D(b, b_C, s) \;=\;& u\,(y - e - \phi(y) - [1 - \mathcal{I}(g)]\, \kappa_C b_C) \\
+\;& \beta \mathbb{E}_{s'|s} \Big[(1 - \psi) V^D(b, (1 - \mathcal{I}(g'))(1 - \kappa_C) b_C + \mathcal{I}(g') b_C, s') \\
+\;& \psi V(\alpha b, (1 - \mathcal{I}(g'))(1 - \kappa_C) b_C + \mathcal{I}(g') b_C, s')\Big],
\end{aligned} \tag{6}$$

The solution to the government's problem yields decision rules for default $\hat{d}(b, b_C, s)$, non-contingent debt $\hat{b}(b, b_C, s)$, concessional loans $\hat{b}_C(b, b_C, s)$, and consumption when not in default $\hat{c}(b, b_C, s)$. The default rule $\hat{d}$ is equal to 1 if the government defaults, and is equal to 0 otherwise. In a rational expectations equilibrium (defined below), investors use the borrowing and default decision rules to price debt contracts. Thus, the bond-price function solves the following functional equation:

$$\begin{aligned} q(b',b'_C,s) &= \mathbb{E}_{s'|s}\left[\exp^{-r}\left[\hat{d}\left(b',b'_C,s'\right)q^D(b',b'_C,s')\right.\right. \\ &+ \left.\left.\left[1-\hat{d}\left(b',b'_C,s'\right)\right]\left[\kappa+(1-\delta)q\left(b'',b''_C,s'\right)\right]\right]\right] \end{aligned} \tag{7}$$

where

$$\begin{aligned} q_d\left(b',b'_c,s\right) = \mathbb{E}_{s'|s}\left\{\exp^{-r}\left[\alpha\psi\ \left(\left(1-d'\right)\left[\kappa+(1-\delta)q\left(\hat{b}\left(\alpha b',\iota'_C,s'\right),\hat{b_c}\left(\alpha b',\iota'_C,s'\right),s'\right)\right]\right.\right.\right. \\ \left.\left.\left.+d'q_d(\alpha b',\iota'_C,s')\right)+(1-\psi)q_d\left(b',\iota'_C,s'\right)\right]\right\}, \end{aligned} \tag{8}$$

where $\iota'_C = (1-\mathcal{I}(g))(1-\kappa_C)b'_C + \mathcal{I}(g)b'_C$, $d' = \hat{d}\left(\alpha b',\iota'_C,s'\right)$ denotes the next-period equilibrium default decision, $b'' = \hat{b}\left(b',b'_C,s'\right)$ denotes the next-period equilibrium non-contingent debt decision and $b''_C = \hat{b}_C\left(b',b'_C,s'\right)$ denotes the next-period equilibrium concessional loan decision.

3.3 Recursive Equilibrium

A *Markov Perfect Equilibrium* is characterized by

1. rules for default $\hat{d}$, non-contingent borrowing $\hat{b}$, and concessional loan borrowing $\hat{b}_C$
2. and bond price functions q and q_C for non-contingent and concessional loans, respectively,

such that:

i. given the bond price functions q and q_C, the policy functions $\hat{d}$, $\hat{b}$, and $\hat{b}_C$ solve the Bellman equations (3), (4), and (6).

ii. given policy rules $\left\{\hat{d},\hat{b},\hat{b}_C\right\}$, the bond price function q satisfy condition (7).

3.4 Computation

Solving the model relies on iterating the value functions V^R and V^D, and price function q. To avoid the potential multiplicity problem outlined in Krusell and Smith (2003), we first solve the equilibrium of the finite-horizon economy. We start with an initial guess for the terminal value and iterate backward until the differences in value and price functions for two subsequent periods are less than 10^{-5}. We then use the obtained values as the equilibrium of the infinite horizon economy. We use 40 grid points for non-contingent debt, 40 grid points for concessional loans, and 30 grid points for income. Expectations are computed using 300 Gauss-Legendre quadrature points.[6]

3.5 Calibration for the economy without concessional loans

Table 2: Parameter values

	Parameter	Value	Target
Risk aversion	σ	2	Standard RBC value
Risk-free rate	r	4%	Standard RBC value
Discount factor	β	0.92	
Probability of reentry after default	ψ	1/3	Hatchondo et al. (2024)
Recovery rate	α	0.63	Cruces and Trebesch (2013)
Standard debt duration	δ	0.1	Average duration 6.7 years
Concessional loan duration	δ_C	0.1	Average duration of 10 years
Minimum bond price	$\underline{q}$	0.60	
Government consumption	$e = e_L$	0.12	data
Concessional loan cap	$\overline{b_C}$	0.10	European Stability Mechanism (2024)
		Calibrated	
Income autocorrelation coefficient	ρ_ϵ	0.78	Estimated
Standard deviation of innovations	σ_ϵ	2.54%	Estimated
Mean log endowment	μ	$(-1/2)\sigma_\epsilon^2$	Normalization
Income cost of defaulting	d_0	-1.13	Spread and debt-to-GDP ratio
Income cost of defaulting	d_1	1.288	Spread and debt-to-GDP ratio
Probability of entering local shock	π_0	0.38	3 high-financing needs episodes every twenty years
Probability of entering local shock	π_1	38	4% lower average income
Probability of grace period ending	π_{SN}	0.1	10 yrs of grace period
Local income shock	e_H	0.22	10% annual income loss

We first calibrate the benchmark model without concessional loans ($i_C = 0$) to reflect key characteristics of the Portuguese economy. This economy is characterized by real debt that cannot be inflated away, underpinned by strong fundamentals, yet stands to benefit from concessional loans during periods of heightened local gross financing needs.

The utility function assumes a constant coefficient of relative risk aversion, given by:

$$u(c) = \frac{c^{1-\gamma} - 1}{1-\gamma}, \text{ with } \gamma \neq 1.$$

The income cost of defaulting is defined as $\phi(y) = d_0 y + d_1 y^2$. This quadratic income cost structure allows us to match the average levels of debt and sovereign spreads observed in the data.

[6]We use tools developed in Önder (2023) for the portfolio problem. In particular, we use bi-dimensional optimizers which are shown to be superior over taste shocks for portfolio problems.

Table 2 presents the benchmark values assigned to all model parameters. Each period in the model represents one year. The risk-free interest rate is set at 4 percent, and the discount factor β is set at 0.92, both standard values in quantitative studies on sovereign defaults and business cycles in small open economies. We set $\underline{q} = 0.60$, which prevents consumption booms prior to defaults and is never binding in the simulations.

Except for the spread data, we use data from 1995 to 2019. The spread data becomes available after 1999, following Portugal's accession to the Euro area. The parameters governing the endowment process are chosen to replicate the behavior of logged and linearly detrended GDP in Portugal during this period.

Public expenditure, e_L, is set at 12 percent of average income, which is within the range of public consumption to GDP in Portugal. We set $\delta = 0.1$, which, alongside the targeted sovereign spread, yields an average debt duration of 6.7 years in the simulations—consistent with the average duration of public debt in Portugal.[7]

We model the local shock as one that increases the government's gross financing needs, such as in the case of a natural disaster. This type of shock is primarily domestic, similar to the framework used in Hatchondo et al. (2024).

Formally, we assume that government expenditures e shock follows a Markov process with probabilities set as $\pi_0 = 0.38$, $\pi_1 = 0.38$, and $\pi_{HL} = 0.8$. The low expenditure level, $e_L = 0.12$, is consistent with the baseline calibration, while the high expenditure level, $e_H = 0.22$, represents a 10 percent increase in public spending relative to average income—comparable to the shocks reported by Bova et al. (2016).

We set the cap on concessional loan limits, $\overline{b_C}$, at 10%, with an average grace period of 10 years ($\pi_{SN} = 0.1$), following the lending practices of the European Financial Stability Facility (EFSF) (see European Stability Mechanism (2024)). The EFSF provided financial assistance to Portugal as part of the EU and IMF bailout program after the 2011 sovereign debt crisis. Loan terms, including grace periods, were determined by the specific agreements made during the bailout negotiations. In Portugal's case, the total loan received from the EFSF amounted to more than 10% of its GDP, with a grace period of approximately 10 years. To align with recent concessional loan proposals, we revisit our analysis using a 4% cap on concessional loans and a 3-year grace period.

To calibrate the model, we adjust two parameters for the cost of default, two parameters for the likelihood of entering a high-financing-need period, and the risk premium (d_0, d_1, π_0, π_1, and π_{HL}). These are calibrated to match five key moments: an average spread of

[7] We use data from the Public Debt Management Office of Portugal (`https://www.igcp.pt/en/`) for the average debt duration and apply the Macaulay definition of duration, which, given the coupon structure in this paper, is given by $D = \frac{1+r^*}{\delta+r^*}$, where r^* denotes the constant per-period yield delivered by the bond.

