Seniority and Sovereign Default*

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Abstract

Sovereign countries do not necessarily repay all its creditors. In fact, one observes a clear pecking order in which multilateral institutions – essentially 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, it presents strong evidence that defaults involving multilateral lenders are infrequent, last relatively longer and are associated with greater private creditors' losses. It subsequently builds a model of endogenous defaults and renegotiations to rationalize those findings. There, the multilateral debt generates an important pecuniary spillover. While it can work as a commitment device and dampen the default risk, it raises the subordination risk of private liabilities. Furthermore, a tough renegotiation strategy ensures that the multilateral lenders can maintain a lending policy at preferential rates. It also rationalizes the longer default's duration and the greater private creditors' losses observed in default episodes involving multilateral lenders. The subordination of private lenders further accounts for the large increase in spreads during debt crises.

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

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1 Introduction

Excluding advanced economies, the multilateral debt 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 entities such as the International Monetary Fund (IMF) and the World Bank (WB) even though they have no legal obligations to do so.[2] 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, default rates and durations as symmetric across creditors. The presents study seeks to fill this gap. Particularly, it gauges the impact of the preferred creditor status of the multilateral debt 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.[3] 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, the level of multilateral debt significantly increases before the default's start. Particularly, one observes a surge of 17% relative to the year preceding the default. 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 quantitatively replicating them. For this purpose, I augment the standard model of incomplete market with default 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 borrower can decide to default on one of the

[1] Multilateral debt primarily consists of loans and debt from the International Monetary Fund (IMF) and the World Bank (WB). See Figure A1 in Appendix A for a breakdown of the world sovereign debt between 1970 and 2019.

[2] 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).

[3] I obtain the default's start and end date from Beers and Chambers (2006) and 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).

two types of creditors – *selective* default – or both – *full* default. Each default is followed by a complete market exclusion and an output penalty. In a *selective* default, the sovereign repudiates one type of debt and continues to service the other while being in autarky.

To model the renegotiation process, I build upon the work of Bi (2008), Benjamin and Wright (2013) and more recently of Dvorkin et al. (2021) as it is capable of generating endogenous default's lengths and haircuts. Particularly, the renegotiation is a non-cooperative multi-round game between the lenders and the borrower. In each round a proposer is selected with a constant probability. If the negotiating parties settle, the sovereign regains access to the market and gets rid of the output penalty. Otherwise, the renegotiation is delayed, the sovereign remains in autarky and the game repeats next period. In equilibrium, delays arise as the negotiating parties perceive that a better recovery value can be achieved by waiting that the risk to re-enter default diminishes. My contribution is to incorporate in this framework two lenders with different behavior in the renegotiation. On the one hand, in line with the current practice of the IMF and the WB, the multilateral lenders request to be repaid in full and do not provide new money.[4] On the other hand, private lenders seek to maximize the recovery value subject to the borrower's acceptance probability.

I model the *de facto* seniority through two complementary channels. First, defaults on multilateral lending institutions are followed by a lengthier expected renegotiation process. Second, they lead to a greater output penalty. While the first channel is endogenous, the second is exogenous. 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 greater punishment provides multilateral lenders an, albeit imperfect, shelter against potential debt repudiations. Particularly, the tough renegotiation process safeguards the lending policy at preferential rates characteristic of the multilateral lending institutions, whereas the penalty controls the frequency of multilateral debt's repudiations.

What differentiates my model from the standard models of endogenous defaults is the following. First and foremost, both the default duration and the haircut are endogenously determined through the renegotiation process. Thus I depart from the mainstream approach which considers exogenous default's lengths and recovery values. Second, the debt restructuring is specific to the type of creditors involved. This is a major difference with respect to Bi (2008), Benjamin and Wright (2013) and Dvorkin et al. (2021) who assume the existence of a single homogenous lender. Finally, I generate an implicit seniority structure which emerges from the complementarity between the output penalty and the renegotiation process. This enables the two types of debt to coexist in equilibrium.

[4] By full repayment, I mean full repayment of the face value of debt. The multilateral lenders forgo the missed interest payments.

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 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 *selective* 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 becomes particularly important when the sovereign is at the verge of a default. There, the sovereign relies more intensively on multilateral borrowing given its relative cheapness.

Furthermore, the *de facto* seniority affects (2) the default's decision. The mechanism present in this model is similar to the one in Dellas and Niepelt (2016) and Ari et al. (2018). On the one hand, a larger share of multilateral debt reduces the value of *selective* 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. The former is due to the fact that multilateral lenders do not provide new money during a restructuring. This depresses the borrowing capacity of the sovereign. Hence, private lenders have no other choice but to accept a lower recovery value to exit the default state. Conversely, the full repayment of multilateral lenders renders restructurings more costly. As a result, the expected default's length increases as the sovereign stays in autarky until the risk to re-enter default *majorly* diminishes. 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 the aforementioned empirical facts relating to the default duration, the multilateral borrowing and the private creditor's haircut alongside the debt structure, the debt-to-GDP ratio, the average spread and the default's frequency. I find that the model fits the data reasonably well. Particularly, it is capable of generating the observed default's lengths and haircuts depending on the different types of creditors involved. It also generate realistic private debt spreads despite modelling positive recovery values. Note also that the model matches the moments established by Benjamin and Wright (2013) and some non-targeted business cycle properties of emerging economies.

I subsequently conduct a series of counterfactual analyses. For instance, I study what happens when one weakens or strengthen the seniority of the multilateral lenders. In the former exercise, I notably introduce a *pari passu* clause and shows that the multilateral debt loses most of its seniority benefits.[5] This comes together with welfare gains for the sovereign despite a greater default frequency. Furthermore, the spread on private debt largely reduces and is now aligned with the one on multilateral debt. Thus, without subordination, it is not possible to match the average private debt spread observed in the data. It is also not possible to explain why multilateral lenders can lend at a lower rate.

In light of this, this study has a clear policy implication: the seniority structure of sovereign debt is necessary to maintain multilateral lending at preferential rates. The context of this implication has to be properly understood, though. In my environment, the sovereign can only trade non-contingent claims and may obtain some limited amount of state contingency through defaults. Hence, without some form of seniority, the multilateral debt would not be superior to private debt and the multilateral lending institutions could not fulfil their mandate.[6]

The paper is organized as follows. I review the existing literature in Section 2 and introduce the conventions on sovereign debt seniority in Section 3. I then present new empirical regularities in section 4. I subsequently describe the economic environment of the model in Section 5. After this, I present the decisions regarding repayment and default in Section 6. I then pass to the endogenous renegotiation process in Section 7. I define and characterize the model's equilibrium in Section 8. Thereafter, I calibrate the model in Section 9 and present the underlying results in Section 10. Finally, I conclude in Section 11.

[5]A *pari passu* clause stipulates that all creditors have the same repayment priority upon default.

[6]This is different than the environment of Liu et al. (2020) who consider that the multilateral lenders (i.e. the Fund in their case) provide state-contingent (Arrow-type) securities. Those authors show that in this context the seniority structure of sovereign debt becomes irrelevant. This comes from the fact that the borrower has access to insurance through a complete set of Arrow-type securities.

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 multilateral 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.[7] Building a more comprehensive dataset, Cruces and Trebesch (2013) refine the previous analysis and present evidence that haircuts impacts 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. Finally, 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. I contribute to this literature by offereing 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) which has been directly extended by Aguiar and Gopinath (2006) and Arellano (2008).[8] 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) 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.[9] 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 subsequently introduces two creditors with different behavior in the renegotiation.

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

[7] 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).

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

[9] 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 private information.

are truly senior throughout the years. Theoretical models only partially addressed this issue, though. While many studies take the seniority structure as granted,[10] 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). Furthermore and to the best of my knowledge, this is the first model to integrate heterogenous creditors, selective default choice and endogenous renegotiations together in a dynamic equilibrium environment.

Finally, the paper also connects to the literature on multilateral lending. Building on Ábrahám et al. (2019), Liu et al. (2020) show that the seniority structure of sovereign debt is irrelevant provided that the borrower has access to a full set of Arrow-type securities. In opposition, I show that with only non state-contingent securities, 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 multilateral 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.[11] 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. The focus of this paper is not directed to a particular entity such as the IMF but to the broader scope of multilateral lending institutions enjoying a preferred creditor status. I nevertheless show that the multilateral debt generates an important pecuniary spillover on private borrowing owing to its *de facto* seniority. My model can therefore gauge the catalytic and repellent effect of multilateral lending.

[10] 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.

[11] 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.[12] Furthermore, there exists no supranational entity capable of prosecuting defaults or supervising restructurings of sovereign debt.[13] 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.[14] 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.[15] 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 A3 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 A4, 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

[12] 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).

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

[14] 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.

[15] 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, many 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.[16] 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.[17] 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).[18]

When building the model, I will take those different policies as given. Most importantly, I will assume that the multilateral lenders endorse their preferred creditor status meaning that, during a restructuring, they ask to be repaid in full and forbid quota-exceeding drawdowns. 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.

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

[17]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.

[18]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.[19] In light of this, my analysis can be seen as the continuation of Benjamin and Wright (2013) and of Schlegl et al. (2019). It relies on 186 default episodes from 1970 to 2014, which all involve external debt and private creditors. 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.

I identify the different restructuring episodes following 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. Conversely, a restructuring ends with the official settlement announcement or the implementation of the debt exchange.[20] I complement this dataset with estimates of private creditor's losses from Cruces and Trebesch (2013).[21] I subsequently identify the different creditors involved in each default episode by means 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.[22] Appendix B gives a detailed overview of the other data used in this section. Notably, Table B1 presents the sample used in this analysis and Table B2 specifies the source.

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, private creditors' haircut and multilateral borrowing. For each statistic, I distinguish between defaults implicating multilateral debt from those which do not. Overall, I identify four main empirical facts. The first empirical regularity relates to the *de facto* seniority structure, namely that defaults on multilateral creditors are infrequent. Indeed, out of the 186 default episodes presented here only 40 involve multilateral creditors.[23]

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

[20]Standard & Poor's classifies defaults in a different manner. It does not discriminate between the settlements of particular creditors during the same default episode.

[21]The dataset contains the 2014 update.

[22]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.

[23]See also the discussion in Section 3 and the related Figures A3 and A4 in Appendix A.

Table 1: Duration, Borrowing and Haircut Statistics

	Mean	Median	Min	Max	Std. Dev.	Obs.
Years in Default						
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
Increase in Multilateral Debt (%)						
Overall	17.2	11.0	-12.0	417.8	35.10	186
With multilateral creditors	16.0	9.5	-6.9	95.0	21.00	40
Without multilateral creditors	17.5	11.2	-12.0	417.8	38.12	146

Source: See Appendix B.

Fact I. *A default involving creditors with de facto seniority is infrequent.*

In addition, I find that sovereign defaults take between 3 and 4 years to be resolved. This duration estimate is in fact closer to the one of Pitchford and Wright (2008) of 6.5 years than the one of Benjamin and Wright (2013) of 8.5 years. Moreover, 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 very important. Hence, defaults on creditors enjoying *de facto* seniority are associated with a doubling of the length of default on average. I summarize this in the second fact:

Fact II. *A default involving creditors with de facto seniority 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 C1. 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 5 additional years depending on the model's specification. I draw similar conclusions from the outcome of the Cox model presented in Table C2. Notably, a default on multilateral creditors is associated with a reduction of the probability of exiting default between 50% and 59% depending on the model's specification. In view of those results, it seems that the second 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 substantial in my dataset. The average haircut is around 37%, consistent with Cruces and Trebesch (2013).[24] 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 creditors with de facto seniority 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.

Table C3 in Appendix C presents the results of the haircut regressions. The coefficient related to multilateral default is statistically and economically important. Defaulting on multilateral creditors is associated with an increase of the private creditors' haircut between 9 and 10 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.

The next empirical regularity relates to the level of multilateral debt prior to the default. Looking at the last part of Table 1, one sees that the level of multilateral debt increases in the year of the default by roughly 17% on average relative to the year preceding it. Looking at the median the surge is somewhat less pronounced and amounts 11%. This holds true for all types of defaults. The fourth empirical fact therefore reads

[24] Note that Benjamin and Wright (2013) report an average haircut of 51%. They compute haircuts based on arrears data and weight the average by the value of outstanding debt.

Fact IV. *The level of debt with de facto seniority increases before a default.*

To gauge the robustness of this fact, I conduct panel regressions with the multilateral debt (i.e. IMF and WB debt) as a dependent variable. I control for the presence of IMF programs and WB adjustment loans and for the general economic and political situation of the sovereign as I did for the previous analyses. Besides this, I add a dummy variable taking value one if the default starts and zero otherwise.

Table C4 in Appendix C presents the results of the multilateral debt panel regressions. The coefficient related to the default start dummy is statistically and economically important. In the year in which a sovereign defaults, it increases its multilateral indebtedness by 0.53 billion USD on average. In the year preceding a default, a sovereign seems to increase its holdings of multilateral debt as well but the coefficient is less statistically and economically significant. The same holds true if one looks at the IMF and the WB debt separately.

5 Theoretical Analysis

Having established new empirical facts, the following section aims at building a model capable of quantitatively replicating them. The elaboration of the model starts with the definition of the economic environment and continues with the formal development of the endogenous default decision and the renegotiation process. It ends with the definition and the characterisation of the equilibrium.

5.1 Intuition

To replicate the empirical regularities unveiled in the previous section, I need the following ingredients. First and foremost, I should account for the existence of private and multilateral lenders. Second, the model ought to generate endogenous default choices and, most importantly, selective default choices between the two types of lenders. Third, as the default's length and haircut vary with the type of creditor involved in the data, it needs to integrate a lender-specific renegotiation process.

The first purpose of the model is to explain the impact of the *de facto* seniority on the borrowing choice. The sovereign can issue either private or multilateral debt. I assume that the latter is *de facto* senior with respect to the former owing to a greater default's punishment, broadly speaking. Given this, the multilateral debt is less sensitive to the risk of default than the private debt. It therefore yields to a larger benefit at issuance but is harder to dilute at maturity. In opposition, the private debt is more sensitive to the default risk and therefore easier to dilute. This tradeoff shapes the optimal debt holdings.

The second purpose of the model is to highlight the impact of the *de facto* seniority on the default's decision. The sovereign faces two main options: either it defaults on its entire debt position – *full* default – or on one type of debt – *selective* default. In the latter case, the sovereign continues to service the debt it did not repudiate while being in autarky. Hence, the tradeoff is the following. The more multilateral debt being accumulated, the less attractive is a *selective* default on private debt – owing to the increasing multilateral debt servicing costs – and the more attractive becomes a *full* default.

The last purpose of the model is to explain how the *de facto* seniority affects the renegotiation process. Building on the practice of the IMF and the WB, I assume that the multilateral lenders ask to be repaid in full and do not provide new money. On the one hand, the full repayment of multilateral lenders renders restructurings more costly, delaying the potential settlement. On the other hand, the limited access to multilateral funds forces the private lenders to reduce their offer which directly translates to greater haircuts.

5.2 Environment

Consider a small open economy in 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 represented 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 endowment represents the only source of uncertainty in this environment. Thus, I use $\mathbb{E}_{z'|z}(\cdot)$ to denote the expectation with respect to z' given that one knows z.[25]

The international capital market is incomplete and composed of two risk-neutral lenders: private and multilateral. The former are competitive, while the latter enjoy *de facto* seniority but still breaks even in expectation. Thus, the sovereign faces two funding opportunities.

[25] I take over the standard notation and use the prime character to designate prospective values.

