Seniority and Sovereign Default: The Role of Official Multilateral Lenders*

Adrien Wicht
European University Institute

January 27, 2023

Abstract

Sovereign countries do not necessarily repay all its creditors. There is a clear pecking order in which (official) multilateral lenders – i.e. the International Monetary Fund and the World Bank – are given priority in repayment. Yet, this preferred status is a market practice and is not legally binding. This paper documents the implications of this *de facto* seniority structure of sovereign debt. Empirically, I present strong evidence that defaults involving multilateral lenders are infrequent, last relatively longer and are associated with greater private creditors' losses. To rationalize those findings, I build a model of endogenous defaults and renegotiations. I show that the typical no-lending-into-arrear policy adopted by multilateral lenders can explain most of the aforementioned empirical facts. In addition, the *de facto* seniority generates important spillovers on other creditors and is a source of fiscal discipline. The borrower values the use of multilateral debt and would not necessarily prefer other seniority regimes.

Keywords: sovereign debt, debt overhang, default, heterogenous creditors, renegotiation

JEL Classification: E43, F34, F36, F37, O11, O19

*I am indebted to my advisors, Ramon Marimon and Alexander Monge-Naranjo, for their advice, encouragement and support. I would like to thank Anna Abate Bessomo, Alessandro Dovis, Aitor Erce, Dirk Krueger, Enrique Mendoza, José-Víctor Ríos-Rull, Tamon Asonuma and seminar participants at the University of Pennsylvania, Federal Reserve Bank of Philadelphia, DebtCon 5, and RIEF conference in Sciences Po Paris for helpful suggestions and comments. I gratefully acknowledge the financial support from the Swiss National Science Foundation (project P1SKP1_199469). All remaining errors are my own.

Correspondence: Adrien Wicht, European University Institute, Department of Economics, Via delle Fontanelle 18, 50014 San Domenico di Fiesole, Italy. E-mail: adrien.wicht@eui.eu.

1 Introduction

Excluding advanced economies, debt from (official) multilateral lenders – i.e. essentially the International Monetary Fund (IMF) and the World Bank (WB) – represents more than 35% of the total sovereign debt and is beside bonds the second largest category of sovereign borrowing.[1] It has the peculiarity that, in the case of a sovereign default, multilateral lenders are usually repaid in full and ahead of other creditors (Schlegl et al., 2019). Yet, legally speaking, nothing enforces this observed pecking order. In other words, market participants give a special rank to multilateral lenders even though they have no legal obligations to do so. This suggests the existence of a *de facto* – as opposed to *de jure* – seniority structure. The literature on sovereign debt and default has generally overlooked this implicit seniority structure modelling haircuts, defaults and durations as symmetric across creditors. The present study seeks to fill this gap. Particularly, it gauges the impact of the preferred creditor status of multilateral lenders on (1) the sovereign borrowing, (2) the default's decision and (3) the restructuring's process.

I begin this inquiry by establishing new empirical facts on multilateral creditors based on 186 episodes of external debt's repudiation from 1970 to 2014.[2] First and foremost, defaults involving multilateral creditors are infrequent. In the sample at hand, such events represent around 21% of all reported episodes. Second, they usually last longer than other defaults taking roughly 7 years to be resolved. In opposition, defaults on other types of creditors last on average 3 years. Third, I find that for default episodes involving multilateral creditors, the average haircut on private creditors raises to 56%, while it falls to 32% otherwise. Finally, multilateral lenders always lend at preferential rates. All these facts hold after controlling for the default's and the country's characteristics.

Having identified the main empirical facts linking defaults with multilateral creditors, I build a model capable of rationalizing them. For this purpose, I augment the standard model of Eaton and Gersovitz (1981) with heterogenous lenders and endogenous restructurings. Most notably, I assume the existence of two types of lenders: private and multilateral. The former are competitive, whereas the latter enjoy *de facto* seniority. The sovereign can decide to default only on private creditors – *partial* default – or on both creditors – *full* default. Each default is followed by a complete market exclusion and an output penalty. In a *partial* default, the sovereign repudiates the private debt but continues to service the multilateral

[1] When I mention the World Bank, I refer to its two financial arms, namely the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). See Figure A.1 in Appendix A for a breakdown of the world sovereign debt between 1970 and 2020.

[2] I obtain the default's date from Asonuma and Trebesch (2016). I then identify which creditors are involved in each default episode by means of the database constructed by Beers and Mavalwalla (2018). I finally retrieve estimates from private creditors' losses from Cruces and Trebesch (2013).

debt while being in autarky.

I model the *de facto* seniority through two complementary channels. First, defaults on multilateral creditors lead to a greater output penalty. Second, multilateral lenders do not tolerate arrears. That is, they do not provide any new funds until the outstanding multilateral debt has been repaid in full. This second element is what I call a no-lending-into-arrear policy and is characteristic of the IMF's and the WB's practice. Seniority is therefore truly *de facto* as it is not enforced by *ex ante* contractual requirements but rather by *ex post* sanctions (Bolton and Jeanne, 2009). This relatively high punishment provides multilateral lenders an, albeit imperfect, shelter against potential debt repudiations. Particularly, the no-lending-into-arrear policy safeguards multilateral lending at preferential rates, whereas the output penalty controls the frequency of multilateral debt's repudiations.

The key feature in the model is that the multilateral debt is at the source of an important pecuniary spillover owing to its *de facto* seniority. On the one hand, the private debt is subordinated meaning that private creditors receive what is left after the full repayment of multilateral debt in a restructuring. Hence, in a *full* default, the level of multilateral debt directly affects the private debt's recovery value. On the other hand, a larger stock of multilateral debt reduces the value of a *partial* default on private debt as it raises the multilateral debt servicing costs in autarky. Thus, while the multilateral debt raises the subordination risk of private liabilities, it can reduce the default risk up to a certain point. The net effect critically depends on the size of the multilateral debt.

With this, the *de facto* seniority impacts (1) the sovereign borrowing in the following way. Owing to the greater default's punishment, the sovereign is less likely to renege multilateral debt. This renders the multilateral debt less sensitive to the default risk and thus increases the marginal benefit of debt issuance. This is what I call the seniority benefit. However, for the same reason mentioned above, the multilateral debt is less prone to dilution than the private debt. The possibility to dilute private debt reduces the marginal cost of debt issuance as it dwindles the future debt burden. This is what I call the subordination benefit. This tradeoff between incentives and insurance sets the seniority structure and is similar to the one determining the maturity structure.

Furthermore, the *de facto* seniority affects (2) the default's decision. On the one hand, a larger share of multilateral debt reduces the value of *partial* default on private creditors owing to larger multilateral debt servicing costs in autarky. As a result, such type of default becomes less attractive. On the other hand, a larger portion of multilateral debt increases the probability of *full* default. The default's decision is therefore shaped by the level of punishment on the different types of defaults and the level of multilateral indebtedness relative to the stock of private debt.

Finally, the *de facto* seniority impacts (3) the debt restructuring's process. Notably, the model predicts larger haircuts and longer default's durations when multilateral lenders are involved. This is a consequence of the no-lending-into-arrear policy which renders restructurings more costly. As a result, the expected default's length increases as the sovereign prefers to postpone the restructuring until the risk to re-enter default *majorly* diminishes. In addition, the no-lending-into-arrear policy depresses the borrowing capacity of the sovereign at restructuring which in turns increases the haircut on private creditors. Thus, what is at the source of the *de facto* seniority also explains the greater default's lengths and haircuts observed in the data.

The model is calibrated to match moments related to Argentina. Except for the share of *full* defaults, none of the aforementioned empirical facts is directly targeted. I find that the model fits the data particularly well. It is capable of generating the observed default's lengths and haircuts depending on the different types of creditors involved. It also generates realistic dynamic of debt, spreads and trade balance around defaults.

I subsequently conduct a series of counterfactual analyses. For instance, I study what happens when one introduces a *de jure* seniority or a *pari passu* clause. For those two exercises, I find welfare losses for the sovereign in most of the states. Moreover, in both cases, the default rate and average indebtedness are higher than in the benchmark model. Hence, the *de facto* seniority forces the borrower to adopt a more rigorous debt management. In other words, it generates a credible threat capable of disciplining the accumulation of debt. Under a *de jure* seniority regime, the threat fades as the *full* default option does not exist anymore. Similarly, under a *pari passu* clause, the restructuring process under *full* default becomes isomorphic to the one under *partial* default.

In light of this, this study has a clear policy implication: the *de facto* seniority structure of sovereign debt not only safeguards multilateral lending at preferential rates, it also provides a source of fiscal discipline that other seniority regimes do not. Most importantly, the sovereign values the *de facto* seniority of multilateral debt and would not necessarily prefer other seniority regimes.

The paper is organized as follows. Section 2 reviews the existing literature. Section 3 introduces the conventions on sovereign debt seniority. Section 4 presents the empirical analysis. Section 5 describes the economic environment of the model. Sections 6 and 7 present the decisions regarding repayment and renegotiation, respectively. Section 8 characterizes the equilibrium. Sections 9 and 10 present the calibration and the result of the quantitative analysis, respectively. Finally, Section 11 concludes.

2 Literature Review

The paper combines elements of the empirical literature about sovereign debt restructurings with elements of the theoretical literature about sovereign debt and default, creditor's seniority and official lending.

In the empirical literature on sovereign restructurings, Benjamin and Wright (2013) are one of the first to document the main statistics on sovereign debt renegotiations.[3] Building a more comprehensive dataset, Cruces and Trebesch (2013) refine the previous analysis and present evidence that haircuts impact the bond spreads and the market exclusion's length. Similarly, Asonuma and Trebesch (2016) show that preemptive restructurings are associated with lower delays and lower creditors' losses relative to post-default restructurings. In addition, Asonuma and Joo (2020) present evidence that the economic conditions on the side of foreign creditors largely influence the length and the terms of a restructuring. Finally, Asonuma et al. (2023) document that haircuts are greater on short-term than on long-term debt. I contribute to this literature by offering new empirical facts related to the presence of multilateral creditors.

The starting point of the theoretical literature on sovereign debt and default is the study of Eaton and Gersovitz (1981), Aguiar and Gopinath (2006) and Arellano (2008).[4] To replicate the characteristics of emerging economies, the original model has been expanded in five main dimensions. First, Hatchondo and Martinez (2009) and Chatterjee and Eyigungor (2012) introduced long-term debt. Subsequently, Arellano and Ramanarayanan (2012) and Niepelt (2014) included mixed maturities. Third, Mendoza and Yue (2012) endogenized the income process and the default cost. Fourth, Arellano et al. (2019) introduced partial defaults to account for arrears. Finally, Bi (2008), Yue (2010) and Benjamin and Wright (2013) endogenized the renegotiation process assuming either a cooperative or a non-cooperative game between the lender and the borrower.[5] All aforementioned studies assume that haircuts and default durations are symmetric across creditors. This paper first documents that this assumption is not supported by the data. It then introduces two creditors with different status in the renegotiation to address this matter.

The paper is further related to the literature on the seniority structure of sovereign debt. Erce and Mallucci (2018) present evidence that countries discriminate between domestic and

[3]See also the earlier work of Lindert and Morton (1989), Rieffel (2003), Finger and Mecagni (2007), Díaz-Cassou et al. (2008), Sturzenegger and Zettelmeyer (2008) and Trebesch (2011).

[4]See also Aguiar and Amador (2014) and Aguiar et al. (2016).

[5]Their framework has been recently extended by Dvorkin et al. (2021) and Mihalache (2020) to account for mix maturities, by Asonuma and Trebesch (2016) to distinguish between preemptive and post-default restructurings, Asonuma and Joo (2020) to introduce risk-averse creditors and Fourakis (2021) to account for reputation.

foreign creditors when defaulting. Among foreign creditors, Schlegl et al. (2019) show that sovereign debt's seniority is mostly *de facto* and that only multilateral lenders are truly senior throughout the years. Theoretical models only partially addressed this issue, though. While many studies take the seniority structure as given,[6] few explicitly model the mechanism leading to a seniority structure of sovereign debt. Chatterjee and Eyigungor (2015) define senior tranches as the tranches which were issued first. Dellas and Niepelt (2016) and Ari et al. (2018) generate an implicit seniority structure by means of the default penalty. Conversely, Bolton and Jeanne (2009) develop a model in which the *de facto* seniority emerges from the renegotiation process. Finally, Cordella and Powell (2021) generate a preferred creditor status through commitment. I contribute this literature by combining the assumption of greater penalty with the assumption of tougher restructuring to generate a *de facto* seniority structure. This generates a tradeoff between multilateral and private debts similar to the one between short-term and long-term debts present in Arellano and Ramanarayanan (2012) and Niepelt (2014).

Finally, the paper also connects to the literature on official lending. Building on Ábrahám et al. (2019), Liu et al. (2020) show that the seniority structure of sovereign debt is irrelevant in optimal contracts. In opposition, I show that without such contracts, the seniority structure of sovereign debt is necessary to sustain the last-resort function of multilateral lending. Such function is important as it often relates to the catalytic effect of such lending. Corsetti et al. (2006), Morris and Shin (2006) and Rochet and Vives (2010) show theoretically that the provision of multilateral debt can bolster the inflow of private funds. However, empirical analyses remain inconclusive and present at most mixed evidence. Focusing on the IMF, the most recent studies have therefore sought to explain this ambivalence.[7] For instance, extending the framework of Corsetti et al. (2006), Krahnke (2020) shows that the *de facto* seniority of the IMF can lead to a crowding-out of private financial flows if the IMF support is sufficiently large. Having a broader focus than the IMF, I show a similar effect. Furthermore, I present evidence that the *de facto* seniority provides a source of fiscal discipline that other seniority regimes do not.

[6]For example, Hatchondo et al. (2017) consider the case of adding a non-defaultable bonds beside traditional defaultable bonds. Similarly, Gonçalves and Guimaraes (2014) analyze the link between fiscal policy and sovereign default taking the seniority structure of sovereign debt as given. Analysing the interaction between default, private debt and multilateral lending institutions, Boz (2011) and Fink and Scholl (2016) adopt the same modelling strategy.

[7]See notably Krahnke (2020), Gehring and Lang (2018), Erce and Riera-Crichton (2015) and Saravia (2013) for empirical analyses and Krahnke (2020) and Zwart (2007) for theoretical ones.

3 Multilateral Lenders and Seniority

This section reviews the existing conventions on sovereign debt seniority. Having supreme and unrestricted power as of a sovereign state, a government can always choose to breach the terms of its debt obligations. Despite major improvements in the 1990s, international law remains limited in enforcing reimbursements of sovereign debt and offers little guidance on the repayment priority of creditors.[8] Furthermore, there exists no supranational entity capable of prosecuting defaults or supervising restructurings of sovereign debt.[9] Thus, the seniority structure of sovereign debt is mostly implicit (Gelpern, 2004). That is why one refers to a *de facto* seniority, as a matter of *ex post* conduct, in contrast to a *de jure* seniority, as a matter of *ex ante* legal requirement.

More precisely, a *de jure* seniority structure relates to *ex ante* enforceable legal clauses that give priority to some creditors. The European Stability Mechanism (ESM), for example, has a *de jure* seniority with respect to the market, meaning that countries obtaining financial support from that institution are legally compelled to prioritize the ESM's repayment.[10] In opposition, a *de facto* seniority structure does not originate from initial contracting clauses or laws. Rather it is a feature that is the result of some *ex post* practice or convention.

Yet, it is the multilateral lending institutions such as the IMF and the WB which enjoy *de facto* seniority.[11] Neither the IMF's nor the WB's Articles of Agreement mention any seniority or preferred creditor status (Raffer, 2009). However, the market participants acknowledge and respect this implicit seniority structure (Standard & Poor's, 2000). That is, those lending institutions are paid ahead of other creditors and, when payments are deferred, are usually repaid in full (Beers and Mavalwalla, 2018). As one can see in Figure A.3 in Appendix A, the IMF and on the International Bank for Reconstruction and Development (IBRD) never represented more than 4% of the total amount of debt in default over the years. Similarly, from Figure A.4, the two institutions combined never accounted for more than 9% of the countries in default. None of the other reported creditors such as the Paris

[8]Even though there exist eminent litigation cases in which creditors successfully enforced repayments (e.g. Bank and Trust Company against the Central Bank of Brazil or Elliott Associates against the Republic of Panama and Banco de la Nación in Peru), few cases managed to obtain full reimbursement. The existing legal framework therefore remains relatively limited in enforcing debt repayments (Panizza et al., 2009). Plus, it provides no explicit priority system for creditors involved in restructurings (Martha, 1990; Gelpern, 2004). Nevertheless, it has gained in importance since the 1990s with notably the development of specialized distressed debt funds and the use of *pari passu* clauses (Schumacher et al., 2021).

[9]See Krueger (2001) for one of the most influential proposals on that matter.

[10]The only exception relates to the program with Spain which was not senior only because of a transitional agreement with the European Financial Stability Facility.

[11]This is a well established fact documented by numerous studies, explicitly supported by the Paris Club and repeatedly acknowledged by the main rating agencies. See notably Jeanne and Zettelmeyer (2001), Roubini and Setser (2003), Gelpern (2004), Raffer (2009), Schadler (2014) and Schlegl et al. (2019).

Club and other official creditors has a better record.

Interestingly, the aforementioned international financial institutions did not initially endorse their *de facto* seniority status (Martha, 1990; Raffer, 2009). Regarding the IMF, many of its loans were restructured jointly with other types of debts in the 1960s (Beers and Mavalwalla, 2018). Subsequently, in the 1970s and until the late 1980s, multiple countries started to accumulate substantial arrears with respect to crisis loans the IMF provided (Reinhart and Trebesch, 2016; Schlegl et al., 2019). This resulted to the official endorsement of the preferred creditor status at the end of the 1980s (IMF, 1988). Regarding the WB, the IBRD's and the International Development Association's (IDA) loans were initially meant to be subordinated to private claims (Raffer, 2009). Moreover, the major credit agencies waited more than a decade after the WB's creation to attribute it the highest rating. Nonetheless, publicly mentioning its preferred creditor status throughout the 1980s, the WB seems to have endorsed its role of privileged creditor earlier than the IMF.[12] As a result, it recorded protracted arrears to a lesser extent than the latter in the 1980s.

This implicit seniority structure provides an, albeit imperfect, shelter to multilateral institutions, allowing them to provide loans to countries with major economic difficulties at preferential rates (Fischer, 1999). To maintain this preferred status, multilateral institutions have developed a set of policies. For example, the IMF has established a clear lending-into-arrears policy consisting of two main lines of conduct.[13] First, it does not tolerate defaults on official creditors and forbids the use of funds to member states with arrears to the IMF (IMF, 1989; IMF, 2015). Second, if a sovereign receives support from an IMF program and defaults on its private creditors, the program should, absent immediate corrective actions by the authorities, be suspended (IMF, 1999). The WB follows a similar scheme as it does not lend into arrears and reserves the right to withdraw its funds in case of lacking reforms (IDA, 2007; IBRD, 2021).[14]

When building the model, I will take those different policies as given. Most importantly, I will assume that the multilateral lenders adopt a strict no-lending-into-arrear policy similar to the one of the IMF and the WB. As one will see, this safeguards the lending policy at preferential rates of multilateral lenders. It is also at the source of a longer defaults as well as of greater private creditors' losses.

[12] Unlike the IMF, it is difficult to historically determine when exactly the WB officially endorsed its preferred creditor status.

[13] As noted by Reinhart and Trebesch (2016), the IMF applies this policy with some degrees of freedom. See also Buchheit and Lastra (2007) and Erce (2014) for a critical appraisal of the IMF's lending-into-arrears policy.

[14] See for example the case of Somalia in March 2020 and Sudan in March 2021 which both could re-access the WB after successfully clearing their arrears and conducting requested reforms.

4 Empirical Facts

In this section, I introduce the main empirical regularities linking defaults with multilateral creditors and analyze their robustness.[15] My analysis relies on 186 default episodes from 1970 to 2014, which all involve external debt and private creditors.[16]

I identify the different restructuring episodes following Asonuma and Trebesch (2016). I complement this dataset with estimates of private creditor's losses from Cruces and Trebesch (2013). I subsequently identify the different creditors involved in each default episode by means of the database of Beers and Mavalwalla (2018). The IMF and the IBRD are the main creditors of interest in my study as they enjoy *de facto* seniority. I therefore aggregate them together under the label of multilateral creditors. Ideally, I would have also liked to include the IDA to this group as it represents the second financial arm of the WB beside the IBRD. However, the IDA is grouped together with other official creditors which do not enjoy a preferential status.[17] Appendix B gives a detailed overview of the other data used in this section. Notably, Table B.1 presents the sample used in this analysis and Table B.2 specifies the source.

Table 1: Duration and Haircut Statistics

	Mean	Median	Min	Max	Std. Dev.	Obs.
Default Duration (year)						
Overall	3.6	1.6	0.2	27.4	4.67	186
With multilateral creditors	7.3	5.3	0.3	27.4	6.90	40
Without multilateral creditors	2.6	1.4	0.2	18.2	3.18	146
SZ Haircut on Private Lenders (%)						
Overall	37.2	32.1	-9.8	97.0	27.67	186
With multilateral creditors	56.1	51.3	12.3	97.0	27.27	40
Without multilateral creditors	32.0	26.9	-9.8	97.0	25.52	146

Source: See Appendix B.

I differentiate the default episodes by creditor's types and especially focus on the cases involving multilateral lenders. Table 1 presents the main figures related to the default's duration and private creditors' haircut. For each statistic, I distinguish between defaults implicating multilateral debt from those which do not.[18] Overall, I identify four main empirical

[15] The facts presented in this section and the regression analyses conducted in Appendix C are not necessarily causal.

[16] I do not include defaults implicating solely official creditors (e.g. the Paris Club, the IMF or the IBRD) and that for two reasons. First, I am mostly interested in the interaction between private and multilateral lenders. Second, data on official creditors' defaults are incomplete.

[17] This is especially true for trade credits and government-to-government loans. Schlegl et al. (2019) present strong evidence that those types of creditors are not senior with respect to private creditors.

[18] A default implicating multilateral lenders is when a country explicitly defaults on such creditor.

facts. The first empirical regularity relates to the *de facto* seniority structure, namely that defaults on multilateral creditors are infrequent. Out of the 186 default episodes presented here only 40 involve multilateral creditors.[19]

Fact I. *A default involving multilateral lenders is infrequent.*

In addition, I find that sovereign defaults take between 3 and 4 years to be resolved. More importantly, if one conditions the length on the type of creditors involved, a default with multilateral creditors takes roughly 7 years to be resolved. In opposition, a default not involving such lenders takes on average 3 years to be resolved. Looking at the median the wedge between the two statistics remains substantial. Hence, defaults on multilateral creditors are associated with a doubling of the length of default on average. I summarize this in the second fact:

Fact II. *A default involving multilateral lenders takes longer to be resolved.*

To go beyond the analysis of simple stylised facts, I conduct a more comprehensive econometric analysis. However, for the continuity of the argument, I only highlight here the main findings. The detailed regression analysis is presented in Appendix C. To gauge the robustness of Fact II, I conduct two main exercises: ordinary least squares (OLS) regressions and Cox proportional hazard (Cox) duration regressions. There I control for the specificity of each default (i.e. amount restructured, presence of a Brady deal and private creditor's losses) but also for the economic and political stands of the country under default.

The outcome of the OLS duration regressions is depicted in Table C.3. There is a strong and positive association between defaults on multilateral creditors and the length of the default duration. Particularly, a default on multilateral debt is associated with a default's duration between 2 and 7 additional years depending on the model's specification. I draw similar conclusions from the outcome of the Cox model presented in Table C.4. Notably, a default on multilateral creditors is associated with a reduction of the probability of exiting default between 49% and 71% depending on the model's specification. In view of those results, it seems that this newly established fact is relatively robust. Controlling for the specificity of each default episode and the countries' characteristics does not reduce the strong association between the default's length and multilateral creditors.