1.8 percent, a public debt-to-GDP ratio of 88.1 percent, three high-financing needs episodes per 20 years, a 4 percent trend-income reduction during these episodes (Calvo et al., 2006b) with a 1.5 percentage point increase in spreads during a local shock. The targets for debt and spread levels are again based on data from Portugal.

In our model, duration of concessional loan repayments are set to be 10 years, $\delta_C = 0.1$, in line with existing proposals. Consistent with previous proposals, we assume that deferred payments accrue interest at the risk-free rate ($r_C = r$), meaning there is no nominal debt forgiveness associated with concessional loans.

Table 3 reports moments in the data and in the simulations of the benchmark economy with non-contingent debt. The simulations match the moments targeted in the calibration well. For the $\rho(b, b_C)$ moment, which computes the cross-correlation between new debt issuances of non-contingent debt and concessional debt, we resort to the cross-country panel moments provided in Table B2. The model also does a good job of matching this negative correlation, which suggests that these debt instruments are rather weak substitutes.

4 Results

We assess the impact of introducing concessional loans by comparing simulation outcomes between a baseline economy without concessional loans and one where the government can issue both non-contingent bonds and concessional loans. Our findings suggest that, over the long run, the introduction of concessional loans leads to an increase in total sovereign indebtedness, as well as a modest rise in default risk and interest rate spreads.

To analyze model dynamics, Figure 4 illustrates the impact of concessional loans on bond prices. The upper panels show the government's equilibrium pricing schedule in economies with and without concessional loans during normal times, while concessional loan utilization is zero ($b_C = 0$). The dashed red line represent the economy with concessional loans and the solid blue lines represent the baseline economy. The upper-left chart plots the equilibrium price functions as a function of income when debt is fixed at the ergodic level of the benchmark economy, specifically $b = 88.8\%$ for both the baseline and for the economy with concessional loans. The upper-right chart displays pricing schedules with income set at 2.5 standard deviations below trend and plots it as a function of non-contingent debt. In the upper-left panel, asset prices are higher in the economy with concessional loans, as the lower probability of default for a given income and debt level reduces interest rates (since bond prices and interest rates are inversely related).

Table 3: Main Results

	(1) Data	(2) Baseline	(3) With concess loans
Mean public debt to GDP (%)	88.1	88.8	92.1
Mean concessional loans to GDP (%)	*n.a.*	*n.a.*	8.3
Mean sovereign spread (r_s) (%)	1.8	1.8	1.9
Spread volatility ($\sigma(r_s)$)	2.9	0.8	0.8
$\sigma(c)/\sigma(y)$	1.1	1.5	1.5
$\rho(r_s, y)$	-0.5	-0.8	-0.8
Defaults per 100 years	n.a.	4.0	4.4
Average duration of debt (in yrs)	6.6	6.7	6.6
Average grace period of concessional loans (in yrs)	*n.a.*	*n.a.*	10
Spread rise during local shocks	1.5	1.6	1.8
$\rho(b, b_C)$	-0.1*	*n.a.*	-0.2

The first column reports Portugal's data moments, the second column reports the results of the baseline model without concessional loans and the third column presents the results with concessional loans. The Standard deviation of a variable is denoted by σ, and the coefficient correlation between variables is denoted by ρ. Consumption and income are reported by natural logs. For $\rho(b, b_C)$ moment, we use the panel average provided in Table B2.

Similarly, in the upper-right panel, prices in the economy with concessional loans remain higher because the risk of default is lower, even with long-term debt, due to future default probabilities.

The lower panel of Figure 4 provides further insights into price and model dynamics. The top-left chart depicts equilibrium prices as a function of income, with non-contingent debt and credit line levels fixed at their respective long-run values (88.8% for the baseline and 92.1% non-contingent debt) and zero credit line utilization. In contrast, the top-right chart illustrates equilibrium prices as a function of non-contingent debt, assuming income is 2.5 standard deviations below its long-run trend and credit line utilization remains at zero. These charts reveal that asset prices improve when credit lines are accessed but unused. The bottom charts replicate these analyses, this time setting credit line utilization to its ergodic value ($b_C = 8.3\%$). They show that asset prices are slightly lower in an economy with credit lines, though this difference is subtle due to scaling. This finding aligns with the mean sovereign spread (r_s) reported in Table 3.

4.1 Transition Dynamics - Model Validation

In this section, we analyze an unanticipated announcement in which the government gains access to concessional loans starting immediately during a local shock. We use this analysis as model validation by comparing our local projection estimates presented in the empirical section. Recall that in our empirical section, we compute our estimates using the

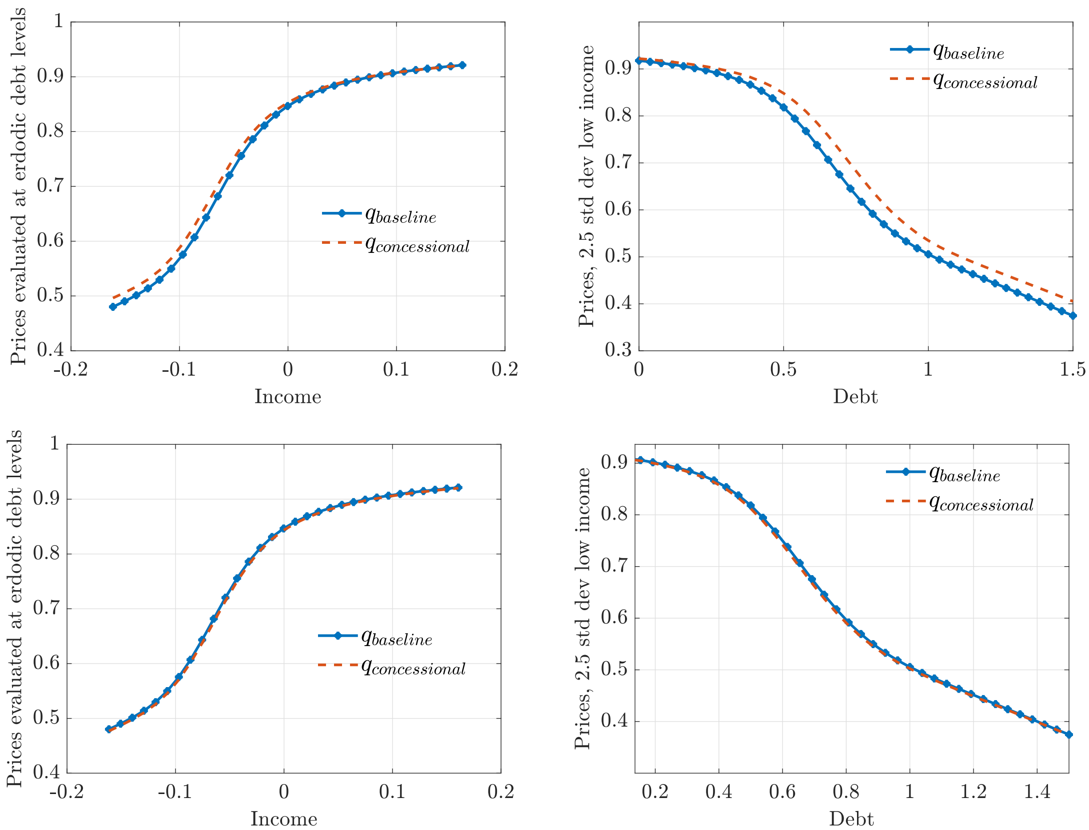


Figure 4: Equilibrium prices. The upper panels display the equilibrium price functions during normal times, when concessional loan utilization is zero ($b_C = 0$)). The upper left panel shows equilibrium prices as a function of income, while the upper right panel shows them as a function of debt. The bottom left panel illustrates the economies at their ergodic levels, with 88.8% non-contingent debt for the baseline case and 92.1% non-contingent debt for the economy with a 10% concessional loan. The bottom right panel replicates the upper right panel, but now b_C is set to 10 percent of mean income, which is normalized to unity.

FCL and swap line arrangements and also provide estimates for their initial introduction in an economy.

Specifically, the constraints on the amount of debt a government can borrow through concessional loans change from 0 to 0.10 when $\ell = e_H$. Figure 5 shows the impulse response functions (IRFs) for a 2.5 standard deviation income shock in an economy facing a local shock. The top left-hand corner shows the path of the income shock fed to the model. The red dashed lines represent the benchmark economy, while the yellow dashed lines represent the economy with unanticipated concessional loans.