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 $q_m(z, b'_m, b'_p)$.[26] Both types of debt are 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. I assume that both types of debt have the same coupon rate, κ, and the same average maturity, δ.

Note that the information about about the sovereign's endowment and bond holdings is symmetric among all market participants.

The sovereign cannot commit to repay its debt – both private and multilateral. If it decides to default, it has two options: *selective* or *full* default.[27] In the former case, the sovereign solely defaults on one type of debt and continues to repay the other, whereas in the latter case it repudiates its entire debt position. Both types of default are followed by a complete bond market exclusion and an output penalty.

The *de facto* seniority emerges from two complementary forces: the output penalty and the renegotiation process. More precisely, a default involving multilateral creditors is followed by a relatively greater output reduction. That is, $y_i^D(z)$ is the endowment upon default on the creditor $i \in \{m, p\}$ where $y \geq y_p^D > y_m^D$. If the sovereign enters into *full* default, it receives $y_m^D(z)$ as it defaulted on the multilateral lenders.[28] Beside the larger output penalty, a default on multilateral debt implies a tougher renegotiation process. While private lenders are ready to make concessions, the multilateral lenders request to be repaid in full and refuse underbids from the borrower. Furthermore, the sovereign has no access to new multilateral funds upon restructuring.[29]

In this environment, the sovereign faces two problems. On the one hand, it decides whether to repay its debts or not. This is the repayment problem which follows the seminal work of Eaton and Gersovitz (1981) and its extension by Aguiar and Gopinath (2006) and Arellano (2008). There the sovereign takes the 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. This is the renegotiation problem which draws from Bi (2008), Benjamin and Wright (2013) and Dvorkin et al. (2021). There the

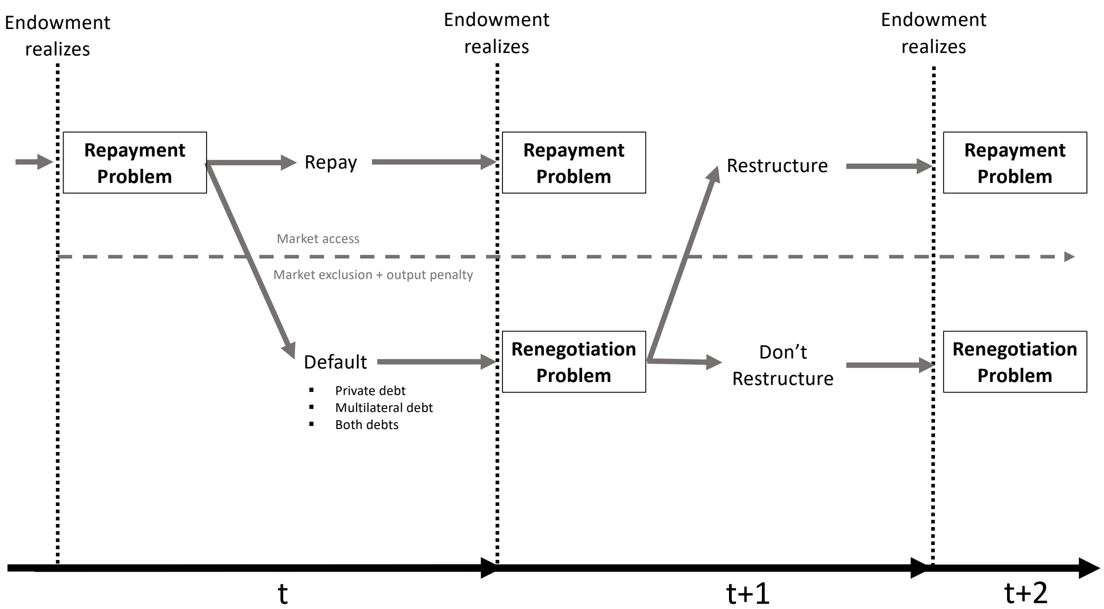
[26]Following the standards in the literature, I designate a debt as a negative asset. In other words, $b_i < 0$ denotes a debt, while $b_i > 0$ denotes an asset for all $i \in \{m, p\}$.

[27]Defaults generate an endogenous limit to the sovereign's borrowing. There is also a lower bound on both the private and the multilateral debt which rules out Ponzi schemes but is not binding in equilibrium.

[28]The rationale behind the larger output penalty on multilateral debt default is the following. First, multilateral lenders are recognized institutions for the good functioning of the world economy (Fischer, 1999). Second, they represent large players in the financial market capable of influencing other creditors. Hence, defaulting on this type of creditor necessarily entails greater costs.

[29]The rationale behind the tougher renegotiation strategy of the multilateral lenders comes from the fact that multilateral lenders officially endorse the status of *de facto* seniority as explained in Section 3.

Figure 1: Timing and Problems



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 1. In the repayment problem, given the endowment's realization, the sovereign decides whether to repay or to default. If it decides to repay, it maintains its market access, determines its prospective borrowing and faces the repayment problem again in the next period.[30]

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 – i.e. it suffers from output penalty and bond market exclusion – and the renegotiation problem repeats next period.

In what follows, I first develop the repayment problem and then pass to the renegotiation problem. Thereafter, I define and characterize the underlying competitive equilibrium.

[30]This is in opposition to Cole and Kehoe (2000), where the government is the second mover and decides to default after the borrowing decision. As a result, while the equilibrium is unique in Eaton and Gersovitz (1981), it is multiple in Cole and Kehoe (2000) due to this shift in the timing of actions (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 endowment and the current level of private as well as of multilateral debt, the sovereign decides whether to repay the contracted debts to maximize its utility. When deciding to default, the sovereign can choose to enter into *selective* or *full* default. Moreover, when deciding about *selective* default, the sovereign can repudiate either the private or the multilateral debt. The overall beginning of the period value function is then given by

$$V(z, b_m, b_p) = \max\{V^P(z, b_m, b_p), V_p^{DS}(z, b_m, b_p), V_m^{DS}(z, b_m, b_p), V^{DF}(z, b_m, b_p)\}, \tag{1}$$

where $V^P(\cdot)$ is the value function under repayment, $V_i^{DS}(\cdot)$ under *selective* default on creditor $i \in \{m, p\}$ and $V^{DF}(\cdot)$ under *full* default.[31]

In the case in which the sovereign decides to honor the terms of all its debt contracts, it determines its prospective borrowing given the realization of the endowment process. The Bellman equation reads as follows

$$\begin{aligned} V^P(z, b_m, b_p) = &\max_{b'_m, b'_p} \; u(c) + \beta \mathbb{E}_{z'|z} V(z', b'_m, b'_p) \\ &\text{s.t.} \quad c + q_m(z, b'_m, b'_p)(b'_m - \delta b_m) + q_p(z, b'_m, b'_p)(b'_p - \delta b_p) \\ &\qquad = y(z) + [1 - \delta + \delta\kappa](b_m + b_p). \\ &\qquad b'_m \geq b'_p. \end{aligned} \tag{2}$$

In terms of borrowing, the sovereign has the choice between the issue of multilateral debt, b'_m, and private debt, b'_p. The two financial instruments differ in the sense that multilateral debt is given *de facto* priority in the repayment of liabilities. I impose $b'_m \geq b'_p$ to get an empirically-plausible debt structure.[32]

If the sovereign decides to enter into *selective* default, it receives an output penalty and is excluded from both the multilateral and the private bond markets. Moreover, it continues to service the debt it did not repudiate. The Bellman equation for the case of *selective* default on *private* debt is given by

$$V_p^{DS}(z, b_m, b_p) = u(c) + \beta \mathbb{E}_{z'|z} V_p^{RS}(z', b'_m, b_p), \tag{3}$$

[31] I generally use the letter m for the objects relating to the multilateral lenders and the letter p for the objects relating to the private lenders.

[32] Without such constraint, the sovereign predominantly accumulates multilateral debt. However, empirically, this form of debt represents only a third of the total debt level in developing economies.

$$\text{s.t.} \quad c = y_p^D(z) + [1 - \delta + \delta\kappa]\, b_m,$$
$$b'_m = \delta b_m.$$

The continuation value $V_p^{RS}(\cdot)$ is the expected payoff from the renegotiation process with the private creditors and is taken as given for the time being. It 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, the less attractive is this type of default. Moreover, in the case of short-term debt (i.e. $\delta = 0$), the debt is repaid in one instalment. This further renders the *selective* default unappealing. In opposition, the longer is the maturity structure (i.e. $\delta \to 1$), the lower is the debt service incurred every period. Similarly, the Bellman equation for the case of *selective* default on *multilateral* debt is given by

$$\begin{aligned} V_m^{DS}(z, b_m, b_p) =& u(c) + \beta \mathbb{E}_{z'|z} V_m^{RS}(z', b_m, b'_p), \\ \text{s.t.} \quad & c = y_m^D(z) + [1 - \delta + \delta\kappa]\, b_p, \\ & b'_p = \delta b_p. \end{aligned} \tag{4}$$

The continuation value $V_p^{RS}(\cdot)$ is the expected payoff derived from the renegotiation process with the multilateral lenders. Generally, $V_p^{RS}(\cdot) \neq V_m^{RS}(\cdot)$ as the private and the multilateral creditors have different behavior in the renegotiation. Moreover, I assumed that $y_m^D(z) < y_p^D(z)$ for all $z \in Z$. Hence, selectively defaulting on the multilateral or on the private debt does not entail the same consequences.

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

$$\begin{aligned} V^{DF}(z, b_m, b_p) =& u(c) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m, b_p), \\ \text{s.t.} \quad & c = y_m^D(z). \end{aligned} \tag{5}$$

The continuation value $V^{RF}(\cdot)$ is the expected payoff derived from the debt renegotiation process with the two creditors.[33] In a *full* default, the sovereign does not need to service any debt while being in autarky. Hence, if I assumed that $y_p^D(z) = y_m^D(z)$ for all z, a *selective* default on private debt would be relatively unattractive. That is why I consider a larger default penalty when multilateral lenders are implicated in a default.

[33] The sovereign can fall into *full* default in two different situations. First, the sovereign can decide to directly default on its entire debt position rather than simply on one type of debt separately. Second, as it will be made clear in the next section, it can fall into *full* default after an initial *selective* default.

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). The main difference with the work of aforementioned authors is that I model two lenders who have different behavior in the renegotiation, while they assume the existence of a single homogenous lender. Moreover, I introduce a new channel of delays in the renegotiation through the full repayment of multilateral lenders.

7.1 Selective default on private debt

The renegotiation is a multi-round non-cooperative game in which the private lender and the sovereign propose stochastically.[34] Figure 2 depicts the sequence of actions in the renegotiation with the underlying payoffs. With probability ϕ_p the private lender is given the opportunity to propose an offer and if so the sovereign decides whether to accept it.[35] Conversely, with probability $1 - \phi_p$, the sovereign can propose a settlement and, conditional on the sovereign proposing, the private lender has to decide whether to accept it. 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 market. Formally, the value under renegotiation is given by

$$V_p^{RS}(z, b_m, b_p) = \max\{\Omega_p^{RS}(z, b_m, b_p), V^{DF}(z, b_m, b_p)\}.$$

with

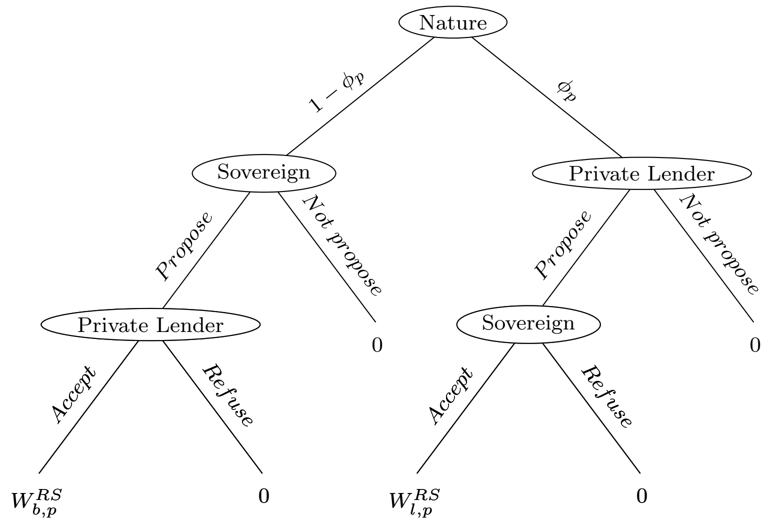
$$\Omega_p^{RS}(z, b_m, b_p) = \phi_p \bar{\Omega}_p^{RS}(z, b_m, b_p, W_{l,p}^{RS}) + (1 - \phi_p)\bar{\Omega}_p^{RS}(z, b_m, b_p, W_{b,p}^{RS}). \tag{6}$$

$\bar{\Omega}_p^{RS}(\cdot)$ is the value derived from a specific offer and $W_{l,p}^{RS}$ and $W_{b,p}^{RS}$ represent the offer made by the private lender and the sovereign, respectively.

[34] As I assume a continuum of private lenders, I can consider that all private lenders are grouped into a single entity which proposes a unique offer on behalf of all. I will therefore use the third person singular for the private lenders from now on.

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

Figure 2: Renegotiation Game Tree



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

$$\bar{\Omega}_p^{RS}(z, b_m, b_p, W) = \max\left\{V_p^{DS}(z, b_m, b_p), V_p^{ES}(z, b_m, W)\right\}, \tag{7}$$

where $V_p^{DS}(\cdot)$ is the value of remaining in autarky and $V_p^{ES}(\cdot, W)$ is the value of exiting the negotiation with a restructured debt of value W. This defines a stopping policy function $A_p^{RF}(z, b_m, b_p, W)$ which takes value one if $V_p^{EF}(z, b_m, W) > V_p^{DS}(z, b_m, b_p)$ and zero otherwise. The value upon restructuring is given by

$$\begin{aligned} V_p^{ES}(z, b_m, W) &= \max_{b'_p} u(c) + \beta \mathbb{E}_{z'|z} V(z', b'_m, b'_p) \\ \text{s.t.} \quad & c = y(z) + \tau(z, W) + [1 - \delta + \delta\kappa] b_m, \\ & \tau(z, W) = q_p(z, b'_m, b'_p)(-b'_p) - W, \\ & \tau(z, W) \geq 0, \\ & b'_m = \delta b_m. \end{aligned} \tag{8}$$

The variable $\tau(\cdot)$ represents the net transfer of debt from the lender. The constraint stating that $\tau(z, W) \geq 0$ obliges the restructuring to entail new money. In other words, the private lender provides new debt in excess of the restructuring deal W.[36] Besides this, upon restructuring, the sovereign gets rid of the output penalty and re-accesses the private bond

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

market. However, it cannot immediately borrow multilateral debt. The complete re-access to the market arises after the renegotiation's end.[37]

Let's now determine $W^{RS}_{b,p}$. Given the risk neutrality of the private lender, the sovereign cannot offer less than the value of the defaulted debt under default if it wants to settle. There is also no reason to offer more. Thus,

$$W^{RS}_{b,p}(z, b_m, b_p) = -b_p q^{DS}_p(z, b_m, b_p),$$

where $q^{DS}_p(\cdot)$ is the market value of the defaulted debt and is specified in the next section. The sovereign's offer corresponds the private lender's reservation value as it represents the present discounted value of the debt in the default's state. The private lender will therefore always accept the sovereign's offer. Nevertheless, the sovereign might decide not to propose (i.e. $A^{RS}_p(z, b_m, W) = 0$) if it is better off in autarky.