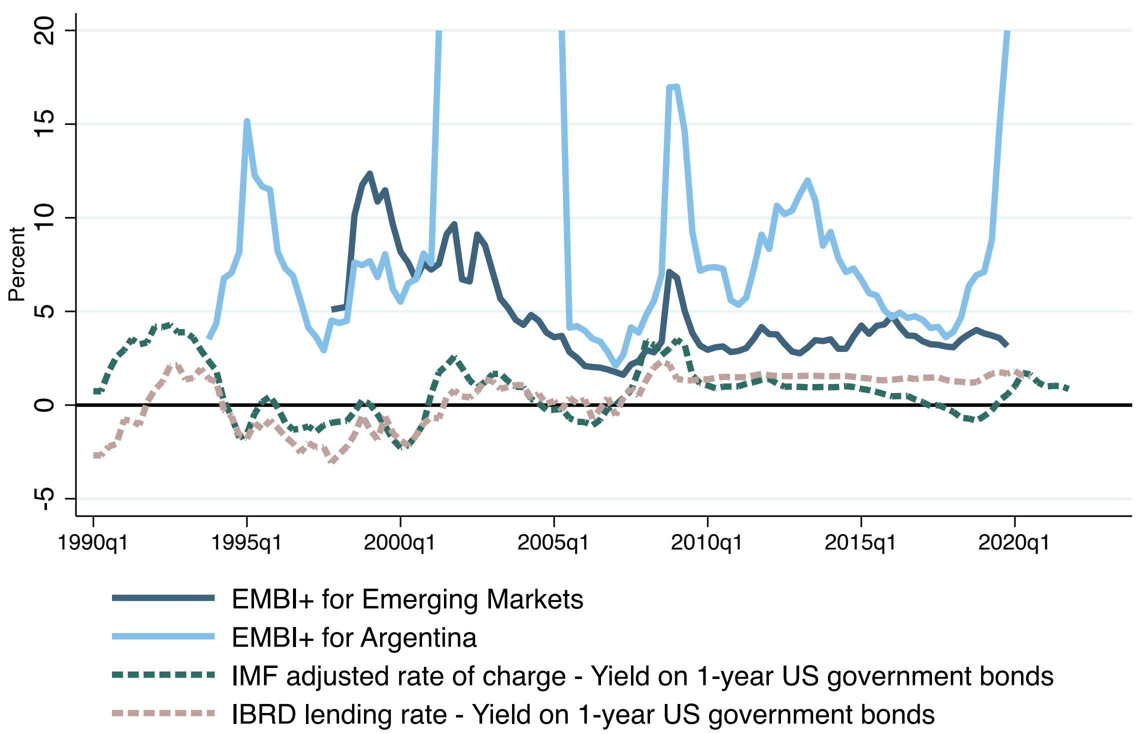
The second part of Table 1 presents the private creditors' haircut computed according to Sturzenegger and Zettelmeyer (2008) (henceforth SZ). Private creditors' haircuts are 37% on

[19] See also the discussion in Section 3 and the related Figures A.3 and A.4 in Appendix A.

average. However, for default episodes involving multilateral creditors, the average haircut raises to 56%, while it falls to 32% otherwise. Looking at the median the wedge between the two statistics is even larger. Thus, the private creditors' loss is on average greater in the case of a default involving multilateral creditors. This leads to the third empirical fact, namely

Fact III. *A default involving multilateral lenders is associated with larger private creditors' losses.*

However, the association between large haircuts and defaults on multilateral creditors might simply be a by-product of other factors not necessarily related to the creditor's identity. Thus, I conduct a thorough econometric analysis to disentangle the forces at play. For this purpose, I run OLS regressions controlling for the specificity of each default episode (i.e. amount restructured, presence of a Brady deal and duration) as well as the economic and political situations of each sovereign under default, like I did for Fact II.



Note: The EMBI+ series for Argentina has been truncated to 20% for expositional reasons. During the default episode of 2001-2005, the EMBI+ almost reached 60%.

Source: See Appendix B.

Figure 1: Spreads on Sovereign Debt

Table C.5 in Appendix C presents the results of the haircut regressions. The coefficient related to multilateral lenders is statistically and economically important. Defaulting on such creditors is associated with an increase of the private creditors' haircut between 8 and 15 percentage points for the SZ haircut depending on the model's specification. I therefore conclude that the third empirical fact is relatively robust as well.

Finally, the last empirical fact relates to the lending conditions. While private creditors can request substantial risk premia, multilateral creditors always provide funds at preferential rates. The fourth and last empirical fact is thus

Fact IV. *Multilateral lenders lend close to the risk-free rate.*

Figure 1 depicts the spread of the IMF adjusted rate of charge and the IBRD lending rate with respect to the yield on 1-year US government bonds. It also presents the EMBI+ for Argentina and emerging economies to have a sense of the premium charged by private creditors. As it is clear, multilateral lenders always charge a rate close to the risk-free one. This has already been pointed out by Boz (2011) for the IMF.

5 Environment

Having established new empirical facts, the following sections aim at building a model capable of rationalizing them. I consider a small open economy in infinite discrete time with a single homogenous good. The sovereign acts as a representative agent and takes the decision on behalf of the small open economy. Preference over consumption is given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t),$$

where $u(\cdot)$ is the instantaneous utility, $\beta \in (0,1)$ stands for the discount factor and c_t denotes the consumption at time t. The instantaneous utility function is differentiable, strictly increasing and strictly concave. Moreover, I assume that the sovereign is relatively impatient meaning that $\beta < 1/(1+r)$. Each period the sovereign receives an exogenous endowment, $y(z)$, which follows a first-order Markov process with a compact support $Z = \{z_1, z_2, ..., z_n\}$.

The financial market is incomplete and composed of a continuum of private lenders and one (official) multilateral lender. Hence, the sovereign faces two funding opportunities. On the one hand, it can issue private debt, b'_p, at the unit price $q_p(z, b'_m, b'_p)$. On the other hand, it can issue multilateral debt, b'_m, at the unit price $q_m(z, b'_m, b'_p)$.[20] Both types of debt are

[20]Following the standards in the literature, I designate a debt as a negative asset. In other words, $b_i < 0$ denotes a debt, while $b_i > 0$ denotes an asset for all $i \in \{m, p\}$.

long-term and follow the structure of Chatterjee and Eyigungor (2012). More precisely, a fraction $1-\delta$ of the bond portfolio matures every period and the remaining fraction δ is rolled over and pays a coupon κ. Both types of debt have the same (κ, δ) and the risk-free rate is given by $\bar{q} \equiv \frac{1-\delta+\delta\kappa}{1+r-\delta}$.

The sovereign cannot commit to repay its debt. If it decides to default, it has two options: *partial* or *full* default. In the former case, the sovereign solely defaults on its private debt, whereas in the latter case it repudiates its entire debt position.[21] Both types of default are followed by a complete bond market exclusion and an output penalty. I denote $y^{DP}(z)$ and $y^{DF}(z)$ as the endowment upon a *partial* and *full* default, respectively.

The private lenders are risk-neutral and competitive. Similarly, the multilateral lender is risk-neutral and breaks even in expectation. Nevertheless, defaulting on the multilateral debt entails greater output cost – i.e. $y \geq y^{DP} > y^{DF}$.[22] In addition, in light of the discussion in Section 3, the multilateral lender follows a strict no-lending-into-arrear policy which consists of two main lines of conduct. First, repayment of outstanding multilateral debt is always in full. Second, the multilateral lender does not provides new resources until arrears have been completely cleared.

Similar to Dvorkin et al. (2021), I introduce additive utility shocks to simplify computation. I assume that debt takes values in a discrete support $B_p = \{b_p^1, \ldots, b_p^{\mathcal{P}}\}$ with $|B_p| = \mathcal{P}$ for the private debt and $B_m = \{b_m^1, \ldots, b_m^{\mathcal{M}}\}$ with $|B_m| = \mathcal{M}$ for the multilateral debt. I then define the vectors $\boldsymbol{b}_p$ and $\boldsymbol{b}_m$, where (b_p^i, b_m^i) are the ith elements of each vector.

$$\boldsymbol{b}_p = [\underbrace{B_p, \ldots, B_p}_{\mathcal{M} \text{ times}}] \quad \text{and} \quad \boldsymbol{b}_m = [\underbrace{b_m^1, \ldots, b_m^1}_{\mathcal{P} \text{ times}}, \underbrace{b_m^2, \ldots, b_m^2}_{\mathcal{P} \text{ times}}, \ldots, \underbrace{b_m^{\mathcal{M}}, \ldots, b_m^{\mathcal{M}}}_{\mathcal{P} \text{ times}}]$$

There is a utility shock vector $\boldsymbol{\epsilon}$ of size $\mathcal{P} \times \mathcal{M} + 2 \equiv \mathcal{J} + 2$, which corresponds to the number of all possible combinations of the entries in B_p and B_m plus two additional elements that accounts for the choices of *partial* and *full* defaults. The random vector is drawn from a multivariate distribution with joint cumulative distribution function $F(\boldsymbol{\epsilon}) = F(\epsilon_1, \epsilon_2, \ldots, \epsilon_{\mathcal{J}}, \epsilon_{\mathcal{J}+1}, \epsilon_{\mathcal{J}+2})$ and joint density function $f(\boldsymbol{\epsilon})$.

In this environment, the sovereign faces two problems. On the one hand, it decides whether to repay or not. This is the repayment problem in which the sovereign takes the

[21] The sovereign does not have the possibility of solely defaulting on the multilateral debt. This is consistent with the fact that, in the data, such event is extremely rare. The main exception is Greece which defaulted on the IMF but continued to repay private lenders in 2015.

[22] There are many ways to rationalize this greater output penalty. First, multilateral lending institutions provide support to and advise countries during debt crises. Such aid is often conditional on not having arrears towards those institutions. Second, multilateral lenders represent large players in the financial market capable of influencing other market actors. Third, the sovereign's reputation is more damaged when it does not respect the *de facto* pecking order of creditors.

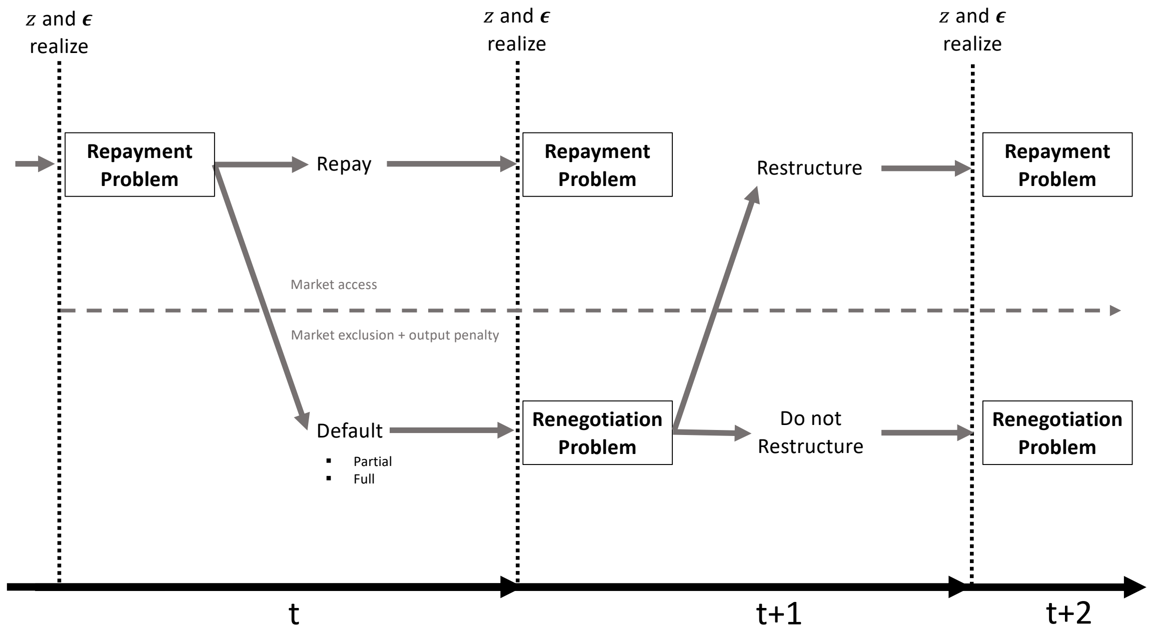


Figure 2: Timing and Problems

prices and the outcome of the renegotiation problem as given to determine whether it is optimal to default. On the other hand, under default, the sovereign has to renegotiate its debt. There the sovereign has to bargain directly with the lenders to determine the recovery value of debt taking the prices and the outcome of the repayment problem as given.

The timing of the model is depicted in Figure 2. In the repayment problem, given the realization of $(z, \boldsymbol{\epsilon})$, the sovereign decides whether to repay or not. If it repays, it maintains its market access, determines its prospective borrowing and faces the repayment problem again in the next period.[23] Upon default, the sovereign receives the output penalty, is excluded from the bond market and faces the renegotiation problem in the next period. In this problem, it has to directly bargain with the lenders to restructure its debt. The creditors and the sovereign propose stochastically over multiple rounds. If the contracting parties agree on a settlement, the sovereign regains access to the market and faces the repayment problem in the next period. Otherwise, the sovereign remains in autarky and the renegotiation problem repeats next period.

[23]This timing rules out self-fulfilling debt crises (Ayres et al., 2018).

6 The Repayment Problem

This section develops the repayment problem. Given the prices, the outcome of the renegotiation problem, the realisation of $(z, \boldsymbol{\epsilon})$ and the current stock of debt, the sovereign decides whether to repay. When deciding to default, the sovereign can choose to enter into *partial* or *full* default. The overall beginning of the period value function is then given by

$$V(z, \boldsymbol{\epsilon}, b_m^i, b_p^i) = \max\{V^P(z, \boldsymbol{\epsilon}, b_m^i, b_p^i), V^{DP}(z, \epsilon_{\mathcal{J}+1}, b_m^i, b_p^i), V^{DF}(z, \epsilon_{\mathcal{J}+2}, b_m^i, b_p^i)\}, \tag{1}$$

where $V^P(\cdot)$ is the value function under repayment, $V^{DP}(\cdot)$ under *partial* default and $V^{DF}(\cdot)$ under *full* default.

In the case in which the sovereign decides to honor the terms of all its debt contracts, the Bellman equation reads

$$\begin{aligned} V^P(z, \boldsymbol{\epsilon}, b_m^i, b_p^i) = \max_{j \in \{1,2,\ldots,\mathcal{J}\}} \quad & u(c) + \epsilon_j + \beta \mathbb{E}_{z'|z} \mathbb{E}_{\boldsymbol{\epsilon}'} V(z', \boldsymbol{\epsilon}', b_m^j, b_p^j) \\ \text{s.t.} \quad & c + q_m(z, b_m^j, b_p^j)(b_m^j - \delta b_m^i) + q_p(z, b_m^j, b_p^j)(b_p^j - \delta b_p^i) \\ & = y(z) + [1 - \delta + \delta\kappa]\,(b_m^i + b_p^i). \end{aligned} \tag{2}$$

If the sovereign decides to enter into *partial* default, it receives an output penalty and is excluded from the bond market. Moreover, it continues to service the multilateral debt. The Bellman equation for the case of *partial* default is given by

$$\begin{aligned} V^{DP}(z, \epsilon_{\mathcal{J}+1}, b_m^i, b_p^i) = & u(c) + \epsilon_{\mathcal{J}+1} + \beta \mathbb{E}_{z'|z} \mathbb{E}_{\boldsymbol{\epsilon}'} V^{RP}(z', \boldsymbol{\epsilon}', b_m^j, b_p^i) \\ \text{s.t.} \quad & c = y^{DP}(z) + [1 - \delta + \delta\kappa]\, b_m^i, \\ & b_m^j = \delta b_m^i. \end{aligned} \tag{3}$$

The continuation value $V^{RP}(\cdot)$ is the expected payoff from the renegotiation process with the private creditors and is specified in the next section. Note that the sovereign continues to service its multilateral debt which decays at the rate δ. Hence, the larger is b_m^i, the less attractive is this type of default. Moreover, in the case of one-period debt (i.e. $\delta = 0$), the debt is repaid in one instalment. This further renders the *partial* default unappealing. In opposition, the longer is the average maturity (i.e. $\delta \to 1$), the lower is the debt service incurred every period.

Finally, if the sovereign decides to enter into *full* default, it is excluded from the international bond market and receives an output penalty, $y^{DF} < y^{DP} \leq y$, but does not need to service any debt. The Bellman equation in the case of *full* default reads as follows

$$
\begin{aligned}
V^{DF}(z, \epsilon_{\mathcal{J}+2}, b_m^i, b_p^i) =& u(c) + \epsilon_{\mathcal{J}+2} + \beta \mathbb{E}_{z'|z} \mathbb{E}_{\boldsymbol{\epsilon}'} V^{RF}(z', \boldsymbol{\epsilon}', b_m^i, b_p^i) \\
\text{s.t.} \quad & c = y^{DF}(z).
\end{aligned} \tag{4}
$$

The continuation value $V^{RF}(\cdot)$ is the expected payoff derived from the debt renegotiation process with the two creditors. In a *full* default, the sovereign does not need to service any debt while being in autarky. It is therefore crucial that $y^{DF} < y^{DP}$. I show in Section 10, that when $y^{DP} = y^{DF}$, the *partial* default becomes completely unattractive.

7 The Renegotiation Problem

The previous section developed the repayment problem taking as given the outcome of the renegotiation problem. This section does the opposite. To endogenize the renegotiation process, I mainly draw from the framework developed by Bi (2008) and Benjamin and Wright (2013) as it is capable of generating endogenous delays and haircuts. The exact form of the renegotiation process follows Dvorkin et al. (2021).

7.1 Partial default

The renegotiation is a multi-round non-cooperative game in which the private lenders and the sovereign propose stochastically. Figure 3 depicts the sequence of actions in the renegotiation with the sovereign's payoffs.

With probability ϕ the private lenders have the opportunity to propose and if so the sovereign decides whether to accept the offer.[24] Conversely, with probability $1 - \phi$, the sovereign can propose and, conditional on the sovereign proposing, the private lenders have to decide whether to accept the offer. An offer states the value of the restructured debt, W. If the proposer does not propose or the recipient does not accept the offer W, the renegotiation is delayed, the sovereign stays in autarky and the game repeats next period. Otherwise, the negotiating parties settle, the game ends and the sovereign can return to the repayment problem. Formally, the value under renegotiation is given by

$$
V^{RP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i) = \phi \Omega^{RP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W_l^{RP}) + (1 - \phi) \Omega^{RP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W_b^{RP}). \tag{5}
$$

[24] The object ϕ directly reflects the private lenders' bargaining power as it represents the probability of having the first-mover advantage (Merlo and Wilson, 1995).

$\Omega^{RP}(\cdot)$ is the value derived from a specific offer and W_l^{RP} and W_b^{RP} represent the offer made by the private lenders and the sovereign, respectively.

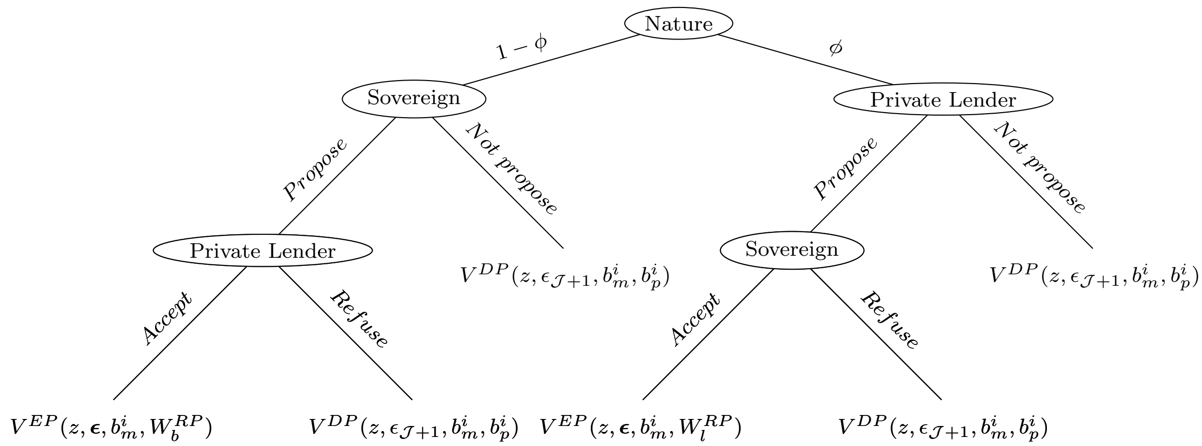


Figure 3: Renegotiation Game Tree in Partial Default

In each round, the sovereign compares the value of remaining in autarky with the value of paying W and re-accessing the market. Hence, one has that

$$\Omega^{RP}(z,\boldsymbol{\epsilon},b_m^i,b_p^i,W) = \max\Big\{V^{DP}(z,\epsilon_{\mathcal{J}+1},b_m^i,b_p^i), V^{EP}(z,\boldsymbol{\epsilon},b_m^i,W)\Big\}, \tag{6}$$

where $V^{DP}(\cdot)$ is the value of remaining in autarky and $V^{EP}(\cdot,W)$ is the value of exiting the negotiation with a restructured debt of value W. This defines a stopping function $A^{RP}(z,\boldsymbol{\epsilon},b_m^i,b_p^i,W)$ which takes value one if the restructuring is preferred and zero otherwise. The value upon restructuring is given by

$$\begin{aligned} V^{EP}(z,\boldsymbol{\epsilon},b_m^i,W) = \max_j\, & u(c) + \epsilon_j + \beta\mathbb{E}_{z'|z}\mathbb{E}_{\boldsymbol{\epsilon}'}V(z',\boldsymbol{\epsilon}',b_m^j,b_p^j) \\ \text{s.t.} \quad & c = y(z) + \tau + [1-\delta+\delta\kappa]b_m^i, \\ & \tau = q_p(z,b_m^j,b_p^j)(-b_p^j) - W, \\ & \tau \geq 0, \\ & b_m^j = \delta b_m^i. \end{aligned} \tag{7}$$

The variable τ represents the net transfer of debt from the lenders. The constraint stating that $\tau \geq 0$ obliges the restructuring to entail new money. In other words, the private lenders provide new debt in excess of the restructuring deal W.[25] Besides this, upon restructuring, the sovereign gets rid of the output penalty and exchanges its old private debt for a new

[25] As a result, the sovereign does not exit the default state with a significant reduction of its indebtedness.

one. However, it cannot immediately borrow multilateral debt. The complete re-access to the market arises after the renegotiation's end.

Let's now determine W_b^{RP}. Given the risk neutrality of the private lender, the sovereign cannot offer less than the present discounted value of the old debt under default if it wants to settle. There is also no reason to offer more. Thus,

$$W_b^{RP}(z, b_m^i, b_p^i) = -b_p^i q_p^{DP}(z, b_m^i, b_p^i),$$

where $q_p^{DP}(\cdot)$ is the market value of the old debt and is specified in the next section. The sovereign's offer corresponds the private lender's reservation value. The private lender will therefore always accept the sovereign's offer. Nevertheless, the sovereign might decide not to propose (i.e. $A^{RP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W) = 0$) if it is better off staying in autarky.

When the private lenders propose, they consider two main aspects. On the one hand, they should come up with a settlement that the sovereign is likely to accept. On the other hand, they have to make sure to maximize the recovery value. The private lenders' offer is therefore the result of

$$\begin{aligned} W_l^{RP}(z, b_m^i, b_p^i) = \arg\max & \left[\mathbb{E}_{\boldsymbol{\epsilon}} A^{RP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W)W + (1 - \mathbb{E}_{\boldsymbol{\epsilon}} A^{RP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W))W_b^{RP}(z, b_m^i, b_p^i)\right] \\ \text{s.t.} \quad & W \leq -b_p^i \bar{q}. \end{aligned}$$

In words, the private lenders seek to maximize the recovery value the sovereign is willing to accept under the constraint that the proposed restructuring does not exceed the initial value of debt. Figure A.5 in Appendix A depicts the optimal offer.

What is the source of delays in this set-up? The sovereign usually defaults in low productivity states with a relatively high level of debt. If the sovereign desires to settle at the lowest cost, the least it could pay is $W_b^{RP} = -q_p^{DP}(z, b_m^i, b_p^i)b_p^i$. To get out of default, it would need to issue new private debt. The problem is that in low productivity states, $q_p(z, b_m^i, b_p^i)$ is very close to $q_p^{DP}(z, b_m^i, b_p^i)$ due to the persistence of the shocks. Owing to the constraint $\tau \geq 0$, the sovereign should accumulate a prospective level of debt similar to the one it just repudiated if it wants to settle. As a result, it runs the risk of falling into default once again next period lowering $V^{EP}(\cdot)$. It is then optimal for the sovereign to wait that the productivity state improves and $q_p(z, b_m^i, b_p^i)$ recovers in order to settle its debt. Note that it is also optimal for the private lenders to wait. When the default risk is high, the recovery value of debt is very low. However, as the default risk diminishes, the private lenders can recover more from the sovereign.

Delays therefore originate from the sovereign's limited commitment to repay its debt. In other words, delays in the renegotiation process emanate from the same force that generates the default itself (Benjamin and Wright, 2013).