The figure shows that after the income shock, the benchmark economy slightly increases its indebtedness. The government would have preferred borrowing more to smooth consumption if it were not constrained by default risk. As the probability of default increases, the cost of borrowing, as measured by spreads, rises sharply, limiting the government's ability to smooth consumption through borrowing. In contrast, at the time of introduction, concessional loans reduce default risk, lead to a significant decline in consumption volatility, and allow for cheaper borrowing compared to an economy without concessional loans, consistent with the equilibrium price dynamics shown in Figure 4. Access to a new source of funding during times of stress is crucial for avoiding significant borrowing costs and default. This incentivizes the government to borrow more, resulting in a higher stock of non-contingent debt in the long run, accompanied by a slightly higher spread and default risk. This is very much in line with our LP estimates in the empirical section, where we show that following the introduction of FCL and swap lines, EMBI spreads and CDS fall considerably.

The economy with concessional loans taps them immediately upon access, leading to an initial short-term surge in consumption. In the long run, however, higher borrowing costs and interest payments take their toll, resulting in lower consumption than in the baseline scenario. This raises the question of whether concessional loans really improve welfare, which we explore in the next section.

4.2 Welfare analysis

In this section, we examine whether switching to an economy with concessional loans is welfare enhancing. We measure the welfare gain from the introduction of concessional loans as the constant proportional change in consumption that would make a consumer indifferent between living in the economy without concessional loans and living in the economy with concessional loans. These welfare gains are given by

$$\left[\frac{\hat{V}^{\mathrm{NC}}(b,y,s)}{\hat{V}^{\mathrm{concession}}(b,0,s)}\right]^{\left(\frac{1}{1-\gamma}\right)}-1,$$

where the super-index "NC" refers to the value function in the benchmark economy and the super-index "concession" refers to the economy with concessional loans. Thus, a positive welfare gain means that agents prefer the economy with concessional loans.

The left panel of Figure 6 plots the welfare gains as a function of the calibration target for the baseline economy (which is 88.8 percent and alternative income levels) from switching to the economy with concessional loans for two cases: the dashed red line is when the economy faces a local shock, while the solid blue line represents normal times. The figure shows that the gains can be substantial. The consumption panel of Figure 5 shows that when concessional loans are introduced, the government taps these concessional loans, which leads to a front-loading of consumption. And in the long run, as higher borrowing

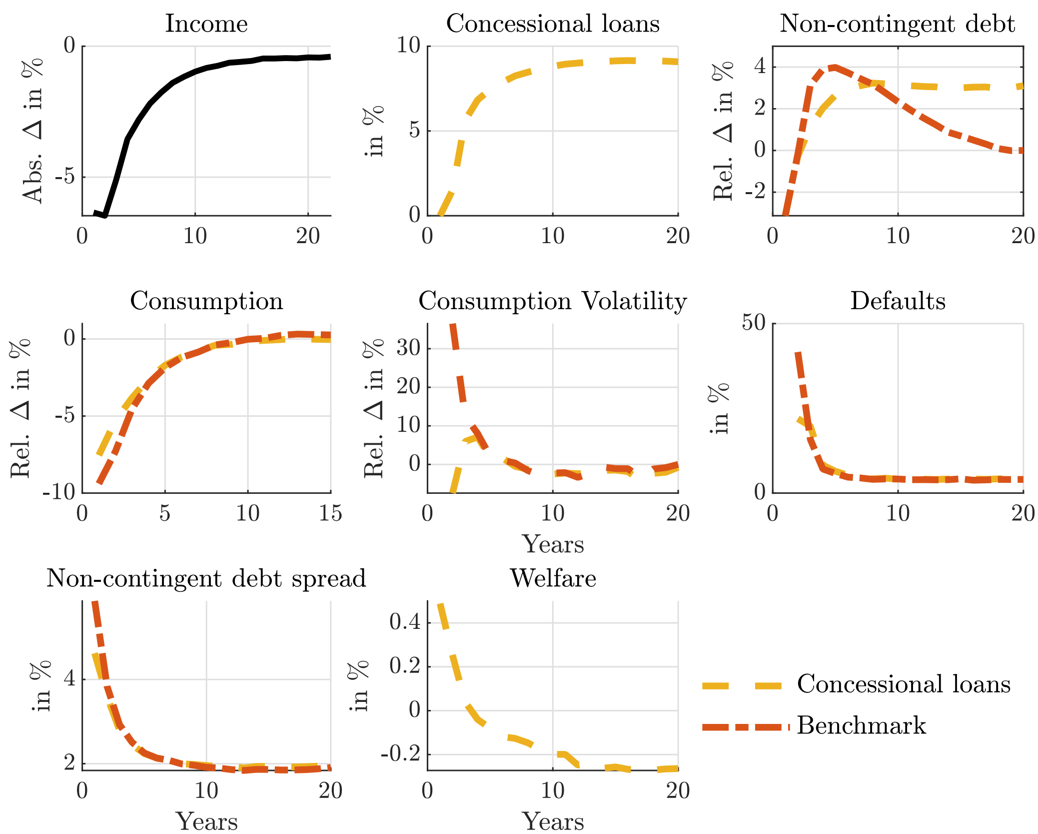


Figure 5: Impulse Response Functions. The figure illustrates the behavior of key variables following a simultaneous shock to each economy, which starts with an initial average debt level (as in the baseline economy) and is jointly affected by a local shock and a negative income shock of two-and-a-half standard deviations. The local shock lasts for one year, while the income shock follows its recovery path, as depicted in the upper left chart. Concessional loans, defaults, spreads, and welfare are shown in levels, while other variables are expressed as percentage deviations from the baseline. The dashed yellow line represents the economy with concessional loans and the red dashed-dotted line corresponds to the benchmark.

takes its toll, welfare closely follows the path of consumption and the economy with concessional loans ends up with a welfare loss.

Turning to Figure 6, we observe lower welfare gains for increasing income levels as the probability of default decreases, which reduces the price differentials between concessional loans and baseline economies. These price differentials are also visually apparent in the panels of Figure 4. The discontinuity in welfare gains arises because the government defaults below a certain income threshold for a given portfolio allocation and state.

The right panel of the figure highlights the source of welfare gains for the mean level of output as a function of the ratio of net debt issuance $(b' - b(1-\delta) + b'_C)$ to mean income (normalized to one) at the time of concessional loan introduction. Thick dots reflect equilibrium realizations. These graphs are consistent with Figure 4. In particular, the thick dots on these price graphs show that the economy with concessional loans issues higher amounts of debt at a lower price, which leads to an increase in consumption and thus an increase in welfare gains.

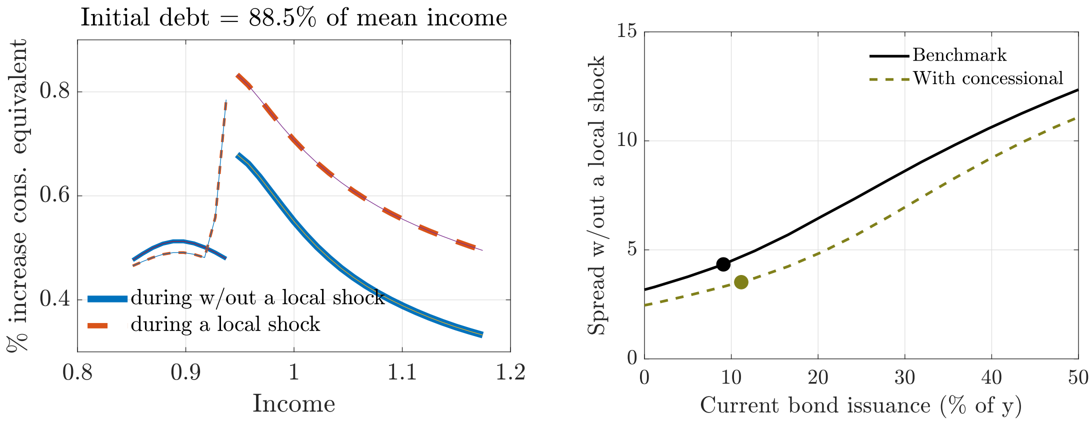


Figure 6: Welfare gains from switching to the economy with concessional loans. The left panel illustrates the welfare gains, expressed in consumption equivalent terms, resulting from transitioning from the baseline economy to the economy with concessional loans. At the time of the switch, the initial debt portfolio includes no concessional loans ($b_C = 0$) and a stock of non-contingent debt that represents long-term indebtedness in the baseline economy. The right panel compares the impact of this switch on the debt pricing schedule, depicting the relationship between the ratio of net debt issuance ($b' - b(1-\delta) + b'_C$) and mean income (normalized to one) at the time of the switch. Thick dots indicate equilibrium realizations.