If the private lender has the chance to propose a settlement, it should consider two main aspects. On the one hand, it should come up with a settlement that the sovereign is likely to accept. On the other hand, it has to make sure it maximizes the recovery value. The private lender's offer is therefore the result of

$$\begin{aligned} W^{RS}_{l,p}(z, b_m, b_p) = \arg\max & \left[A^{RS}_p(z, b_m, W)W + (1 - A^{RS}_p(z, b_m, W))W^{RS}_{b,p}(z, b_m, b_p)\right] \\ \text{s.t.} \quad & W \leq -b_p. \end{aligned}$$

In words, the private lender seeks 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 the defaulted debt. Figure A5 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 price, the least it could pay is $W^{RS}_{l,p} = -q^{DS}_p(z, b_m, b_p)b_p$. Now to get out of default, it would need to issue new private debt. The problem is that in low productivity states, $q_p(z, b_m, b_p)$ is very close to $q^{DS}_p(z, b_m, b_p)$ due to the persistence of the shocks. Owing to the constraint $\tau(z, W) \geq 0$, 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^{ES}_p. It is then optimal for the sovereign to wait that the productivity state improves and $q_p(z, b_m, b_p)$ recovers in order to settle its debt.

Delays therefore originate from the sovereign's limited commitment to repay its debt. In

[37] In other words, the sovereign must first settle its position with the private lender before it can issue multilateral debt. As a result, it cannot use multilateral funds to settle its debt. Otherwise, the sovereign would be willing to enter *selective* default to rearrange its portfolio at lower costs.

other words, delays in the renegotiation process emanate from the same force that generates the default itself. The risk of future debt repudiation reduces the value of restructuring. In low productivity states, this value is typically very low as the incidence of default right after the settlement is highly probable. The sovereign therefore stays in autarky until the risk of default diminishes. Note that it is also optimal for the private lender to wait that the productivity state improves before settling. When the default risk is high, the recovery value of debt is very low. However, as it diminishes, the private lender can recover more money from the sovereign.

7.2 Selective default on multilateral debt

In the case of a default involving the multilateral debt, I take the behavior of the IMF and the WB as given. That is, following the exposition in Section 3, I assume that the multilateral lender requests to be repaid in full, refuses underbids from the sovereign and quota-exceeding drawdowns.[38] This is tantamount to setting $\phi_m = 1$ meaning an absolute bargaining power of the multilateral lender. Thus,

$$V_m^{RS}(z, b_m, b_p) = \max\{\Omega_m^{RS}(z, b_m, b_p), V^{DF}(z, b_m, b_p)\}. \tag{9}$$

with

$$\Omega_m^{RS}(z, b_m, b_p) = \max\left\{V_m^{DS}(z, b_m, b_p), V_m^{ES}(z, W_{l,m}, b_p)\right\} \quad \text{and} \quad W_{l,m}(z, b_m, b_p) = -b_m, \tag{10}$$

where the value of re-accessing the market is given by

$$\begin{aligned} V_m^{ES}(z, W, b_p) = & \max_{b_p', b_m'} u(c) + \beta \mathbb{E}_{z'|z} V(z', b_m', b_p') \\ \text{s.t.} \quad & c = y(z) + \tau(z, W) + [1 - \delta + \delta\kappa] b_p, \\ & \tau(z, W) = q_m(z, b_m', b_p')(-b_m') + q_p(z, b_m', b_p')(-b_p' + \delta b_p) - W, \\ & \tau(z, W) \geq 0, \\ & b_m' \geq \mathcal{A}. \end{aligned} \tag{11}$$

Upon settlement, the sovereign gets rid of the output penalty and can re-access the market. However, compared to the previous case, one notices two changes. First, the sovereign

[38] By full repayment, I mean full repayment of the face value of debt. The multilateral lender forgoes the missed interest payments.

is limited in the level of multilateral debt it can issue due to the lending quota $\mathcal{A}$. The multilateral lender therefore does not accept that the sovereign draw extra funds to repay what it owes. Second, the sovereign can access private funding immediately at the moment of the settlement. Otherwise, it might not be able to repay the multilateral lender in full.

From this set-up, it is already clear that a *selective* default on multilateral debt is not attractive. There will be no such defaults in any of my quantitative exercise.

7.3 Full default

The renegotiation under *full* default is a combination of the two preceding renegotiation processes. I consider that the sovereign renegotiates with each lender separately and needs to settle with both to regain access to the market. Thus, given that $\phi_m = 1$ and $\phi_p \in (0,1)$, one has

$$\Omega^{RF}(z, b_m, b_p) = \phi_p \bar{\Omega}^{RF}(z, b_m, b_p, W_{l,p}^{RF} + W_{l,m}) + (1-\phi_p)\bar{\Omega}^{RF}(z, b_m, b_p, W_{b,p}^{RF} + W_{l,m}) \quad (12)$$

where $W_{b,p}^{RF}$ and $W_{l,p}^{RF}$ represent the offer for the private debt made by the sovereign and the private lender, respectively. Conversely, $W_{l,m}$ is the offer of the multilateral lender. Following the same logic as before, the stopping function $A^{RF}(z, b_m, b_p, W)$ is the result of

$$\bar{\Omega}^{RF}(z, b_m, b_p, W) = \max\left\{V^{DF}(z, b_m, b_p), V^{EF}(z, W)\right\} \quad (13)$$

where $V^{DF}(\cdot)$ is the value of remaining in full default and $V^{EF}(\cdot, W)$ is the value of exiting the negotiation with a restructured debt of value W. The latter reads

$$\begin{aligned} V^{EF}(z, W) = & \max_{b'_m, b'_p} u(c) + \beta \mathbb{E}_{z'|z} V(z', b'_m, b'_p) \quad (14) \\ \text{s.t.} \quad & c = y(z) + \tau(z, W), \\ & \tau(z, W) = q_m(z, b'_m, b'_p)(-b'_m) + q_p(z, b'_m, b'_p)(-b'_p) - W, \\ & \tau(z, W) \geq 0, \\ & b'_m \geq \mathcal{A}. \end{aligned}$$

Once again, upon restructuring, the sovereign gets rid of the output penalty and regains access to the market. It is nevertheless limited in the access of multilateral funds by $\mathcal{A}$. The sovereign's offer to the private lender is given by

$$W_{b,p}^{RF}(z, b_m, b_p) = -b_p q_p^{DF}(z, b_m, b_p).$$

The private lender's offer is the result of

$$W_{l,p}^{RF}(z,b_m,b_p) = \arg\max\left[A^{RF}(z,b_m,b_p,W+W_{l,m})W + (1-A^{RF}(z,b_m,b_p,W+W_{l,m}))W_{b,p}^{RF}(z,b_m,b_p)\right]$$
$$\text{s.t.} \quad W \leq -b_p.$$

The full repayment of multilateral lenders generates a clear externality for the private lenders by affecting the stopping function A^{RF}. The level of multilateral debt therefore directly impacts $W_{l,p}^{RF}$. The opposite is not true, though. Given that $\phi_m = 1$, only the multilateral lender proposes and its offer is independent of the level of private debt,

$$W_{l,m}(z,b_m,b_p) = -b_m.$$

How is this setting supposed to generate additional delay? If $\phi_m < 1$, the sovereign could offer them $q_m^{DF}(z,b_m,b_p)(-b_m)$ with $q_m^{DF}(z,b_m,b_p) < 1$ instead of $-b_m$. In words, the complete repayment of the multilateral debt renders the debt restructuring more costly for the sovereign. Particularly, it forces the sovereign to accumulate a greater level of new debt during a restructuring. The sovereign has therefore to wait that the productivity state *majorly* improves before settling.

Given additional delays, the lending quota 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 lending quota is thus introduced to counterbalance this effect.

More precisely, provided that the access to multilateral funds is tight, the sovereign has to issue most of its new debt in the private bond market. However, the private debt is more sensitive to the risk of default and its price drastically depresses with the amount borrowed. This forces the private lenders to lower their settlement offer in order to successfully exit the default state. Figure A5 in Appendix A depicts the optimal private lender's offer.

8 Defaults, 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 and characterising the equilibrium.

8.1 Bond prices

Before I determine the prices, I have to properly define the different default policies. The *selective* default policy on creditor i for all $i, j \in \{m, p\}$ and $i \neq j$ is defined by

$$D_i^{DS}(z, b_m, b_p) = \begin{cases} 1 & \text{if} \quad V_i^{DS}(z, b_m, b_p) > V^P(z, b_m, b_p),\ V_i^{DS}(z, b_m, b_p) > V_j^{DS}(z, b_m, b_p) \text{ and} \\ & \qquad V_i^{DS}(z, b_m, b_p) > V^{DF}(z, b_m, b_p) \\ 0 & \text{else} \end{cases}$$

Conversely, the *full* default policy is defined by

$$D^{DF}(z, b_m, b_p) = \begin{cases} 1 & \text{if} \quad V^{DF}(z, b_m, b_p) > V^P(z, b_m, b_p) \text{ and} \\ & \qquad V^{DF}(z, b_m, b_p) > V_i^{DS}(z, b_m, b_p) \text{ for all } i \in \{m, p\} \\ 0 & \text{else} \end{cases}$$

Finally define the default policies on the private and the multilateral debts as $D_p = D_p^{DS} + D^{DF}$ and $D_m = D_m^{DS} + D^{DF}$, 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.

$$\begin{aligned} q_p(z, b_m', b_p') = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[&(1 - D_p(z', b_m', b_p'))(1 - \delta + \delta\kappa + \delta q_p(z', b_m'', b_p'')) + \\ &D_p(z', b_m', b_p') q_p^D(z', b_m', b_p')\big]. \end{aligned} \tag{15}$$

If the sovereign decides to repay (i.e. $D_p(z', b_m', b_p') = 0$), 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, $\delta q_p(z', b_m'', b_p'')$ (Chatterjee and Eyigungor, 2012).[39] If the sovereign decides to renege the debt contract (i.e. $D_p(z', b_m', b_p') = 1$), the private lenders receive the recovery value of the debt defined as

$$q_p^D(z, b_m, b_p) = D_p^{DS}(z, b_m, b_p) q_p^{DS}(z, b_m, b_p) + D^{DF}(z, b_m, b_p) q_p^{DF}(z, b_m, b_p).$$

The private lenders' recovery value depends on the acceptance probability, the private

[39] Notice that the last term depends on the prospective productivity shock, z', and the level of borrowing in the next period, $b_m'' = b_m(z', b_m', b_p')$ and $b_p'' = b_p(z', b_m', b_p')$ where $b_i(\cdot)$ is the bond policy function for debt of type $i \in \{m, p\}$.

lender's bargaining power and the proposed offer.[40] In the case of *selective* default,

$$q_p^{DS}(z, b_m, b_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - \phi_p A_p^{RS}(z', b'_m, b_p))q_p^{DS}(z', b'_m, b_p)+$$
$$\phi_p A_p^{RS}(z', b'_m, b_p)\frac{1}{-b_p}W_{l,p}^{RS}(z', b'_m, b_p)\big].$$

The price is again shaped by the break-even condition of the private lenders. If the private lenders propose and the sovereign accepts the deal (i.e. $A_p^{RS}(z', b'_m, b_p) = 1$) then the recovery value per unit of bond is $\frac{1}{-b_p}W_{l,p}^{RS}(z', b'_m, b_p)$. This implicitly considers that the recovered value is equally shared among the private lenders. Conversely, if the sovereign proposes, the private lenders receive their outside option, $q_p^{DS}(z', b'_m, b_p)$. Finally, if the sovereign refuses to settle or does not propose, it does not disburse anything now, but in present value it pays $q_p^{DS}(z', b'_m, b_p)$. Similarly, in the case of *full* default,

$$q_p^{DF}(z, b_m, b_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - \phi_p A^{RF}(z', b_m, b_p))q_p^{DF}(z', b_m, b_p)+$$
$$\phi_p A^{RF}(z', b_m, b_p)\frac{1}{-b_p}(W_{l,p}^{RF}(z', b_m, b_p) + b_m)\big].$$

I can now pass to the price of one unit of multilateral bond. Given the break-even assumption, the price formula is similar to the private bond,

$$q_m(z, b'_m, b'_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - D_m(z', b'_m, b'_p))(1 - \delta + \delta\kappa + \delta q_m(z', b''_m, b''_p))+ \tag{16}$$
$$D_m(z', b'_m, b'_p)q_m^D(z', b'_m, b'_p)\big],$$

The recovery value upon default is given by

$$q_m^D(z, b_m, b_p) = D_m^{DS}(z, b_m, b_p)q_m^{DS}(z, b_m, b_p) + D^{DF}(z, b_m, b_p)q_p^{DF}(z, b_m, b_p).$$

In the case of *selective* and *full* defaults, the multilateral lenders request a full repayment and allow no underbid from the sovereign implying that

$$q_m^{DS}(z, b_m, b_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - A_m^{RS}(z', b_m, b'_p))q_m^{DS}(z', b_m, b'_p) + A_m^{RS}(z', b_m, b'_p)\big],$$

and

$$q_m^{FD}(z, b_m, b_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - A^{RF}(z', b_m, b_p))q_m^{FD}(z', b_m, b_p) + A^{RF}(z', b_m, b_p)\big].$$

[40] By a slight abuse of notation, I define $A_p^{RS}(z', b'_m, b_p) \equiv A_p^{RS}(z', b'_m, W(z', b'_m, b_p))$.

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 *de facto* seniority assumption. Second, the recovery value for the multilateral debt is potentially higher than the recovery value of private debt. Thus, the multilateral debt price will be relatively higher than the private price, in general.

8.2 Competitive equilibrium

Having properly defined the price, one can define the equilibrium of the economy. 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 decisions. Second, given the prices and the outcome of the repayment problem, the sovereign sets its restructuring decisions. On the lenders' side, the equilibrium is governed by the break even assumption.

Definition 1 (Recursive Competitive Equilibrium)**.** *A recursive competitive equilibrium in this environment consists of*

- *Policy functions for the sovereign's consumption,* $c(z, b_m, b_p)$*, private bond holdings,* $b'_p = b_p(z, b_m, b_p)$*, multilateral bond holdings,* $b'_m = b_m(z, b_m, b_p)$*, default,* $D_p^{DS}(z, b_m, b_p)$*,* $D_m^{DS}(z, b_m, b_p)$ *and* $D^{DF}(z, b_m, b_p)$*, proposed settlement,* $W_{b,p}^{RS}(z, b_m, b_p)$ *and* $W_{b,p}^{RF}(z, b_m, b_p)$*, and stopping functions,* $A_m^{DS}(z, b_m, b_p)$*,* $A_p^{DS}(z, b_m, b_p)$ *and* $A^{DF}(z, b_m, b_p)$*.*
- *Policy functions for the lenders' proposed settlement,* $W_{l,m}(z, b_m, b_p)$*,* $W_{l,p}^{RS}(z, b_m, b_p)$ *and* $W_{l,p}^{RF}(z, b_m, b_p)$*.*
- *Price schedules for the multilateral debt,* $q_m(z, b_m, b_p)$*, and the private debt,* $q_p(z, b_m, b_p)$*.*

such that

1. *Taking the above prices as given,*
   (a) *and taking the solution to the renegotiation problem as given, the policy functions* $c(z, b_m, b_p)$*,* $b_p(z, b_m, b_p)$*,* $b_m(z, b_m, b_p)$*,* $D_p^{DS}(z, b_m, b_p)$*,* $D_m^{DS}(z, b_m, b_p)$ *and* $D^{DF}(z, b_m, b_p)$ *solve the sovereign's repayment problem in (1)-(5).*
   (b) *and taking the solution to the repayment problem as given, the policy functions* $W_{l,m}(z, b_m, b_p)$*,* $W_{l,p}^{RS}(z, b_m, b_p)$*,* $W_{b,p}^{RS}(z, b_m, b_p)$*,* $W_{l,p}^{RF}(z, b_m, b_p)$*,* $W_{b,p}^{RF}(z, b_m, b_p)$*,* $A_m^{DS}(z, b_m, b_p)$*,* $A_p^{DS}(z, b_m, b_p)$ *and* $A^{DF}(z, b_m, b_p)$ *solve the sovereign's renegotiation problem in (6)-(14).*

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

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

8.3 Optimal debt structure

To properly characterize the portfolio choice, I first need to determine the evolution of prices. The following proposition is made of two parts. First, for a given level of private (multilateral) debt, the price of multilateral (private) debt decreases with additional multilateral (private) borrowing. Second, for a given level of private debt, the price of private debt does not necessarily decrease with additional multilateral borrowing.