7.2 Full default

To simplify the renegotiation under *full* default, I assume that there are neither coordination nor cooperation problems between the private and the multilateral lenders. The former acknowledge the full repayment of the latter. Hence, the two types of lender jointly propose a common offer with probability ϕ.[26] The value under renegotiation is given by

$$V^{RF}(z,\boldsymbol{\epsilon},b_m^i,b_p^i) = \phi\Omega^{RF}(z,\boldsymbol{\epsilon},b_m^i,b_p^i,W_l^{RF}-b_m^i\bar{q}) + (1-\phi)\Omega^{RF}(z,\boldsymbol{\epsilon},b_m^i,b_p^i,W_b^{RF}-b_m^i\bar{q})$$

where W_b^{RF} and W_l^{RF} represent the offer for the private debt made by the sovereign and the two types of lenders, respectively. Consistent with the no-lending-into-arrear policy, irrespective of the proposer, the multilateral debt is always repaid in full – i.e. $-b_m^i\bar{q}$. Following the same logic as before, the stopping function $A^{RF}(z,\boldsymbol{\epsilon},b_m^i,b_p^i,W-b_m^i\bar{q})$ is the result of

$$\Omega^{RF}(z,\boldsymbol{\epsilon},b_m^i,b_p^i,W-b_m^i\bar{q}) = \max\left\{V^{DF}(z,\epsilon_{\mathcal{J}+2},b_m^i,b_p^i),V^{EF}(z,\boldsymbol{\epsilon},b_m^i,W-b_m^i\bar{q})\right\} \tag{8}$$

where $V^{DF}(\cdot)$ is the value of remaining in full default and $V^{EF}(\cdot,W-b_m^i\bar{q})$ is the value of exiting the negotiation with a restructured private debt of value W and multilateral debt of value $-b_m^i\bar{q}$. The value under restructuring is given by

$$\begin{aligned} V^{EF}(z,\boldsymbol{\epsilon},b_m^i,W-b_m^i\bar{q}) = \max_j\, & u(c)+\epsilon_j+\beta\mathbb{E}_{z'|z}\mathbb{E}_{\boldsymbol{\epsilon}'}V(z',\boldsymbol{\epsilon}',b_m^j,b_p^j) \\ \text{s.t.}\quad & c = y(z)+\tau, \\ & \tau = q_p(z,b_m^j,b_p^j)(-b_p^j)-(W-b_m^i\bar{q}), \\ & \tau \geq 0, \\ & b_m^j = 0. \end{aligned} \tag{9}$$

Once again, upon restructuring, the sovereign gets rid of the output penalty and exchanges its old private debt for a new one. There is however no debt exchange for the multilateral debt. Consistent with the no-lending-into-arrears policy, the sovereign needs to completely clear its arrears before getting new funds from the multilateral lender. The sovereign's offer

[26] It is similar to assume that the sovereign renegotiates with each lender separately but the multilateral lender has a bargaining power of 1.

for the private debt is given by

$$W_b^{RF}(z, b_m^i, b_p^i) = -b_p^i q_p^{DF}(z, b_m^i, b_p^i).$$

Conversely, the lenders' offer for the private debt is the result of

$$\begin{aligned} W_l^{RF}(z, b_m^i, b_p^i) = \arg\max \Big[& \mathbb{E}_{\boldsymbol{\epsilon}} A^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W - b_m^i \bar{q}) W \\ & + (1 - \mathbb{E}_{\boldsymbol{\epsilon}} A^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W - b_m^i \bar{q})) W_b^{RF}(z, b_m^i, b_p^i) \Big] \\ \text{s.t.} \quad & W \leq -b_p^i \bar{q}. \end{aligned}$$

The full repayment of multilateral lenders affects the stopping function $A^{RF}(\cdot, W - b_m^i \bar{q})$. The level of multilateral debt therefore directly impacts W_l^{RF}.

How is this setting supposed to generate additional delay? If the multilateral lender were not requesting full repayment, the sovereign could offer $q_m^{DF}(z, b_m^i, b_p^i)(-b_m^i)$ with $q_m^{DF}(z, b_m^i, b_p^i) < \bar{q}$ instead of $\bar{q}(-b_m^i)$. In words, the complete repayment of the multilateral debt renders the debt restructuring more costly for the sovereign which prefers to wait that the endowment state *majorly* improves before settling.

As shown in Section 10, given additional delays, the absence of multilateral debt exchange is necessary to generate haircuts in line with the empirical evidence. In this bargaining game, the haircut is shaped by two opposing forces. On the one hand, for a given level of endowment, the larger is the level of debt, the larger is the haircut. On the other hand, for a given level of debt, the higher is the endowment, the lower is the haircut due to the price recovery. As mentioned above, in the case of a *full* default, delays in the renegotiation process are more pronounced which mechanically lead to lower haircuts. The restriction on the multilateral debt exchange is thus introduced to counterbalance this effect.

8 Prices and Debt Structure

The previous two sections exposed the repayment problem and, subsequently, the renegotiation problem the sovereign faces. The present section aims at defining prices and characterising the optimal debt structure.

8.1 Bond prices

Before I determine the prices, I have to properly define some policy functions. Define $D^{DP}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i)$ as the *partial* default policy which takes value one in case of such default and zero otherwise. Similarly, define $D^{DF}(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$ as the *full* default policy. Regarding borrowing, $b_p(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$ and $b_m(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$ correspond to the private and multilateral bond policy, respectively.

Private lenders are competitive meaning that in expectations they make zero profit. The price of one unit of bond can therefore be separated into two parts: the return when the sovereign decides to repay and the recovery value when the sovereign defaults.

$$
\begin{aligned}
q_p(z, b^j_m, b^j_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\mathbb{E}_{\boldsymbol{\epsilon}'}\Big[&\big(1 - D^{DP}(z', \boldsymbol{\epsilon}', b^j_m, b^j_p) - D^{DF}(z', \boldsymbol{\epsilon}', b^j_m, b^j_p)\big)\times \\
&\big(1 - \delta + \delta\kappa + \delta q_p(z', b_m(z', \boldsymbol{\epsilon}', b^j_m, b^j_p), b_p(z', \boldsymbol{\epsilon}', b^j_m, b^j_p))\big) + \\
&D^{DP}(z', \boldsymbol{\epsilon}', b^j_m, b^j_p) q^{DP}_p(z', b^j_m, b^j_p) + \\
&D^{DF}(z', \boldsymbol{\epsilon}', b^j_m, b^j_p) q^{DF}_p(z', b^j_m, b^j_p)\Big].
\end{aligned}
\tag{10}
$$

If the sovereign decides to repay, the private lenders receive the fraction of bond maturing, $1-\delta$, the coupon for the share of debt that is rolled-over, $\delta\kappa$, and the value of the outstanding debt in the next period, δq_p. If the sovereign decides to renege the debt contract, the private lenders receive the recovery value of debt.

The private lenders' recovery value depends on the acceptance probability, the bargaining power and the proposed offer.[27] In the case of *partial* default,

$$
\begin{aligned}
q^{DP}_p(z, b^i_m, b^i_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[&(1 - \phi\mathbb{E}_{\boldsymbol{\epsilon}'} A^{RP}(z', \boldsymbol{\epsilon}', \delta b^i_m, b^i_p)) q^{DP}_p(z', \delta b^i_m, b^i_p) + \\
&\phi\mathbb{E}_{\boldsymbol{\epsilon}'} A^{RP}(z', \boldsymbol{\epsilon}', \delta b^i_m, b^i_p) \frac{W^{RP}_l(z', \delta b^i_m, b^i_p)}{-b^i_p}\big].
\end{aligned}
$$

The price is again shaped by the break-even condition. If the private lenders propose and the sovereign accepts the deal, then the recovery value per unit of bond is $\frac{1}{-b^i_p} W^{RP}_l(z', b^j_m, b^i_p)$.[28] Conversely, if the sovereign proposes, the private lenders receive their outside option, $q^{DP}_p(z', b^j_m, b^i_p)$. Finally, if the sovereign refuses to settle or does not propose, it does not disburse anything now, but in present value it pays $q^{DP}_p(z', b^j_m, b^i_p)$. Similarly, in the case of *full* default,

$$
\begin{aligned}
q^{DF}_p(z, b^i_m, b^i_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[&(1 - \phi\mathbb{E}_{\boldsymbol{\epsilon}'} A^{RF}(z', \boldsymbol{\epsilon}', b^i_m, b^i_p)) q^{DF}_p(z', b^i_m, b^i_p) + \\
&\phi\mathbb{E}_{\boldsymbol{\epsilon}'} A^{RF}(z', \boldsymbol{\epsilon}', b^i_m, b^i_p) \frac{W^{RF}_l(z', b^i_m, b^i_p)}{-b^i_p}\big].
\end{aligned}
$$

I can now pass to the price of multilateral debt. Given the risk neutrality and the break-even

[27] By a slight abuse of notation, I define $A^{RP}(z', \boldsymbol{\epsilon}', b^j_m, b^i_p) \equiv A^{RP}(z', \boldsymbol{\epsilon}', b^j_m, b^i_p, W(z', b^j_m, b^i_p))$.

[28] This implicitly says that the recovered value is equally shared among the private lenders.

assumption, the price formula is similar to the one of private debt,

$$q_m(z, b_m^j, b_p^j) = \frac{1}{1+r}\mathbb{E}_{z'|z}\mathbb{E}_{\boldsymbol{\epsilon}'}\Big[\big(1 - D^{DF}(z', \boldsymbol{\epsilon}', b_m^j, b_p^j)\big)\times \tag{11}$$
$$\big(1 - \delta + \delta\kappa + \delta q_m(z', b_m(z', \boldsymbol{\epsilon}', b_m^j, b_p^j), b_p(z', \boldsymbol{\epsilon}', b_m^j, b_p^j))\big) +$$
$$D^{DF}(z', \boldsymbol{\epsilon}', b_m^j, b_p^j) q_m^{DF}(z', b_m^j, b_p^j)\Big].$$

Given that the multilateral lender is always repaid in full, the recovery value upon *full* default is given by

$$q_m^{DF}(z, b_m^i, b_p^i) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - \mathbb{E}_{\boldsymbol{\epsilon}'} A^{RF}(z', \boldsymbol{\epsilon}', b_m^i, b_p^i)) q_p^{DF}(z', b_m^i, b_p^i) + \mathbb{E}_{\boldsymbol{\epsilon}'} A^{RF}(z', \boldsymbol{\epsilon}', b_m^i, b_p^i)\bar{q}\big].$$

When comparing the multilateral and private debt prices, two points deserve to be noted. First, the expected default probability in the case of multilateral debt will be lower owing to the greater output penalty. Second, the recovery value for the multilateral debt is usually higher than the recovery value of private debt due to the no-lending-into-arrear policy. Thus, the multilateral debt price will be relatively higher than the private bond price, in general.

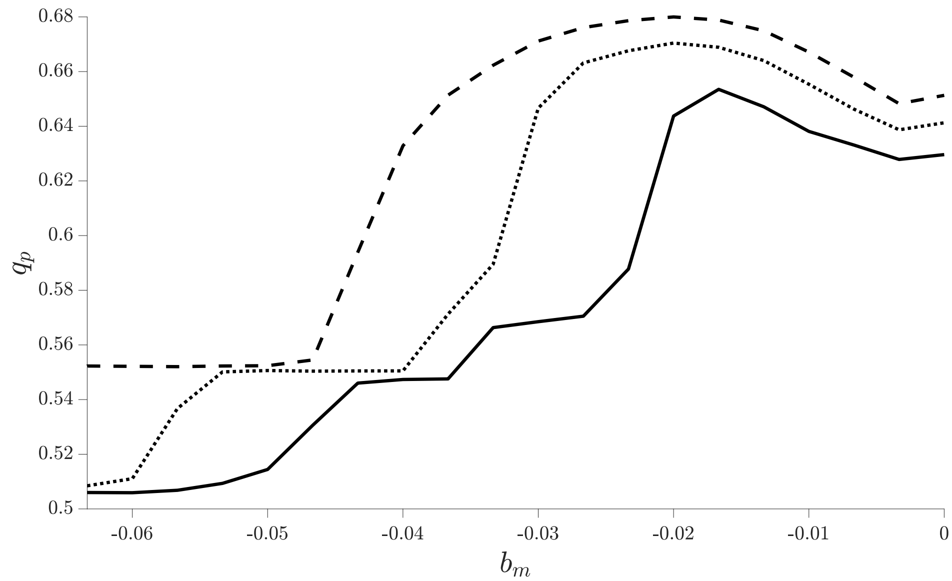
8.2 Optimal debt structure

Having determined the prices, I can now characterize the optimal portfolio choice. The definition of the competitive equilibrium can be found in Appendix D.

The level of multilateral debt, b_m^i, has two opposite effects. On the one hand, in a *partial* default, the sovereign continues to service its multilateral debt. Hence, as one can see in (3), a larger level of multilateral debt directly reduces the value of *partial* default. In other words, more multilateral debt reduces the probability of a *partial* default. On the other hand, more multilateral debt increases the probability of a *full* default. Furthermore, in a *full* default, absolute priority is given to the repayment of the multilateral debt and the private lenders receive what is left. This means that the level of multilateral debt directly affects the private debt's recovery value.

Given this and the fact that $y \geq y^{DP} > y^{DF}$, there should exist an interval of multilateral debt, in which more multilateral debt decreases the probability of a *partial* default without a one-to-one increase in the probability of *full* default. In such interval, the multilateral debt effectively reduces the default probability. In other words, it works as a commitment device.

This shows that the multilateral debt is at the source of an important pecuniary spillover for the private debt. On the one hand, the multilateral debt drastically reduces the private debt's recovery value owing to its repayment priority upon default. On the other hand, it can increase the sovereign's willingness to repay by rendering a *partial* default on private debt more costly. The multilateral debt is therefore capable of reducing the default risk, while increasing the subordination risk of private liabilities.



Note: Depending on the exact calibration, the hump-shaped pattern of q_p can be more or less pronounced.

Figure 4: Private Bond Price at z_{min}

Figure 4 depicts the private bond price as a function of b_m for different levels of b_p. One clearly sees that the multilateral debt has two opposing effects. On the one hand, when multilateral debt is relatively small, it works as a commitment device and reduces the incentive to default which increases q_p. In opposition, as b_m gets more important, this effect disappears and the sovereign defaults again. This time however, the sovereign does not choose a *partial* default but a *full* default in which the private debt is subordinated. The private bond price largely depresses as the recovery value of private debt decreases.

The above pecuniary spillover addresses the catalytic function of official multilateral lending.[29] As noted by Schadler (2014) and formally shown by Krahnke (2020), the seniority can crowd out private capital flows if the amount of senior debt becomes too large. A similar effect arises in this model. While some level of multilateral debt encourages the sovereign to repay its debt, large amounts of multilateral debt considerably dilute the private debt holdings. Importantly, this effect solely originates from the *de facto* seniority assumption as I do not model conditionality.

Having determined the main dynamic of prices, I can now define the optimal borrowing policy. To better identify the forces at play, I consider that bond choices have a continuous

[29]This function is generally attributed to the IMF in the literature, whereas the present model is not targeted to a specific lending institution.

and compact support $B_p = [b_p^1, b_p^{\mathcal{P}}]$ and $B_m = [b_m^1, b_m^{\mathcal{M}}]$ and remove the utility shock $\boldsymbol{\epsilon}$. Moreover, as Arellano and Ramanarayanan (2012), I assume that the bond price functions $q_m(\cdot)$ and $q_p(\cdot)$ and the value of repaying $V^P(\cdot)$ are differentiable. I then derive the first-order necessary conditions of the sovereign's problem given in (2). With respect to b'_m, one obtains

$$u_c(c)\left[\frac{\partial q_m}{\partial b'_m}(b'_m - \delta b_m) + q_m + \frac{\partial q_p}{\partial b'_m}(b'_p - \delta b_p)\right] = \beta \mathbb{E}_{z'|z}\left[u_c(c')(1 - \delta + \delta\kappa + \delta q'_m)\right], \tag{12}$$

and with respect to b'_p,

$$u_c(c)\left[\frac{\partial q_m}{\partial b'_p}(b'_m - \delta b_m) + \frac{\partial q_p}{\partial b'_p}(b'_p - \delta b_p) + q_p\right] = \beta \mathbb{E}_{z'|z}\left[u_c(c')(1 - \delta + \delta\kappa + \delta q'_p)\right], \tag{13}$$

where $u_c(\cdot)$ represents the first derivative of $u(\cdot)$ with respect to c and $q'_j = q_j(z', b''_m, b''_p)$ for $j \in \{m, p\}$ is the bond price next period. The left-hand side of each first-order condition represents the marginal benefits of issuing one additional unit of the type of debt concerned, whereas the right-hand side represents the marginal costs of this additional issuance. Most notably, the terms in squared brackets on the left-hand side determine how the benefits of additional borrowing depend on the level of indebtedness. Following the argument of Chatterjee and Eyigungor (2012), with monotonic bond policy functions, one has

$$\frac{\partial q_p}{\partial b'_p} \geq 0 \quad \text{and} \quad \frac{\partial q_m}{\partial b'_m} \geq 0.$$

However, regarding my previous argument, it holds that

$$\frac{\partial q_p}{\partial b'_m} \lesseqgtr 0.$$

This together with the first-order conditions unveil two effects that shape the optimal holdings of debt in the model: the seniority benefit and the subordination benefit. The former relates to the multilateral debt and is given by the ratio of the left-hand side of (12) and (13) divided by the private debt price,

$$\text{Seniority benefit} = \frac{\frac{q_m}{q_p} + \frac{\partial q_m}{\partial b'_m}\frac{(b'_m - \delta b_m)}{q_p} + \frac{\partial q_p}{\partial b'_m}\frac{(b'_p - \delta b_p)}{q_p}}{1 + \frac{\partial q_m}{\partial b'_p}\frac{(b'_m - \delta b_m)}{q_p} + \frac{\partial q_p}{\partial b'_p}\frac{(b'_p - \delta b_p)}{q_p}}.$$

The numerator (denominator) corresponds to the marginal impact of issuing multilateral (private) debt on the incentive to repay. There are two components here. First, *full* defaults are relatively infrequent and even under such event, the multilateral debt is repaid in full.

Hence, one would expect that $\frac{\partial q_m}{\partial b'_m}$ and $\frac{\partial q_m}{\partial b'_p}$ are both close to zero. Second, as noted before, additional units of multilateral debt do not necessarily decrease the price of private debt. Thus, whenever $\frac{\partial q_p}{\partial b'_m} < 0$, the sovereign has a greater incentive to repay compared to when it issues private debt. In opposition, for any additional level of private debt, q_p sinks reducing the willingness to repay.

The subordination benefit relates to the private debt and corresponds to the ratio of the right-hand side of (12) and (13),

$$\text{Subordination benefit} = \frac{\mathbb{E}_{z'|z}\left[u_c(c')(1-\delta+\delta\kappa+\delta q'_m)\right]}{\mathbb{E}_{z'|z}\left[u_c(c')(1-\delta+\delta\kappa+\delta q'_p)\right]},$$

which one can reformulate as

$$\frac{\mathbb{E}_{z'|z}\left[u_c(c')\right]\mathbb{E}_{z'|z}\left[1-\delta+\delta\kappa+\delta q'_m\right]+\operatorname{cov}(u_c(c'),\delta q'_m)}{\mathbb{E}_{z'|z}\left[u_c(c')\right]\mathbb{E}_{z'|z}\left[1-\delta+\delta\kappa+\delta q'_p\right]+\operatorname{cov}(u_c(c'),\delta q'_p)}.$$

Owing to the *de facto* seniority assumption, it is difficult to dilute the multilateral debt. The sovereign is less likely to renege multilateral debt and when it does it has to repay in full what it defaulted on. Hence, q'_m remains relatively high due to the high recovery value, while q'_p can be pretty low. This means that in low productivity states, the price of private debt tomorrow, q'_p, can decrease relatively more when the prospective consumption is low. If this is the case, then the above ratio is greater than one as $\operatorname{cov}(u_c(c'),q'_p) \leq \operatorname{cov}(u_c(c'),q'_m) < 0$ and $\mathbb{E}_{z'|z}\left[q'_m\right] \geq \mathbb{E}_{z'|z}\left[q'_p\right]$. The private debt becomes therefore more attractive to the sovereign than the multilateral debt. The possibility to dilute private debt reduces the marginal cost of debt issuance as it dwindles the future debt burden.

The multilateral debt has the advantage generating a larger value at the issuance for the sovereign. However, it is less prone to dilution making it more costly to repay at the maturity. The balance between those two forces shapes the borrowing choice of the sovereign. Particularly, the optimal portfolio is determined such that the seniority benefit equates the subordination benefit.

This tradeoff closely relates to the one in Arellano and Ramanarayanan (2012) and Niepelt (2014), where the sovereign has to choose between short-term and long-term debts. The former debt instrument has to be repaid in the next period, while a fraction of the latter is rolled over. The price of long-term bonds therefore includes the prospective value of the debt rendering it more sensitive to the default risk. As a result, the short-term debt has beneficial effects on the incentive to repay – what the authors call incentive benefits, whereas the long-term debt provides an hedge against future low productivity shocks – what the authors call hedging benefits.[30] In my model, the tradeoff is similar but does not originate from the laddering of payments through time. Rather, it is entirely due to the *de facto* seniority assumption that protects multilateral lenders against defaults and incomplete repayments.

9 Calibration and Model Evaluation

This section presents the calibration of the model and evaluates the goodness of fit with respect to targeted moments, the empirical facts presented in Section 4 and other non-targeted moments.

9.1 Calibration and targeted moments

The model is solved using numerical methods presented in Appendix E and is calibrated in the following way. Some parameters are borrowed from the literature, some are estimated directly from the data and the remainders are selected to match some specific moments.

Argentina is the basis of calibration with a yearly frequency. Table 2 summarizes the main parameters of the model. The utility function takes the constant relative risk aversion (CRRA) form,

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma}$$

where the risk aversion parameter, σ, is set to the standard value of 2 adopted in the real business cycle literature. The risk-free rate is 4.2% to match the average real 10-year US Treasury bonds yield (Dvorkin et al., 2021).[31] Finally, the stochastic process follows a log-normal AR(1) process,

$$\log y_t = \rho \log y_{t-1} + \varepsilon_t \quad \text{with} \quad \varepsilon \sim N\left(0, \sigma_\varepsilon^2\right).$$

Following the estimation of Aguiar and Gopinath (2006) for Argentina, the persistence of the endowment shock ρ is set to 0.9 and the standard deviation σ_ε to 0.034. The stochastic process is discretized into a 8-state Markov chain following the approach of Tauchen (1986).

Following Chatterjee and Eyigungor (2012), I set $\kappa = 0.12$ to directly match the average coupon rate of Argentina. However, unlike those authors, I target the average maturity and therefore sets $\delta = 0.9$ while they target the median maturity. I subsequently select the value of the discount factor, β to match the average external debt-to-GDP ratio of Argentina. I

[30]See Aguiar et al. (2019) for a discussion on the tradeoff between short-term and long-term debt.

[31]Average 10-year US Treasury bond rate minus PCE inflation between 1980 and 2010.

Table 2: Parameters

Parameter	Value	Description	Targeted Moment	Target	Model
A. Based on Literature					
σ	2	Risk aversion			
B. Direct Measure from the Data					
r	0.042	Risk-free rate	Average 10-year US real Treasury yield		
δ	0.9	Reciprocal of average maturity	Average maturity structure		
κ	0.12	Coupon payments	Average coupon rate		
ρ	0.9	Output persistence	Argentina GDP		
σ_ϵ	0.034	Standard deviation			
C. Based on Model solution					
β	0.942	Discount factor	Debt-to-GDP ratio (%)	43.75	39.60
$\mathcal{A}$	-0.1	Multilateral borrowing limit	Multilateral-debt-to-GDP ratio (%)	5.50	6.17
ϕ	0.5	Bargaining power	Average SZ haircut (%)	37.20	40.52
ψ	0.882	General default cost	Average default duration (year)	3.60	3.52
$\varkappa^{DP}$	0.89	Initial *partial* default cost	Default rate (%)	2.50	2.66
$\varkappa^{DF}$	0.857	Initial *full* default cost	Share multilateral debt default (%)	21.51	24.97
α_1	0.0001	Portfolio adjustment cost	Average issuance costs (%)	1.10	0.17
α_2	30	Portfolio adjustment cost	Debt increase prior to default (percentage point)	15.00	18.69
ω	0.0095	Utility shock variance parameter	Standard deviation debt-to-GDP ratio	13.10	10.56
υ	0.1	Utility shock correlation parameter	Standard deviation duration	4.67	4.40

obtain $\beta = 0.942$ which is within the bounds admitted in the real business cycle and sovereign debt literature. In addition, the bargaining power is set so as to match the overall average SZ haircut. The value of 0.5 is slightly below the one of 0.51 chosen by Benjamin and Wright (2013) and the one of 0.55 chosen by Dvorkin et al. (2021). Note that the average haircut for defaults involving multilateral creditors (i.e. *full* defaults) is not targeted.

Regarding the private debt, defaults generate an endogenous limit to the sovereign's borrowing. However, such endogenous limit does not necessarily exist for the multilateral debt given the *de facto* seniority. There is therefore an exogenous limit $\mathcal{A}$ which is set to -0.1 to match the multilateral debt-to-GDP ratio of Argentina.

Similar to Dvorkin et al. (2021), I differentiate the default cost when entering and staying in default. That is when the sovereign enters *partial* default, its endowment is given by $y^{DP}(z) = \varkappa^{DP} y^D(z)$, while if it enters *full* default, it receives $y^{DF}(z) = \varkappa^{DF} y^D(z)$. Conversely, if the sovereign stays in default its endowment is given by $y^{DP}(z) = y^{DF}(z) = y^D(z)$, where

$$y^D(z) = \begin{cases} \bar{y}, & \text{if } y(z) \geq \bar{y} \\ y(z) & \text{if } y(z) < \bar{y} \end{cases} \quad \text{with } \bar{y} = \psi \mathbb{E}[y(z)]$$

The penalty cost is made of two components: ψ and $(\varkappa^{DF}, \varkappa^{DP})$. The former relates to the standard asymmetric cost of Arellano (2008). It directly impacts the length of default and is therefore not specific to the type of default as I target the overall average default duration. The initial default cost impacts the default rate. Hence, I consider $\varkappa^{DF} < \varkappa^{DP}$ to ensure that defaults on multilateral debt are infrequent. I calibrate $\varkappa^{DP}$ to match a 2.5% default rate (Tomz and Wright, 2007, 2013) and $\varkappa^{DF}$ to match the share of defaults on multilateral debt reported in Section 4.

Owing to the positive recovery value of debt, this model is subject to large increases in indebtedness and consumption boom prior to default. There are different ways of dealing with this problem. Hatchondo et al. (2016) impose a limit on the private bond spread, Dvorkin et al. (2021) set a transaction cost on portfolio adjustments and Fourakis (2021) adds a premium related to the default risk. To avoid to distort too much the tradeoff between private and multilateral debt and the choice between *partial* and *full* default, I also adopt a transaction cost. Similar to Dvorkin et al. (2021), the functional form is

$$\varpi(b_p^i, b_p^j, b_m^i, b_p^j) = \alpha_1 \exp\left(- \frac{\alpha_2(b_p^i + b_p^j)}{2}|b_p^i - b_p^j| - \frac{\alpha_2(b_m^i + b_m^j)}{2}|b_m^i - b_m^j| \right) - \alpha_1.$$

The parameter α_1 commands the intercept, while α_2 gives the slope of the transaction cost. The former is calibrated to match issuance cost of 1.1% and the latter to match the increase of the debt ratio prior to default.