4.3 Role of grace periods

In this section, we explore the role of grace periods, a key feature of nearly all proposed concessional loan frameworks. Recall that in our baseline concessional loan economy, once accessed, the concessional loan involves a 10-year suspension period. The probability of accessing the concessional loan is tightly tied to the adverse developments of income shocks. In column 2 of Table 4, we set the grace period to three years, during which the severity of the income shock subsides. In the last column, we remove grace periods entirely. Several key observations arise from these variations. First, shorter grace periods are associated with higher non-contingent debt-to-GDP ratios and reduced reliance on concessional loans. This is because shorter grace periods facilitate better market completion. A 3-year grace period is particularly effective, as the sovereign is likely to recover from an adverse shock within that time frame, whereas a 10-year grace period risks coinciding with a new business cycle, potentially leading to another recession. Thus, if the government faces a new fiscal shock within the 10-year period, it may have already exhausted its available concessional loan resources.

Another mechanism relates to the anticipated changes in default costs. As shown in equation (6), sovereign payments can be suspended during periods of default. For instance, if a concessional loan is accessed in period 1 with a 10-year grace period and the sovereign defaults in period 2, the grace period continues for the remaining 8 periods. Since sovereigns are typically excluded from credit markets for an average of three years following a default, they may not be required to make any payments during the exclusion period. Consequently, shortening the grace period also serves as a *disciplining device*. The results in the third column indicate that the disciplining effect of shorter grace periods is more pronounced than their impact on market completion. We further investigate the disciplining device channel in Section 4.6.2. In the fourth column, we drop grace periods as in column 3, but now assume that concessional loans are one-period. As a result, concessional loans are short-term contracts and only available when the gross financing needs of a government jump. In that regards, it closely resembles the construction of swap lines. The results provide important insights about concessional loans. When concessional loans are long-term and non-defaultable, they exacerbate the debt-dilution problem inherent in long-term debt models. The mean concessional loans-to-GDP ratio is lower under the fourth column because concessional loans are one-period and available only when the government's gross financing needs surge. In contrast, in other columns, concessional loans are long-term and decay at a rate of δ_C.

Figure 7 plots the IRF of introducing concessional loans with no grace period, denoted as 'No grace period' in the figure. Both concessional loan economies display similar dynamics in the very short run. In summary, both economies immediately tap into concessional loans to stave off default and initially rely on concessional loan financing, leading to consumption front-loading and lower borrowing costs during a local shock when concessional loans are first introduced. This finding is also in line with our empirical estimates, where we show that swap line arrangements, which mainly differ in their grace period structure, lead to a steeper decline in EMBI spreads and CDS.

The key differences, however, emerge in the long run. The economy with no grace period chooses lower concessional loan utilization. Interestingly, this increases the sovereign's precautionary motives of saving on concessional loans to use it during more adverse economic shocks. Yet, this implied increase in the default cost allows the sovereign to sustain higher non-contingent debt accumulation in equilibrium. This, in turn, leads to higher interest payments on debt and, eventually, slightly lower consumption levels. Since welfare

Table 4: Role of grace periods

	(1) Baseline concess loans	(2) 3 years grace period	(3) No grace period	(4) No grace one period
Mean public debt to GDP (%)	92.1	94.8	93.9	88.6
Mean concessional loans to GDP (%)	8.3	5.5	5.4	1.2
Mean sovereign spread (r_s) (%)	1.9	1.9	1.7	1.3
Spread volatility ($\sigma(r_s)$)	0.8	0.8	0.7	0.5
$\sigma(c)/\sigma(y)$	1.5	1.5	1.5	1.5
$\rho(r_s, y)$	-0.8	-0.8	-0.9	-0.9
Defaults per 100 years	4.4	4.4	4.1	4.8
Avrg duration of debt (in yrs)	6.6	6.6	6.7	6.8
Avrg grace period of concessional loans	10	3	0	0
Spread rise during local shocks	1.8	1.6	1.3	1.0

The first column presents the results of the baseline model with concessional loans, the second column reports the results for the economy with a three-year grace period for concessional loans, and the third column shows the outcomes when grace periods are removed from the model while the last columns shows the results with grace periods are removed and the concessional loans are set to be one-period ($\delta_C = 1$). The standard deviation of a variable is denoted by σ, and the correlation coefficient between variables is denoted by ρ. Both consumption and income are reported in natural logarithms.

closely tracks consumption, long-term welfare in the economy with the no grace period is lower than the concessional loan economy with 10 years of grace period.

4.4 Net present value preserving (voluntary) debt exchange

In this section, we examine the impact of introducing concessional loans through a debt exchange, where the government negotiates concessions from bondholders as in Hatchondo et al. (2014). Bondholders are not disadvantaged by this exchange, as they benefit from capital gains due to both the reduction in non-contingent debt and the introduction of concessional loans. Following the framework of Hatchondo et al. (2017), we describe such a debt exchange as "voluntary" because it does not impose direct losses on bondholders. However, it is important to note that this notion of a voluntary exchange should not imply that each creditor's participation is entirely voluntary. While the exchange may be collectively beneficial for creditors, individual bondholders might prefer to free-ride on the participation of others, choosing not to participate. Collective action challenges are already acknowledged and these challenges related to sovereign debt arise when multiple creditors need to coordinate their actions regarding a country's debt exchange. Sovereign debt restructuring usually involves multiple creditors, including bondholders, private lenders, and international institutions. Without a central authority to coordinate, individual creditors might hold out for better terms, which can delay or complicate the process. In practice, determining the degree of government pressure on

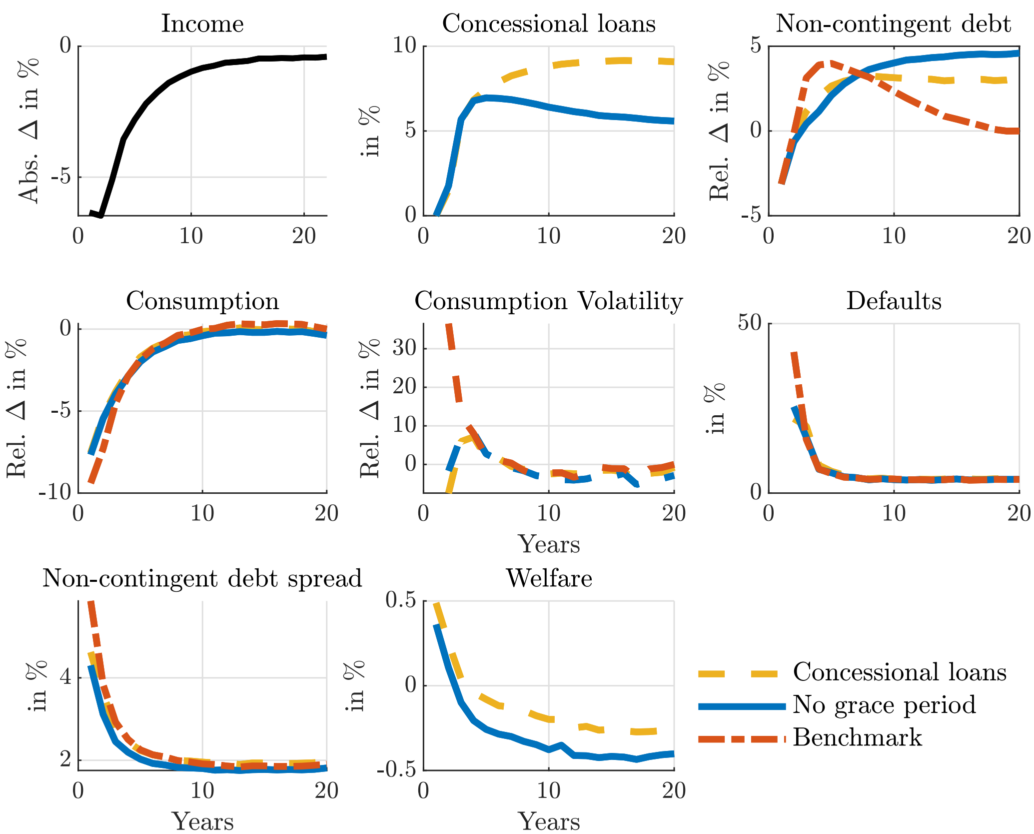


Figure 7: Impulse Response Functions. The figure illustrates the behavior of key variables following a simultaneous shock to each economy, which starts with an initial average debt level (as in the baseline economy) and is jointly affected by a local shock and a negative income shock of two-and-a-half standard deviations. The local shock lasts for one year, while the income shock follows its recovery path, as depicted in the upper left chart. Concessional loans, defaults, spreads, and welfare are shown in levels, while other variables are expressed as percentage deviations from the baseline. The blue solid line represents the case where the grace period is absent, while the dashed yellow line represents the economy with concessional loans and a 10-year grace period. The red dashed-dotted line corresponds to the benchmark.

bondholders to participate in such exchanges can be difficult. By focusing on voluntary debt exchanges, we explore the ideal scenario in which the government captures the full value of bondholders' capital gains resulting from the arrangement of concessional loans. As noted in Hatchondo et al. (2017), voluntary debt exchanges are prominent in policy discussions (Claessens and Dell'Ariccia (2011)) and are frequently observed in practice (Hatchondo et al. (2014)).