Proposition 1 (Price Dynamic)**.** *In equilibrium, if $b_m(z, b_m, b_p)$ and $b_p(z, b_m, b_p)$ are increasing in b_p and b_m:*

I. *In any state (z, b_m), for all $b_p^1 > b_p^2$, then $q_m(z, b_m, b_p^1) \geq q_m(z, b_m, b_p^2)$ and $q_p(z, b_m, b_p^1) \geq q_p(z, b_m, b_p^2)$.*

II. *In any state (z, b_p), for all $b_m^1 > b_m^2$, then $q_m(z, b_m^1, b_p) \geq q_m(z, b_m^2, b_p)$ but $q_p(z, b_m^1, b_p) \lesseqgtr q_p(z, b_m^2, b_p)$.*

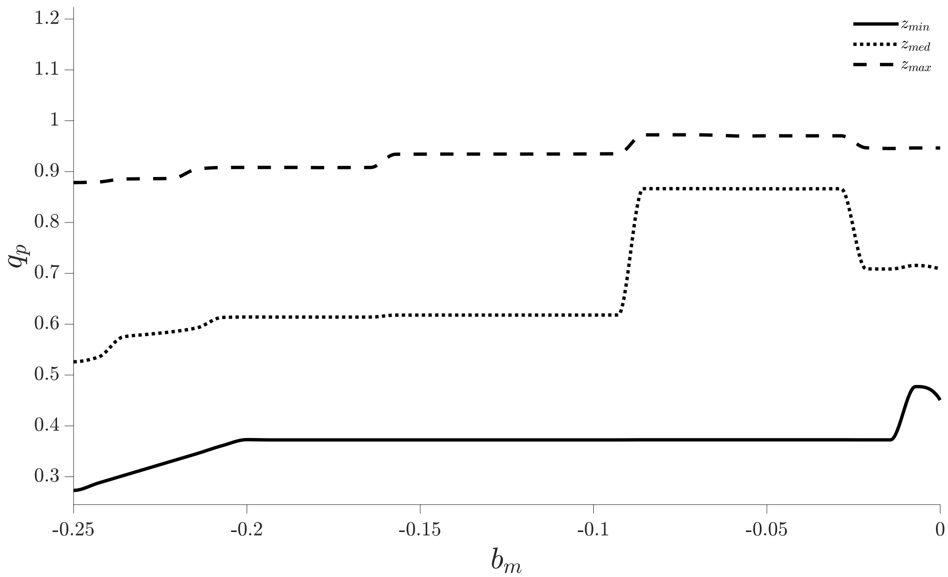
Proof. See Appendix D $\square$

Part I of the proposition is a standard prediction of that type of model. Following Eaton and Gersovitz (1981), a sovereign has a reduced incentive to repay with greater level of debt due to the larger debt servicing costs.

Part II of the proposition is somewhat different. With the *de facto* seniority assumption, the sovereign is less willing to default on its multilateral debt. Hence, accumulating some level of multilateral debt can work as a commitment device. The sovereign is indeed less wiling to default as it is more costly to do so. I show that there is some level of multilateral debt for which a *selective* default on private lenders has become too costly because of the increased multilateral debt servicing costs and yet a *full* default remains too damaging for the sovereign. There, more multilateral debt effectively reduces the default risk.

The second part of Proposition 1 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 *selective* 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.

Figure 3: Private Bond Price



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

Source: Author's computation.

Figure 3 depicts the private bond price as a function of b_m for a given 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 increasing q_p. In opposition, as b_m gets more important, this effects disappears and the sovereign defaults again. This time however, the sovereign does not choose a *selective* default on private debt but a *full* default in which the private debt in subordinated. The private bond price largely depresses as the recovery value of private debt decreases.

The above pecuniary spillover addresses the catalytic function of multilateral lending.[41] 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.

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

Having determined the main dynamic of prices, I can now define the optimal borrowing policy. As Arellano and Ramanarayanan (2012), I assume that the bond price functions q_m and q_p and the value of repaying V^P are differentiable. I then derive the first-order necessary conditions of the sovereign's problem given in (2).[42] With respect to b'_m, one obtains

$$u'(c)\left[\frac{\partial q_m}{\partial b'_m}(b'_m-\delta b_m)+q_m+\frac{\partial q_p}{\partial b'_m}(b'_p-\delta b_p)\right]=\beta\mathbb{E}_{z'|z}\left[u'(c')(1-\delta+\delta\kappa+\delta q'_m)\right], \tag{17}$$

and with respect to b'_p,

$$u'(c)\left[\frac{\partial q_m}{\partial b'_p}(b'_m-\delta b_m)+\frac{\partial q_p}{\partial b'_p}(b'_p-\delta b_p)+q_p\right]=\beta\mathbb{E}_{z'|z}\left[u'(c')(1-\delta+\delta\kappa+\delta q'_p)\right]. \tag{18}$$

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. Under Proposition 1,[43]

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

Proposition 1 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 (17) and (18) 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. As noted before, additional units of multilateral debt do not necessarily decrease the price of private debt. Thus, the sovereign has a greater incentive to repay compared to when it issues private debt. In opposition, for any additional level of private debt, the private debt price sinks reducing the willingness to repay. In that situation, the above ratio is bigger than one inducing a greater incentive to repay when

[42] I do not consider the constraint $b'_m \geq b'_p$ to remain general in my exposition.

[43] Recall that one defines debt as a negative asset. Hence, the depicted derivatives are tantamount to $\frac{\partial q_p}{\partial(-b'_p)}\leq 0$ and $\frac{\partial q_m}{\partial(-b'_m)}\leq 0$.

issuing multilateral debt compared to private debt.

The seniority benefit is especially important when the sovereign is at the verge of a default. In this situation, the private debt price decreases faster than the multilateral debt price as it is more sensitive to the risk of default. It is then optimal for the sovereign to accumulate more multilateral debt because of its relative cheapness. The model therefore predicts a surge in multilateral borrowing prior to default consistent with Fact IV.

The subordination benefit relates to the private debt and corresponds to the ratio of the right-hand side of (17) and (18),

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

which one can reformulate as

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

Owing to the 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 $\text{cov}(u'(c'), q'_p) \leq \text{cov}(u'(c'), q'_m) < 0$ 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), 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 the relative incentive benefits, whereas the long-term debt provides an hedge against future low productivity shocks – what the authors call the hedging benefits.[44] 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

This section presents the calibration adopted to match the moments presented in Section 4 among others. 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. The frequency of the model is yearly.

The data used in this section are the same as the ones in Section 4 and are detailed in Appendix B. As one can observe in Table 2, there is quite a large variability between the countries in terms of indebtedness, maturity, spread and trade balance. I will therefore match moments that correspond to the median country in the sample. Interestingly, the median country is representative of the typical emerging economies – Argentina, Brazil, Mexico and Peru – analyzed in the literature on sovereign debt and default.

Table 2: Sample Property

	Sample p25	Sample p50	Sample p75	ARG	BRA	MEX	PER
Consumption over GDP	75.0	83.3	92.5	74.4	79.9	80.2	79.7
Trade balance over GDP	-12.3	-3.7	2.1	2.2	-0.9	-2.4	3.2
Total Debt over GDP	10.7	30.2	61.6	25.8	30.7	29.0	36.1
Multilateral debt over GDP	1.1	8.4	19.8	5.7	3.1	3.4	8.1
Maturity	7.0	11.4	21.4	9.2	12.3	11.0	9.1
Coupon rate	2.6	5.8	9.8	7.7	7.7	7.5	8.1

Source: See Appendix B.

The moments I seek to target are the following. First and foremost, the model ought to match the haircuts and the durations reported in Table 1 of Section 4. That is, for defaults (not) involving multilateral creditors, the haircut should average (32.0%) 56.1% and the default's length ought to amount (2.6) 7.3 years. In addition, the share of defaults implicating multilateral creditors shall be around 21.5%. Furthermore, there should be a surge in the multilateral indebtedness prior to default of 17.2%. Besides this, I target a default rate of 2.5% (Tomz and Wright, 2007, 2013). In terms of debt structure, the average maturity should equate roughly 10 years with an average coupon of 5.8%. The total level of

[44] Those two effects are also present in notably Dovis (2019) and Mihalache (2020). See also Aguiar et al. (2019) for a thorough discussion on the tradeoff between short-term and long-term debt.

indebtedness shall be around 30% of GDP, which is the standard value adopted by studies on emerging economies. The targeted level of multilateral debt is 8.4% of GDP. Finally, the average spread on private debt shall be around 7%.

Table 3 summarizes the main parameters of the model. The utility function takes the constant relative risk aversion (CRRA) form,

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

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 4.76% to match the average of the real 10-year US Treasury bonds yield.[45] This value is close to the one of 4.2% adopted by Dvorkin et al. (2021). Finally, the stochastic process follows log-normal AR(1) process,

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

The persistence of the endowment shock ρ is set to 0.89 and the standard deviation σ_ϵ to 0.08 to match the average length of defaults implicating multilateral debt. The persistence parameter is within the range admitted in the literature. For example, Arellano (2008) estimates for Argentina $\rho = 0.945$, while Sánchez et al. (2018) come up with $\rho = 0.89$ for Colombia. The standard deviation is however a bit larger than the one chosen in the two aforementioned studies which is around 0.025 and 0.03, respectively. Nevertheless, it relates more closely to the value $\sigma_\epsilon = 0.055$ of Asonuma and Joo (2020) estimated for Argentina. The stochastic process is then discretized into a 6-state Markov chain following the approach of Tauchen (1986). On top of that, I add a 4-state i.i.d. shock to ensure convergence of the bond price schedules (Chatterjee and Eyigungor, 2012).

Regarding the maturity structure, I set $\kappa = 0.058$ to directly match the coupon rate and $\delta = 0.9$ to match the median maturity of 10 years reported in Table 2. I subsequently select the value of the discount factor, β to match the debt-to-GDP ratio. I obtain $\beta = 0.952$ 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 average SZ haircut for defaults not implicating multilateral lenders. The value of 0.59 is higher to the value of 0.52 chosen by Benjamin and Wright (2013) and the value of 0.55 chosen by Dvorkin et al. (2021).

Besides this, the multilateral lending quota is set to -0.1357 to match the average SZ haircut for defaults implicating multilateral lenders. This corresponds to roughly 14% of the stationary value of output. In comparison, the sample average of the IMF lending quota

[45] Average 10-year US Treasury bond rate minus PCE inflation during the period of the great moderation.

Table 3: Parameters

Parameter	Value	Description	Targeted Moment
A. Based on Literature			
σ	2	Risk aversion	
B. Direct Measure from the Data			
r	0.0476	Risk-free rate	Average 10-year US real Treasury yield
δ	0.9	Reciprocal of average maturity	Average maturity structure
κ	0.058	Coupon payments	Average coupon rate
C. Based on Model solution			
β	0.952	Discount factor	Debt-to-GDP ratio
ϕ	0.59	Bargaining power	Average SZ haircut without multilateral
ρ	0.89	Output persistence	Length default multilateral debt
σ_ϵ	0.08	Standard deviation	Length default multilateral debt
$\underline{B}$	-0.35	*Ad hoc* borrowing limit	Change in debt prior to default
$\mathcal{A}$	-0.1357	Multilateral lending quota	Average SZ haircut with multilateral
ψ_p	0.847	Asymmetric default cost	Default rate
ψ_m	0.793	Asymmetric default cost	Average private spread
$\varkappa_p$	0	Fixed default cost	Share multilateral debt default
$\varkappa_m$	0.021	Fixed default cost	Multilateral-debt-to-GDP ratio

is 2.5% of GDP in 2018 and countries can lend up to 6 times this amount. Obviously, the quota indirectly impact the level of multilateral debt the sovereign is willing to accumulate.

The output penalty is creditor-specific. Defaults on multilateral lenders are followed by a more severe cost. Formally, for each $i \in \{m, p\}$,

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

The penalty cost is made of two components: ψ and $\varkappa$. The former relates to the standard asymmetric cost of Arellano (2008) and obviously $\psi_m \leq \psi_p$. The second component is a fixed output penalty that is imposed on top of the asymmetric cost with $\varkappa_m < \varkappa_p$. The rationale behind this fixed cost is the following. Under *selective* default on the private debt, the sovereign consumes $y_p^D(z) + [1 - \delta + \delta\kappa]b_m$, whereas under *full* default, it consumes $y_m^D(z)$. If one assumes that $\psi_m = \psi_p$ and $\varkappa_m = \varkappa_p = 0$, *selective* defaults become unattractive due to the multilateral debt service, $[1 - \delta + \delta\kappa]b_m$. The fixed penalty is therefore a way to counterbalance the debt service cost that is absent in *full* default.

The level of penalty is selected to match different moments. First, ψ_m and ψ_p are chosen to match the average private debt spread and the default rate, respectively. The fixed default cost serves to determine the share of defaults on multilateral lenders. In comparisons to existing studies, those default penalties are close to the ones of Dvorkin et al. (2021) but relatively high compared to Arellano (2008) who selects $\psi_p = 0.969$.

This model is subject to large increases in debt 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. All those cost structures are ill-suited to the present analysis as they would affect the tradeoff between private and multilateral debt and the choice between *selective* and *full* default. I therefore introduce an *ad hoc* borrowing limit, $\underline{B}$, on private debt. I calibrate this limit in order to match the increase of total indebtedness per GDP prior to a default.

10 Results

This section presents the results of the model's calibration. First, it discusses how the model quantitatively replicates the facts presented in Section 4 alongside the other targeted moments. Second, it assesses the fit of the model with respect to non-targeted moments and presents some simulation results. Third, it presents counterfactual analyses. Notably, it analyzes what happens when one weakens or strengthens the *de facto* seniority.

As already mentioned, I record *selective* defaults on multilateral debt in none of the following quantitative exercise. Thus, every time I refer to a *selective* default, I mean a *selective* default on private debt.[46]

10.1 Facts and targeted moments

I first assess how the model matches the newly established empirical facts and other targeted moments. The column on the left-hand side of Table 4 displays the empirical facts and their model counterpart. The model generates haircuts and durations that are in line with the empirical evidence and that for defaults involving both multilateral creditors and the remaining creditors. The model nonetheless slightly underestimate the length and the haircut of defaults implicating multilateral creditors. In addition, the model predicts a share of multilateral debt defaults close to the data. The same holds true for the surge in multilateral indebtedness prior to a default.

The column on the right-hand side of Table 4 depicts the model's fit with respect to other targeted moments. First and foremost, the average private spread gets very close to the target. This result needs a particular highlight given the difficulty to match the spread in this literature and the fact that the model generates positive recovery values. Besides this, with the specification of the long-term bond structure, I directly match the average

[46]This is consistent with what is observed in the data. Usually countries do not default solely on multilateral lenders. The main exception is Greece which defaulted on the IMF but continued to repay private lenders in 2015.