Finally, I need to calibrate the variance and the correlation parameters of the utility shocks. I target the standard deviation of the debt-to-GDP ratio for the former and the standard deviation of the duration for the latter. I show below that with this calibration, the utility shocks do not significantly impact the default rate, haircuts, duration or the debt choices.

9.2 Facts and other non-targeted moments

In terms of non-targeted moments, I first assess how the model matches the newly established empirical facts. Table 3 displays the empirical facts and their model counterpart. Without directly targeting such moments, the model generates haircuts and durations that are in line with the empirical evidence and that for defaults involving multilateral creditors or not. The model nonetheless underestimates the average length and haircut of defaults implicating multilateral creditors. Finally, the multilateral lender lends with a spread very close to the one charged by the IMF and the IBRD.

I also gauge how the model matches non-targeted business cycles moments presented in Table 4. I find that it replicates moments related to consumption in an accurate way except maybe for the relative volatility which is below 1. For the trade balance, the model indicates a surplus as in the data. However, as other models with endogenous restructurings, it fails to generate countercyclical trade balance.

As shown in Table 5, the model cannot reproduce large spreads in terms of mean and

Table 3: Empirical Facts

	Data	Model
Default length (year) (with multilateral lenders)	7.30	5.15
Default length (year) (without multilateral lenders)	2.60	2.95
Private creditors' haircut (%) (with multilateral lenders)	56.10	51.85
Private creditors' haircut (%) (without multilateral lenders)	32.00	36.68
Share multilateral defaults (%)	21.50	24.97
Multilateral debt spread	0.56	0.44

volatility. Nevertheless, the maximum level of spread amounts 32% which is in-between the maximum observed in Argentina and emerging economies. The spread on multilateral debt is 0.44% which is more than three times smaller than the private one. The same holds true for the relative volatility which is around 0.30 for the private debt, but only amounts 0.06 for the multilateral debt. Hence, the multilateral lending rate remains closer to the risk-free rate than the private lending rate. This is due to the fact that the multilateral lender is always repaid in full and that the multilateral debt is subject to default to a lesser extent than private debt.

In comparison to previous studies, the present model matches relatively well moments related to emerging economies. Dvorkin et al. (2021) report an average spread of 1.01% overall and 1.37% in bad time. They also cannot generate a countercyclical trade balance. Calibrating a model with long-term bonds and exogenous restructuring to Argentina, Chatterjee and Eyigungor (2012) report an average spread of 8.15% with a standard deviations of 0.04.[32] Moreover, they obtain a correlation between consumption and output of 0.99 and a correlation between the trade balance (over output) and output of −0.44. Finally, they report a volatility of consumption relative to output of 1.11 and a volatility of the trade balance (over output) relative to output of 0.2. Hence, except for the countercyclical trade

[32] I do not compare my results in terms of business cycle moments with the ones of Arellano (2008) and Benjamin and Wright (2013) as they both use short-term bonds. See Asonuma and Joo (2020) for a comparison of models with endogenous and exogenous restructurings under short-term debt.

Table 4: Selected Business-Cycle Moments

	Mean(x)	Std(x)	Std(x)/Std(y)	Corr(x,y)
Consumption				
Model	97.9	0.02	0.89	0.93
Argentina	75.1	0.04	1.17	0.93
Trade Balance over GDP				
Model	2.1	0.01	0.37	0.48
Argentina	1.9	0.02	0.71	-0.53

Note: Consumption mean is with respect to output. Output, consumption, the trade balance and the spread are detrended with the Hodrick-Prescott filter. See Appendix B.

Table 5: Spreads

	Mean(x)	Max(x)	Min(x)	Std(x)	Std(x)/Std(y)
$r_p - r$					
Model	1.37	32.53	0.00	0.02	0.30
EMBI+ for Emerging Markets	4.72	12.36	1.62	2.49	0.81
EMBI+ for Argentina	13.78	66.39	2.10	16.66	5.41
$r_m - r$					
Model	0.44	7.90	0.00	0.01	0.06
IMF	0.76	4.28	-2.27	1.47	0.48
IBRD	0.37	2.33	-3.06	1.42	0.46

balance and the spread moments, my model generates statistics very close the aforementioned ones. Especially, Chatterjee and Eyigungor (2012) obtain a better fit for the spread for two reasons. First, they assume a recovery value of zero, while the present model generates substantial recovery values. Second, they use a quadratic default penalty function to match the volatility of spread, while I adopt the standard asymmetric penalty.

10 Quantitative Analysis

In this section, I first present the dynamic of default through an event analysis. I subsequently conduct counterfactual analyses with respect to the output penalty and the seniority structure. Finally, I discuss the sensitivity of the results with respect to the calibration of utility shocks.

10.1 Default dynamic

This subsection aims at explaining the dynamic of defaults in the model. For this purpose, I first compute the statistics of endowment and indebtedness close to default episodes. I subsequently conduct an event analysis in a window of five years before and after a default.

Table 6: Endowment and Debt Around Default

		Endowment (percent of mean y)	Private debt (percent of y)	Multilateral debt (percent of y)	Total debt (percent of y)
Partial default	Before	86.2	37.3	8.2	45.5
	During	86.1	60.6	0.5	61.1
	After	91.5	43.2	0.4	43.6
Full default	Before	90.7	56.7	7.4	64.2
	During	88.1	79.4	11.3	90.8
	After	97.5	61.5	0.0	61.5

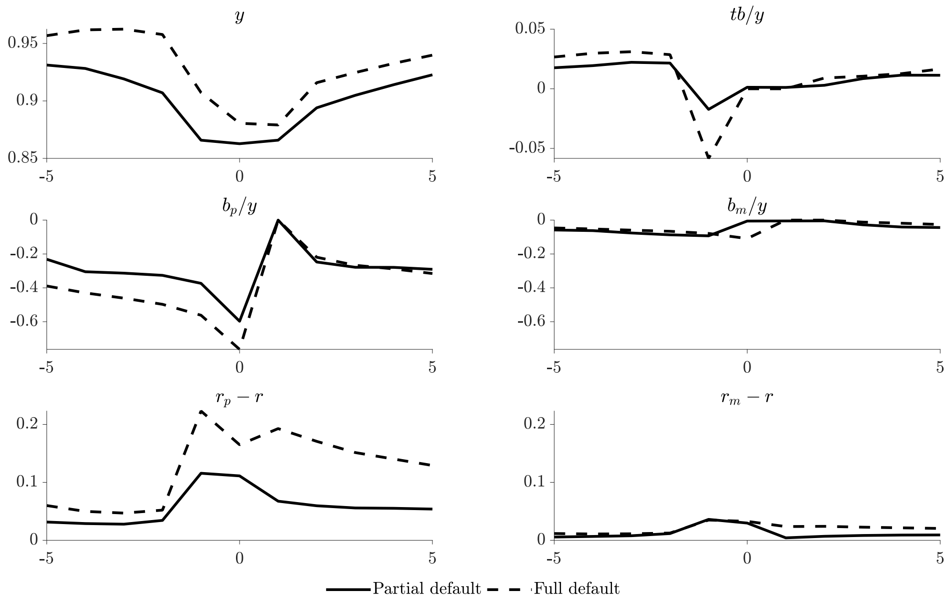
Note: Figures obtained by simulation over 5000 economies for 500 periods. The initial 100 periods are discarded. Average over simulated panel.

Table 6 depicts the main statistics of the model around defaults. The general dynamic is consistent with the empirical findings of Benjamin and Wright (2013). First, default's settlements usually arise when the sovereign's economic situation recovers. Most notably, defaults tend to start when the sovereign's GDP is below trend, whereas it usually ends when the sovereign's GDP settles back on the trend. Second, default's resolutions are not associated with a substantial reduction of indebtedness. This means that renegotiations do not achieve to reduce the debt burden. Third, the sovereign does not necessarily accumulate the same level of debt depending on the type of default. Particularly, *partial* defaults are associated with lower levels of debt than *full* defaults.

To construct the event analysis, I simulate 5000 economies for 500 periods. To make sure that the initial conditions do not matter, I discard the first 100 periods. I then identify the five periods preceding and succeeding a default and take the average over the simulated panel. I discriminate between *partial* and *full* defaults.

Figure 5 depicts the event analysis for some selected variables. Period 0 corresponds to the occurrence of default. The solid line relates to a *partial* default, while the dashed line corresponds to a *full* default. As one can clearly see, *full* defaults are precedented by a rapid output contraction and a greater accumulation of debt in general. Furthermore, the sovereign country records a trade balance reversal at time 0. In the years before a *full* default, the trade balance becomes negative and suddenly reverts with the default. Finally, the private bond spread experiences a sudden and very large increase shortly before the occurrence of default. The multilateral debt spread also reacts but in a negligible manner.

In opposition, *partial* defaults are related to a slower output contraction. Moreover, there is a relatively limited trade balance reversal in the vicinity of default. Besides this, one observes a reduction of multilateral indebtedness on the default path. Most of the indebtedness comes from the private sector. The private bond spread increase as the economy



Note: Simulation over 5000 economies for 500 periods. The initial 100 periods are discarded. Five-year window average over the simulated panel prior and after default.

Figure 5: Event Analysis

approaches default but far less than in the case of *full* default. Consistent with what has been said before, the multilateral debt spread remains relatively modest in comparison to the private debt one.

Hence, defaults on multilateral debt arise in the conjunctions of two factors: first, a sudden and sharp reduction in endowment and, second, a relatively large stock of outstanding debt. The combination of those two factors is necessary to make a *full* default attractive given the larger output penalty.

10.2 Output penalty and de jure seniority

This subsection analyses the role of the output penalty. In the calibration, I assumed that the output penalty differs between *partial* and *full* defaults only when entering default. I therefore consider two extreme cases. First, I equalize $\varkappa^{DF}$ and $\varkappa^{DP}$ to show that this only affects the share of *full* default and not directly the haircut and the duration of each type of default. Second, I set $\varkappa^{DF} = 0$ which, given the form of utility function, implies a *de jure* seniority on multilateral debt.

Table 7 depicts the moments related to the model with different output penalties alongside the benchmark model and the data moments. In the case of equal output penalty – i.e. $\varkappa^{DF} = \varkappa^{DP} = 0.857$, the share of multilateral debt default becomes 100% and the default rate diminishes. However, the default's length and the haircut remain on average close to the benchmark prediction. As seen in the previous subsection, *full* defaults are associated

Table 7: Alternative Settings

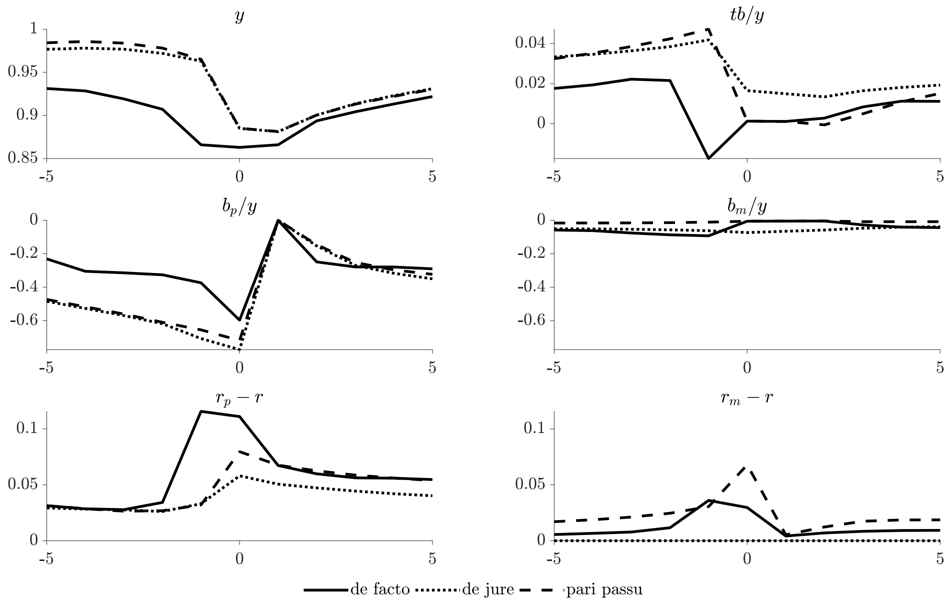
	Data	Benchmark	$\varkappa^{DF} = \varkappa^{DP}$	*de jure*	$\mathcal{A} = 0$	*pro rata*	Debt exchange	*pari passu*
Default length (year) (with multilateral lenders)	7.30	5.15	6.09	-	-	4.99	5.96	5.49
Default length (year) (without multilateral lenders)	2.60	2.95	-	5.93	5.31	3.08	5.94	5.82
Private creditors' haircut (%) (with multilateral lenders)	56.10	51.85	51.18	-	-	40.69	30.52	35.48
Private creditors' haircut (%) (without multilateral lenders)	37.20	36.68	-	25.10	30.68	31.75	27.27	24.64
Share multilateral defaults (%)	21.50	24.97	100.00	0.00	-	38.92	62.55	21.43
Default rate (%)	2.50	2.66	2.74	3.92	3.98	3.06	3.86	4.03
Total debt increase (percentage point) (prior to default)	15.00	18.69	29.57	9.78	13.77	16.99	10.92	10.98
Total debt to GDP (%)	43.75	39.60	45.57	69.83	56.09	41.22	67.50	59.50
Multilateral debt to GDP (%)	5.70	6.17	6.02	4.99	-	4.79	5.04	2.10
Private debt spread (%)	13.78	1.37	2.12	1.71	2.03	1.40	2.06	1.86
Multilateral debt spread (%)	0.56	0.44	0.53	0.00	-	1.38	0.79	1.72

with larger indebtedness. This explains the greater average debt ratio. Moreover, the private bond spread is larger as private debt is subordinated in *full* defaults. Nonetheless, despite the more frequent occurrence of *full* defaults, the multilateral debt spread remains stable. This is because multilateral debt always get repaid in full eventually.

The model with equal output penalty exaggerates the occurrence of *full* default compared to the data but does not directly affect the length and the duration of a *full* default. It therefore shows the role of such channel in generating the *de facto* seniority.

Turning to the case in which $\varkappa^{DF} = 0$, the multilateral debt becomes *de jure* senior. The model becomes similar to the one of Hatchondo et al. (2017) with the difference that the default's length and the haircut are endogenous. As one can see in Table 7, the default's duration becomes more pronounced, while the average haircut reduces relative to the benchmark case. Furthermore, the default rate, the private bond spread and the private debt ratio increase, while the average holdings of multilateral debt decreases.

What explains the larger duration and the lower haircut on average? As one can see in Figure 6, the sovereign accumulates more debt prior and at the occurrence of default compared to the benchmark. This mechanically produces longer *partial* default as the sovereign waits that the default risk reduces before restructuring. The lower average haircut is then



Note: Simulation over 5000 economies for 500 periods. The initial 100 periods are discarded. Five-year window average over the simulated panel prior and after default.

Figure 6: Event Analysis Partial Default

due to the fact that the sovereign restructures when the endowment is closer to the mean compared to the benchmark case. As explained in Section 6, longer duration goes together with lower haircut when the multilateral lender is not involved.

The fact that the default dynamic under *de jure* seniority is different blurs the direct comparison with the benchmark case in terms of average haircut and duration. That is why I compute those statistics at the average endowment in default and for similar levels of debt. Table 8 shows that under *de jure* seniority, haircut and duration are always lower than in the benchmark case. Moreover, the wedge with the benchmark model is more pronounced when multilateral debt is high.

10.3 Towards a pari-passu clause

In this subsection, I assess the goodness of introducing a *pari passu* clause between the multilateral and private lender. A *pari passu* agreement consists of two components. On the one hand, there is a proper debt exchange for the multilateral debt upon restructuring. On the other hand, the multilateral and private lenders make a common offer W which is split *pro rata*. That is the multilateral lender is not anymore repaid in full. To identify the impact of each of these two components, I consider them separately before joining them together.

To analyze the *pro rata* split, consider that the two types of lenders make a joint offer

Table 8: Duration and Haircut in Partial Default

	Private debt	Multilateral debt	Average duration (year)	Average haircut (%)
Partial default	High	High	5.8	46.8
(*de facto*)	High	Low	5.6	38.1
	Low	High	1.4	10.0
	Low	Low	1.4	9.5
Partial default	High	High	5.6	22.0
(*de jure*)	High	Low	5.4	22.2
	Low	High	1.4	9.0
	Low	Low	1.4	8.8
Partial default	High	High	5.5	31.6
(*pari passu*)	High	Low	5.5	25.6
	Low	High	1.4	9.7
	Low	Low	1.3	9.4

Note: Figures obtained by simulation over 5000 economies for 500 periods starting at the average endowment under default. Average over simulated panel. A high level of debt corresponds to the largest level of debt in the grid for both the private and the multilateral debt. A low level is three times less.

W. Formally, the value of a restructuring upon *full* default reads

$$V^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i) = \phi \Omega^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W_l^{RF}) + (1-\phi)\Omega^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W_b^{RF})$$

where the sovereign's offer is given by

$$W_b^{RF}(z, b_m^i, b_p^i) = -b_p^i q_p^{DF}(z, b_m^i, b_p^i) - b_m^i q_m^{DF}(z, b_m^i, b_p^i).$$

Conversely, the joint offer of the private and multilateral lender is

$$\begin{aligned} W_l^{RF}(z, b_m^i, b_p^i) = \arg\max \Big[& \mathbb{E}_{\boldsymbol{\epsilon}} A^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W) W \\ & + (1 - \mathbb{E}_{\boldsymbol{\epsilon}} A^{RF}(z, \boldsymbol{\epsilon}, b_m^i, b_p^i, W)) W_b^{RF}(z, b_m^i, b_p^i) \Big] \\ \text{s.t.} \quad W \leq -(b_p^i + b_m^i)\bar{q}. & \end{aligned}$$

Finally, the transfer upon restructuring is given by

$$\tau = q_m(z, b_m^j, b_p^j)(-b_m^j) - W \geq 0,$$

where the private lenders get a share $\frac{b_p^j}{b_p^j + b_m^j}$ of W upon restructuring and the multilateral lender the remaining part. Note that there is no multilateral debt exchange yet.

Table 7 presents the result of the *pro rata* split. A *full* default still lasts longer and record greater haircuts on average than a *partial* default. Thus, the *pro rata* split is not critical here. Despite similar debt ratio and default rate, one observes a greater share of *full* default and a larger multilateral debt spread compared to the benchmark case. Thus, the *pro rata* split does weaken the *de facto* seniority of multilateral lenders and the multilateral debt loses part of its seniority benefit. This shows that the full repayment of multilateral lending institutions is a prerequisite to safeguard lending at preferential rates.

Having shown the impact of relaxing the full repayment of multilateral lenders, I now consider that upon restructuring, there is a multilateral debt exchange entailing new money. Formally, one has that

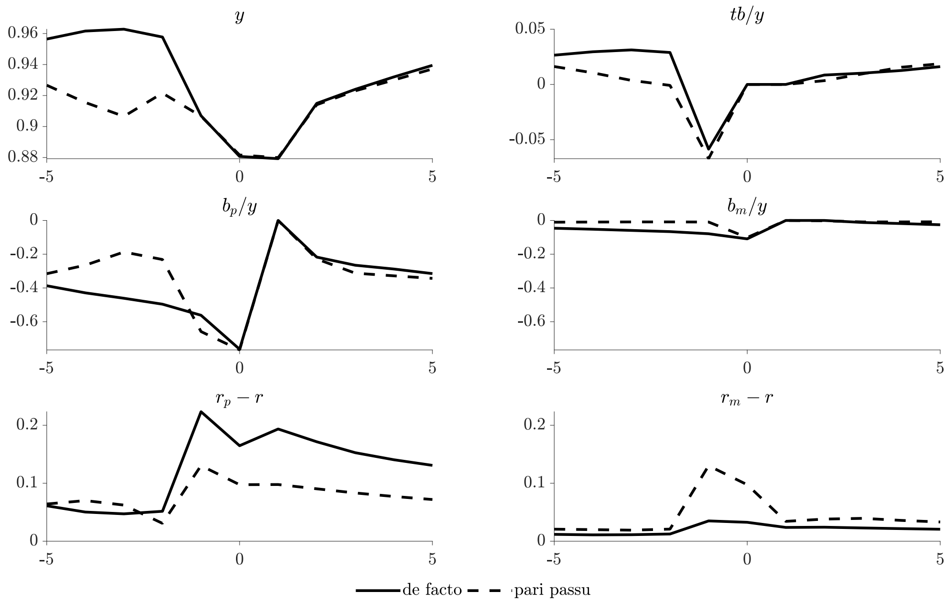
$$\begin{aligned} V^{EF}(z, \boldsymbol{\epsilon}, b_m^i, W - b_m^i \bar{q}) = \max_j \; & u(c) + \epsilon_j + \beta \mathbb{E}_{z'|z} \mathbb{E}_{\boldsymbol{\epsilon}'} V(z', \boldsymbol{\epsilon}', b_m^j, b_p^j) \\ \text{s.t.} \quad & c = y(z) + \tau, \\ & \tau = q_m(z, b_m^j, b_p^j)(-b_m^j) + q_p(z, b_m^j, b_p^j)(-b_p^j) - (W - b_m^i \bar{q}), \\ & \tau \geq 0. \end{aligned}$$

Thus, b_m^j is not anymore restricted to be zero. This means that the sovereign's value of restructuring is larger than in the benchmark case.

Table 7 presents the result of introducing a debt exchange upon restructuring. The multilateral lender is still repaid in full here – i.e. $-b_m^i \bar{q}$. A *full* default lasts on average 5 years similar to what the benchmark model predicts. However, the haircut is now around 31% on average instead of 51%. This is similar to the haircut under *partial* default which has a comparable average duration as a *full* default. The equalization of haircut and duration is due to the fact that the restructuring under *full* default is now isomorphic to the one under *partial* default.

Joining the debt exchange of multilateral debt together with the *pro rata* split, I obtain a *pari passu* clause between the two types of lenders.[33] As shown in Table 7, similar to the case of a simple multilateral debt exchange, the two types of default have analogous average haircut and duration. Moreover, similar to the case of a *pro rata* split, the multilateral debt spread largely increases and comes closer to the private one. Private and multilateral debt become therefore closer substitutes. In other words, the multilateral debt loses part of its seniority benefit. As a result, the sovereign accumulates more private and less multilateral debt than in the benchmark case. This exercise therefore shows the role of the no-lending-into

[33] In this case, the transfer upon restructuring is given by $\tau = q_m(z, b_m^j, b_p^j)(-b_m^j) + q_p(z, b_m^j, b_p^j)(-b_p^j) - W \geq 0$, where W is split *pro rata*.



Note: Simulation over 5000 economies for 500 periods. The initial 100 periods are discarded. Five-year window average over the simulated panel prior and after default.

Figure 7: Event Analysis Full Default

arrear policy in generating the *de facto* seniority.

Table 9: Duration and Haircut in Full Default

	Private debt	Multilateral debt	Average duration (year)	Average haircut (%)
full default	High	High	5.8	39.4
(*de facto*)	High	Low	5.6	35.8
	Low	High	5.6	9.9
	Low	Low	1.4	8.8
full default	High	High	5.5	30.6
(*pari passu*)	High	Low	5.5	26.6
	Low	High	1.4	9.2
	Low	Low	1.3	9.1

Note: Figures obtained by simulation over 5000 economies for 500 periods starting at the average endowment under default. Average over simulated panel. A high level of debt corresponds to the largest level of debt in the grid for both the private and the multilateral debt. A low level is three times less.

Similar to a *de jure* seniority, the larger duration of *partial* default is due to the larger debt accumulation as one can see in Figure 6. As shown in Figure 7, the length of a *full* default is close to the benchmark given that debt accumulation is very similar around such default. Conversely, the lower haircut in *full* default comes from the combination of the multilateral debt exchange with the *pro rata* split. These elements blur the direct comparison with the benchmark case in terms of average haircut and duration. Again, I compute those statistics at the average endowment in default and for similar level of debt. Tables 8 and 9 show that under a *pari passu* clause, haircut and duration are always lower than in the benchmark case. Moreover, the wedge with the benchmark model is more pronounced when multilateral debt is high.

In addition, the larger debt ratio, default rate and private debt spread observed in both a *de jure* seniority and a *pari passu* clause indicate that the *de facto* seniority forces the borrower to adopt a more rigorous debt management. In other words, it generates a credible threat capable of disciplining the accumulation of debt. Under a *de jure* seniority regime, the threat fades as the *full* default option does not exist anymore. Similarly, under a *pari passu* clause, the restructuring process under *full* default becomes isomorphic to the one under *partial* default.

10.4 No multilateral lender

In this subsection, I consider the benchmark model without multilateral lenders. That is, the sovereign has only access to private debt – i.e. $\mathcal{A} = 0$. This brings my analysis closer to the one of Benjamin and Wright (2013) and Dvorkin et al. (2021).

As one can see in Table 7, the model without the multilateral lender generates predictions very close to the case of *de jure* seniority in terms of haircut, default length, default rate and spread. However, it produces unrealistic default durations compared to the ones reported in Table 1. Hence, even though multilateral debt represents a small portion of the total debt and *full* defaults are infrequent, the presence of multilateral lenders directly affect the average haircut and duration. The coexistence of multilateral and private debt seem therefore a key element explaining the dynamic of emerging economies.