Assume that at the beginning of the period when concessional loans are introduced, the government offers bondholders a take-it-or-leave-it proposal. For each non-contingent debt coupon payment due during this period, bondholders would receive a deferred payment of $\frac{\overline{b_C}}{b}$, to be paid in the following period, along with a portion of non-contingent bonds worth b_V/b, which start paying coupons immediately. If the bondholders reject this offer, concessional loans will not be introduced.

The government determines the level of non-contingent debt, denoted by b_V, such that bondholders, as a group, are indifferent between accepting or rejecting the offer. This allows the government to capture all the benefits of introducing concessional loans. The post-exchange quantity of non-contingent bonds, b_V, satisfies the following condition:

$$\begin{aligned}\frac{\overline{b_C}}{b(1+r)} &+ \frac{b_V(b,\overline{b_C},s)[\kappa+(1-\delta)q((1-\delta)b_V(b,\overline{b_C},s),\overline{b_C},s)]}{b} \\ &= \kappa+(1-\delta)q_N(\hat{b}_N(b,s),s), \qquad (9)\end{aligned}$$

where q_N and $\hat{b}_N$ represent the bond price and the government's borrowing function, respectively, in an economy without concessional loans (i.e., where $\overline{b_C}=0$, so $\overline{b_C}$ is not needed as a state variable).

The right-hand side of the equation reflects the value a bondholder would receive if they reject the exchange, incorporating both current period payments and future obligations. The left-hand side represents the value a bondholder would receive if they accept the exchange, accounting for the deferred payments and the newly issued non-contingent bonds.

Figure 8 illustrates gains from arranging concessional loans through a voluntary debt exchange, as a function of income, based on the average non-contingent debt level of 88.8 percent observed in the benchmark economy. The upper-left panel shows how much non-contingent debt can be exchanged with bondholders solely due to the price effect triggered by the announcement of concessional loans, even if the government does not utilize them (i.e., setting $\overline{b_C}=0$ in equation (9)). The amount of debt eligible for exchange is substantial at lower income levels, as these periods correspond to heightened default risk. Concessional loans help mitigate these risks, resulting in significant price differentials between an economy with and without concessional loans. The bottom left chart plots the corresponding welfare gains measured in consumption equivalent terms from switching to the economy with concessional loans through voluntary debt exchange.

The right panels of Figure 8 show how much non-contingent debt can be exchanged under a concessional loan limit of 10 percent, along with the corresponding welfare gains from such an arrangement. A key takeaway from this analysis is that with a 10 percent concessional loan limit, the government can exchange significant amounts of non-contingent debt by leveraging capital gains from asset price improvements. However, voluntary debt exchanges have no long-term effects. Therefore, concessional loans can be viewed as a financial tool to reduce long-term sovereign indebtedness. This suggests that concessional loans could be arranged with certain conditions, which will be explored in the next subsection.

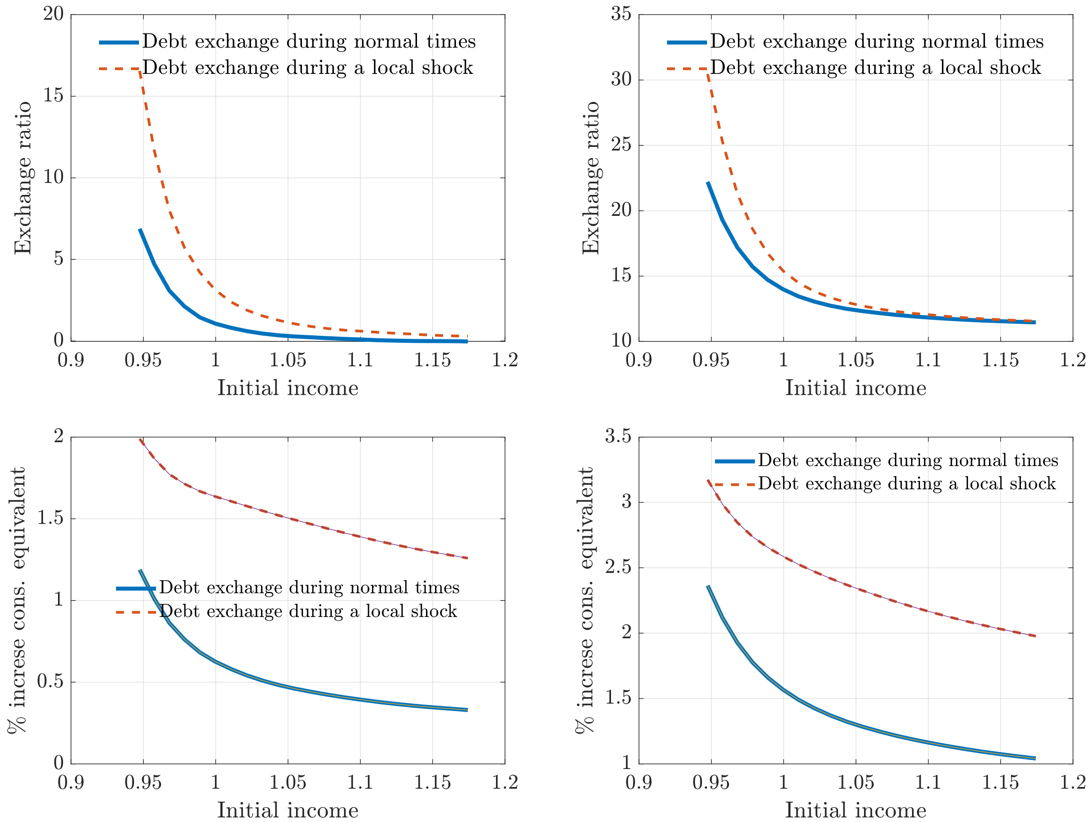


Figure 8: Voluntary Debt Exchanges

4.5 Voluntary debt exchanges with a debt break for non-contingent debt

Fiscal rules, such as debt brakes, are institutionalized constraints on government fiscal policies, aimed at maintaining sustainable public finances over time. Debt brakes are a specific type of fiscal rule designed to prevent excessive government borrowing and ensure that public debt remains manageable (see Kopits and Symansky (1998) for fiscal rules). The debt brake is a rule designed to limit the amount of debt that a government can take on. It was pioneered by Switzerland and has been adopted or modified by several other countries, such as Germany, to regulate government borrowing and enforce fiscal discipline (see Hofmann (2022)).

Switzerland's debt brake, introduced in 2003, mandates that over the economic cycle, federal expenditures cannot exceed revenues. The rule is embedded in the Swiss constitution and is credited with maintaining balanced budgets and low debt-to-GDP ratios. Germany's "Schuldenbremse" (debt brake) was introduced in 2009.

Debt brakes are a powerful fiscal rule that can promote sustainable public finances by limiting government borrowing. When designed with appropriate flexibility and enforcement mechanisms, they can help prevent fiscal crises and ensure economic stability. Concessional loans, can thus be viewed as a financing tool to attain more sustainable debt levels.

As previously discussed, while the introduction of concessional loan may offer only short-term benefits, such financial instruments can be pivotal in supporting the transition toward achieving fiscal targets mandated by debt brakes, potentially resulting in more lasting positive effects. The complementarities between concessional loans and fiscal rules have been recognized for some time (see Hatchondo et al. (2022), Hatchondo et al. (2017), Önder (2022)).

In this analysis, we explore the effects of introducing concessional loans in conjunction with a debt brake that imposes limits on non-contingent debt. Specifically, we assume that non-defaultable bonds, equating to 10 percent of mean income (normalized to one), are issued to facilitate a voluntary debt restructuring. At the same time, we implement an immediate cap on defaultable debt at 60 percent of mean income which is normalized to one. This threshold is selected for two key reasons: (i) the concessional loans provide sufficient financing to support the necessary debt reduction to implement this cap, and (ii) the cap substantially lowers the likelihood of default.

Figure 9 presents the IRFs following the introduction of concessional loans, subsequent to the voluntary debt exchange undertaken with bondholders. The charts depicting concessional loans and non-contingent debt reflect the outcomes of this exchange. The entirety of the concessional loans was allocated to finance the debt exchange, thereby reducing the government's non-contingent debt in compliance with the prescribed 60 percent debt threshold. Immediately after the exchange, both default risk and debt spreads decline sharply. In contrast to the scenario without debt exchange, as indicated by the yellow dashed line, the economy featuring voluntary exchanges and debt breaks exhibits higher immediate and long-term welfare, as well as increased consumption upon impact. However, one notable drawback of the debt break mechanism, which has also been highlighted in policy discussions, is that stringent debt break rules constrain the government's capacity to smooth consumption during adverse economic conditions. This is evident from the consumption volatility chart, which shows that consumption volatility remains elevated relative to the baseline scenario.