Table 4: Targeted Moments

	Data	Model		Data	Model
A. Empirical Facts			B. Other targeted moments		
Default length (year) (with multilateral lenders)	7.3	6.2	Debt Maturity (year)	10.0	10.0
Default length (year) (without multilateral lenders)	2.6	2.5	Debt coupon rate (%)	5.8	5.8
Private creditors' haircut (%) (with multilateral lenders)	56.1	50.8	Default rate (%)	2.5	1.7
Private creditors' haircut (%) (without multilateral lenders)	32.0	31.2	Private debt spread (%)	7.0	7.4
Multilateral debt increase (%) (prior to default)	17.2	14.1	Total debt increase (% points) (prior to default)	15.0	32.1
Share multilateral defaults (%)	21.5	19.0	Total debt to GDP (%)	30.2	31.9
			Multilateral debt to GDP (%)	8.4	10.2

maturity and the coupon rate. In addition, the model generates a default rate close to the target. The same holds true for the increase of debt prior to default. However, it does not match the increase in indebtedness prior to default.

All in all, the model is capable of quantitatively replicating the newly established empirical facts. It generates different haircuts and default's lengths depending on which creditor is involved. The greater haircut in the case of a default involving multilateral lenders is due to the fact that no quota-exceeding drawdowns are allowed during restructurings. Besides this, the longer default's length is the consequence of the full repayment of multilateral lenders and the greater debt repudiation compared to a *selective* default on private creditors. Finally, the subordination of private debt enables the model to replicate the observed average spread on private debt.

10.2 Non-targeted moments

Having assessed how the model replicates the targeted moments presented in Section 4, I can now gauge how it matches non-targeted moments. Table 5 depicts the fit of the model with respect to selected business cycle facts. I match moments related to consumption in an accurate way. For the trade balance, the model indicates a surplus which is consistent with Argentina and Peru. However, as other models with endogenous restructurings, it fails to generate countercyclical trade balance. In terms of interest rates, the model can reproduce large spreads but cannot replicate the observed volatility.

Table 5: Non-Targeted Moments

	$\mu(x)$	$\sigma(x)$	$\sigma(x)/\sigma(y)$	$\text{corr}(x,y)$
Consumption				
Model	99.0	0.19	0.95	0.99
ARG	74.4	0.04	1.17	0.93
BRA	79.9	0.02	0.95	0.83
MEX	80.2	0.02	1.01	0.90
PER	79.7	0.04	1.14	0.94
Trade Balance over GDP				
Model	1.0	0.03	0.17	0.38
ARG	2.2	0.02	0.65	-0.57
BRA	-0.9	0.03	1.20	-0.26
MEX	-2.4	0.03	1.23	-0.49
PER	3.2	0.04	1.12	-0.42
EMBIG Spread				
Model	7.4	0.09	0.45	-0.85
ARG	16.6	0.18	5.16	-0.71
BRA	5.1	0.04	1.69	-0.34
MEX	2.8	0.01	0.64	0.10
PER	3.4	0.02	0.53	-0.25

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.

In comparison to previous studies, the present model matches relatively well business cycle moments of emerging economies. 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.[47] Moreover, they obtain a correlation between consumption and output of 0.99, a correlation between the trade balance (over output) and output of -0.44 and a correlation between the spread and output of -0.65. 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 balance and the volatility of spread, my model generates statistics very close the aforementioned ones. Especially, Chatterjee and Eyigungor (2012) obtain a better fit for the spread because they assume a recovery value of zero, while the present model generates positive and substantial recovery values.[48]

[47] 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.

[48] Note further that Chatterjee and Eyigungor (2012) use a quadratic default penalty function to match the volatility of spread. I do not use such function as it prevents the model to generate large delays.

Table 6: Spreads

x	$\mu(x)$	$\max(x)$	$min(x)$	$\sigma(x)$	$\sigma(x)/\sigma(y)$	$corr(x,y)$
$r_p - r$	7.43	46.29	0.10	0.09	0.45	-0.85
$r_m - r$	1.31	8.11	0.06	0.01	0.07	-0.88

As shown in Table 6, the average spread on private bonds amounts 7.4%. The maximum level of spread amounts 46.3% which is very close to the maximum spread of 57.7% recorded by Argentina in 2002. The spread on multilateral debt is 1.31% – four times smaller than the private one. The same holds true for the relative volatility which is around 0.09 for the private debt, but only amounts 0.01 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 multilateral lenders are always repaid in full and that the multilateral debt is subject to default to a lesser extent than private debt.

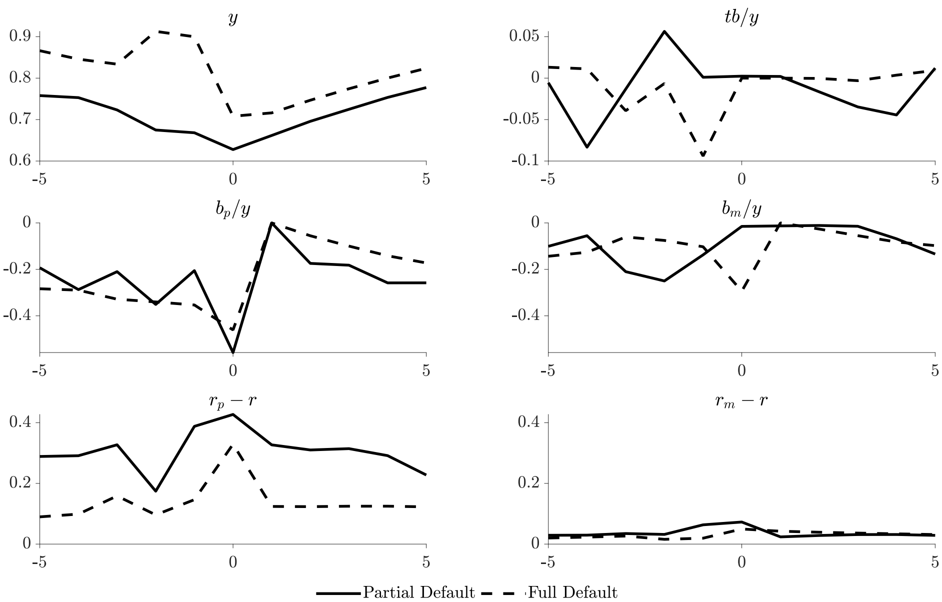
Finally, I check whether the model matches the five empirical facts of Benjamin and Wright (2013). First, (BW1) the two authors report that a default takes time to be resolved and (BW2) that private haircuts are substantial. In light of what is reported in Table 4, I match (BW1) and (BW2) relatively well. Third, (BW3) there is a strong and positive association between the default's length and the private creditors' haircuts. The two authors report a correlation coefficient around 0.6. I also report a positive correlation but it only amounts 0.14. Fourth, (BW4) 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. The same holds true in my model as the source of delays in this model is the same as the one used by the two authors. Finally, (BW5) default's resolutions are not associated with a substantial reduction of indebtedness. This means that renegotiations do not achieve to reduce the debt burden. Consistent with that, I find that the level of debt at the default's start averages 58% of GDP, while it amounts 45% once a settlement arises.

10.3 Bond and price dynamic

This subsection aims at explaining the dynamic of prices and debt in the model. For this purpose, I conduct an event analysis in a window of five years before and after a default.

To construct the event analysis, I simulate 10'000 economies for 400 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 *selective* and *full* defaults.

Figure 4: Event Analysis



Source: Author's computation.

Figure 4 depicts the event analysis for some selected variables. Period 0 corresponds to the occurrence of default. The solid line relates to a *selective* default, while the dashed line corresponds to a *full* default. As one can clearly see, *full* defaults are precedented by a lower output contraction and a greater accumulation of multilateral debt. Especially, they arise after a relatively rapid drop in output. 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.

In opposition, *selective* defaults are related to a greater output contraction, albeit slower in pace. Moreover, there seems to be no 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. Interestingly, one sees that the larger spread arises during a *selective* default. This is due to the fact that *full* defaults (1) are relatively infrequent and (2) arise in a higher endowment state. Consistent with what has been said before, the multilateral debt spread remains relatively modest in comparison to the private debt one.

10.4 Weakening the de facto seniority

There are two ways of weakening the *de facto* seniority assumption in this model. On the one hand, I can lift the tough renegotiation of multilateral lenders. This consists in assuming a *pari passu* agreement between the lenders. On the other hand, I can equalize y_p^D and y_m^D making defaults with and without multilateral lenders equally costly in terms of output penalty. This is tantamount to assuming an equal reputation cost for all types of defaults.

Both thought experiments are important. First, more and more debt contracts entail *pari passu* agreements (Schumacher et al., 2021). Second, the reputation cost of defaulting on multilateral lenders more often than not goes together with the credibility of such lending institutions.

Let's first consider the case of a *pari passu* agreement between the two lenders. For this purpose, I assume two things. On the one hand, the multilateral lenders do not ask to be repaid in full after a *full* default. More precisely, the private and multilateral lenders equally share the burden of the restructuring. On the other hand, the multilateral lenders do not impose a lending quota anymore. This setting mimics a *pari passu* debt contract as all lenders are given the same priority upon restructuring.

Table 7: Alternative Settings

	Data	Benchmark	*Pari passu*	Equal output penalty	$\mathcal{A} = 0$	$\psi_m = 0.77$	*de jure*	No multilateral lenders
Default length (year) (with multilateral lenders)	7.3	6.2	1.3	7.2	10.0	8.3	-	-
Default length (year) (without multilateral lenders)	2.6	2.5	1.0	-	2.7	1.3	1.0	2.2
Private creditors' haircut (%) (with multilateral lenders)	56.1	50.8	22.4	31.9	62.0	64.0	-	-
Private creditors' haircut (%) (without multilateral lenders)	32.0	31.2	20.8	-	33.3	25.0	20.0	37.1
Multilateral debt increase (%) (prior to default)	17.2	14.1	21.6	47.8	-10.5	-23.7	18.9	-
Share multilateral defaults (%)	21.5	19.0	99.9	100.0	6.2	1.0	0	-
Private debt spread (%)	7.0	7.4	1.0	4.1	1.6	4.1	1.0	4.3
Default rate (%)	2.5	1.7	7.1	2.5	3.7	7.7	5.4	12.6
Total debt increase (% points) (prior to default)	15.0	32.1	76.4	17.8	20.3	36.8	10.0	47.8
Total debt to GDP (%)	30.2	31.9	33.7	23.1	15.7	18.8	34.3	23.2
Multilateral debt to GDP (%)	8.4	10.2	15.9	4.5	3.7	1.2	14.0	-

Table 7 depicts the moments related to the model with *pari passu* restructuring alongside the benchmark model and the data moments. The private bond spread largely decreases as

Table 8: Welfare Gains Relative to Benchmark

Endowment state	Private debt	Multilateral debt	Welfare gains (%)				
			Pari passu	Equal output cost	$\mathcal{A}=0$	$\psi_m=0.77$	*de jure*
z_{min}	High	High	1.64	2.72	0.01	0.04	0.23
	High	Zero	0.41	0.47	0.01	0.04	0.46
	Zero	High	1.28	0.53	-0.24	0.02	0.78
	Zero	Zero	0.69	0.05	0.01	0.01	0.81
z_{med}	High	High	0.18	0.15	-0.05	0.03	0.10
	High	Zero	0.16	0.06	0.02	0.04	0.16
	Zero	High	0.18	0.05	0.01	0.04	0.16
	Zero	Zero	0.16	0.02	0.04	0.04	0.18
z_{max}	High	High	0.11	0.02	0.03	0.03	0.12
	High	Zero	0.11	0.02	0.03	0.03	0.13
	Zero	High	0.11	0.02	0.03	0.03	0.13
	Zero	Zero	0.11	0.02	0.04	0.03	0.14

Note: A high level of debt corresponds to $\underline{B}$ for both the private and the multilateral debt.

the private debt is not subordinated anymore. Moreover, the multilateral debt spread is now aligned with the private one. Private and multilateral debt become close substitutes. As a result, the sovereign accumulates more private and multilateral debt than in the benchmark case. However, this does not mean that default arise less frequently. The default rate raises to 7.1% and the share of multilateral defaults to almost 100%. The rationale behind this is that the multilateral debt loses its characteristic of commitment device.

I now turn to the second channel through which the *de facto* seniority emerges: the default penalty. I assume that $y_p^D = y_m^D$. This makes defaulting on multilateral debt equally costly in terms of reputation than defaulting on the private debt.

Table 7 depicts the moments related to the model with equal output penalty alongside the benchmark model and the data moments. As expected, the share of multilateral debt default becomes 100%. Default's length increase but without necessarily increasing the haircut. This is due to the fact that the country holds less debt than in the benchmark case.

The model with *pari passu* restructuring and the model with equal output penalty cannot produce differentiated default's length and haircuts depending on the creditor involved as in the data. It therefore shows the importance of having both channels to generate *de facto* seniority.

Table 8 presents the consumption-equivalent welfare gains with respect to the benchmark model for the private lenders for the period under default. The exact computation of the welfare is exposed in Appendix F. One observes that a *pari passu* agreement is related to substantial welfare gains for the sovereign when debt is high and endowment is low. This comes from the fact that the sovereign now avoids the very long default in which the private debt is subordinated. The case of equal output penalty also brings welfare gains to the sovereign, as it reduces the default cost in autarky.

10.5 Strengthening the de facto seniority

This subsection gauges the impact of strengthening the *de facto* seniority assumption. For this purpose, I conduct three exercises. First I set lending quota $\mathcal{A}$ to zero implying that the sovereign is more restricted in a restructuring involving multilateral debt. Second, I increase the output penalty in defaults implicating multilateral lenders. Third, I impose a *de jure* seniority on multilateral debt.

Let's start with the narrower lending quota. Table 7 depicts the moments related to the model with reduced lending quota alongside the benchmark model. One sees that $\mathcal{A}$ largely impacts the haircuts and the default's lengths. This renders *full* defaults more costly and therefore reduces the share of multilateral debt defaults. As a result, the sovereign reduces its multilateral indebtedness in general.

Turning to the increased output penalty, the impact is similar to a narrower lending quota. The sovereign defaults less frequently on the multilateral debt, while default's lengths and haircuts are larger relative to the benchmark case. Setting $\varkappa_m \to \infty$, I obtain a form of *de jure* seniority on multilateral debt. The model becomes similar to Hatchondo et al. (2017) with the difference that the default's length and the haircuts are endogenous. The default's lengths and haircut are less pronounced than in the benchmark case for *selective* defaults. Otherwise, the model with *de jure* seniority gets very close to the benchmark.

Table 8 presents the consumption-equivalent welfare gains for the three above exercises. I find mixed evidence on the effect of strengthening the *de facto* seniority. Welfare gains are relatively small and in some state, there are even welfare losses. This is mainly due to the fact that multilateral debt defaults are already infrequent in the benchmark model.

10.6 No multilateral lenders

In this subsection, I consider the benchmark model without multilateral lenders. That is, the sovereign has only access to private debt. 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 multilateral lenders produces realistic default durations and haircuts as reported in Table 1. This is mainly due to the fact that multilateral debt defaults are infrequent and therefore do not necessarily affect the average haircut and duration. However, the model cannot replicate the large spread observed in the data. The average spread is 4.13% and the maximum spread is 24.9%, almost half of what the benchmark model generates.[49] The subordination of private debt seems therefore a key element explaining the spreads of the countries considered in this analysis.