10.5 Welfare Analysis

In this subsection, I calculate the consumption-equivalent welfare gains with respect to the benchmark model for the sovereign. The exact computation of the welfare is exposed in Appendix F. I consider each of the above exercises one by one.

As shown in Table 10, an equal output penalty is associated with welfare losses in most states. This is because the sovereign does not have access to a "cheap" *partial* default in which it would get a lower output penalty. One observes a similar picture in the case of a *de jure* seniority. In low endowment states with a large level of debt, there are major welfare losses as the sovereign can only enter in *partial* default in which it continues to repay the multilateral lender. The debt service of multilateral debt directly increases the cost of default

Table 10: Welfare Gains Relative to Benchmark

Endowment state	Private debt	Multilateral debt	Welfare gains (%)					
			$\varkappa^{DF} = \varkappa^{DP}$	*de jure*	$\mathcal{A} = 0$	*pro rata*	Debt exchange	*pari passu*
z_{min}	High	High	0.00	-1.21	-	-0.13	-0.50	-0.23
	High	Zero	-0.28	-0.20	-0.07	-0.18	-0.22	-0.22
	Zero	High	0.07	0.05	-	-0.01	-0.06	-0.16
	Zero	Zero	0.05	0.06	-0.30	-0.07	-0.07	-0.21
z_{med}	High	High	-0.01	0.04	-	-0.09	-0.02	-0.09
	High	Zero	-0.01	0.17	-0.10	-0.11	0.08	-0.05
	Zero	High	-0.04	-0.04	-	-0.02	-0.09	-0.15
	Zero	Zero	-0.04	-0.03	-0.22	-0.02	-0.08	-0.14
z_{max}	High	High	-0.01	0.10	-	-0.01	0.04	0.01
	High	Zero	-0.01	0.07	-0.09	-0.02	0.01	-0.03
	Zero	High	-0.03	-0.02	-	-0.01	-0.05	-0.09
	Zero	Zero	-0.03	-0.02	-0.14	-0.01	-0.05	-0.09

Note: A high level of debt corresponds to the largest level of debt in the grid for both the private and the multilateral debt.

generating the welfare losses. There are some welfares gains when debt and endowment are high, though.

Regarding the *pari passu* clause, I find welfare losses in most states. Hence, as already argued by Hatchondo et al. (2017), the sovereign highly values the use of last-resort funds at near risk-free bonds. The *pari passu* clause weakens the seniority benefit of multilateral debt which is particularly valued in bad times when the default risk is high. The same holds true when I completely remove the multilateral lenders – i.e. $\mathcal{A} = 0$.

All in all, the *de facto* seniority seems to be beneficial for the sovereign. Except in a few states, the sovereign is better off than in a *de jure* or a *pari passu* regime. The former is certainly too strict and does not allow for full debt default, while the latter does not permit the multilateral debt to be a last-resort source of funding.

10.6 Sensitivity to utility shocks

The utility shocks ease the numerical computation of the model. In fact without such shocks, I cannot solve the model using standard value function iteration. It is possible to obtain some convergence under the refinement suggested by Chatterjee and Eyigungor (2012) but not for all specifications of the model.

Nevertheless, utility shocks are likely to affect the solution of the model. Especially, as shown by Dvorkin et al. (2021), they mainly affect the choices regarding debt and default. That is why I calibrated the variance parameter ω and the correlation parameter ν to the standard deviation debt-to-GDP ratio and the default duration, respectively.

Table 11: Sensitivity to ω and ν

	Baseline	$\omega \times 0.8$	$\omega \times 1.25$	$\nu \times 0.8$	$\nu \times 1.25$
Default length (year) (with multilateral lenders)	5.1	6.6	6.5	5.3	5.3
Default length (year) (without multilateral lenders)	3.0	2.9	3.8	4.5	3.1
Private creditors' haircut (%) (with multilateral lenders)	51.9	51.4	52.1	51.9	52.0
Private creditors' haircut (%) (without multilateral lenders)	36.7	33.9	32.2	30.3	34.9
Debt-to-GDP ratio (%)	39.6	40.4	37.8	43.1	40.5
Multilateral-debt-to-GDP ratio (%)	6.2	6.6	5.7	6.1	6.0
Default rate (%)	2.7	2.4	2.7	3.1	2.7
Debt increase prior to default (percentage point)	18.7	20.0	13.9	22.2	18.6
Standard deviation debt-to-GDP ratio	10.6	11.6	8.7	13.0	11.0
Standard deviation duration	4.4	5.5	5.4	6.1	4.8

As one can see in Table 11, changes in ω and ν affect the main moments of the model in a negligible manner. Most notably, the variance parameter seems to affect the default duration and the debt dynamic. Conversely, the correlation parameter affects the duration and the default dynamic.

11 Conclusion

This paper uncovers the implication of the *de facto* seniority of (official) multilateral lenders – i.e. essentially the IMF and the WB – in terms of defaults, borrowing and restructurings. I first present strong evidence that defaults implicating multilateral lenders are infrequent, last relatively longer and are associated with greater private haircuts. To address this, I augment the standard model of Eaton and Gersovitz (1981) with heterogenous creditors and endogenous renegotiations. To the best of my knowledge, I am the first to develop a dynamic model of this type.

I show that the presence of the multilateral debt has an important impact on the price of private debt. On the one hand, the multilateral debt drastically reduces the private debt's recovery value owing to its repayment priority upon default. On the other hand, it can increase the sovereign's willingness to repay by rendering a *partial* default on private debt more costly. The multilateral debt is therefore capable of reducing the default risk, while increasing the subordination risk of private liabilities.

The model quantitatively matches the empirical regularities relating to the default durations, the multilateral lending rate and private creditors' haircuts. A strict no-lending-into arrear policy in the spirit of the one adopted by the IMF and the WB explains most of the model's dynamic. Moreover, such policy ensures that multilateral creditors can lend at preferential rates. Better still, coupled with a greater output penalty, it generates a threat capable of enforcing greater fiscal discipline than other seniority regimes.

My analysis highlights the importance of the renegotiation process and the type of creditors involved. It focuses on multilateral lending institutions and abstracts from the Paris Club, which is a major player in the sovereign debt renegotiation game. Very few studies analyze this entity which does not properly enjoy a preferred creditor status but largely impacts the private haircuts and imposes a comparability of treatment among creditors. I leave this inquiry for future work.

References

Abbas, S. M., A. Nazim Belhocine, A. El-Ganainy, and M. Horton (2010): "A Historical Public Debt Database," *IMF Working Paper*.

Ábrahám, Á., E. Carceles-Poveda, Y. Liu, and R. Marimon (2019): "On the Optimal Design of a Financial Stability Fund," Working Paper 2018/105, ADEMU.

Aguiar, M. and M. Amador (2014): "Sovereign Debt," in *Handbook of International Economics*, ed. by G. Gopinath, E. Helpman, and K. Rogoff, North Holland, vol. 4, 647–687.

Aguiar, M., M. Amador, H. Hopenhayn, and I. Werning (2019): "Take the Short Route: Equilibrium Default and Debt Maturity," *Econometrica*, 87, 423–462.

Aguiar, M., S. Chatterjee, H. Cole, and Z. Stangebye (2016): "Quantitative Models of Sovereign Debt Crises," in *Handbook of Macroeconomics*, ed. by J. B. Taylor and H. Uhlig, North Holland, vol. 2, 1697–1755.

Aguiar, M. and G. Gopinath (2006): "Defaultable Debt, Interest Rates and the Current Account," *Journal of International Economics*, 69, 64–83.

Allen, M. (2008): "Staff Guidance Note on Debt Sustainability Analysis for Market Access Countries," *Prepared by the Policy Development and Review Department, International Monetary Fund*.

Arellano, C. (2008): "Default Risk and Income Fluctuations in Emerging Economies," *American Economic Review*, 98, 690–712.

Arellano, C., X. Mateos-Planas, and V. Rios-Rull (2019): "Partial Default," *NBER Working Paper*.

Arellano, C. and A. Ramanarayanan (2012): "Default and the Maturity Structure in Sovereign Bonds," *Journal of Political Economy*, 120, 187–232.

Ari, A., G. Corsetti, and L. Dedola (2018): "Debt Seniority and Sovereign Debt Crises," *IMF Working Paper*.

Asonuma, T. and H. Joo (2020): "Sovereign Debt Restructurings: Delays in Renegotiations and Risk Averse Creditors," *Journal of the European Economic Association*, 18, 1–47.

Asonuma, T., D. Niepelt, and R. Rancière (2023): "Sovereign Bond Prices, Haircuts and Maturity," *Journal of International Economics*, 140.

Asonuma, T. and C. Trebesch (2016): "Sovereign Debt Restructurings: Preemptive or Post-Default," *Journal of the European Economic Association*, 14, 175–214.

Ayres, J., G. Navarro, J. P. Nicolini, and P. Teles (2018): "Sovereign Default: The Role of Expectations," *Journal of Economic Theory*, 175, 803–812.

Babic, M. and E. Primorac (1986): "Some Causes of the Growth of the Yugoslav External Debt," *Soviet Studies*, 38, 69–88.

Bartusch, R. L. (1986): "Cuba: An Historical Appraisal of Its Foreign Debt and Soviet Economic Assistance," *Air Force Institute Of Technology*.

Beers, D. and J. Mavalwalla (2018): "The BoC-BoE Sovereign Default Database Revisited: What's New in 2018?" *Bank of Canada Staff Working Paper*.

Beers, D. T. and J. Chambers (2006): "Default Study: Sovereign Defaults At 26-Year Low, To Show Little Change In 2007," *Standard & Poor's CreditWeek*, 18.

Benjamin, D. and M. L. J. Wright (2013): "Recovery Before Redemption? A Theory of Delays in Sovereign Debt Renegotiations." Working Paper.

Bi, R. (2008): ""Beneficial" Delays in Debt Restructuring Negotiations," *IMF Working Papers*.

Bjørnskov, C. and M. Rode (2020): "Regime Types and Regime Change: A New Dataset on Democracy, Coups, and Political Institutions," *Review of International Organizations*, 15, 531–551.

Bolton, P. and O. Jeanne (2009): "Structuring and Restructuring Sovereign Debt: The Role of Seniority," *Review of Economic Studies*, 76, 879–902.

Boughton, J. (2012): *Tearing Down Walls: The International Monetary Fund 1990-1999*, Washington, DC.: International Monetary Fund.

Boz, E. (2011): "Sovereign Default, Private Sector Creditors, and the IFIs," *Journal of International Economics*, 83, 70–82.

Buchheit, L. C. and R. M. Lastra (2007): "Lending into Arrears – A Policy Adrift," *International Lawyer*, 41, 939–955.

Chatterjee, S. and B. Eyigungor (2012): "Maturity, Indebtedness, and Default Risk," *American Economic Review*, 102, 2674–2699.

——— (2015): "A Seniority Arrangement for Sovereign Debt," *American Economic Review*, 105, 3740–3765.

Cordella, T. and A. Powell (2021): "Preferred and Non-Preferred Creditors," *Journal of International Economics*, 132, 1–23.

Corsetti, G., B. Guimarães, and N. Roubini (2006): "International Lending of Last Resort and Moral Hazard: A Model of IMF's Catalytic Finance," *Journal of Monetary Economics*, 53, 441–471.

Cruces, J. and C. Trebesch (2013): "Sovereign Defaults: The Price of Haircuts," *American Economic Journal: Macroeconomics*, 5, 85–117.

Dell'Ariccia, G., I. Schnabel, and J. Zettelmeyer (2006): "How Do Official Bailouts Affect the Risk of Investing in Emerging Markets," *Journal of Money, Credit and Banking*, 38, 1689–1714.

Dellas, H. and D. Niepelt (2016): "Sovereign Debt with Heterogeneous Creditors," *Journal of International Economics*, 99, 16–26.

Díaz-Cassou, J., A. Erce, and J. Vázquez-Zamora (2008): "Recent Episodes of Sovereign Debt Restructurings. A Case-study Approach," *Banco de Espana Occasional Paper*.

Dovis, A. (2019): "Efficient Sovereign Default," *Review of Economic Studies*, 86, 282–312.

Dreher, A. and M. Gassebner (2012): "Do IMF and World Bank Programs Induce Government Crises? An Empirical Analysis," *International Organization*, 66, 329–358.

Dvorkin, M., J. Sánchez, H. Sapriza, and E. Yurdagul (2021): "Sovereign Debt Restructurings," *American Economic Journal: Macroeconomics*, 13, 26–77.

Eaton, J. and M. Gersovitz (1981): "Debt with Potential Repudiation: Theoretical and Empirical Analysis," *Review of Economic Studies*, 48, 289–309.

Erce, A. (2014): "Banking on Seniority: The IMF and the Sovereign's Creditors," *Federal Reserve Bank of Dallas Working Papers*.

Erce, A. and E. Mallucci (2018): "Selective Sovereign Defaults," *International Finance Discussion Papers*.

Erce, A. and D. Riera-Crichton (2015): "Catalytic IMF? A Gross Flows Approach," *ESM Working Paper Series*.

Finger, H. and M. Mecagni (2007): "Sovereign Debt Restructuring and Debt Sustainability: An Analysis of Recent Cross-Country Experience," *IMF Occasional Paper*.

Fink, F. and A. Scholl (2016): "A Quantitative Model of Sovereign Debt, Bailouts and Conditionality," *Journal of International Economics*, 98, 176–190.

Fischer, S. (1999): "On the Need for an International Lender of Last Resort," *Journal of Economic Perspectives*, 13, 85–104.

Fourakis, S. (2021): "Sovereign Default and Government Reputation," *University of Minnesota*.

Gehring, K. and V. F. Lang (2018): "Stigma or Cushion? IMF Programs and Sovereign Creditworthiness," *CESifo Working Paper Series*.

Gelpern, A. (2004): "Building a Better Seating Chart for Sovereign Restructurings," *Emory Law Journal*, 53, 1119–1161.

Gonçalves, C. E. and B. Guimaraes (2014): "Sovereign Default Risk and Commitment for Fiscal Adjustment," *Journal of International Economics*, 95, 68–82.

Górniewicz, G. (2018): "Polish External Debt," *Torun International Studies*, 11, 103–115.

Hatchondo, J. C. and L. Martinez (2009): "Long-duration Bonds and Sovereign Defaults," *Journal of International Economics*, 79, 117–125.

Hatchondo, J. C., L. Martinez, and Y. K. Onder (2017): "Non-defaultable Debt and Sovereign Risk," *Journal of International Economics*, 105, 217–229.

Hatchondo, J. C., L. Martinez, and H. Sapriza (2010): "Quantitative Properties of Sovereign Default Models: Solution Methods Matter," *Review of Economic dynamics*, 13, 919–933.

Hatchondo, J. C., L. Martinez, and C. Sosa-Padilla (2016): "Debt Dilution and Sovereign Default Risk," *Journal of Political Economy*, 124, 1383–1422.

Hinrichsen, S. (2019): "Tracing Iraqi Sovereign Debt Through Defaultsand Restructuring," *LSE Economic History Working Papers.*

International Bank for Reconstruction and Development (2021): "General Conditions for IBRD Financing: Program-for-Results Financing," *IBRD Policy.*

International Development Association (2007): "Further Elaboration of a Systematic Approach to Arrears Clearance," *Resource Mobilization Department.*

International Monetary Fund (1988): "Communique of the Interim Committee of the Board of Governors of the IMF," *IMF Press Release.*

——— (1989): *Selected Decisions of the International Monetary Fund*, vol. 14, Washington, D. C.: International Monetary Fund.

——— (1999): "IMF Policy on Lending into Arrears to Private Creditors," *Policy Development and Review and Legal Departments.*

——— (2015): "Reforming the Fund's Policy on Non-Toleration of Arrears to Official Creditors," *IMF Policy Papers.*

Jeanne, O. and J. Zettelmeyer (2001): "International Bailouts, Moral Hazard and Conditionality," *Economic Policy*, 16, 407–432.

Krahnke, T. (2020): "Doing More With Less: The Catalytic Function of IMF Lending and the Role of Program Size," *Deutsche Bundesbank Discussion Paper.*

Krueger, A. O. (2001): "International Financial Architecture for 2002: A New Approach to Sovereign Debt Restructuring," *Address given at the National Economists' Club Annual Members' Dinner, Washington, D.C.*

Lindert, P. H. and P. J. Morton (1989): "How Sovereign Debt Has Worked," in *Developing Country Debt and Economic Performance: The International Financial System*, ed. by J. Sachs, Chicago: University of Chicago Press, vol. 1.

Liu, Y., R. Marimon, and A. Wicht (2020): "Making Sovereign Debt Safe with a Financial Stability Fund," .

Martha, R. S. J. (1990): "Preferred Creditor Status under International Law: The Case of the International Monetary Fund," *International and Comparative Law Quarterly*, 39, 801–826.

Mendoza, E. and V. Z. Yue (2012): "A General Equilibrium Model of Sovereign Default and Business Cycle," *Quarterly Journal of Economics*, 127, 889–946.

Merlo, A. and C. Wilson (1995): "A Stochastic Model of Sequential Bargaining with Complete Information," *Econometrica*, 63, 371–399.

Mihalache, G. (2020): "Sovereign Default Resolution through Maturity Extension," *Journal of International Economics*, 125, 103–126.

Morris, S. and H. S. Shin (2006): "Catalytic Finance: When Does It Work?" *Journal of International Economics*, 70, 161–177.

Niepelt, D. (2014): "Debt Maturity Without Commitment," *Journal of Monetary Economics*, 68, 37–54.

Panizza, U., F. Sturzenegger, and J. Zettelmeyer (2009): "The Economics and Law of Sovereign Debt and Default," *Journal of Economic Literature*, 47, 651–698.

Pitchford, R. and M. L. J. Wright (2008): "Restructuring the Sovereign Debt Restructuring Mechanism," *Society for Economic Dynamics Meeting Papers*.

Raffer, K. (2009): "Preferred or Not Preferred: Thoughts on Priority Structures of Creditors." *Unpublished Document Prepared for Discussion at the 2nd Meeting of the ILA Sovereign Insolvency Study Group*.

Reinhart, C. and K. Rogoff (2009): *This Time is Different: Eight Centuries of Financial Folly*, Princeton: Princeton Univeristy Press.

Reinhart, C. M. and K. S. Rogoff (2004): "Serial Default and the "Paradox" of Rich-to-Poor Capital Flows," *American Economic Review*, 94, 53–58.

Reinhart, C. M. and C. Trebesch (2016): "The International Monetary Fund: 70 Years of Reinvention," *Journal of Economic Perspectives*, 30, 3–28.

Rieffel, L. (2003): *Restructuring Sovereign Debt: The Case for Ad Hoc Machinery*, Washington, D.C.: Brooking Institute Press.

Rochet, J.-C. and X. Vives (2010): "Coordination Failures and the Lender of Last Resort: Was Bagehot Right after All," *Journal of the European Economic Association*, 2, 1116–1147.

Roubini, N. and B. Setser (2003): "Seniority of Sovereign Debts," in *Bailouts or Bail-ins? Responding to Financial Crises in Emerging Economies*, Peterson Institute for International Economics, chap. 7, 249–287.

Rust, J. (1988): "Statistical Models of Discrete Choice Processes," *Transportation Research Part B: Methodological*, 22, 125–158.

Saravia, D. (2013): "Vulnerability, Crises and Debt Maturity: Do IMF Interventions Increase Reliance on Short-Term Debt?" *International Finance*, 16, 311–331.

Sarkees, M. R. and F. Wayman (2010): *Resort to War: 1816 - 2007*, Washington D.C.: CQ Press.

Schadler, S. (2014): "The IMF's Preferred Creditor Status: Does It Still Make Sense After the Euro Crisis," *CIGI Policy Brief.*

Schlegl, M., C. Trebesch, and M. L. J. Wright (2019): "The Seniority Structure of Sovereign Debt," *CESifo Working Paper Series.*

Schumacher, J., C. Trebesch, and H. Enderlein (2021): "Sovereign Defaults in Court," *Journal of International Economics*, 131, 1–45.

Standard & Poor's (2000): "Securitization in Latin America 2000," *Structured Finance.*

Sturzenegger, F. and J. Zettelmeyer (2008): "Haircuts: Estimating Investor Losses in Sovereign Debt Restructurings," *Journal of international Money and Finance*, 27, 780–805.

Tauchen, G. (1986): "Finite State Markov-Chain Approximations to Univariate and Vector Autoregressions," *Economic Letters*, 20, 177–181.

Tomz, M. and M. L. Wright (2013): "Empirical Research on Sovereign Debt and Default," *Annual Review of Economics*, 5, 247–272.

Tomz, M. and M. L. J. Wright (2007): "Do Countries Default in 'Bad Times'?" *Journal of the European Economic Association*, 5, 352–360.

Trebesch, C. (2008): "Delays in Sovereign Debt Restructurings: Should We Really Blame the Creditors?" *Proceedings of the German Development Economics Conference, Zurich.*

——— (2011): "Sovereign Default and Crisis Resolution," *Ph.D. dissertation, Free University Berlin.*

Yue, V. Z. (2010): "Sovereign Default and Debt Renegotiation," *Journal of International Economics*, 80, 176–187.

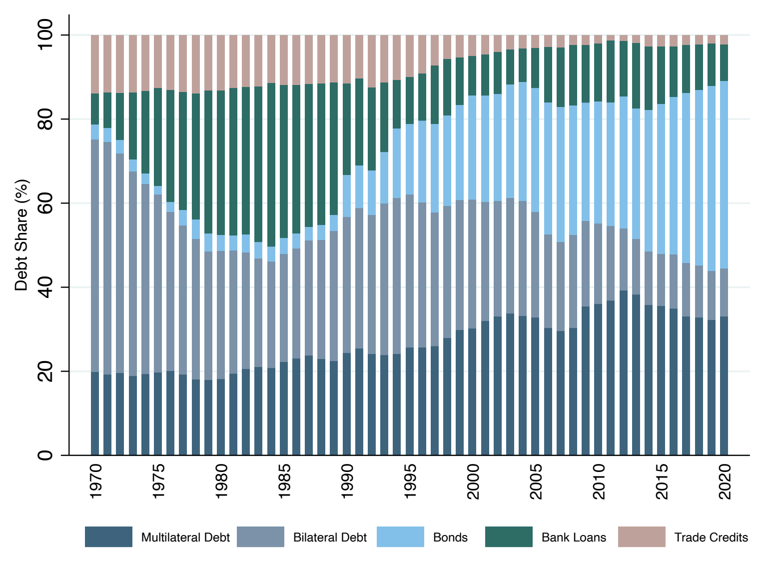
Zettelmeyer, J., C. Trebesch, and M. Gulati (2014): "The Greek Debt Restructuring: An Autopsy," *Economic Policy*, 28, 513–563.

Zwart, S. (2007): "The Mixed Blessing of IMF Intervention: Signalling Versus Liquidity Support," *Journal of Financial Stability*, 3, 149–174.

Appendix

A Additional Tables and Figures

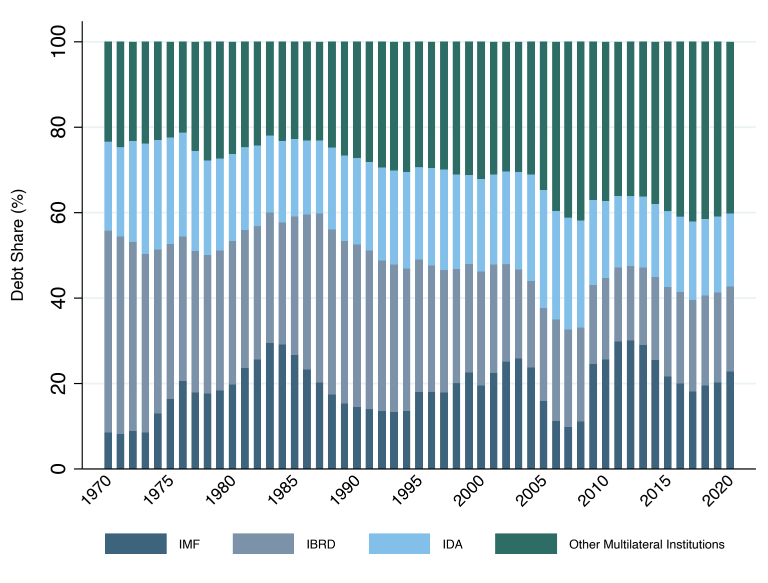
This section presents additional tables and figures. Figure A.1 presents the composition of the sovereign debt excluding advanced economies. One observes significant changes over the years. While in the 1970s, bilateral loans represented the biggest share of the pie, it is now the smallest with bank loans and trade credits. In opposition, bonds which were rare in the 1970s are now the largest part of the sovereign debt. The switch appeared in the 1990s after the numerous defaults on bank loans in Latin American and the emergence of Brady deals. The multilateral debt has always been important representing 20% of the total in the 1970s. It has followed a growing trend over the past decades and amounts now between 30% and 35% of the total sovereign debt.



Note: Multilateral debt refers to loans from official institutions such as the IMF, the IBRD, the IDA, the ESM, regional development bank and other intergovernmental agencies. Bilateral debt refers to loans from other sovereign governments. *Source*: Schlegl et al. (2019), WB, ESM, author's calculation.