Thus, our findings highlight a trade-off. Debt brakes, when paired with concessional loans and voluntary debt exchanges to achieve targeted debt levels, foster fiscal discipline by reducing the likelihood of default crises. However, while debt brakes are effective at maintaining fiscal responsibility, they are also criticized for their rigidity, which can inhibit the necessary fiscal expansion during economic downturns.

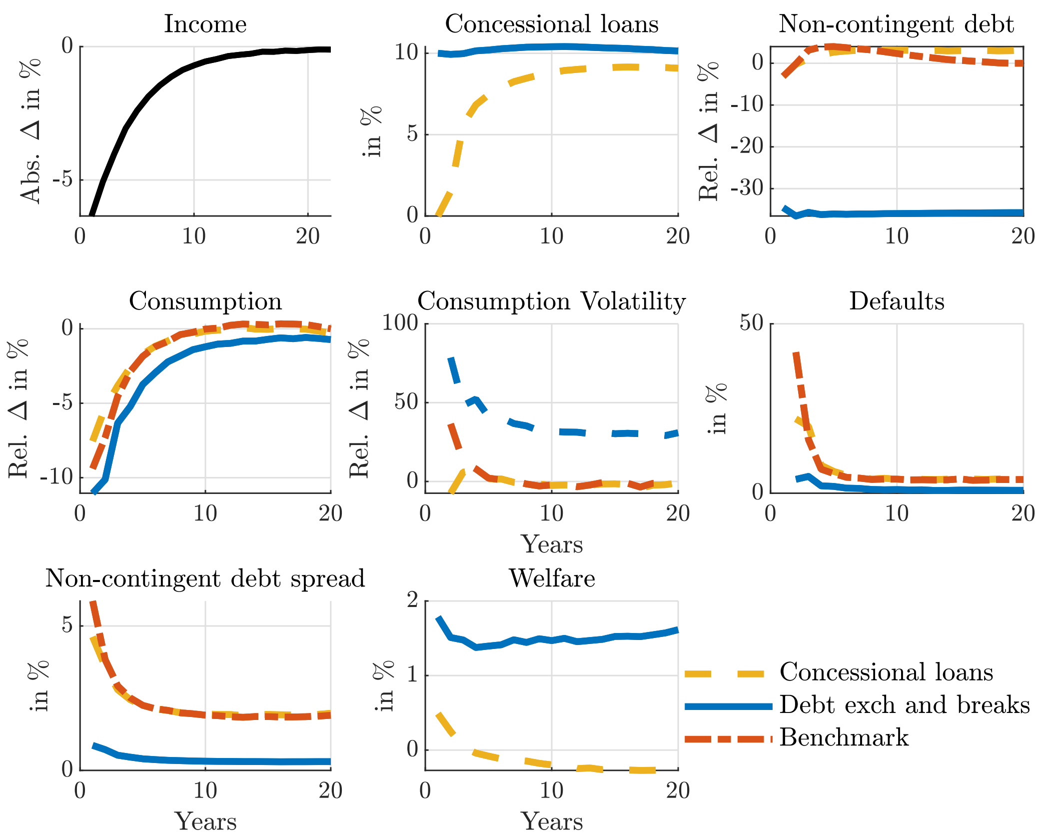


Figure 9: Impulse Response Functions. The figure illustrates the behavior of key variables following a simultaneous shock to each economy, which starts with an initial average debt level (as in the baseline economy) and is jointly affected by a local shock and a negative income shock of two-and-a-half standard deviations. The local shock lasts for one year, while the income shock follows its recovery path, as depicted in the upper left chart. Concessional loans, non-contingent debt, defaults, spreads, and welfare are shown in levels, while other variables are expressed as percentage deviations from the baseline. The blue solid line represents the economy where voluntary debt exchanges occur, with the sovereign adhering to a 60% debt brake rule. In contrast, the dashed yellow line represents the economy with concessional loans and a 10-year grace period. The red dashed-dotted line corresponds to the benchmark.

4.6 Investigating Model Mechanism

4.6.1 Permanent concessional loans

This section presents the quantitative analysis of an economy in which concessional loans are permanently available, rather than only during local shocks. The model is solved using one-period concessional loans, which distinguishes the contribution of this paper from the existing literature. In particular, we introduce concessional loans to be available permanently, as in Hatchondo et al. (2017), including periods of default, and emphasize the importance of a trigger mechanism in the contract. Specifically, we set $\mathcal{I}(\ell) = 1$ at all times, with $\delta_C = 1$. The results of this analysis are presented in the second column of the Table 5, with the first column showing the baseline economy for reference. Our results indicate that, consistent with Hatchondo et al. (2017), concessional loans have no long-run effects.[8]

Next, we eliminate the grace period feature of concessional loans while retaining their long-term debt characteristics. Consequently, we revisit the analysis from Hatchondo et al. (2017), now incorporating long-term concessional loans. The results are presented in the third column of Table 5. Allowing long-term concessional loans to be continuously available does not significantly affect the long-run moments compared to their one-period counterpart. With such loans, the government only needs to roll over the coupon payments, $b_C\kappa_C$, whereas, with one-period concessional loans, it must roll over the full principal, b_C. Since long-term loans can be rolled over indefinitely, no significant differences emerge.

Next, we eliminate the grace period feature of the concessional loans while maintaining their long-term debt characteristics. As a result, we re-conduct the analysis from Hatchondo et al. (2017), but now with long-term concessional loans. The results are presented in the third column of Table 5. The use of long-term concessional loans, when available all the time, does not change long-run moments meaningfully compared to its one-period correspondent. With long-term concessional loans, the government only has to roll over its coupon payments, i.e., $b_C\kappa_C$, whereas, with one-period concessional loans, it has to roll over the full amount b_C. As the sovereign can roll over them indefinitely, we do not observe meaningful differences.

[8] We omit IRFs for brevity, as they closely mirror those in Hatchondo et al. (2017). In essence, the government utilizes these funds to avert default upon introduction, but subsequently continues to roll over the debt indefinitely, rendering the concessional loans akin to a free lunch.

Table 5: Model mechanism

	(1) Baseline	(2) Perm. lines one-period	(3) Perm. lines long-term	(4) Pay all if default	(5) Stigma (p=0.25)	(6) Stigma no grace (p=0.05)
Mean public debt to GDP (%)	88.8	87.6	88.0	102.9	89.6	89.6
Mean concessional loans to GDP (%)	*n.a.*	8.6	8.1	8.6	1.4	0.5
Mean sovereign spread (r_s) (%)	1.8	1.8	1.8	1.5	1.8	1.7
Spread volatility ($\sigma(r_s)$)	0.8	0.8	0.8	0.7	0.8	0.8
$\sigma(c)/\sigma(y)$	1.5	1.7	1.5	1.5	1.5	1.5
$\rho(r_s, y)$	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
Defaults per 100 years	4.0	4.0	4.1	3.7	4.0	4.0
Avrg duration of debt (in yrs)	6.7	6.7	6.7	6.8	6.7	6.7
Avrg grace period of concessional loans	*n.a.*	0	0	10	10	0
Spread rise during local shocks	1.6	1.4	1.4	1.3	1.6	1.5

The first column presents the results of the baseline model. The second column reports the results for an economy with no grace periods, where concessional loans are available at all times, including during defaults, with a duration of one period, i.e., $\delta_c = 1$. The third column shows the results from the second column but with long-term concessional loans, where $\delta_c = 0.1$. The fourth column displays the results when the sovereign is required to fully repay its concessional loan obligations upon default. The fifth column presents the results under a stigma premium of $p = 0.25$, while the final column shows the outcomes with a stigma premium of $p = 0.05$ and no grace periods. The standard deviation of a variable is denoted by σ, and the correlation coefficient between variables is denoted by ρ. Both consumption and income are reported in natural logarithms.

4.6.2 Pay all concessional loans if defaulted

In this subsection, we examine a counterfactual scenario where the sovereign repays the full concessional loan obligations upon defaulting on its debt. Specifically, the budget constraint during default becomes $y - e - \phi(y) - b_C$, and, upon reentry into the credit markets, the sovereign starts with no outstanding concessional loans.

The results are presented in the fourth column of Table 5. Notably, while the government's long-run public debt-to-GDP ratio increases by 14 percentage points, interest rate spreads decrease by nearly one-fifth, and default rates fall. This is because the seniority of concessional loans and the requirement to repay them in full serve as a *disciplining device*, increasing the cost of default for the sovereign.