11 Conclusion

This analysis uncovers the implication of the *de facto* seniority structure of sovereign debt 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 harcuts. 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 *selective* 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 borrowing and private creditors' haircuts. It additionally generate realistic private debt spreads and debt ratios. The model further matches some non-targeted business cycle properties of emerging economies.

The model provides an important policy implication: the seniority structure of sovereign debt is necessary to maintain multilateral lending at preferential rates. Without this, the multilateral debt would not be superior to private debt and the multilateral lending institutions could not fulfil their mandate.

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.

[49] Dvorkin et al. (2021) report an average spread of 4.1% overall and 6.86% in bad time.

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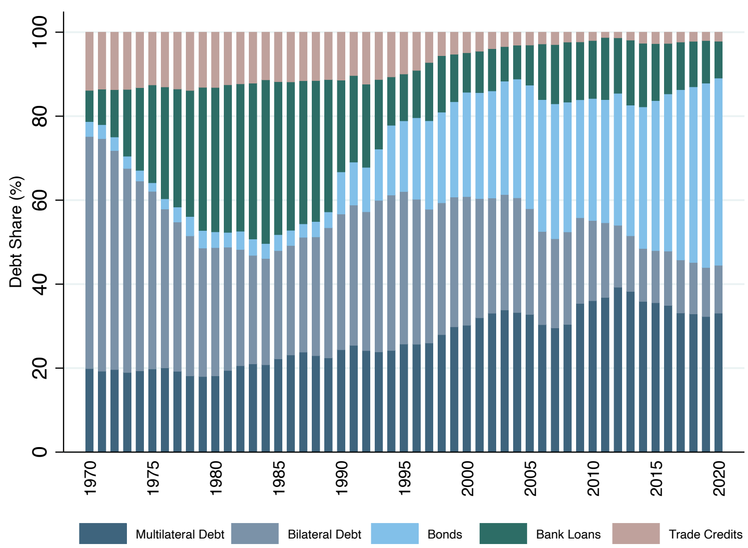
Appendix

A Additional Tables and Figures

Figure A1 presents the composition of the sovereign debt. 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.

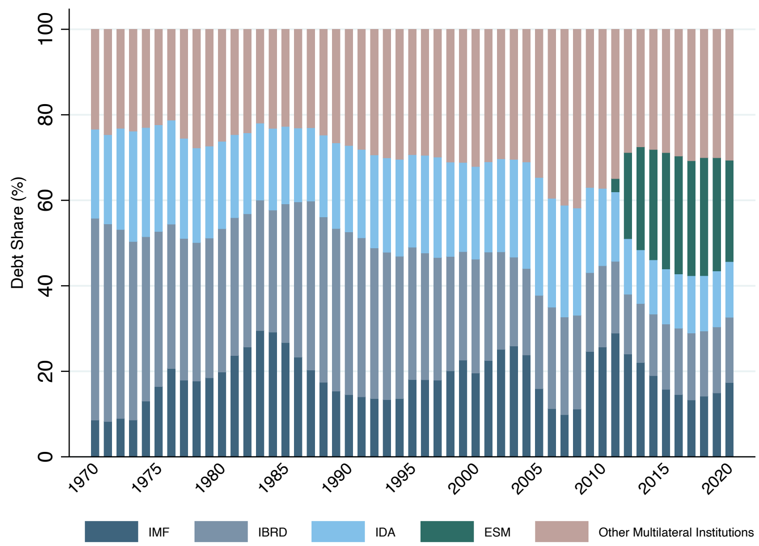
Figure A1: Structure of Sovereign Debt



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 A2 presents the composition of the multilateral sovereign debt. 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). Second, the apparition of the ESM coincides with a reduction of the IMF's and the WB's share. Even though it has been established for a decade, the ESM is part of the main multilateral creditors with a share of roughly 20%, above the IMF.

Figure A2: Structure of Multilateral Sovereign Debt

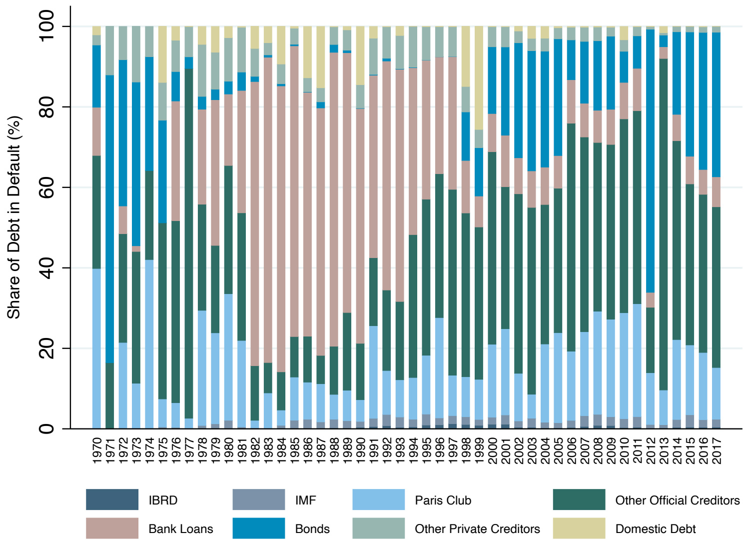


Note: Other Multilateral Institutions refer to loans from regional development bank and other intergovernmental agencies different from the IMF, the IBRD, the IDA and the ESM.
Source: Schlegl et al. (2019), WB, ESM, author's calculation.

Figure A3 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.

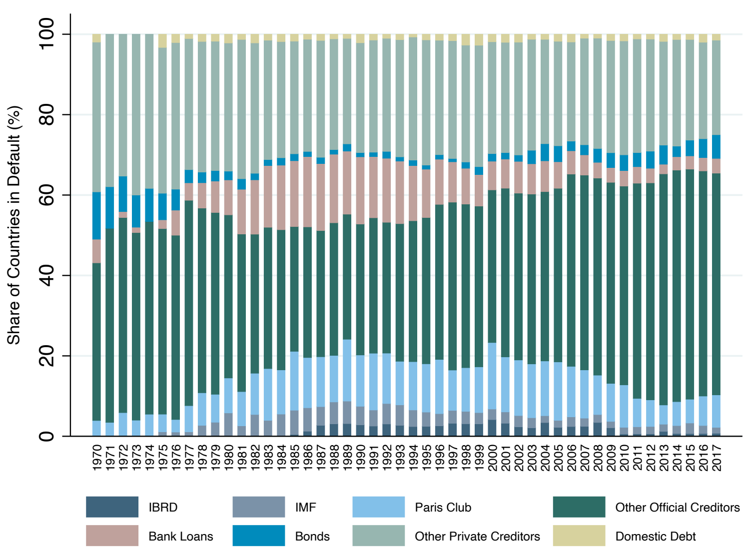
Figure A4 presents the breakdown of countries in default by creditors. As in the previous figure, I note very few countries in default on the IMF and the IBRD. The two institutions combined never accounted for more than 9% of the countries in default. In opposition, the Paris Club and the other official creditors are involved once more in a big part of the defaults. The same holds true for private creditors.

Figure A3: Debt in Default by Creditors



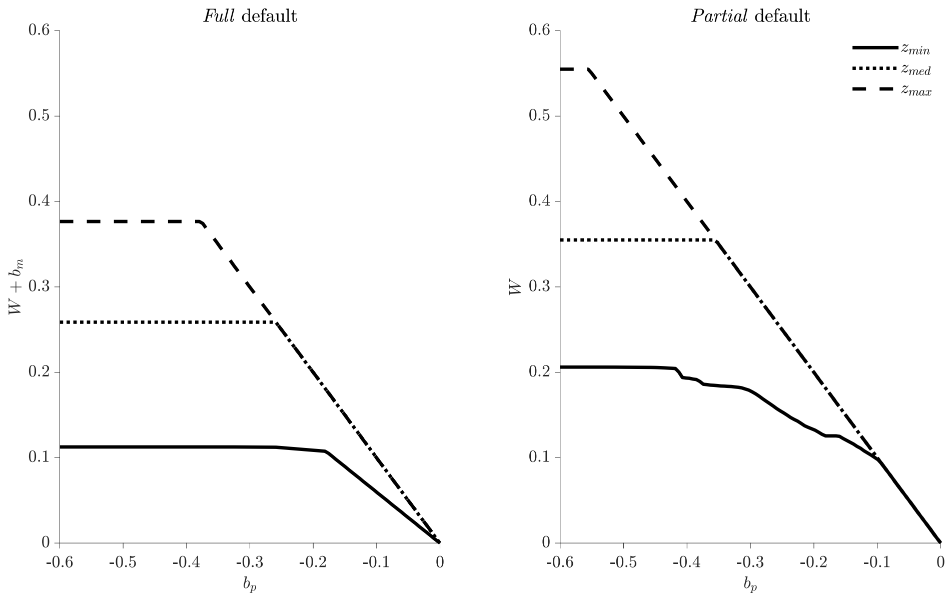
Source: Beers and Mavalwalla (2018), author's calculation.

Figure A4: Countries in Default by Creditors



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

Figure A5: Private Lender's Offer



Source: Author's computation.

The left-hand side of Figure A5 displays the private lender's optimal offer in the case of *selective*. 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 $W \leq -b_p$ is binding and the private lender asks for a full repayment. However, as the level of debt increases, the private lender differentiates its 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.

The right-hand side of Figure A5 depicts the private lenders' offer in the case of a *full* defaults. One observes that the presence of the lending quota 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 *selective* default. This goes back to the argument made in Proposition 1.

Table A1: Private Lender's Welfare Gains under *de jure* Seniority

Productivity state	Private debt	Multilateral debt	Welfare gains (%)		
			$\mathcal{A}=0$	$\psi_m = 0.77$	*de jure*
z_{min}	High	High	0.01	0.04	0.23
	High	Medium	0.01	0.04	0.46
	Medium	High	-0.24	0.02	0.78
	Medium	Medium	0.01	0.01	0.81
z_{med}	High	High	-0.05	0.03	0.10
	High	Medium	0.02	0.04	0.16
	Medium	High	0.01	0.04	0.16
	Medium	Medium	0.04	0.04	0.18
z_{med}	High	High	0.03	0.03	0.12
	High	Medium	0.03	0.03	0.13
	Medium	High	0.03	0.03	0.13
	Medium	Medium	0.04	0.03	0.14

Note: A high level of debt corresponds to $\underline{B}$ for both the private and the multilateral debt.

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 and foremost, 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.[50] Conversely, a restructuring ends with the official settlement announcement or the implementation of the debt exchange.[51]

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.[52] The category other official creditors contains the IDA, bilateral 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

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

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

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

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 B1 indicates the default episodes implicating multilateral lenders.

Table B1: 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

Finally, haircut statistics on private creditors are retrieved from Cruces and Trebesch (2013).[53] 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 25 default episodes implicate multilateral creditors. Table B1 depicts the sample used in the analysis.

I complement my datasets with other data presented in Table B2. 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. For the external debt, I fill the missing observations with the IMF's historical public debt database of Abbas et al. (2010), while being careful with the integrity of the series over time. For countries that are not referenced in either databases, I obtain debt estimates from different sources specified in Table B3.

Multilateral debt data come from the aforementioned WB dataset. Missing values are filled by the joint BIS-IMF-OECD-WB Statistics on external debt. Moreover, I retrieve the level IMF debt by means of the "use of IMF credit" variable proposed by the WB's IDS. Again, for missing values, I use the joint BIS-IMF-OECD-WB Statistics on external debt. Finally, for WB debt is simply formed by IBRD loans and IDA credits data from the WB's IDS.

For the calibration of the model, I also gather information on the maturity structure and

[53] 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).

Table B2: 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)	Abbas et al. (2010)		Covers some missing World Bank data*
	IMF Loans (current USD)	Joint BIS, IMF, OECD and World Bank		Covers IMF debt missing data
	Multilateral Loans (current USD)	Joint BIS, IMF, OECD and World Bank		Covers multilateral debt missing data
	ESM debt (current EUR)	ESM		Converted in USD
EMBIG spread		World Bank	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
EUR/USD exchange rate		Federal Reserve Bank of St. Louis		
Federal Funds rate		Federal Reserve Bank of St. Louis		
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		
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)	Beers and Chambers (2006) Benjamin and Wright (2013) Asonuma and Trebesch (2016)		
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

* Remaining missing observations on external debt are retrieved from different sources specified in Table B3.

the average coupon rate of debt. Unfortunately, there is no systematic and publicly-available record of those statistics. I therefore proxy the maturity structure by dividing the debt level by the debt servicing costs. Moreover, for major countries of interests such as Argentina, Brazil, Mexico, Peru, Russia, Turkey, Uruguay and Venezuela, I retrieve more accurate estimates of the maturity structure from different sources listed in Table B3. Regarding the coupon, I again proxy the average coupon rate with the ratio of interest payments over debt. For the aforementioned group of countries, I obtain more detailed data from other sources presented in Table B3. Note that the time span of available data is greatly reduced. Some specific moments of the sample are depicted in Table B4.

As the focus of the analysis is the IMF and the WB, it is important to account for their respective programs and projects in the sample countries. For this purpose, I extend the dataset of Dreher and Gassebner (2012) by means on the IMF MONA database and the WB Projects & Operations listing.[54] 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

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

Table B3: Alternative Debt Data Sources

Country	Debt		Maturity		Coupon	
	Period	Source	Period	Source	Period	Source
Argentina			1992-2001	Broner et al. (2013)	1992-2001	Broner et al. (2013)
Bosnia and Herzegovina	1992-1997	Boughton (2012) New York Times Archives				
Brazil			1988-2002	Broner et al. (2013)	1988-2002	Broner et al. (2013)
Croatia	1992-1996	Boughton (2012) New York Times Archives				
Cuba	1983-1985	Bartusch (1986)				
Iraq	1986-2006	Hinrichsen (2019)				
Macedonia	1992-1997	Boughton (2012) New York Times Archives				
Mexico			1990-2002 2003-2010	Broner et al. (2013) OECD	1990-2002	Broner et al. (2013)
Peru			1970-2014	World Bank	1999-2014	Central Reserve Bank of Peru
Poland	1981-1994	Górniewicz (2018)				
Russia			1993, 1996-200	Broner et al. (2013)	1993, 1996-200	Broner et al. (2013)
Serbia	1992-1997	Boughton (2012) New York Times Archives				
Slovenia	1992-1996	Boughton (2012) New York Times Archives				
Turkey			1988-2003	Broner et al. (2013)	1988-2003	Broner et al. (2013)
Uruguay			1993-2002	Broner et al. (2013)	1993-2002	Broner et al. (2013)
Venezuela			1988, 1990-2001	Broner et al. (2013)	1988, 1990-2001	Broner et al. (2013)
Vietnam	1982-1997	New York Times Archives				
Yugoslavia	1983-1988	Babic and Primorac (1986) New York Times Archives				

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.

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).

Table B4: Sample Property

	Mean	p50	p25	p75	Std. Dev.
Consumption over GDP	83.3	83.3	75.0	92.5	16.10
Trade balance over GDP	-4.9	-3.7	-12.3	2.1	16.01
Total Debt over GDP	47.3	30.2	10.7	61.6	69.98
Multilateral debt over GDP	15.3	8.4	1.1	19.8	25.17
Maturity	17.9	11.4	7.0	21.4	17.63
Coupon rate	8.0	5.8	2.6	9.8	9.15
EMBIG spread*	5.6	3.6	2.0	6.3	6.95

Note: Due to data availability, for the EMBIG spread, the sample is restricted.