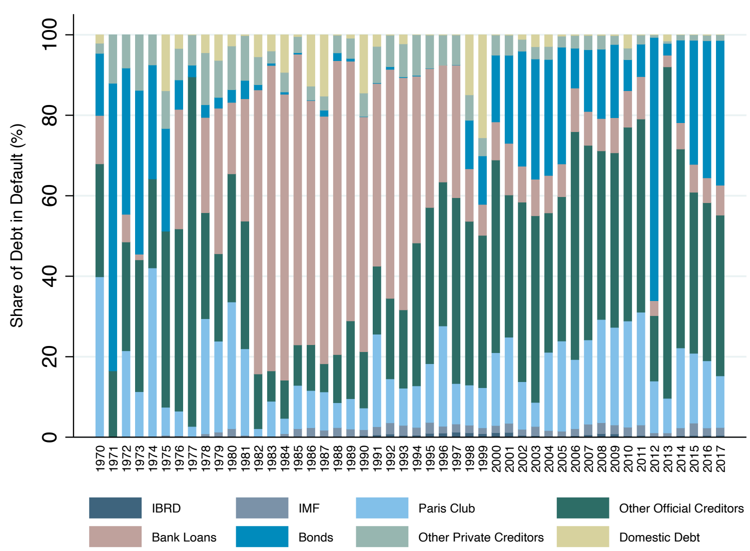
Figure A.1: Structure of Sovereign Debt

Figure A.2 presents the composition of the multilateral sovereign debt excluding advanced economies. Two main elements deserve to be noted. First, the share of debt held by the IMF and WB (i.e. IBRD and IDA) represents the majority of the total. Notably, one observes that the share of the IMF was the largest in the 1980s, while the WB has dominated the scene of multilateral lending until the beginning of the 21st century. For the IMF specifically, one sees a large drop of its share in the second half of the Great Moderation before rebounding with the Great Financial crisis of 2007-2008 (Reinhart and Trebesch, 2016).



Note: Other Multilateral Institutions refer to loans from regional development bank and other intergovernmental agencies different from the IMF, the IBRD, the IDA and the ESM.
Source: Schlegl et al. (2019), WB, ESM, author's calculation.

Figure A.2: Structure of Multilateral Sovereign Debt

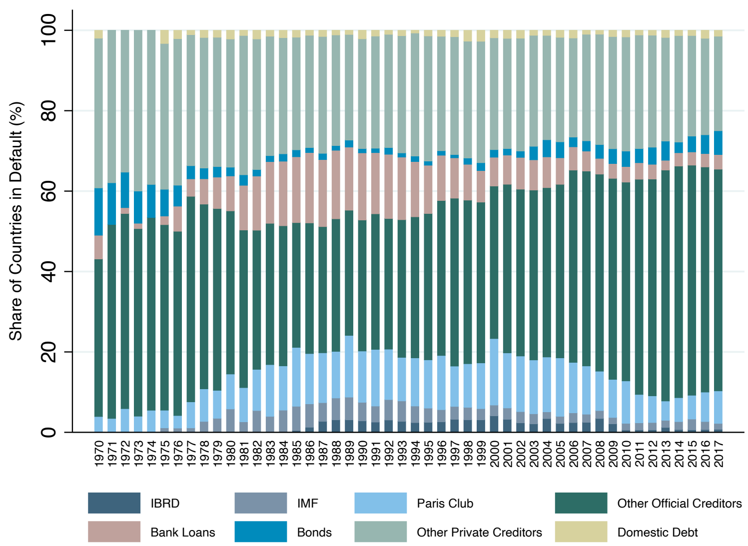


Source: Beers and Mavalwalla (2018), author's calculation.

Figure A.3: Debt in Default by Creditors

Figure A.3 presents the breakdown of debt in default by creditors. One directly sees that the IMF and the IBRD represent a negligible share throughout the entire sample. The two entities combined never represented more than 4% of the total amount of debt in default. This is however not the case for the Paris Club and the other official creditors which account for a large share of defaulted debt in the 1970s and in the last two decades depicted. Another large share of the pie goes to the private creditors especially in the 1980s through bank loans and in the 1990s-2000s through bonds.

Figure A.4 presents the breakdown of countries in default by creditors. As in the previous figure, I note very few countries in default on the IMF and the IBRD. The two institutions combined never accounted for more than 9% of the countries in default. In opposition, the Paris Club and the other official creditors are involved once more in a big part of the defaults. The same holds true for private creditors.



Source: Beers and Mavalwalla (2018), author's calculation.

Figure A.4: Countries in Default by Creditors

The left-hand side of Figure A.5 displays the private lender's optimal offer in the case of *partial*. The tradeoff is the following: the higher is W, the higher is the recovery value but the lower is the acceptance probability. For low levels of debt, the constraint $W \leq -\bar{q}b_p$ is binding and the private lenders ask for a full repayment. However, as the level of debt increases, the private lenders differentiate their offer by productivity states. Particularly, the optimal offer decreases with the level of output. This is because, for a given level of defaulted private debt, the acceptance probability increases in the level of endowment as the opportunity cost of remaining in autarky increases. Finally, for very large values of private debt, the requested recovery value flattens. This owes to the fact that for such levels of debt, the price sharply declines, lowering the value of a potential settlement.

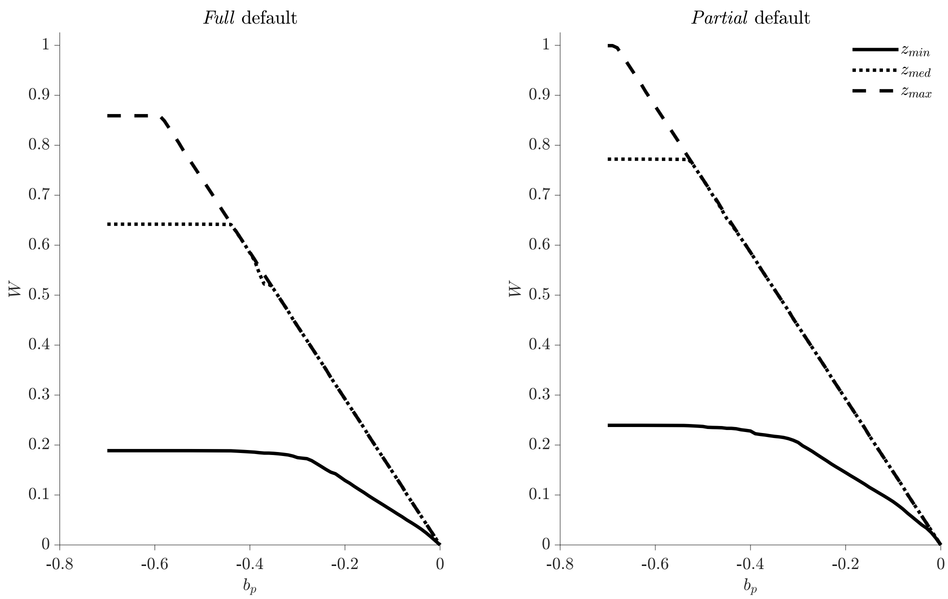


Figure A.5: Private Lender's Offer

The right-hand side of Figure A.5 depicts the private lenders' offer in the case of a *full* defaults. One clearly sees that the no-lending-into-arrear policy majorly impacts the lenders' offer. Focusing on the region with strictly positive haircuts, for a similar level of endowment and debt, the offered settlement under *full* default is always lower than under *partial* default.

B Data

This section presents the different sources of data used in the empirical analysis and for the calibration of the model. Generally, there are three main sources of data.

First, to find the duration of the default, I rely on the restructurings' dates contained in Asonuma and Trebesch (2016). A restructuring starts whenever a sovereign misses some payments beyond any contract-specified grace period, or if the sovereign undergoes renegotiations of the original debt contract.[34] Conversely, a restructuring ends with the official settlement announcement or the implementation of the debt exchange.[35]

Second, given the above default duration, I retrieve the creditors involved in each default by means of the database of Beers and Mavalwalla (2018). The dataset specifies 7 types of foreign creditors: IMF, IBRD, Paris Club, other official creditors, banks, bondholders and other private creditors.[36] The category other official creditors contains the IDA, bilateral

[34]This definition follows the one of Standard & Poor's (Beers and Chambers, 2006).

[35]This definition may differ from the one of Standard & Poor's which defines the end of a restructuring when a settlement occurs with no prospects of further resolutions (Beers and Chambers, 2006).

[36]The category other private creditors sometimes aggregate banks and bondholders together when separate data on those two types of creditors are not available.

trade credits, regional development banks and other intergovernmental agencies. I merge the IMF and the IBRD together under the label of multilateral creditors. Optimally, I would have liked to include the IDA to this category as this entity has *de facto* seniority like the IMF and the IBRD. Unfortunately, the IDA cannot be separated from other official creditors which do not all have a preferred creditor status. I therefore end up with 6 dummies: multilateral creditors, Paris Club, other official creditors, bank loans, bond and other private creditors. Table B.1 indicates the default episodes implicating multilateral lenders.

Finally, haircut statistics on private creditors are retrieved from Cruces and Trebesch (2013).[37] The database contains information about defaulted amounts and haircuts of defaults on external private debt from 1970 to 2014. I use two specifications of the haircut. The first one is the market haircut and is the one used by many financial institutions such as credit rating agencies as well as official lenders. The second one is computed according to Sturzenegger and Zettelmeyer (2008) and is becoming the standard in the empirical literature on sovereign defaults. The haircuts account for private creditors (i.e. bondholders and banks) and disregard official creditors (e.g. the IMF, the WB, the Paris Club).

With the above data, I obtain a dataset containing the start and the end date of each default in months with the underlying haircut on private creditors and that for a total 186 default episodes between 1970 and 2014. Furthermore, for each default episode, I identify which types of creditor is involved. I find that overall 40 default episodes implicate multilateral creditors. Table B.1 depicts the sample used in the analysis.

I complement my datasets with other data presented in Table B.2. First, I use UN data for national accounting statistics. For many of the countries covered in my analysis the default's start coincides with a major political revolution (e.g. Yemen), a civil war (e.g. Liberia and Ethiopia), an independence or a dismantlement (e.g. former Yugoslavia). The UN keeps track record of the different political entities and their evolution. Hence, compared to the WB's WDI data it is possible to obtain data on former political entities.

Second, statistics on the countries' external debt comes mainly from the WB's WDI and IDS. The WB provides a breakdown of debt by creditor types: multilateral, bilateral and private. However, the time and geographic coverage is imperfect. Regarding private debt, complementing the dataset with the IMF's historical public debt database of Abbas et al. (2010) does not fill all the missing values. Hence, I do not integrate such variable in the regression analysis. Regarding multilateral debt, I retrieve the level IMF debt by means of the "use of IMF credit". The WB debt is simply formed by the sum of IBRD loans and IDA

[37] I use the database updated in 2014. In addition to revised computations, the update contains new default cases. Those are Belize, Cote d'Ivoire, Greece, St. Kitts and Nevis, Liberia, Mozambique, Nicaragua, the Republic of Congo and Peru. The haircut of Greece follows the estimation of Zettelmeyer et al. (2014).

credits. Missing values are filled by the joint BIS-IMF-OECD-WB Statistics and newspaper articles from the New York Times archives.[38]

Table B.1: Sample

Country	Default's start	Default's end	Duration	SZ haircut	Multilateral creditors involved	Country	Default's start	Default's end	Duration	SZ haircut	Multilateral creditors involved
Albania	01/11/91	31/08/95	3.8	80.4	No	Mexico	01/08/87	01/03/88	0.7	56.3	No
Argentina	01/07/82	27/08/85	3.2	30.3	No	Mexico	01/12/88	04/02/90	1.3	30.5	No
Argentina	01/08/85	21/08/87	2.1	21.7	No	Macedonia	01/05/92	26/03/97	4.9	34.6	Yes
Argentina	01/01/88	07/04/93	5.3	32.5	No	Mozambique	01/06/83	27/12/91	8.6	90.0	No
Argentina	01/11/01	10/06/05	3.7	76.8	Yes	Mozambique	01/03/93	01/09/07	14.6	91.0	No
Bulgaria	01/03/90	29/06/94	4.3	56.3	No	Mauritania	01/06/92	01/08/96	4.3	90.0	No
Bosnia and Herzegovina	01/06/92	09/12/97	5.6	89.6	Yes	Malawi	12/07/82	06/03/83	0.8	28.5	No
Belize	02/08/06	20/02/07	0.6	23.7	No	Malawi	01/08/87	04/10/88	1.3	39.2	No
Belize	31/08/12	01/02/13	0.6	31.5	No	Niger	01/06/83	09/03/84	0.8	37.4	No
Bolivia	01/09/80	17/03/88	7.6	92.7	Yes	Niger	01/06/84	01/04/86	1.9	45.8	No
Bolivia	01/04/88	01/04/93	5.1	76.5	Yes	Niger	01/06/86	08/03/91	4.8	82.0	No
Brazil	01/12/82	25/02/83	0.3	-9.8	No	Nigeria	01/08/82	01/07/83	1.0	1.2	No
Brazil	01/01/83	27/01/84	1.1	1.7	No	Nigeria	01/08/82	01/09/83	1.2	2.1	No
Brazil	01/06/84	05/09/86	2.3	19.2	No	Nigeria	01/10/83	01/04/84	0.6	-2.8	No
Brazil	01/09/86	11/11/88	2.3	18.4	No	Nigeria	01/01/86	23/11/87	1.9	19.3	No
Brazil	01/06/89	20/11/92	3.5	27.0	No	Nigeria	01/10/87	01/01/88	0.3	41.5	No
Brazil	01/06/89	15/04/94	4.9	29.3	No	Nigeria	01/03/88	01/06/89	1.3	30.1	No
Chile	01/01/83	01/11/83	0.9	0.7	No	Nigeria	01/06/89	20/12/91	2.6	40.1	No
Chile	01/01/83	25/01/84	1.1	8.4	No	Nicaragua	01/09/78	01/12/80	2.3	26.1	No
Chile	01/08/84	14/04/86	1.8	31.7	No	Nicaragua	01/01/81	01/12/81	1.0	48.5	No
Chile	01/10/86	17/06/87	0.8	14.3	No	Nicaragua	01/01/82	01/03/82	0.3	56.3	No
Chile	01/04/90	12/12/90	0.8	17.0	No	Nicaragua	01/03/83	01/02/84	1.0	41.7	Yes
Cote d'Ivoire	01/06/83	01/03/98	14.8	62.8	No	Nicaragua	01/04/85	01/11/95	10.7	92.0	Yes
Cote d'Ivoire	01/03/00	16/04/10	10.2	55.2	Yes	Pakistan	01/07/98	12/12/99	1.5	11.6	No
Cote d'Ivoire	01/08/10	01/10/12	2.3	6.1	No	Pakistan	30/01/99	13/12/99	1.0	15.0	No
Cameroon	01/06/85	01/08/03	18.3	85.5	No	Panama	01/11/84	01/10/85	1.0	12.0	No
Congo, Dem. Rep. (Zaire)	01/06/75	12/04/80	4.9	29.6	Yes	Panama	01/03/87	01/08/94	7.5	15.1	Yes
Congo, Dem. Rep. (Zaire)	01/04/82	29/01/83	0.8	38.2	Yes	Panama	01/03/87	17/04/96	9.2	34.9	Yes
Congo, Dem. Rep. (Zaire)	01/02/83	01/06/84	1.4	30.1	Yes	Peru	01/03/76	01/12/78	2.8	-7.2	No
Congo, Dem. Rep. (Zaire)	01/09/84	01/05/85	0.8	37.0	Yes	Peru	01/09/79	01/01/80	0.4	-4.6	No
Congo, Dem. Rep. (Zaire)	01/06/85	01/05/86	1.0	35.4	Yes	Peru	01/03/83	01/07/83	0.4	6.3	No
Congo, Dem. Rep. (Zaire)	01/06/86	20/05/87	1.0	26.8	Yes	Peru	01/06/84	07/03/97	12.8	63.9	Yes
Congo, Dem. Rep. (Zaire)	01/06/87	01/06/89	2.1	50.6	Yes	Philippines	01/10/83	01/04/86	2.6	42.6	No
Congo, Rep.	01/06/83	27/02/88	4.8	42.3	No	Philippines	01/09/86	01/12/87	1.3	15.4	No
Congo, Rep.	01/03/88	14/12/07	19.8	90.8	Yes	Philippines	01/07/88	01/02/90	1.7	42.8	No
Costa Rica	15/07/81	10/09/83	2.3	39.4	No	Philippines	01/07/90	01/12/92	2.5	25.4	No
Costa Rica	01/10/84	27/05/85	0.7	35.6	No	Poland	01/01/82	04/11/82	0.9	62.9	No
Costa Rica	01/05/86	21/05/90	4.1	71.9	No	Poland	01/03/81	06/04/82	1.2	40.6	No
Cuba	01/09/83	30/12/83	0.3	42.9	No	Poland	01/12/82	04/11/83	1.0	52.5	No
Cuba	01/01/84	24/12/84	1.0	44.2	No	Poland	01/12/83	13/07/84	0.7	26.9	No
Cuba	01/01/85	19/09/85	0.8	49.5	No	Poland	01/01/86	01/09/86	0.8	37.5	No
Dominica	01/07/03	15/06/04	1.0	54.0	No	Poland	01/10/86	20/07/88	1.8	24.4	No
Dominican Republic	01/06/82	24/02/86	3.8	49.9	No	Poland	01/08/88	01/07/89	1.0	12.0	No
Dominican Republic	01/06/87	30/08/94	7.3	50.5	No	Poland	01/10/89	27/10/94	5.1	49.0	No
Dominican Republic	01/04/04	11/05/05	1.2	4.7	No	Paraguay	01/01/86	01/07/93	7.6	29.2	No
Dominican Republic	01/08/04	18/10/05	1.3	11.3	No	Romania	01/09/81	07/12/82	1.3	32.9	Yes
Algeria	01/10/90	01/03/92	1.5	8.7	No	Romania	01/01/83	20/06/83	0.5	31.7	Yes
Algeria	01/12/93	17/07/96	2.7	23.5	No	Romania	01/06/86	01/09/86	0.3	12.3	Yes
Ecuador	08/10/82	14/10/83	1.1	6.3	No	Russian Federation	01/08/91	01/12/97	6.4	26.2	No
Ecuador	01/12/83	09/08/84	0.8	5.7	No	Russian Federation	17/08/98	07/05/99	0.8	46.0	No
Ecuador	01/08/84	11/12/85	1.4	15.4	No	Russian Federation	20/04/99	03/02/00	0.9	51.5	No
Ecuador	01/08/86	28/02/95	8.6	42.2	No	Russian Federation	20/11/98	25/08/00	1.8	50.8	No
Ecuador	28/01/99	23/08/00	1.7	38.3	No	Sudan	01/06/75	01/10/85	10.4	54.6	Yes
Ecuador	14/11/08	03/06/09	0.7	67.7	No	Senegal	01/05/81	01/02/84	2.8	28.8	No
Ethiopia	01/06/90	16/01/96	5.7	92.0	No	Senegal	01/01/85	07/05/85	0.4	31.3	No
Gabon	15/09/86	01/12/87	1.3	7.9	No	Senegal	01/06/90	28/09/90	0.3	35.7	No
Gabon	01/06/89	16/05/94	5.0	16.2	No	Senegal	01/06/92	18/12/96	4.6	92.0	No
Guinea	01/06/85	20/04/88	2.9	26.1	No	Sierra Leone	01/06/80	01/08/95	15.3	88.6	Yes
Guinea	01/06/91	01/12/98	7.6	87.0	No	Serbia	01/06/92	22/07/04	12.2	70.9	Yes
Gambia	01/06/84	15/02/88	3.8	49.3	Yes	São Tomé and Príncipe	01/06/84	01/08/94	10.3	90.0	No
Greece	01/07/11	01/03/12	0.8	64.6	No	Slovenia	01/06/92	12/03/96	3.8	3.3	No
Grenada	01/10/04	16/11/05	1.2	33.9	No	Seychelles	01/07/08	11/02/10	1.7	56.2	No
Guyana	01/03/82	24/11/92	10.8	89.2	Yes	Togo	01/01/87	01/05/88	1.4	46.0	No
Guyana	01/01/93	01/12/99	7.0	91.0	Yes	Togo	01/06/91	01/12/97	6.6	92.3	No
Honduras	01/06/81	01/10/89	8.4	73.2	Yes	Trinidad and Tobago	01/09/88	20/12/89	1.3	15.5	No
Honduras	01/01/90	01/08/01	11.7	82.0	Yes	Turkey	01/12/76	01/06/79	2.6	22.2	No
Croatia	01/06/92	31/07/96	4.2	11.0	No	Turkey	02/12/76	22/08/79	2.8	19.5	No
Iraq	01/09/86	01/01/06	19.4	89.4	Yes	Turkey	01/01/81	01/08/81	0.7	8.6	No
Jamaica	01/06/77	01/09/78	1.3	2.2	No	Turkey	01/01/81	13/03/82	1.3	17.0	No
Jamaica	01/09/78	01/04/79	0.7	3.5	No	Tanzania	01/06/81	01/01/04	22.7	88.0	Yes
Jamaica	01/03/80	20/06/81	1.3	15.2	Yes	Uganda	01/06/79	26/02/93	13.8	88.0	No
Jamaica	01/06/83	01/06/84	1.1	18.1	Yes	Ukraine	12/08/98	21/09/98	0.2	11.8	No
Jamaica	01/07/84	01/09/85	1.3	31.7	Yes	Ukraine	12/08/98	20/10/98	0.3	14.7	No
Jamaica	01/09/86	07/05/87	0.8	32.8	Yes	Ukraine	18/05/99	20/08/99	0.3	-8.3	No
Jamaica	01/01/90	26/06/90	0.5	44.0	Yes	Ukraine	10/01/00	07/04/00	0.3	18.0	No
Jordan	01/02/89	23/12/93	4.9	54.6	No	Uruguay	01/01/83	29/07/83	0.6	0.7	No
Kenya	01/01/92	02/06/98	6.5	45.7	No	Uruguay	01/04/85	10/07/86	1.3	24.3	No
St. Kitts and Nevis	01/06/11	01/02/12	0.8	62.9	No	Uruguay	01/05/87	04/03/88	0.9	20.3	No
Liberia	01/11/80	01/12/82	2.2	35.7	No	Uruguay	01/07/89	31/01/91	1.6	26.3	No
Liberia	01/12/81	01/04/09	27.4	97.0	Yes	Uruguay	11/03/03	29/05/03	0.3	9.8	No
Morocco	25/08/83	01/02/86	2.6	23.5	No	Venezuela	01/03/83	27/02/86	3.0	9.9	No
Morocco	22/10/85	23/09/87	2.0	21.3	No	Venezuela	24/04/86	18/09/87	1.5	4.3	No
Morocco	01/02/89	01/09/90	1.7	40.3	No	Venezuela	12/01/89	05/12/90	2.0	36.7	No
Moldova	12/06/02	29/10/02	0.4	36.9	No	Vietnam	01/06/82	05/12/97	15.6	52.0	Yes
Moldova	01/06/01	17/06/04	3.1	56.3	No	Yemen	01/06/83	01/02/01	17.8	97.0	No
Madagascar	01/01/81	01/11/81	0.9	19.0	No	Yugoslavia	01/01/83	09/09/83	0.8	6.5	No
Madagascar	01/01/82	25/10/84	2.8	41.3	No	Yugoslavia	01/09/83	16/05/84	0.8	-7.5	No
Madagascar	01/01/85	15/06/87	2.5	13.7	No	Yugoslavia	01/06/84	18/12/85	1.6	14.5	No
Madagascar	01/06/87	10/04/90	2.9	52.7	No	Yugoslavia	01/07/87	21/09/88	1.3	19.7	No
Mexico	01/08/82	27/08/83	1.1	-0.2	No	South Africa	01/09/85	24/03/87	1.6	8.5	No
Mexico	01/05/84	29/08/85	1.3	5.4	No	South Africa	01/06/89	18/10/89	0.4	12.7	No
Mexico	01/05/84	29/03/85	0.9	2.2	No	South Africa	01/01/92	27/09/93	1.8	22.0	No
Mexico	02/09/86	01/03/87	0.6	18.1	No	Zambia	07/01/83	14/09/94	11.8	89.0	Yes

As the focus of the analysis is the IMF and the WB, it is important to account for their respective programs and projects financing in the sample countries. For this purpose, I

[38]Multilateral debt in newspaper articles are for the following countries: Cuba (1983-1985), Iraq (1986-2006), Poland (1981-1994) and all the former republics of Yugoslavia (1983-1988 and 1992-1997).

extend the dataset of Dreher and Gassebner (2012) by means on the IMF MONA database and the WB Projects & Operations listing.[39] The two aforementioned authors propose three variables. The first one is a dummy taking value one if the sovereign is under a IMF's Structural Adjustment Facility (SAF) or Poverty Reduction and Growth Facility (PRGF) program for at least five months. The second variable is also a dummy taking value one if the sovereign is under a IMF's Stand-by Agreement (SBA) program for at least five months. I merge those two dummies together under the label of IMF program. Finally, the two authors propose a variables counting the number of WB's loans given for structural adjustment in effect for at least five months. I label this variable as WB adjustment loan.