4.6.3 Stigma premium

An obvious question is why concessional loans, despite their clear benefits and long-standing availability, have not been widely adopted. We attribute this to a political *stigma premium*. The stigma premium on loans from financial institutions refers to the additional costs or challenges that countries may encounter when seeking financial assistance from such entities due to associated reputational, political risks and negative perceptions. It has been long established that for many countries, IMF loans are seen as a measure of last resort, and borrowing from the IMF can carry a significant social and economic stigma. This perception can result in elevated costs for the borrowing country, both directly and indirectly, beyond the standard interest rate or repayment terms (see Reinhart and Trebesch (2016)).

Next, in the spirit of Moretti (2020) and Hatchondo et al. (2024) we measure the effects of assuming that concessional loans carry a stigma premium over the advertised rate, given by $q_c = \frac{1}{1+r+p}$. Column (5) of Table 5 reports the relevant moments when the assumed stigma premium is set to 2,500 basis points, $p = 0.25$. This analysis underscores critical dynamics: for the government to refrain from using these concessional loans, the effective rate would need to increase by nearly 2,500 basis points.

Apart from the stigma premium, this analysis also highlights the important role of grace periods. Notably, the sovereign continues to tap concessional loans despite their significant costs. For example, when $p = 0.05$, the share of concessional loans in budget balances disappears. However, if we remove the grace period from the model, the uptake of these concessional loans declines, especially when an extra premium is involved. This outcome reflects the sovereign's impatience. Although concessional loans accrue interest, maintaining a constant net present value during the grace period, an impatient government prefers them as it avoids coupon payments for the next 10 years after its access.

4.6.4 Lower concessional loan limit

In this analysis, we explore the model dynamics by imposing a lower cap on the available concessional loans, specifically setting it to 4 percent of GDP, i.e., $\overline{b_C} = 0.04$, as opposed to the 10 percent used in the main analysis.

Several trade-offs emerge with this lower cap. While the reduction in the government's default probability and spreads in the next period is less pronounced upon its introduction, long-term consumption and welfare are higher than under the higher cap counterpart while long-term debt is lower. It is important to recall that during a local shock, the government's gross financing needs increase by 10 percent, but the reduced concessional loans can only partially finance this.

A potential drawback of the 4 percent cap is that it may prevent the sovereign from achieving its long-term debt target of 60 percent through a voluntary debt exchange that is highlighted in Section 4.5.

5 Conclusion

Our study contributes to the understanding of grace periods and concessional loans in sovereign debt markets both empirically and theoretically. Empirically, we document the widespread use of grace periods in sovereign borrowing, particularly in concessional loans, and estimate their effects using local projections. Our findings show that concessional

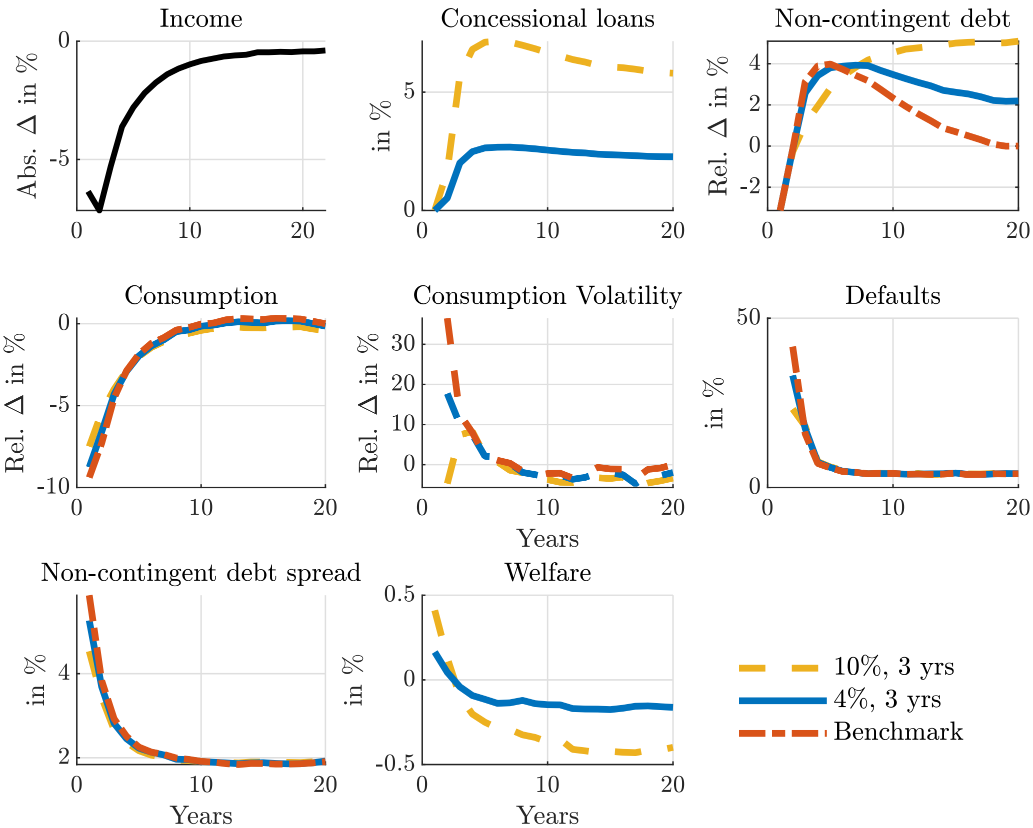


Figure 10: Impulse Response Functions. The figure illustrates the behavior of key variables following a simultaneous shock to each economy, which starts with an initial average debt level (as in the baseline economy) and is jointly affected by a local shock and a negative income shock of two-and-a-half standard deviations. The local shock lasts for one year, while the income shock follows its recovery path, as depicted in the upper left chart. Concessional loans, defaults, spreads, and welfare are shown in levels, while other variables are expressed as percentage deviations from the baseline. The blue solid line represents the case where the grace period is set to 3 years with a concessional loan cap of 4%, while the dashed yellow line represents the economy with concessional loans and a 3-year grace period with a concessional loan cap of 10%. The red dashed-dotted line corresponds to the benchmark.

loans with grace periods reduce sovereign default risk and lower borrowing spreads. Theoretically, we develop a sovereign default model incorporating grace periods and concessional loans alongside traditional non-contingent debt. Model validation shows that concessional loans with grace periods support debt sustainability by reducing default risk. However, prohibiting debt payment suspensions during default acts as a disciplining mechanism, increasing the cost of default and reinforcing fiscal responsibility.

Our policy exercise demonstrates that concessional loans can facilitate sovereign deleveraging. Using a debt exchange framework for Portugal, we show that voluntary exchanges financed through concessional loans can nearly eliminate default risk and sovereign spreads, though they increase consumption volatility due to debt brakes. Structuring concessional loans appropriately—such as limiting their use to risk-on periods and reducing grace periods—can improve long-term debt sustainability while mitigating debt dilution concerns.

Finally, our findings highlight political and economic barriers to broader adoption. Despite their benefits, a stigma premium discourages the use of concessional loans. Our estimates suggest that a stigma premium of up to 25% explains government reluctance, particularly for loans with long grace periods. This underscores the trade-off between short-term relief and long-term risks such as debt dilution and higher borrowing costs.

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Appendix A External Debt Composition and Loan Characteristics, Full Sample

Table A1: External Debt Composition and Loan Terms by Creditor Type (1970-2019)

Panel (A): External Debt Composition

Country group	Official Creditors			Private Creditors				With Grace Periods?	
	Multilateral (1)	Bilateral (2)	China (3)	Commercial Banks (4)	Bonds (5)	Other Creditors (6)	China (7)	Yes (8)	No (9)
Low Income	49.0	36.9	5.3	2.4	0.4	6.0	0.1	93.6	6.4
Low Mid. Income	35.9	38.7	4.3	8.0	6.0	7.0	0.3	87.0	13.0
Upper Mid. Income	28.7	26.4	1.9	16.1	19.1	7.9	0.1	73.1	26.9
High Income	18.4	16.3	0.0	28.8	31.9	4.5	0.0	63.6	36.4
Emerging Market	27.7	28.1	1.6	16.2	18.8	7.5	0.1	73.6	26.4
All	36.3	33.0	3.6	10.2	10.1	6.9	0.2	83.1	16.9