C Regression Analysis

This section assesses the robustness of the empirical facts presented in Section 4. While Fact I can be directly imputed to the multilateral creditors, Facts II, III and IV might be associated to different factors.[55]

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 sovereign'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 C1. 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.

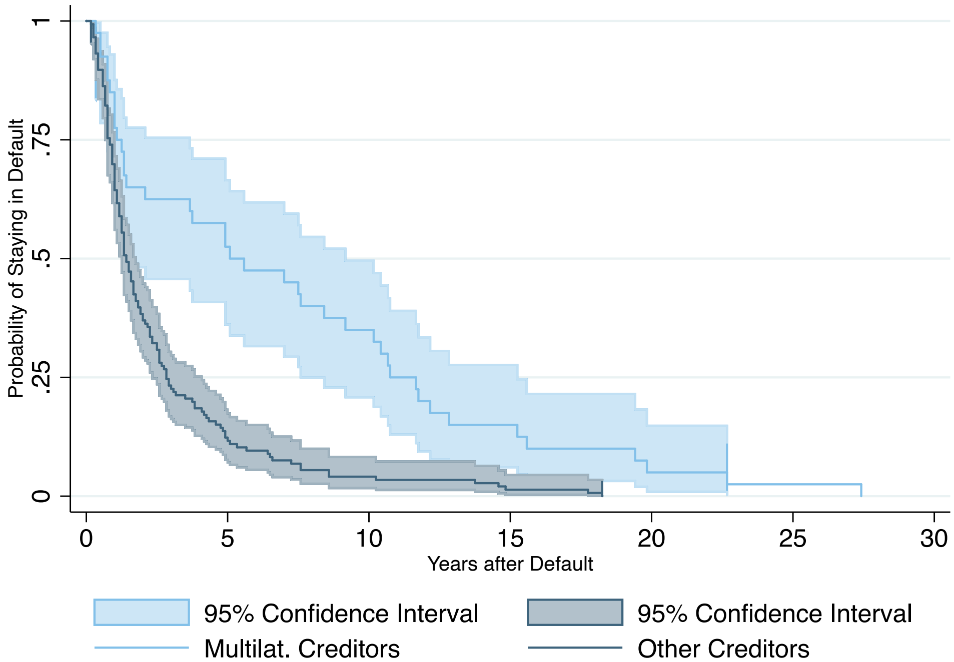
It is entirely plausible that some other factors that are at the source of lengthy defaults also explain the default on multilateral debt. That is why I estimate both an OLS and a semi-parametric proportional hazard model. Both models treat the default duration as functions of the types of creditor involved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

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

where i refers to a specific default episode, y is the default duration in years with $k \in$

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

Figure C1: Non-Parametric Survival Function



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

$\{\text{A\&P}, \text{S\&P}\}$, $\mathbf{D}$ 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 our 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 of Standard & Poor's (i.e. S&P) which often aggregates restructurings together.

For the choice of control variables I follow the literature on the determinants of default (Dell'Ariccia et al., 2006; Trebesch, 2008; Cruces and Trebesch, 2013; Asonuma and Joo, 2020). 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.

The second set of controls accounts for the economic condition of the sovereign in default. I first add the standard control variables such as the debt-to-GDP ratio, 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 sovereign defaulted at least twice in the period under study. Finally, I introduce a dummy to account for whether the sovereign is eligible for the HIPC or IDA programs following Allen (2008). Once a sovereign 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 sovereign under default. Indeed, 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.[56] 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 sovereign 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.[57]

Finally, following Cruces and Trebesch (2013), I introduce time and region fixed effects. The former 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 time fixed effects control for potential issues in the timing of restructuring as defaults often happen in waves (Reinhart and Rogoff, 2009).

[56] 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.

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

Table C1: OLS Duration Regressions

	(1) A&T	(2) A&T	(3) A&T	(4) S&P	(5) S&P	(6) S&P
Multilateral Creditors	2.23**	4.69***	3.18***	3.90**	5.13**	3.74**
	[0.95]	[1.14]	[0.90]	[1.61]	[2.11]	[1.63]
Paris Club	-0.03	2.26***	0.33	-0.71	-0.42	-0.98
	[0.64]	[0.75]	[0.65]	[1.59]	[1.52]	[1.61]
Other Official Creditors	1.62*	2.80**	0.46	2.08	4.64*	0.57
	[0.95]	[1.11]	[0.95]	[1.85]	[2.46]	[2.16]
Bank Loans	-1.81**	-0.84	-3.04*	-3.19*	-2.37	-4.08*
	[0.90]	[1.48]	[1.69]	[1.85]	[2.17]	[2.18]
Bond	-1.04	-2.83*	-2.24**	0.66	4.93	1.13
	[1.30]	[1.55]	[1.04]	[1.41]	[3.74]	[2.98]
Other Private Creditors	-0.90	-1.84	-0.28	-0.61	-0.47	0.28
	[1.10]	[1.25]	[0.99]	[1.46]	[2.63]	[1.61]
SZ Haircut	0.09***		0.10***	0.09***		0.10***
	[0.01]		[0.02]	[0.02]		[0.03]
Debt Restructured	0.00		-0.00	0.00		-0.00
	[0.00]		[0.00]	[0.00]		[0.00]
Brady Deal	3.10**		2.11**	3.36**		4.75***
	[1.25]		[0.86]	[1.64]		[1.55]
HIPC or IDA Eligibility		7.18***	4.03***		4.72**	2.94*
		[1.24]	[1.09]		[1.84]	[1.62]
Serial Defaulter		1.71*	1.17		-1.77	-2.16
		[0.89]	[0.74]		[1.67]	[1.51]
Real GDP, Start		-0.00	0.00*		-0.00	0.00
		[0.00]	[0.00]		[0.00]	[0.00]
Real GDP Growth, Start		0.74*	0.89**		1.38	1.21
		[0.44]	[0.35]		[0.96]	[0.77]
Real GDP per Capita Growth, Start		-0.75*	-0.91**		-1.39	-1.29
		[0.44]	[0.35]		[0.96]	[0.77]
Inflation, Start		0.02	0.01		0.07	0.09*
		[0.02]	[0.02]		[0.06]	[0.05]
Federal Fund Rate, Start		-0.36	0.85		2.24*	1.72
		[0.61]	[0.57]		[1.20]	[1.07]
Trade Openness, Start		0.86	2.47**		-0.01	0.01
		[1.25]	[1.20]		[0.02]	[0.02]
Net Exports (% GDP), Start		0.06**	0.06***		0.07	0.08*
		[0.03]	[0.02]		[0.05]	[0.04]
Debt (% GDP), Start		-0.01	-0.01		0.02	-0.00
		[0.01]	[0.01]		[0.02]	[0.02]
IMF Debt (% GDP), Start		0.15***	0.05		0.12	0.05
		[0.04]	[0.03]		[0.09]	[0.07]
WB Debt (% GDP), Start		-0.33***	-0.29***		-0.50***	-0.39**
		[0.09]	[0.07]		[0.18]	[0.17]
IMF Program, Start		-1.83	-2.59*		-0.04	1.07
		[1.51]	[1.45]		[1.38]	[1.31]
WB Adjustment loans, Start		-0.32	-0.18		-0.37	-0.53
		[0.26]	[0.20]		[0.51]	[0.46]
Coup, Start		1.86	0.65		3.53	1.43
		[1.56]	[1.26]		[3.04]	[2.23]
Communist Regime, Start		0.33	-0.55		-3.26	-3.81
		[1.16]	[1.07]		[2.87]	[2.52]
Dictatorial Regime, Start		-0.24	-0.63		1.00	0.54
		[0.77]	[0.72]		[1.98]	[1.58]
Regime Change to Dictatorship, Start		-2.64	-2.42		-9.11**	-5.81
		[2.68]	[2.39]		[4.21]	[3.90]
Legislative Election, Start		-0.31	-0.48		1.29	0.50
		[0.73]	[0.63]		[1.72]	[1.46]
Postponed Legislative Election, Start		0.93	3.34**		7.47	6.41
		[2.24]	[1.60]		[5.49]	[4.51]
War, Start		3.09*	2.95**		1.67	2.81
		[1.58]	[1.43]		[3.09]	[2.87]
Civil War, Start		-4.44***	-4.11***		1.90	-1.10
		[1.40]	[1.20]		[3.18]	[3.01]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	186	186	186	104	104	104
R^2 adjusted	0.49	0.43	0.60	0.63	0.52	0.67

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

The outcome of the OLS duration regressions is depicted in Table C1. 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 5 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 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 statistical significance. Interestingly, except for the debt held at the WB, none of the coefficients relating directly to the level debt shows some level of significance.

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 $k \in \{\text{A\&P}, \text{S\&P}\}$.[58] Using the duration jargon, a failure corresponds to the moment in which the sovereign exits the default state. That is, the dependent variable is a dummy taking value 1 if the sovereign exits the default and zero otherwise. The period of observation spans from the moment the sovereign 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

[58]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.

exceptions are the debt-to-GDP ratio, 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 event and the year preceding it and zero otherwise. Finally, similar to the previous set of regressions, I introduce time 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.

The outcome of the Cox duration regressions is depicted in Table C2. 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 61% 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. In opposition to the OLS estimation, it seems that defaults involving bondholders are settled more rapidly consistent with the findings of Trebesch (2008).

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. However, this time, the coefficients relating directly to the level debt are statistically significant – at least at the default's start. More precisely, the total level of debt and the level of debt held at the IMF are associated with a reduced probability of exiting default. The opposite is true for the WB debt. Furthermore, the participation to an IMF program or a WB adjustment loan significantly increases the probability of exiting default. Note also that a serial defaulter has a greater probability of ending its default.

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 sovereign's characteristics does not reduce the strong association between the default's length and multilateral creditors.

Table C2: Cox Duration Regressions

	(1) A&T	(2) A&T	(3) A&T	(4) S&P	(5) S&P	(6) S&P
Multilateral Creditors	0.51***	0.41***	0.50***	0.37***	0.39***	0.41***
	[0.23]	[0.22]	[0.25]	[0.26]	[0.28]	[0.31]
Paris Club	1.02	0.47***	0.71	0.68	0.47**	0.65
	[0.18]	[0.21]	[0.23]	[0.27]	[0.36]	[0.39]
Other Official Creditors	0.80	0.86	1.12	0.67	0.30**	0.48
	[0.28]	[0.29]	[0.31]	[0.42]	[0.53]	[0.53]
Bank Loans	2.43**	1.07	2.02	1.59	1.06	1.35
	[0.37]	[0.45]	[0.44]	[0.40]	[0.38]	[0.47]
Bond	1.61*	2.34***	2.37***	0.98	1.46	1.95
	[0.27]	[0.29]	[0.29]	[0.36]	[0.38]	[0.42]
Other Private Creditors	1.03	1.26	0.97	0.92	0.95	0.80
	[0.26]	[0.28]	[0.29]	[0.35]	[0.44]	[0.40]
SZ Haircut	0.98***		0.97***	0.98***		0.98***
	[0.00]		[0.00]	[0.00]		[0.01]
Debt Restructured	1.00		1.00	1.00		1.00*
	[0.00]		[0.00]	[0.00]		[0.00]
Brady Deal	0.58**		0.58**	0.57*		0.40***
	[0.28]		[0.27]	[0.31]		[0.31]
HIPC or IDA Eligibility		0.20***	0.34***		0.27***	0.34**
		[0.28]	[0.29]		[0.39]	[0.43]
Serial Defaulter		0.58***	0.66**		1.41	1.60**
		[0.17]	[0.17]		[0.22]	[0.21]
Real GDP		1.00*	1.00		1.00	1.00
		[0.00]	[0.00]		[0.00]	[0.00]
Real GDP Growth		1.00	0.99		1.04	1.01
		[0.05]	[0.05]		[0.09]	[0.09]
Real GDP per Capita Growth		1.00	1.01		0.96	1.00
		[0.05]	[0.05]		[0.09]	[0.09]
Inflation		1.00	1.00		1.01	1.01
		[0.00]	[0.00]		[0.01]	[0.01]
Federal Funds Rate		0.02***	0.02***		0.01***	0.01***
		[0.08]	[0.07]		[0.07]	[0.08]
Trade Openness		0.81	0.38***		1.04	0.70
		[0.26]	[0.30]		[0.30]	[0.34]
Net Exports (% GDP)		0.99	0.99***		0.99	0.99**
		[0.00]	[0.00]		[0.01]	[0.01]
Debt (% GDP), Start		1.00	1.00*		0.99**	0.99
		[0.00]	[0.00]		[0.00]	[0.00]
IMF Debt (% GDP), Start		0.98*	0.99		0.97**	0.97**
		[0.01]	[0.01]		[0.01]	[0.01]
WB Debt (% GDP), Start		1.04	1.04		1.06	1.04
		[0.03]	[0.03]		[0.04]	[0.04]
Debt (% GDP), End		1.00	1.00**		1.01	1.01**
		[0.00]	[0.00]		[0.01]	[0.01]
IMF Debt (% GDP), End		0.99	0.99		1.00	1.01
		[0.01]	[0.01]		[0.01]	[0.02]
WB Debt (% GDP), End		0.97**	0.99		1.01	1.02
		[0.02]	[0.02]		[0.02]	[0.02]
IMF Program		1.41**	1.43**		2.01***	2.03***
		[0.15]	[0.14]		[0.25]	[0.25]
WB Adjustment loans		1.15***	1.10*		1.13**	1.10*
		[0.05]	[0.05]		[0.06]	[0.05]
Coup		1.40	1.49		1.96	2.08
		[0.36]	[0.32]		[0.58]	[0.64]
Communist Regime		1.27	1.25		1.28	1.12
		[0.27]	[0.26]		[0.44]	[0.50]
Dictatorial Regime		0.88	0.93		1.43	1.40
		[0.22]	[0.19]		[0.39]	[0.39]
Postponed Legislative Election		1.01	0.85		1.18	1.02
		[0.59]	[0.62]		[0.70]	[0.80]
Legislative Election		0.88	0.86		1.16	1.10
		[0.14]	[0.14]		[0.19]	[0.20]
War		0.85	0.60		1.02	0.87
		[0.67]	[0.76]		[0.83]	[0.83]
Civil War		1.11	1.08		0.56	0.42**
		[0.21]	[0.21]		[0.37]	[0.43]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	642	642	642	684	684	684
Episodes	159	159	159	99	99	99
Pseudo R^2	0.09	0.09	0.11	0.16	0.18	0.20

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

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}.

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 sovereign 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 sovereign 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 sovereign 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 time and region fixed effects to account for regional characteristics and timing issues.

Table C3 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 9 and 12 percentage points for the market haircut and between 9 and 10 percentage points for the SZ haircut depending on the model's specification.[59] 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 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

[59] 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.

deal across the different specifications.