Table B.2: Data Source

Item	Details	Source	Missing values	Comments
National accounts	Nominal GDP (USD) Real GDP (2015 USD) Real GDP per capita (2015 USD) Real consumption (2015 USD) Real exports of goods and services (2015 USD) Real imports of goods and services (2015 USD)	UN		Consistent with PWT and World Bank data
Debt	External debt stock (current USD) PPG, commercial banks (current USD) PPG, bonds (current USD) PPG, other private creditors (current USD) PPG, IBRD (current USD) PPG, bilateral (current USD) PPG, multilateral (current USD) IBRD loans and IDA credits Use of IMF credit (current USD)	World Bank	Chile, Croatia, Cuba, Greece, Iraq, Panama, Poland, Seychelles, Slovenia, St. Kitts and Nevis, Trinidad and Tobago, Uruguay, Yugoslavia.	Missing only for PPG debt
	External debt stock (% of GDP) IMF Loans (current USD) Multilateral Loans (current USD) Multilateral debt	Abbas et al. (2010) Joint BIS, IMF, OECD and World Bank Joint BIS, IMF, OECD and World Bank New York Times Archives		Covers some missing World Bank data Covers IMF debt missing data Covers multilateral debt missing data Covers remaining missing data
EMBI+ spread		World Bank, Global Financial Data	Albania, Bolivia, Bosnia and Herzegovina, Cameroon, Congo Rep., Congo Dem. Rep., Cuba, Dominica, Ethiopia, Yugoslavia, Gambia, Grenada, Guinea, Guyana, Honduras Kenya, Liberia, Madagascar, Malawi, Mauritania, Mozambique, Nicaragua, Niger Paraguay, Moldova, North Macedonia, Romania, Saint Kitts and Nevis, Sao Tome and Principe, Serbia, Seychelles, Sierra Leone, Slovenia, Sudan Togo, Uganda, Tanzania, Yemen.	Only available from 1997 to 2014
IBRD lending rate		World Bank		Average across sample, when no rate available take 5-year Libor plus 1.5 spread
IDA service charge		World Bank		
IMF adjusted rate of charge		IMF		
Yield on 1-year US government bond	Real Yield curve rate	US Treasury		Only available from 1990
10-year US Treasury rate	10-year US Treasury constant maturity rate	Federal Reserve Bank of St. Louis		
US PCE inflation rate	Personal Consumption Expenditures inflation rate	Federal Reserve Bank of St. Louis		
Federal Funds rate		Federal Reserve Bank of St. Louis		
Haircut, private creditors	Preferred haircut (Sturzenegger and Zettelmeyer, 2008) Market haircut	Cruces and Trebesch (2013)		With 2014 update
Creditors involved	Default by creditor groups	Beers and Mavalwalla (2018)		
IMF program World Bank adjustment loan	IMF's SAF, PRGF or SBA program in effect for at least 5 months World Bank's adjustement loans in effect for at least 5 months	Dreher and Gassebner (2012)		Extended to 2014 using IMF MONA database and World Bank Projects & Operations
Default duration	Default's start and end date (month and year)	Asonuma and Trebesch (2016) Beers and Chambers (2006)		 Definition of Standard & Poor's
War	Inter-state wars Intra-state wars	Sarkees and Wayman (2010)		Dummy variables
Political Regime	Regime type (communist, dictatorship) Regime change (election, postponed election, coup)	Bjørnskov and Rode (2020)		Dummy variables

Regarding the IMF's and WB's charged interest rate, I retrieve the IMF adjusted rate of charge and the IDA service charge directly from the IMF and the WB. For the IBRD lending rate, I gather the historical data on IBRD Statement Of Loans. I take the average rate over the entire set of loans. For loans which do not report interest rates, I take the

[39] Link to the WB Projects & Operations listing is available here.

5-year Libor rate to which I add the standard front-end fee of 0.25%, the commitment fee of 0.25%, the contractual spread of 0.50% and the excess borrowing charge of 0.50%. Spreads are calculated as the rate charged minus 1-year US government bonds yield.

To control for the political situation of each sovereign I add two main sources of data. First, I use the database of Bjørnskov and Rode (2020) who propose a set of dummies to account for the type of and the change in political regimes. I would have liked to have a single variable controlling for the political risk. Unfortunately, the variables developed by Political Risk Services Group – which is the standard in the empirical literature and has the most comprehensive coverage – only starts in 1984 and does not cover all the countries in my sample. Finally I obtain dummies for the irruption of inter- and intra-state wars using the database of Sarkees and Wayman (2010).

C Regression Analysis

This section assesses the robustness of the empirical facts presented in Section 4. While Fact I and IV can be directly imputed to the multilateral creditors, Facts II and III might be associated to different factors.[40]

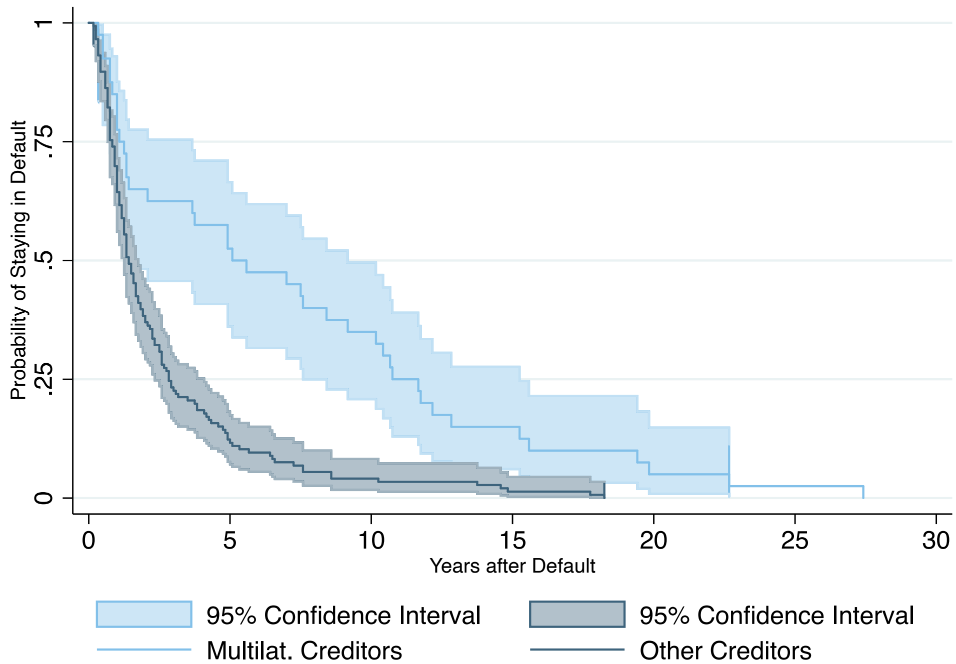
I start with Fact II and analyze the probability of remaining in default when defaulting on multilateral creditors. For this purpose, I conduct three analytical exercises. First, I estimate the survival function using a non-parametric estimator. Second, I conduct a cross-sectional analysis controlling for the default's and the country's specificities using an OLS estimator. Finally, I run a longitudinal analysis with similar control variables using a semi-parametric Cox proportional hazard model.

The non-parametric estimate of the survival function is presented in Figure C.6. It indicates a lower probability of leaving the default's state in the case of default on multilateral creditors. Most notably, default episodes not involving multilateral creditors have a 75% probability of successfully exiting the default state within 3 years, while for defaults implying multilateral creditors this same probability amounts 30% only.

It is entirely plausible that some other factors that are at the source of lengthy defaults also explain the default on multilateral debt. That is why I estimate both an OLS and a semi-parametric proportional hazard model. Both models treat the default duration as functions of the types of creditor involved in the default alongside a number of control variables. For the OLS regression, I estimate the following equation

$$y_i^k = \alpha + \mathbf{D}_i\beta + \mathbf{X}_i\delta + v$$

[40] The following regression analyses are not necessarily causal.



Note: Kaplan-Meyer estimates of the unconditional survival function.

Figure C.6: Non-Parametric Survival Function

where i refers to a specific default episode, y is the default duration in years with $k \in \{\text{A\&P}, \text{S\&P}\}$, $\mathbf{D}$ is a vector of 6 dummy variables accounting for the type creditors involved in the default (multilateral creditors, Paris Club, other official creditors, banks, bondholders and other private creditors), $\mathbf{X}$ is a vector of controls, α is a constant and the remaining variable is the error term, v.

I consider two specifications for the default duration to ensure the robustness of my analysis. On the one hand, I take the definition Asonuma and Trebesch (2016) (i.e. A&T) which accounts for the duration of individual restructuring processes. On the other hand, I follow the definition of Standard & Poor's (i.e. S&P) which often aggregates restructurings together (Beers and Chambers, 2006).

For the choice of control variables I follow the literature on the determinants of default.[41] More precisely, I account for three sets of control variables. The first one relates to the specificity of the default episode and includes the total amount of debt defaulted, a dummy for the presence of a Brady deal and the private creditors' SZ haircut.

[41]See for instance Dell'Ariccia et al. (2006), Trebesch (2008), Cruces and Trebesch (2013), Asonuma and Trebesch (2016) and Asonuma and Joo (2020).

The second set of controls accounts for the economic condition of the country in default. I first add the standard control variables such as the debt held at the IMF as a share of GDP, the debt held at the WB as a share of GDP, the real GDP, the real GDP growth, the real GDP per capita growth, the net export per GDP, the inflation rate and the US Federal Funds Rate. Furthermore, I account for the trade openness of the economy by the sum of exports and imports as a share of GDP. Drawing on Reinhart and Rogoff (2004), I generate a dummy for serial defaulters taking value one if the country defaulted at least twice in the period under study. Finally, I introduce a dummy to account for whether the country is eligible for the HIPC or IDA programs following Allen (2008). Once a country enters such program, it becomes qualified for some automatic debt relief and other concessional actions. In a similar logic, Reinhart and Trebesch (2016) show that defaults often overlap with an IMF program. I therefore include a dummy taking values one if an IMF program (SAF, PRGF or SBA) is in effect for at least five months. Besides this, I introduce a variables counting the number of WB adjustment loans in effect for at least five months. Those two variables are retrieved from Dreher and Gassebner (2012).

The last set of control variables accounts for the political situation of the country under default. A default often coincides with a major political disruption or the outbreak of a war. Hence, I add a batterie of dummy variables accounting for such events.[42] I control for the outbreak of inter- and intra-state wars in the year of the default and the year preceding it using two dummies from Sarkees and Wayman (2010). For the political system, I use the database of Bjørnskov and Rode (2020). More precisely, I add a set of dummy variables accounting for whether the defaulting country is a communist regime, whether it is a dictatorial regime, whether it changed to a dictatorial regime the year of the default or the year preceding it, whether there has been legislative elections or those elections have been postponed in the year of the default or the year preceding it and whether there has been a coup in the year of the default or the year preceding it.[43]

Finally, following Cruces and Trebesch (2013), I introduce year and region fixed effects. The latter accounts for the fact that defaults of Latin American countries have very different characteristics (including unobservables) compared to defaults in Europe or Asia. Conversely, the year fixed effects control for potential issues in the timing of restructuring as defaults often happen in waves (Reinhart and Rogoff, 2009).

[42]Ideally I would have like to include a single variable accounting for political risk. The standard variable used in the literature with an extensive coverage comes from the Political Risk Services Group but only start in 1984. The main result remain unchanged if I run the different regressions presented below with that variable. I however lose more than 20 observations due to the imperfect geographical and time coverage.

[43]There is no transition to a communist regime in the sample at hand. I therefore do not include a dummy for that.

Table C.3: OLS Duration Regressions

	(1) A&T	(2) A&T	(3) A&T	(4) A&T	(5) A&T	(6) S&P	(7) S&P	(8) S&P	(9) S&P	(10) S&P
Multilateral Creditors	3.89***	2.23**	2.39***	2.70***	3.12***	6.51***	3.90**	2.89*	3.23**	3.69**
	[1.18]	[0.95]	[0.91]	[0.97]	[0.95]	[1.74]	[1.61]	[1.52]	[1.50]	[1.56]
Paris Club	1.27*	-0.03	-0.17	0.29	0.08	-0.69	-0.71	-1.50	-0.63	-0.88
	[0.76]	[0.64]	[0.70]	[0.66]	[0.67]	[1.77]	[1.59]	[1.62]	[1.53]	[1.53]
Other Official Creditors	3.40***	1.62*	0.58	0.59	0.32	5.74**	2.08	0.24	0.59	0.62
	[1.19]	[0.95]	[1.05]	[1.01]	[0.96]	[2.19]	[1.85]	[1.84]	[1.74]	[2.07]
Bank Loans	-1.98**	-1.81**	-2.34**	-3.01*	-3.52**	-2.69	-3.19*	-3.13	-4.32*	-3.92*
	[0.90]	[0.90]	[1.01]	[1.67]	[1.77]	[2.12]	[1.85]	[2.38]	[2.29]	[2.22]
Bond	-0.48	-1.04	-0.86	-1.80*	-2.28**	2.51	0.66	0.68	0.84	1.09
	[1.18]	[1.30]	[1.31]	[1.08]	[1.06]	[2.28]	[1.41]	[1.56]	[1.76]	[2.90]
Other Private Creditors	-1.61	-0.90	-0.54	-0.12	-0.18	-1.03	-0.61	-0.22	0.37	0.15
	[1.43]	[1.10]	[1.19]	[1.09]	[1.00]	[2.09]	[1.46]	[1.56]	[1.48]	[1.49]
SZ Haircut		0.09***	0.09***	0.10***	0.10***		0.09***	0.10***	0.09***	0.10***
		[0.01]	[0.02]	[0.02]	[0.02]		[0.02]	[0.03]	[0.03]	[0.03]
Debt Restructured		0.00	-0.00	-0.00	-0.00		0.00	0.00	0.00	-0.00
		[0.00]	[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]	[0.00]
Brady Deal		3.10**	2.97***	2.46***	2.24**		3.36**	4.33***	4.41***	4.66***
		[1.25]	[1.07]	[0.94]	[0.93]		[1.64]	[1.41]	[1.52]	[1.54]
HIPC or IDA Eligibility			1.03	2.24**	3.29***			0.39	1.88	2.89*
			[1.05]	[1.08]	[1.10]			[1.63]	[1.61]	[1.59]
Serial Defaulter			1.10	1.26*	1.09			-1.95	-1.68	-2.19
			[0.73]	[0.69]	[0.74]			[1.36]	[1.31]	[1.45]
Real GDP, Start			0.00**	0.00	0.00**			0.00	0.00	0.00
			[0.00]	[0.00]	[0.00]			[0.00]	[0.00]	[0.00]
Real GDP Growth, Start			0.40	0.71*	0.93**			0.58	1.03	1.26
			[0.39]	[0.39]	[0.39]			[0.55]	[0.62]	[0.77]
Real GDP per Capita Growth, Start			-0.46	-0.74*	-0.94**			-0.72	-1.15*	-1.33*
			[0.41]	[0.40]	[0.39]			[0.57]	[0.63]	[0.77]
Inflation, Start			0.02	0.01	0.01			0.09**	0.09*	0.10*
			[0.02]	[0.02]	[0.02]			[0.05]	[0.05]	[0.05]
Federal Fund Rate, Start			1.53**	1.32**	0.99			2.31**	2.36**	1.69
			[0.60]	[0.60]	[0.61]			[0.95]	[0.98]	[1.06]
Trade Openness, Start			2.64**	2.50**	2.61**			0.02	0.02	0.01
			[1.26]	[1.26]	[1.20]			[0.02]	[0.02]	[0.02]
Net Exports (% GDP), Start			0.04*	0.04*	0.06***			0.05	0.06*	0.07*
			[0.02]	[0.02]	[0.02]			[0.03]	[0.03]	[0.04]
IMF Program, Start				-1.86	-2.73*				0.36	1.00
				[1.50]	[1.46]				[1.22]	[1.28]
WB Adjustment loans, Start				-0.11	-0.12				-0.31	-0.53
				[0.20]	[0.21]				[0.40]	[0.45]
IMF Debt (% GDP), Start				-0.00	-0.00				0.06	0.05
				[0.06]	[0.06]				[0.06]	[0.07]
WB Debt (% GDP), Start				-0.23***	-0.29***				-0.30**	-0.40**
				[0.06]	[0.07]				[0.14]	[0.16]
Coup, Start					0.66					1.41
					[1.28]					[2.20]
Communist Regime, Start					-0.70					-3.81
					[1.03]					[2.48]
Dictatorial Regime, Start					-0.65					0.56
					[0.69]					[1.57]
Regime Change to Dictatorship, Start					-2.71					-5.71
					[2.33]					[3.82]
Legislative Election, Start					-0.51					0.50
					[0.61]					[1.43]
Postponed Legislative Election, Start					3.44**					6.29
					[1.60]					[4.40]
War, Start					3.14**					2.77
					[1.39]					[2.79]
Civil War, Start					-3.88***					-1.01
					[1.28]					[2.79]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	186	186	186	186	186	104	104	104	104	104
R^2 adjusted	0.25	0.49	0.54	0.57	0.60	0.49	0.63	0.66	0.67	0.68

Note: *** $p < .01$, ** $p < .05$, * $p < .10$. Robust standard errors in brackets.

The outcome of the OLS duration regressions is depicted in Table C.3. There is a strong and positive association between defaults on multilateral creditors and the length of the default duration. A default on multilateral debt is associated with a default's duration between 2 and 7 additional years depending on the model's specification. Similarly, defaults on other official creditors are associated with an increased default's length even though the coefficients lack statistical significance. In opposition, the association between defaults on the Paris Club and the default's length is ambiguous as it reverses across the different specifications. Regarding private creditors, the association also remains unclear as the magnitude and the statistical significance of the coefficients drastically change with the model's specification. It seems nonetheless that defaults on bank loans are settled more quickly.

Regarding the control variables, there are some significant results. First and foremost, the SZ haircut is positively associated with the default's duration. This stark relationship is consistent with the findings of Benjamin and Wright (2013). Besides this, countries eligible for the HIPC or IDA programs record a longer default's duration. The same holds true for default episodes implicating a Brady deal. IMF programs and WB adjustment loans are associated with a reduced default's length but the coefficients lack robustness. Interestingly, the WB debt is related to a reduced default length, while there is almost no effect associated with the IMF debt.

I now turn to the Cox proportional hazard model. The major advantage of this model compared to an OLS regression is that it can integrate both constant and time-varying covariates. While the OLS specification relied on a cross-sectional structure of the data, the Cox model builds on longitudinal datasets. In other words, the latter can control for the evolution of the economic and political variables throughout the default's duration. More precisely, I estimate the following equation

$$g_i^k(t) = g_0^k(t)\exp(\mathbf{D}_i\beta + \mathbf{X}_i\delta)$$

where i is the exclusion episode and t indicates the survival time (i.e. the time in default), $g^k(t)$ is the hazard function and g_0^k is the baseline hazard for $k \in \{\text{A\&P}, \text{S\&P}\}$.[44] Using the duration jargon, a failure corresponds to the moment in which the country exits the default state. That is, the dependent variable is a dummy taking value 1 if the country exits the default and zero otherwise. The period of observation spans from the moment the country enters the default to the moments it exits. As I solely consider settled default episodes, there is no censoring.

In terms of controls, I use the same sort of variables as before. The major difference with the OLS regression is that most control variables are time-varying. The only major exceptions are the IMF-debt-to-GDP ratio and the WB-debt-to-GDP ratio as the time series are incomplete for many countries. I therefore integrate those two variable as constant over time and add their value both at the beginning and at the end of the default episode. The other variables that are not time-varying are: the creditor's dummies, the HIPC or IDA eligibility and the SZ haircut. Note that the political dummies referring to legislative elections, postponed elections and coups take value one in the year of occurrence of such

[44]The Cox model is said to be a semi-parametric estimator as there is no parametric assumption regarding the baseline hazard. Unlike other models such as the Weibull or the log-logistic, g_0 is considered as unknown.

event and the year preceding it and zero otherwise. Finally, similar to the previous set of regressions, I introduce year and region fixed effects.

Note that the cox model cannot account for defaults lasting only one year as the failure coincides with the observation's start. I therefore lose 5 episodes for the S&P definition and 27 episodes for the A&T definition.

Table C.4: Cox Duration Regressions

	(1) A&T	(2) A&T	(3) A&T	(4) A&T	(5) A&T	(6) S&P	(7) S&P	(8) S&P	(9) S&P	(10) S&P
Multilateral Creditors	0.37***	0.51***	0.49***	0.43***	0.45***	0.29***	0.37***	0.38***	0.48***	0.43***
	[0.21]	[0.23]	[0.22]	[0.25]	[0.26]	[0.24]	[0.26]	[0.26]	[0.28]	[0.30]
Paris Club	0.91	1.02	1.02	0.82	0.84	0.69	0.68	0.69	0.59	0.54*
	[0.19]	[0.18]	[0.21]	[0.22]	[0.22]	[0.27]	[0.27]	[0.29]	[0.34]	[0.35]
Other Official Creditors	0.65*	0.80	1.01	1.06	1.09	0.44**	0.67	0.68	0.80	0.81
	[0.23]	[0.28]	[0.30]	[0.31]	[0.31]	[0.40]	[0.42]	[0.45]	[0.43]	[0.45]
Bank Loans	1.53	2.43**	2.82**	2.63**	2.53**	1.07	1.59	1.35	1.21	1.20
	[0.31]	[0.37]	[0.46]	[0.48]	[0.45]	[0.35]	[0.40]	[0.44]	[0.46]	[0.47]
Bond	1.79**	1.61*	1.90**	2.18***	1.98**	1.03	0.98	1.17	1.24	1.70
	[0.23]	[0.27]	[0.27]	[0.28]	[0.29]	[0.33]	[0.36]	[0.38]	[0.39]	[0.42]
Other Private Creditors	1.01	1.03	1.05	0.98	0.94	0.86	0.92	1.00	0.72	0.62
	[0.25]	[0.26]	[0.28]	[0.29]	[0.30]	[0.38]	[0.35]	[0.36]	[0.34]	[0.36]
SZ Haircut		0.98***	0.97***	0.97***	0.97***		0.98***	0.98***	0.98***	0.98***
		[0.00]	[0.00]	[0.00]	[0.00]		[0.00]	[0.01]	[0.01]	[0.01]
Debt Restructured		1.00	1.00**	1.00	1.00		1.00	1.00	1.00	1.00
		[0.00]	[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]	[0.00]
Brady Deal		0.58**	0.59**	0.49**	0.48**		0.57*	0.43***	0.46***	0.43***
		[0.28]	[0.25]	[0.28]	[0.30]		[0.31]	[0.32]	[0.30]	[0.30]
HIPC or IDA Eligibility			0.63**	0.51***	0.44***			0.56**	0.37***	0.30***
			[0.22]	[0.23]	[0.25]			[0.28]	[0.37]	[0.44]
Serial Defaulter			0.67***	0.62***	0.65**			1.48*	1.48**	1.42*
			[0.14]	[0.15]	[0.17]			[0.21]	[0.19]	[0.20]
Real GDP			1.00**	1.00	1.00			1.00	1.00	1.00
			[0.00]	[0.00]	[0.00]			[0.00]	[0.00]	[0.00]
Real GDP Growth			0.99	0.97	0.98			0.99	1.02	1.03
			[0.04]	[0.04]	[0.05]			[0.07]	[0.08]	[0.09]
Real GDP per Capita Growth			1.02	1.03	1.03			1.01	0.99	0.97
			[0.04]	[0.04]	[0.05]			[0.07]	[0.08]	[0.08]
Inflation			1.00	1.00	1.00			1.00	1.01	1.01
			[0.00]	[0.00]	[0.00]			[0.01]	[0.01]	[0.01]
Federal Funds Rate			0.01***	0.01***	0.01***			0.01***	0.01***	0.01***
			[0.07]	[0.07]	[0.07]			[0.07]	[0.08]	[0.08]
Trade Openness			0.39***	0.37***	0.36***			0.50**	0.71	0.79
			[0.28]	[0.30]	[0.30]			[0.31]	[0.27]	[0.28]
Net Exports (% GDP)			0.99**	0.99**	0.99**			0.99**	0.99*	0.99*
			[0.00]	[0.00]	[0.01]			[0.01]	[0.01]	[0.01]
IMF Program				1.39**	1.44***				1.91***	2.01***
				[0.13]	[0.14]				[0.24]	[0.25]
WB Adjustment loans				1.06	1.07				1.06	1.09
				[0.05]	[0.05]				[0.05]	[0.05]
IMF Debt (% GDP), Start				1.03**	1.04**				0.98	0.97**
				[0.02]	[0.02]				[0.01]	[0.01]
WB Debt (% GDP), Start				1.03	1.04*				1.02	1.02
				[0.02]	[0.02]				[0.03]	[0.03]
IMF Debt (% GDP), End				1.00	0.99				1.01	1.02
				[0.01]	[0.01]				[0.01]	[0.01]
WB Debt (% GDP), End				0.98	0.98				1.03*	1.04**
				[0.02]	[0.02]				[0.02]	[0.02]
Coup					1.42					1.77
					[0.31]					[0.62]
Communist Regime					1.29					1.18
					[0.26]					[0.44]
Dictatorial Regime					1.03					1.44
					[0.20]					[0.39]
Postponed Legislative Election					0.87					1.09
					[0.57]					[0.80]
Legislative Election					0.83					1.09
					[0.14]					[0.20]
War					0.75					2.74
					[0.81]					[0.74]
Civil War					1.27					0.63
					[0.22]					[0.39]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	642	642	642	642	642	684	684	684	684	684
Episodes	159	159	159	159	159	99	99	99	99	99
Pseudo R^2	0.06	0.09	0.10	0.10	0.11	0.14	0.16	0.17	0.19	0.20

Note: *** $p < .01$, ** $p < .05$, * $p < .10$. Robust standard errors in brackets. Hazard ratios are reported.