Panel (B): Loan Characteristics of New External Debt Issuances

Country group	New Concessional Loans						New Loans		
	All Creditors			China			Private Creditors		
	Grace periods (years) (1)	Maturity (years) (2)	Interest Rate (%) (3)	Grace periods (years) (4)	Maturity (years) (5)	Interest Rate (%) (6)	Grace periods (years) (7)	Maturity (years) (8)	Interest Rate (%) (9)
Low Income	8.1	32.3	1.7	8.5	19.2	0.9	2.7	6.2	9.6
Low Mid. Income	7.1	25.9	3.1	7.2	18.3	2.0	4.2	6.5	10.5
Upper Mid. Income	5.4	19.3	4.5	5.3	15.6	2.9	5.5	7.0	10.8
High Income	4.9	16.8	5.9	7.0	30.0	3.0	6.6	7.6	10.1
Emerging Market	5.5	20.0	4.5	5.3	15.6	3.0	5.6	7.0	10.8
All	6.7	25.0	3.3	7.1	18.0	1.9	4.6	6.7	10.5

Authors' calculations. The table shows several statistics on external debt averaged within countries of different income groups, Emerging Market countries, and across all countries. We employ annual aggregate data from the International Debt Statistics (World Bank) for 108 countries during 1970-2019. External debt stocks is the sum of Public and Publicly Guaranteed (PPG) loans from official and private creditors. We define external debt from official creditors as concessional debt. External debt from official creditors includes PPG loans from international organizations (multilateral) and loans from governments and their agencies (bilateral). Private creditors external debt captures PPG loans from private commercial banks, loans from other private financial institutions (other creditors), and bonds publicly issued or privately placed. We define grace loans as the sum of concessional external debt plus external debt from commercial banks. All data on external debt stocks is expressed in current U.S. dollars. Panel A reports average external debt composition. Columns (1)–(3) show shares from official sources (multilateral, bilateral ex. China, bilateral with China). Columns (4)–(7) show shares from private sources (banks, bonds, other creditors ex. China, China). Columns (8)–(9) report shares of debt with and without grace periods. Panel B documents three key loan characteristics: (i) grace period length (in years), (ii) loan maturity (in years), and (iii) interest rates (in %). Columns (1)–(6) present the statistics for new concessional loans, columns (7)–(9) are new borrowing from private creditors. Within the concessional category, columns (1)–(3) capture loans from official creditors globally, and columns (4)–(6) isolate concessional lending from Chinese official creditors.

Appendix B Correlations External Debt Issuances

Table B2: Correlations External Debt Issuances (Disbursements)

	Concessional	Multilateral	Bilateral	Private	Banks	Bonds	Other Priv.
	Panel A: All Years						
Concessional	1.00						
Multilateral	0.74	1.00					
Bilateral	0.84	0.27	1.00				
Private	0.12	-0.04	0.20	1.00			
Banks	0.05	-0.05	0.12	0.74	1.00		
Bonds	-0.12	-0.10	-0.09	0.46	0.01	1.00	
Other Priv.	0.28	0.08	0.34	0.69	0.35	-0.07	1.00
	Panel B: 2000-2019						
Concessional	1.00						
Multilateral	0.75	1.00					
Bilateral	0.71	0.07	1.00				
Private	-0.05	-0.10	0.04	1.00			
Banks	0.05	-0.08	0.16	0.44	1.00		
Bonds	-0.08	-0.08	-0.04	0.90	0.05	1.00	
Other Priv.	0.04	-0.02	0.08	0.21	0.11	-0.03	1.00
	Panel C: 1970-1999						
Concessional	1.00						
Multilateral	0.73	1.00					
Bilateral	0.85	0.27	1.00				
Private	0.11	-0.06	0.20	1.00			
Banks	-0.01	-0.10	0.06	0.81	1.00		
Bonds	-0.12	-0.10	-0.09	0.26	0.08	1.00	
Other Priv.	0.25	0.04	0.32	0.78	0.34	-0.05	1.00

Authors' calculations. The table shows the correlation for debt issuances of different types of external debt. We employ annual aggregate data from the International Debt Statistics (World Bank) for 108 countries during 1970-2019. External debt stocks is the sum of Public and Publicly Guaranteed (PPG) loans from official and private creditors. We define external debt from official creditors as concessional debt. External debt from official creditors includes PPG loans from international organizations (multilateral) and loans from governments and their agencies (bilateral). Private creditors external debt captures PPG loans from private commercial banks, loans from other private financial institutions (other private), and bonds publicly issued or privately placed. We calculate debt issuances as disbursements on external debt relative to trend GDP. Trend GDP is obtained by taking the exponential of the logged nominal GDP trend, which is estimated using the HP filter. Disbursements refer to the amounts drawn by the borrower from loan commitments during the specified year. We present the correlations for the entire period (Panel A), post-2000 (Panel B), and pre-2000 (Panel C).

Appendix C First-Time Announcements: A Difference-in-Differences Approach

In this section we present our DID analysis for the first time introduction of FCLs and swap line for Mexico. In particular, our estimating equation is:

$$Y_t = \alpha + \lambda_{\text{year}} + \lambda_{\text{month}} + \delta_{\text{FCL}} D_t^{\text{FCL}} + \delta_{\text{swap}} D_t^{\text{swap}} + \sum_{j=1}^{2} \beta_j \Delta Y_{t-j} + \sum_{j=0}^{2} \gamma_j' X_{t-j} + \epsilon_t, \quad \text{(C1)}$$

where Y_t denotes either Mexico's daily CDS spread or EMBI+ index, and D_t^{FCL} and D_t^{swap} are treatment dummies that equal one from the date of the first announcement onward. The specification includes year and month fixed effects (λ_{year}, λ_{month}) to absorb seasonality and calendar effects, two lags of the dependent variable in first differences to control for short-run persistence, and a vector of global financial controls X_t that includes the current and lagged daily changes in the VIX index and the EMBI Global index.

The inclusion of lagged changes in Y_t accounts for persistence or short-term adjustment dynamics in sovereign risk pricing. The ΔVIX terms capture shifts in global risk sentiment, while ΔEMBI absorbs changes in emerging market credit spreads more broadly. Together, these controls help ensure that our estimates reflect the effects of the FCL and swap announcements, rather than coincident global financial disturbances.

The estimation results are reported in Table C3. Columns (1) and (4) show estimates from the full specification in Equation (C1) using CDS and EMBI+ data, respectively. The FCL announcement is associated with a 63 percentage points (pp) reduction in CDS spreads, while the swap line announcement is linked to an additional 133 pp decline. For EMBI+, the corresponding estimates are 37 and 159 pp. All effects are statistically significant at the 1% percent level.

Columns (2), (3), (5), and (6) assess the contribution of each policy instrument by estimating the model with only one first time introduction included in the model. When the FCL is estimated in isolation (columns 2 and 5), the estimated impact rises to approximately 201 and 193 pp, respectively. Similarly, the swap-only specifications (columns 3 and 6) yield declines of 194 and 195 basis points. These results might indicate that, when estimated independently, each policy appears to explain nearly the full effect observed in the joint model. However, if we compare its with joint estimates in column (1) and (4) we can draw two key findings.

Based on this finding we can draw two conclusions. First, the similarity between the individual estimates and the sum of the joint coefficients suggests that the two interventions generated distinct market responses and can be separately identified, despite their close timing.[9] Second, while markets began adjusting as early as the FCL announcement, swap lines appear to have driven the larger share of the overall response. This is consistent with the local projection estimates for Mexico, but the focus on first-time announcements confirms that our findings are not confounded by anticipation of later program renewals or extensions which is why our reported estimates are significantly higher that the ones estimates with local projections at the time of the FCL/swap arrangement.

We note, however, that the estimates should be interpreted with some caution. Due to the narrow five-day window between announcements, the effect of the FCL is identified using a limited pre-swap period. In contrast, the swap coefficient captures the additional decline in spreads relative to the FCL baseline. While the specification is formally identified, the close timing of the two announcements implies that the FCL estimate may be more sensitive to measurement error or omitted shocks. We return to this issue in the discussion of implications.

Table C3: DID estimates CDS and EMBI+: Mexico

	CDS			EMBI+		
	(1)	(2)	(3)	(4)	(5)	(6)
δ_{FCL}	-63.47***	-200.79***		-37.16***	-193.34***	
	(14.22)	(20.77)		(11.54)	(10.05)	
δ_{SWAP}	-133.17***		-194.46***	-159.23***		-195.16***
	(14.15)		(13.61)	(14.52)		(9.80)
year	✓	✓	✓	✓	✓	✓
month	✓	✓	✓	✓	✓	✓
N_{obs}	687	343	687	687	687	687
$\bar{R}^2$	0.63	0.67	0.63	0.61	0.61	0.61

Notes: In parentheses we report heteroskedasticity consistent standard errors. *,**,*** indicate significance at the 10% 5% and 1% respectively.

[9] If our results didn't show this additive structure We wouldn't know whether spreads fell because of the first introduction of the FCL, the swap, both, or some unobserved shock that occurred in the same window.