The outcome of the Cox duration regressions is depicted in Table C.4. I find similar results as in the OLS estimation. Nevertheless, the interpretation of the coefficient is here different as I report the hazard ratios. An hazard ratio above one means that the variable is associated with a greater probability of exiting default, while a ratio below one indicates the opposite. As before, a default implicating multilateral creditors is related to a longer default. More precisely, such event is associated with a reduced probability of exiting default between 49% and 71% depending on the model's specification. The magnitude and the statistical significance of the effect is more stable here compared to the OLS regression. Moreover, defaults involving the Paris Club or other official creditors seem to reduce the probability of exiting default, but the coefficients lack robustness. Like the OLS estimation, little can be said about private creditors as the magnitude and the statistical significance of the coefficients vary a great deal across the different specifications. Again, it seems that defaults on bank loans are settled more quickly.

Regarding the control variables, I find more significant results compared to the OLS regression. Like the OLS regression, greater haircuts are associated with a reduced probability of exiting the default state. The same holds true for the HIPC or IDA eligibility, serial defaulters and Brady deals. Unlike the OLS regression, the IMF debt is associated to an increasing probability of ending default – at least at the default's start, while there is little effect related to the WB debt. The same holds true for the participation to an IMF program or a WB adjustment loan.

In view of the results presented above, it seems that Fact II is relatively robust. Controlling for the specificity of each default episodes and the country's characteristics does not reduce the strong association between the default's length and multilateral creditors.

I now assess the robustness of Fact III. The aim is to gauge whether greater private creditors' losses are due to the presence of multilateral lenders or are simply a by-product of other factors. For this purpose, I conduct OLS regressions with similar controls and fixed effects as before. The equation, I estimate is the following

$$H_i^k = \mathbf{D}_i \beta + \mathbf{X}_i \delta + u_i$$

where i refers to a specific restructuring episode, H_i^k is the haircut's specification of $k \in \{M, SZ\}$ and the remaining variable is the error term, u_i.

I consider two specifications of the haircut. The first one is the market haircut, H^M, and is the one computed by rating agencies and official lenders. It however tends to overestimate the level of creditor's losses. That is why I consider a second haircut specification based on the estimation method of Sturzenegger and Zettelmeyer (2008), H^{SZ}.

Table C.5: Haircut Regressions

	(1) H^{M}	(2) H^{M}	(3) H^{M}	(4) H^{M}	(5) H^{M}	(6) H^{M}	(7) H^{SZ}	(8) H^{SZ}	(9) H^{SZ}	(10) H^{SZ}
Multilateral Creditors	16.03***	11.96***	8.15**	8.25**	8.91**	15.31***	10.25**	7.58**	8.08**	8.99**
	[4.39]	[4.29]	[3.73]	[3.79]	[3.92]	[4.50]	[4.19]	[3.79]	[3.85]	[3.99]
Paris Club	12.74***	11.36**	12.30***	11.94***	11.48***	12.56***	11.09**	12.77***	12.57***	11.95***
	[4.60]	[4.46]	[3.56]	[2.85]	[2.84]	[4.70]	[4.46]	[3.73]	[3.02]	[3.02]
Other Official Creditors	8.76*	8.11	14.55***	13.11***	15.20***	7.67	7.30	12.83***	11.34***	13.99***
	[5.25]	[5.42]	[4.36]	[4.14]	[4.25]	[5.13]	[5.41]	[4.45]	[4.25]	[4.40]
Bank Loans	3.75	-3.92	17.97*	21.37***	22.69***	9.60	0.27	21.26**	24.62***	26.13***
	[9.16]	[10.22]	[9.16]	[7.78]	[6.90]	[9.10]	[10.81]	[9.14]	[7.81]	[6.96]
Bond	-13.66*	-5.79	-1.76	0.24	-0.02	-13.79*	-4.13	-1.17	0.78	0.40
	[6.95]	[7.96]	[6.38]	[4.96]	[5.12]	[7.19]	[8.29]	[7.05]	[5.73]	[6.05]
Other Private Creditors	-7.36	-8.78	-9.20**	-10.24**	-10.54**	-7.29	-8.96	-9.84**	-11.09**	-11.59**
	[5.24]	[5.63]	[4.60]	[4.63]	[4.70]	[5.10]	[5.62]	[4.67]	[4.74]	[4.80]
Private Debt Restructured		0.00	0.00***	0.00***	0.00***		0.00	0.00***	0.00***	0.00***
		[0.00]	[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]	[0.00]
Default Duration		1.77**	0.46	0.58	0.50		2.11***	0.69	0.83	0.73
		[0.70]	[0.62]	[0.54]	[0.55]		[0.74]	[0.69]	[0.60]	[0.62]
Brady Deal		-6.45	-2.45	5.32	4.43		-13.25*	-9.18	-1.26	-2.52
		[7.36]	[5.11]	[4.57]	[4.75]		[7.66]	[5.71]	[5.61]	[5.72]
HIPC or IDA Eligibility			17.81***	14.66***	14.12***			20.13***	16.52***	15.62***
			[4.44]	[3.85]	[4.15]			[4.69]	[4.17]	[4.45]
Serial Defaulter			-6.61**	-4.86*	-4.11			-5.00	-3.18	-2.15
			[3.03]	[2.91]	[3.05]			[3.14]	[3.07]	[3.18]
Real GDP, End			-0.00***	-0.00***	-0.00***			-0.00***	-0.00***	-0.00***
			[0.00]	[0.00]	[0.00]			[0.00]	[0.00]	[0.00]
Real GDP Growth, End			-3.15*	-3.82**	-4.02**			-3.26*	-4.04**	-4.22**
			[1.76]	[1.78]	[1.74]			[1.81]	[1.78]	[1.75]
Real GDP per Capita Growth, End			3.91**	4.48**	4.65***			4.00**	4.67***	4.83***
			[1.76]	[1.78]	[1.72]			[1.81]	[1.78]	[1.73]
Inflation, End			0.15*	0.14	0.18**			0.15*	0.13	0.18*
			[0.08]	[0.08]	[0.09]			[0.09]	[0.09]	[0.09]
Federal Funds Rate, End			-11.16***	-11.50***	-11.57***			-12.31***	-12.57***	-12.60***
			[2.09]	[1.80]	[1.92]			[2.27]	[2.01]	[2.10]
Trade Openness, End			-30.79***	-27.05***	-26.97***			-26.94***	-22.29***	-22.11***
			[5.53]	[4.59]	[4.56]			[5.81]	[4.89]	[4.89]
Net Exports (% GDP), End			-0.23**	-0.15*	-0.15*			-0.23**	-0.15	-0.15
			[0.10]	[0.08]	[0.09]			[0.11]	[0.09]	[0.09]
IMF Program, End				-1.17	-0.82				-1.03	-0.57
				[2.74]	[2.70]				[2.96]	[2.93]
WB Adjustment loans, End				-1.32*	-1.43**				-1.10	-1.21
				[0.73]	[0.71]				[0.80]	[0.76]
IMF Debt (% GDP), End				-0.34**	-0.32**				-0.45***	-0.42***
				[0.14]	[0.16]				[0.14]	[0.16]
WB Debt (% GDP), End				1.17***	1.15***				1.23***	1.20***
				[0.21]	[0.20]				[0.22]	[0.21]
Communist Regime, End					-1.82					-1.15
					[4.49]					[5.05]
Dictatorial Regime, End					4.30					4.79
					[3.47]					[3.65]
Legislative Election, End					-4.21					-5.07*
					[2.78]					[2.85]
Postponed Legislative Election, End					-0.64					1.29
					[8.43]					[9.80]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	186	186	186	186	186	186	186	186	186	186
R^2 adjusted	0.47	0.50	0.70	0.74	0.75	0.44	0.49	0.67	0.72	0.72

Note: *** $p < .01$, ** $p < .05$, * $p < .10$. Robust standard errors in brackets.

In terms of controls, I add similar variables as for the previously exposed regressions. First, I control for the default's specificity by including the amount of private debt the country defaulted on, a dummy for the presence of a Brady deal and the default's duration in year. Second, I control for the economic situation of the country at the default's end using the same control variables as for the OLS duration regression. Furthermore, I account for the political system of the economy at the moment of the restructuring. More precisely, I add a dummy controlling whether the country is a communist or a dictatorial regime as well as two dummies to control for legislative elections and postponed legislative elections in the year of the restructuring or the year preceding it. Finally, in accordance to what has been done previously, I introduce year and region fixed effects to account for regional characteristics and timing issues.

Table C.5 presents the results of the haircut regressions. The coefficient related to multilateral defaults is statistically and economically important. Defaulting on multilateral creditors is associated with an increase of the private creditors' haircut between 8 and 16 percentage points for the market haircut and between 8 and 15 percentage points for the SZ haircut depending on the model's specification.[45] Similarly, defaults involving the Paris Club seem to be associated with larger haircuts. The magnitude and the significance of the coefficient are somewhat larger than for multilateral creditors. Defaults with other official creditors are also associated with greater private haircuts but the coefficient oscillates largely in terms of magnitude and statistical significance across the different specifications. Regarding private creditors, one can observe that defaults on bank loans are associated with greater haircuts. The effect is the strongest in terms of magnitude for the last specification but varies a great deal across the different specifications.

Regarding the control variables, one observes many significant results. The HIPC or IDA eligibility have a strong and positive association with the private haircut. This was to be expected as such programs automatically provide substantial debt reliefs. The coefficients attached to the real GDP, the Federal Funds Rate, trade openness and the trade balance are strongly and negatively associated with the private haircut. This indicates that better recovery of the economy tend to be associated with lower haircuts. Finally, the level of WB debt to GDP is positively associated with the haircut, while the opposite is true for the level of IMF debt to GDP. Note however that, for the SZ haircut, neither an IMF program nor a WB adjustment loan seem to significantly affect the haircut.

Hence, in view of those results, it seems that there is a link between private creditor's losses and the presence of multilateral lenders. The statistical and economic significance of this link is important and remains relatively stable across the different specifications.

D Competitive equilibrium

In this section, I define the competitive equilibrium. On the sovereign's side, the equilibrium is composed of two components. First, given the prices and the outcome of the renegotiation problem, the sovereign determines its repayment decision. Second, given the prices and the outcome of the repayment problem, the sovereign sets its restructuring decision. On the lenders' side, the equilibrium is governed by the break even assumption.

Definition D.1 (Recursive Competitive Equilibrium)**.** *A recursive competitive equilibrium*

[45]The lower coefficient for the regression using the SZ haircut was to be expected as the market haircut is known to overestimate the creditor's losses.

in this environment consists of

- *Policy functions for the sovereign's consumption,* $c(z, b^i_m, b^i_p)$*, private bond holdings,* $b_p(z, b^i_m, b^i_p)$*, multilateral bond holdings,* $b_m(z, b^i_m, b^i_p)$*, default,* $D^{DP}(z, b^i_m, b^i_p)$ *and* $D^{DF}(z, b^i_m, b^i_p)$*, proposed settlement,* $W^{RP}_b(z, b^i_m, b^i_p)$ *and* $W^{RF}_b(z, b^i_m, b^i_p)$*, and stopping functions,* $A^{DF}(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$ *and* $A^{DF}(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$*.*

- *Policy functions for the lenders' proposed settlement,* $W^{RP}_l(z, b^i_m, b^i_p)$ *and* $W^{RF}_l(z, b^i_m, b^i_p)$*.*

- *Price schedules for the multilateral debt,* $q_m(z, b^i_m, b^i_p)$*, and the private debt,* $q_p(z, b^i_m, b^i_p)$*.*

such that

1. *Taking the above prices as given,*

   (a) *and taking the solution to the renegotiation problem as given, the policy functions* $c(z, b^i_m, b^i_p)$*,* $b_p(z, b^i_m, b^i_p)$*,* $b_m(z, b^i_m, b^i_p)$*,* $D^{DP}(z, b^i_m, b^i_p)$ *and* $D^{DF}(z, b^i_m, b^i_p)$ *solve the sovereign's repayment problem in (1)-(4).*

   (b) *and taking the solution to the repayment problem as given, the policy functions* $W^{RP}_l(z, b^i_m, b^i_p)$*,* $W^{RP}_b(z, b^i_m, b^i_p)$*,* $W^{RF}_l(z, b^i_m, b^i_p)$*,* $W^{RF}_b(z, b^i_m, b^i_p)$*,* $A^{DS}_m(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$*,* $A^{DS}(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$ *and* $A^{DF}(z, \boldsymbol{\epsilon}, b^i_m, b^i_p)$ *solve the sovereign's renegotiation problem in (5)-(9).*

2. *The price charged by the private and multilateral lenders correctly reflects the default probability and the expected recovery rate and is consistent with zero expected profit.*

E Numerical Solution

In this section, I present the different value functions, policies and prices after taking the expectations over the utility shock $\boldsymbol{\epsilon}$. I then describe how the model is solved.

The use of of extreme value shocks simplifies the computation of the model. Following Rust (1988) and Dvorkin et al. (2021), the continuation value upon repayment is given by

$$\begin{aligned} V(z, b^i_m, b^i_p) =& \omega \ln \Bigg\{ \Bigg(\sum_{j=1}^{\mathcal{J}} \exp(u(c_{i,j}) + \beta \mathbb{E}_{z'|z} V(z', b^j_m, b^j_p))^{\frac{1}{\omega\nu}} \Bigg)^{\nu} \\ &+ \Bigg(\exp(u(y^{DP}(z) + (1 - \delta + \delta\kappa) b^i_m) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b^i_m, b^i_p)) \Bigg)^{\frac{1}{\omega}} \\ &+ \Bigg(\exp(u(y^{DF}(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b^i_m, b^i_p)) \Bigg)^{\frac{1}{\omega}} \Bigg\} \end{aligned} \tag{E.1}$$

$$\text{s.t. } c_{i,j} = y(z) + [1-\delta+\delta\kappa]\,(b_m^i + b_p^i) - q_m(z, b_m^j, b_p^j)(b_m^j - \delta b_m^i) - q_p(z, b_m^j, b_p^j)(b_p^j - \delta b_p^i).$$

The probability of choosing the portfolio $\{b_m^j, b_p^j\}$ is then given by

$$H(b_m^j, b_p^j; z, b_m^i, b_p^i) = \frac{\exp\Big(u(c_{i,j}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j)\Big)^{\frac{1}{\omega\nu}}}{\sum_{k=1}^{\mathcal{J}} \exp\Big(u(c_{i,k}) + \beta \mathbb{E}_{z'|z} V(z', b_m^k, b_p^k)\Big)^{\frac{1}{\omega\nu}}}. \tag{E.2}$$

The probability of a *partial* and *full* default are respectively

$$\begin{aligned}
D^{DP}(z, b_m^i, b_p^i) &= \frac{\mathcal{X}(z, b_m^i, b_p^i)}{\mathcal{X}(z, b_m^i, b_p^i) + \mathcal{Y}(z, b_m^i, b_p^i) + \mathcal{Z}(z, b_m^i, b_p^i)}, \\
D^{FP}(z, b_m^i, b_p^i) &= \frac{\mathcal{Y}(z, b_m^i, b_p^i)}{\mathcal{X}(z, b_m^i, b_p^i) + \mathcal{Y}(z, b_m^i, b_p^i) + \mathcal{Z}(z, b_m^i, b_p^i)},
\end{aligned}$$

where

$$\begin{aligned}
\mathcal{X}(z, b_m^i, b_p^i) &= \exp\Big(u(y^{DP}(z) + (1-\delta+\delta\kappa) b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)\Big)^{\frac{1}{\omega}}, \\
\mathcal{Y}(z, b_m^i, b_p^i) &= \exp\Big(u(y^{DF}(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^i, b_p^i)\Big)^{\frac{1}{\omega}}, \\
\mathcal{Z}(z, b_m^i, b_p^i) &= \left(\sum_{k=1}^{\mathcal{J}} \exp\Big(u(c_{i,k}) + \beta \mathbb{E}_{z'|z} V(z', b_m^k, b_p^k)\Big)^{\frac{1}{\omega\nu}}\right)^{\nu}.
\end{aligned}$$

The value of renegotiation after a *partial* default is given by

$$\begin{aligned}
V^{RP}(z, b_m^i, b_p^i) =& \omega\phi \ln\Bigg\{\Bigg(\sum_{j, \tau_j \geq 0, b_m^j = \delta b_m^i} \exp\Big(u(c_{i,j}(W_l^{RP}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j)\Big)^{\frac{1}{\omega\nu}}\Bigg)^{\nu} \\
&+ \exp\Big(u(y^{DP}(z) + (1-\delta+\delta\kappa) b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)\Big)^{\frac{1}{\omega}}\Bigg\} \\
&+ \omega(1-\phi) \ln\Bigg\{\Bigg(\sum_{j, \tau_j \geq 0, b_m^j = \delta b_m^i} \exp\Big(u(c_{i,j}(W_b^{RP}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j)\Big)^{\frac{1}{\omega\nu}}\Bigg)^{\nu} \\
&+ \exp\Big(u(y^{DP}(z) + (1-\delta+\delta\kappa) b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)\Big)^{\frac{1}{\omega}}\Bigg\}
\end{aligned} \tag{E.3}$$

$$\text{s.t. } c_{i,j}(W) = y(z) + [1-\delta+\delta\kappa]\, b_m^i - W - q_p(z, b_m^j, b_p^j) b_p^j.$$

The related probability of accepting a restructuring offer, for $k \in \{l, b\}$, is

$$A_k^{RP}(z, b_m^i, b_p^i) = \frac{\left(\sum_{j,\tau_j \geq 0, b_m^j = \delta b_m^i} \exp\left(u(c_{i,j}(W_k^{RP}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j) \right)^{\frac{1}{\omega\nu}} \right)^{\nu}}{\left(\sum_{j,\tau_j \geq 0, b_m^j = \delta b_m^i} \exp\left(u(c_{i,j}(W_k^{RP}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j) \right)^{\frac{1}{\omega\nu}} \right)^{\nu} + \mathcal{X}(z, b_m^i, b_p^i)}.$$

The value of renegotiation after a *full* default is given by

$$\begin{aligned} V^{RF}(z, b_m^i, b_p^i) =& \omega\phi \ln \Bigg\{ \Bigg(\sum_{j,\tau_j \geq 0, b_m^j = 0} \exp\left(u(c_{i,j}(W_l^{RF}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j) \right)^{\frac{1}{\omega\nu}} \Bigg)^{\nu} \\ & + \exp\left(u(y^{DF}(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^i, b_p^i) \right)^{\frac{1}{\omega}} \Bigg\} \\ & + \omega(1-\phi) \ln \Bigg\{ \Bigg(\sum_{j,\tau_j \geq 0, b_m^j 0} \exp\left(u(c_{i,j}(W_b^{RF}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j) \right)^{\frac{1}{\omega\nu}} \Bigg)^{\nu} \\ & + \exp\left(u(y^{DF}(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^i, b_p^i) \right)^{\frac{1}{\omega}} \Bigg\} \\ & \text{s.t. } c_{i,j}(W) = y(z) + b_m^i \bar{q} - W - q_p(z, b_m^j, b_p^j) b_p^j. \end{aligned} \tag{E.4}$$

The related probability of accepting a restructuring offer, for $k \in \{l, b\}$, is

$$A_k^{RF}(z, b_m^i, b_p^i) = \frac{\left(\sum_{j,\tau_j \geq 0, b_m^j = 0} \exp\left(u(c_{i,j}(W_k^{RF}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j) \right)^{\frac{1}{\omega\nu}} \right)^{\nu}}{\left(\sum_{j,\tau_j \geq 0, b_m^j = 0} \exp\left(u(c_{i,j}(W_k^{RF}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j) \right)^{\frac{1}{\omega\nu}} \right)^{\nu} + \mathcal{Y}(z, b_m^i, b_p^i)}.$$

The private bond price therefore reduces to

$$\begin{aligned} q_p(z, b_m^j, b_p^j) = \frac{1}{1+r} \mathbb{E}_{z'|z} \Bigg[& \Big(1 - D^{DP}(z', b_m^j, b_p^j) - D^{DF}(z', b_m^j, b_p^j) \Big) \times \\ & \Big(1 - \delta + \delta\kappa + \delta \sum_{k=1}^{\mathcal{J}} q_p(z', b_m^k, b_p^k) H(b_m^k, b_p^k; z, b_m^j, b_p^j) \Big) + \\ & D^{DP}(z', b_m^j, b_p^j) q_p^{DP}(z', b_m^j, b_p^j) + \\ & D^{DF}(z', b_m^j, b_p^j) q_p^{DF}(z', b_m^j, b_p^j) \Bigg]. \end{aligned} \tag{E.5}$$

with recovery value

$$q_p^{DP}(z, b_m^i, b_p^i) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1-\phi A_l^{RP}(z', \delta b_m^i, b_p^i))q_p^{DP}(z', b_m^j, b_p^i) + \\ \phi A_l^{RP}(z', \delta b_m^i, b_p^i)\frac{W_l^{RP}(z', b_m^j, b_p^i)}{-b_p^i \bar{q}}\big],$$

and

$$q_p^{DF}(z, b_m^i, b_p^i) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1-\phi A_l^{RF}(z', \delta b_m^i, b_p^i))q_p^{DF}(z', b_m^j, b_p^i) + \\ \phi A_l^{RF}(z', \delta b_m^i, b_p^i)\frac{W_l^{RF}(z', b_m^j, b_p^i)}{-b_p^i \bar{q}}\big].$$

Conversely, the multilateral debt price reduces to

$$q_m(z, b_m^j, b_p^j) = \frac{1}{1+r}\mathbb{E}_{z'|z}\Bigg[\Big(1 - D^{DF}(z', b_m^j, b_p^j)\Big)\times \\ \Big(1-\delta+\delta\kappa+\delta\sum_{k=1}^{\mathcal{J}} q_m(z', b_m^k, b_p^k)H(b_m^k, b_p^k; z, b_m^j, b_p^j)\Big) + \\ D^{DF}(z', b_m^j, b_p^j)q_m^{DF}(z', b_m^j, b_p^j)\Bigg]. \tag{E.6}$$

with recovery value

$$q_m^{DF}(z, b_m^i, b_p^i) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - A_l^{RF}(z', \delta b_m^i, b_p^i))q_p^{DF}(z', b_m^j, b_p^i) + A_l^{RF}(z', \delta b_m^i, b_p^i)\bar{q}\big].$$

I solve the model using value function iterations on a discretized grid for output, private and multilateral debts. Following Hatchondo et al. (2010), both the value functions and the prices are iterated in the same loop.

The process starts with a guess of the value function V as well as of the prices q_p and q_m. Given those guesses, I first determine the repayment value given by (2). I compute the value for each combination of multilateral and private debts. I also compute the bond policy through (E.2).

For the autarky values (3)-(4), I first solve the optimal lenders' offer over a W-grid. For each point on the W-grid, I determine the value of reentering the market given in (7) and (9) by means of a grid search.[46] I subsequently generate the values of renegotiation using

[46]For efficiency purpose, this step is performed at the same stage as the grid search for the repayment value.

(E.3)-(E.4) and compute the different sovereign's acceptance probabilities.

Having calculated the value under repayment and the value under default, I retrieve the default decision and the new value of V from equation (E.1) and generate the different default probabilities.

With the acceptance probabilities and the lender's offer, I can calculate the recovery price for each debt instrument and for each default case as specified above. Once this is done, I compute the new bond prices q_p and q_m by means of equations (E.5) and (E.6), respectively.

Subsequently, I compare the initial guesses with the new outcome. I compute the maximal absolute distance between the newly-computed and previously-computed prices of private and multilateral debts. The same is done for the value V. If convergence is not attained, guesses are updated using a relaxation parameter and the whole process starts again.

Once the model is solved, I run simulations for 5000 countries and 500 years. The first 100 years are discarded to ensure that the initial conditions do not matter. The model-generated moments are computed as averages across countries. Business cycle moments are HP filtered with a smoothing parameter of 6.25.

F Welfare Analysis

In this section, I present how welfare gains are calculated. To compute the sovereign's welfare, first define the value of the sovereign for a sequence of consumption $\{c(z^t)\}$ starting from an initial state at $t = 0$ as

$$V^P(\{c(z^t)\}) = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(c(z^t)) = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c(z^t)^{1-\sigma}}{1-\sigma},$$

where the last equality is obtained from the functional form considered in Section 9. I denote the sovereign's consumption allocation in the benchmark model by $\{c^b(z^t)\}$ and the consumption allocation in the alternative model by $\{c^a(z^t)\}$. The sovereign's value in the benchmark model in state (z, b^i_m, b^i_p) is given by

$$V^P_b(z, b^i_m, b^i_p) \equiv V^P(\{c^b(z^t)\}),$$

Conversely, the sovereign's value under the alternative model in the exact same state (z, b^i_m, b^i_p) reads

$$V^P_a(z, b^i_m, b^i_p) \equiv V^P(\{c^a(z^t)\}).$$

Now define the consumption-equivalent welfare gain of the alternative model with respect to the benchmark model by χ such that

$$V^P(\{(1+\chi)c^b(z^t)\}) = V^P(\{c^a(z^t)\}).$$

Given the functional form of the instantaneous utility one obtains

$$(1+\chi)^{1-\sigma} V_b^P(z, b_m^i, b_p^i) = V_a^P(z, b_m^i, b_p^i).$$

The welfare gain therefore boils down to

$$\chi(z, b_m^i, b_p^i) = \left[\frac{V_a^P(z, b_m^i, b_p^i)}{V_b^P(z, b_m^i, b_p^i)}\right]^{\frac{1}{1-\sigma}} - 1.$$