Table C3: Haircut Regressions

	(1) H^M	(2) H^M	(3) H^M	(4) H^{SZ}	(5) H^{SZ}	(6) H^{SZ}
Multilateral Creditors	11.96***	9.95**	8.54**	10.25**	10.30**	8.63**
	[4.29]	[4.06]	[3.97]	[4.19]	[4.03]	[4.06]
Paris Club	11.36**	9.87***	11.18***	11.09**	10.63***	11.64***
	[4.46]	[3.10]	[2.85]	[4.46]	[3.22]	[3.02]
Other Official Creditors	8.11	14.65***	14.93***	7.30	12.74***	13.73***
	[5.42]	[4.33]	[4.12]	[5.41]	[4.37]	[4.30]
Bank Loans	-3.92	20.13**	21.85***	0.27	24.81***	25.30***
	[10.22]	[8.45]	[6.73]	[10.81]	[7.68]	[6.76]
Bond	-5.79	-1.98	0.09	-4.13	-2.74	0.51
	[7.96]	[4.86]	[5.10]	[8.29]	[5.34]	[6.03]
Other Private Creditors	-8.78	-10.48**	-10.10**	-8.96	-11.47**	-11.15**
	[5.63]	[4.71]	[4.66]	[5.62]	[4.67]	[4.76]
Private Debt Restructured	0.00		0.00***	0.00		0.00***
	[0.00]		[0.00]	[0.00]		[0.00]
Default Duration	1.77**		0.50	2.11***		0.73
	[0.70]		[0.54]	[0.74]		[0.60]
Brady Deal	-6.45		4.90	-13.25*		-2.05
	[7.36]		[4.65]	[7.66]		[5.60]
HIPC or IDA Eligibility		14.17***	12.94***		16.79***	14.44***
		[4.09]	[4.35]		[4.18]	[4.62]
Serial Defaulter		-4.29	-3.99		-2.74	-2.02
		[2.95]	[3.07]		[3.09]	[3.21]
Real GDP, End		-0.00***	-0.00***		-0.00**	-0.00***
		[0.00]	[0.00]		[0.00]	[0.00]
Real GDP Growth, End		-3.60*	-4.11**		-3.80**	-4.32**
		[1.84]	[1.74]		[1.83]	[1.77]
Real GDP per Capita Growth, End		4.06**	4.75***		4.24**	4.93***
		[1.84]	[1.73]		[1.83]	[1.75]
Inflation, End		0.17*	0.18**		0.15	0.18**
		[0.08]	[0.08]		[0.09]	[0.09]
Federal Funds Rate, End		-11.56***	-11.12***		-13.06***	-12.15***
		[2.13]	[2.02]		[2.13]	[2.18]
Trade Openness, End		-29.62***	-26.81***		-24.49***	-21.99***
		[4.84]	[4.49]		[5.07]	[4.80]
Net Exports (% GDP), End		-0.20**	-0.17*		-0.19**	-0.17*
		[0.09]	[0.09]		[0.09]	[0.09]
Debt (% GDP), End		0.08*	0.06		0.08*	0.06
		[0.04]	[0.04]		[0.05]	[0.04]
IMF Debt (% GDP), End		-0.33**	-0.43***		-0.45***	-0.53***
		[0.14]	[0.14]		[0.14]	[0.15]
WB Debt (% GDP), End		0.89***	1.04***		1.03***	1.09***
		[0.21]	[0.22]		[0.21]	[0.23]
IMF Program, End		0.45	-0.82		0.36	-0.58
		[2.81]	[2.67]		[3.03]	[2.90]
WB Adjustment loans, End		-1.15	-1.16		-1.02	-0.94
		[0.94]	[0.73]		[0.95]	[0.77]
Communist Regime, End		-1.52	-0.94		-1.44	-0.25
		[5.15]	[4.89]		[5.67]	[5.38]
Dictatorial Regime, End		3.33	3.00		3.58	3.45
		[3.82]	[3.73]		[3.93]	[3.86]
Legislative Election, End		-3.05	-3.45		-3.76	-4.33
		[3.06]	[2.90]		[3.07]	[2.95]
Postponed Legislative Election, End		1.04	-1.83		2.14	0.10
		[8.29]	[8.60]		[9.57]	[9.95]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	186	186	186	186	186	186
R^2 adjusted	0.50	0.72	0.75	0.49	0.70	0.72

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

Regarding the control variables, one observes many significant results. Consistent with the findings of Benjamin and Wright (2013), the default's duration is strongly and positively associated with the private creditor's haircut. Similarly, 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 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.

Finally, I gauge the robustness of Fact IV. The aim is to assess whether the surge in multilateral indebtedness prior to a default is due to the prospect of a default or is simply a by-product of other factors. For this purpose, I build a panel dataset that tracks the evolution of the multilateral debt in the years prior to the default's start for each default episode.[60] If a sovereign records multiple default episodes, I discard the periods in which the sovereign is in default. By means of an OLS estimator, I estimate the following equation,

$$\text{Debt}^m_{i,t} = \theta_t + \zeta_i + \beta_1 d_{i,t} + \beta_2 d_{i,t+1} + \mathbf{X}_{i,t}\delta + u_{i,t}$$

where i refers to a specific sovereign and t to a specific year. In addition, $d_{i,t}$ is a dummy taking value one if a default starts for i at time t and zero otherwise, $\text{Debt}^m_{i,t}$ is the debt's specification of $m \in \{\text{IMF}, \text{WB}, \text{IMF+WB}\}$, θ_t is a year fixed-effect, ζ_i is a sovereign fixed-effect and the remaining variable is the error term, $u_{i,t}$.

As already mentioned, debt statistics are incomplete especially in the years before the end of the 1980s. I am therefore unable to account for all 186 default episodes in the regressions. Besides this, for a same sovereign, two defaults might overlap. Hence, I remove the episodes for which I have less than 2 data points before the default's start.

In terms of controls, I add similar variables as in the previous regressions. First, I control for the presence of IMF programs and WB adjustment loans. Second, I control for the economic and political situation of the sovereign at the default's end using the exact same control variables as for the OLS haircut regressions.

[60] The dataset starts in 1970 and I consider a maximum of 15 years prior to the default's start. Reducing or enlarging the window by 5 years do not drastically change the results.

Table C4: Multilateral Debt Regressions

	(1) IMF+WB debt	(2) IMF debt	(3) WB debt
Default Start t	0.53**	0.35*	0.18**
	[0.27]	[0.21]	[0.09]
Default Start t-1	0.17	0.04	0.13*
	[0.19]	[0.16]	[0.07]
IMF Program	0.57***	0.38**	0.19***
	[0.21]	[0.18]	[0.07]
WB Adjustment loans	0.60***	0.35***	0.25***
	[0.17]	[0.09]	[0.09]
HIPC or IDA Eligibility	2.63***	0.48	2.14***
	[0.70]	[0.49]	[0.32]
Serial Defaulter	0.93	0.47	0.46
	[1.14]	[0.70]	[0.52]
Real GDP	0.00***	0.00***	0.00***
	[0.00]	[0.00]	[0.00]
Real GDP Growth	-0.08	-0.10	0.02
	[0.08]	[0.06]	[0.03]
Real GDP per Capita Growth	0.06	0.09	-0.03
	[0.08]	[0.06]	[0.04]
Inflation	-0.00	-0.00*	-0.00
	[0.00]	[0.00]	[0.00]
Federal Funds Rate	-0.09	-0.01	-0.08
	[0.14]	[0.11]	[0.05]
Trade Openness	0.72***	0.42**	0.30***
	[0.21]	[0.18]	[0.07]
Net Exports (% GDP)	-0.00	-0.00	0.00
	[0.01]	[0.01]	[0.00]
Coup	0.15	0.04	0.10*
	[0.10]	[0.06]	[0.05]
Communist Regime	0.77***	0.42**	0.35***
	[0.26]	[0.17]	[0.11]
Dictatorial Regime	-1.08***	-0.36	-0.72***
	[0.38]	[0.23]	[0.19]
Legislative Election	0.01	0.05	-0.05
	[0.09]	[0.07]	[0.03]
Postponed Legislative Election	0.02	-0.06	0.08
	[0.27]	[0.19]	[0.09]
War	-0.21	-0.17	-0.05
	[0.24]	[0.15]	[0.09]
Civil War	-0.49	-0.23	-0.27*
	[0.34]	[0.20]	[0.15]
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	750	750	750
Episodes	81	81	81
R^2 adjusted	0.61	0.39	0.83

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

Table C4 presents the results of the multilateral debt regressions. The coefficient related to the default start dummy is statistically and economically important. In the year in which the sovereign default, it increases its multilateral indebtedness (i.e. IMF and WB debt) by 0.53 billion USD. In the year preceding the default, the sovereign seems to increase its holdings of multilateral debt as well but the coefficient is less statistically and economically significant. The same holds true if one looks at the IMF and the WB debt separately. More precisely, in the year of the default's start, the IMF and the WB debt increase by 0.35 and 0.18 billion USD, respectively. Notice however, that the coefficient is statistically less significant for the former than the latter.

Regarding the control variables, one observes many significant results. As one would expect, the presence of IMF programs and WB adjustment loans are strongly and positively related to the level of multilateral indebtedness. The magnitudes of the effects are similar to the one of the default's start dummy. Besides this, the level of GDP and the degree of trade openness are positively related to the level of multilateral debt. Finally, communist regimes seems to receive more multilateral debt, while the opposite is true for dictatorial regimes.

Hence, in view of those results, it seems that there is a link between the path towards default and the level of multilateral indebtedness. Controlling for the specificity of each sovereign and the presence of IMF programs and WB adjustment loans does not reduce the strong association between the default's start and multilateral debt.

D Proofs

I start this section with some preliminary propositions that will help proving the main proposition in the text.

Proposition D1 (Default and Private Debt)**.** *In equilibrium,*

I. In a given state (z, b_m), for all $0 > b_p^1 > b_p^2$, if $D_p(z, b_m, b_p^1) = 1$ it must be that $D_p(z, b_m, b_p^2) = 1$.

II. In a given state (z, b_p), for all $0 > b_m^1 > b_m^2$, if $D_m(z, b_m^1, b_p) = 1$ it must be that $D_m(z, b_m^2, b_p) = 1$.

Proof. I prove each part separately.

Part I

The proof follows Eaton and Gersovitz (1981) and Arellano (2008). Consider any pair of private debt b_p^1 and b_p^2 with $0 > b_p^1 > b_p^2$. Moreover, assume a given level of endowment $y(z)$ and a fixed level of multilateral debt, b_m. With b_p^1, the sovereign optimally choose $(b_p^{1\prime}, b_m^{1\prime})$ and with b_p^2, it optimally picks $(b_p^{2\prime}, b_m^{2\prime})$.

Let's start with the case of exogenous renegotiation and then pass to the endogenous one. Preliminarily define the net lending or borrowing as

$$R(b_m, b_m', b_p, b_p') := q_m(z, b_m', b_p')(b_m' - \delta b_m) + q_p(z, b_m', b_p')(b_p' - \delta b_p) - (1 - \delta + \delta\kappa)(b_m + b_p)$$

Now for any b_p' and b_m', it holds that

$$V^P(z, b_m, b_p^1) = u(y(z) + R(b_m, b_m^{1\prime}, b_p^1, b_p^{1\prime})) + \beta \mathbb{E}_{z'|z} V(z', b_m^{1\prime}, b_p^{1\prime})$$

$$
\begin{aligned}
&> u(y(z) + R(b_m, b_m^{2\prime}, b_p^1, b_p^{2\prime})) + \beta \mathbb{E}_{z'|z} V(z', b_m^{2\prime}, b_p^{2\prime}) \\
&> u(y(z) + R(b_m, b_m^{2\prime}, b_p^2, b_p^{2\prime})) + \beta \mathbb{E}_{z'|z} V(z', b_m^{2\prime}, b_p^{2\prime}) \\
&= V^P(z, b_m, b_p^2),
\end{aligned}
$$

where the first inequality comes from optimality and the second from the fact that for any (b_p', b_m'),

$$
R(b_m, b_m', b_p^1, b_p') - R(b_m, b_m', b_p^2, b_p') > 0
$$

As the value of autarky (either *selective* or *full*) is independent of the level of private debt and V^P decreases monotonically with the level of private debt, it directly follows from equation (1) that the default probability monotonically increases in b_p.

In the case of endogenous renegotiation, the value of autarky is not anymore independent of the level of private debt. The value of autarky is nevertheless decreasing in the level of debt. To see this, let's focus on the case of *full* default

$$
\begin{aligned}
V^{DF}(z, b_m, b_p^1) &= u(y_m^D(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m, b_p^1) \\
&\geq u(y_m^D(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m, b_p^2) \\
&= V^{DF}(z, b_m, b_p^2),
\end{aligned}
$$

where the weak inequality comes from the fact that for some level b_p^1 and b_p^2, the restructured value demanded by the private lenders might be the same.

Assume now that $D_p(z, b_m, b_p^1) = 1$ implying that $V^{DF}(z, b_m, b_p^1) = V^P(z, b_m, b_p^1)$. Using the two results found above, one directly obtains that

$$
\begin{aligned}
V^P(z, b_m, b_p^2) - V^{DF}(z, b_m, b_p^2) &\leq V^P(z, b_m, b_p^2) - V^{DF}(z, b_m, b_p^1) \\
&= V^P(z, b_m, b_p^2) - V^P(z, b_m, b_p^1) \\
&< 0,
\end{aligned}
$$

where the first inequality comes from the above result, the second from the assumption of default and the last one from the monotonicity of the repayment value. The exact same argument holds for the case of *selective* default.

Part II

Consider any pair of multilateral debt b_m^1 and b_m^2 with $0 > b_m^1 > b_m^2$. Moreover, assume a given level of endowment $y(z)$ and a fixed level of private debt, b_p. Using the exact same argument as in the proof of Proposition I, one concludes that

$$V^P(z, b_m^1, b_p) > V^P(z, b_m^2, b_p),$$

and similarly,

$$\begin{aligned} V^{DF}(z, b_m^1, b_p) &= u(y_m^D(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^1, b_p) \\ &\geq u(y_m^D(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^2, b_p) \\ &= V^{DF}(z, b_m^2, b_p). \end{aligned}$$

Like the proof of Part I, I have a weak inequality as the proposed offer might be the same for two different levels of debt.

Assume now that $V^{DF}(z, b_m^1, b_p) = V^P(z, b_m^1, b_p)$. Using the two results found above, one directly obtains that

$$\begin{aligned} V^P(z, b_m^2, b_p) - V^{DF}(z, b_m^2, b_p) &\leq V^P(z, b_m^2, b_p) - V^{DF}(z, b_m^1, b_p) \\ &= V^P(z, b_m^2, b_p) - V^P(z, b_m^1, b_p) \\ &< 0, \end{aligned}$$

which completes the proof.

□

Proposition D2 (Repayment Incentives and Multilateral Debt)**.** *In some state* (z, b_p)*, there exists an interval* I_m *with upper bound* $\bar{b}_m = \bar{\mathbf{B}}(z, b_p)$ *and a lower bound* $\underline{b}_m = \underline{\mathbf{B}}(z, b_p)$ *such that for every* $b_m \in I_m = [\underline{b}_m, \bar{b}_m]$*,* $D_p(z, b_m, b_p) = 0$*.*

Proof. Following that same logic as in Propositions I and II, in a given state (z, b_p), for any pair of multilateral debt b_m^1 and b_m^2 with $0 > b_m^1 > b_m^2$

$$\begin{aligned} V_p^{DS}(z, b_m^1, b_p) &= u(y_p^D(z) + (1 - \delta + \delta\kappa) b_m^1) + \beta \mathbb{E}_{z'|z} V_p^{RS}(z', b_m^{1\prime}, b_p) \\ &\geq u(y_p^D(z) + (1 - \delta + \delta\kappa) b_m^2) + \beta \mathbb{E}_{z'|z} V_p^{RS}(z', b_m^{2\prime}, b_p) \\ &= V_p^{DS}(z, b_m^2, b_p). \end{aligned}$$

Furthermore, the borrower can always decide to transit from the state of *selective* default to *full* default if it is better off in the latter than the former. Hence, for any (z, b_m, b_p),

$$V_p^{DS}(z, b_m, b_p) \geq V^{DF}(z, b_m, b_p).$$

Define $\tilde{b}_m$ as the level of debt at which the value under *selective* default cross the value under *full* default. Given the *de facto* seniority assumption, one has for $b_m^1 > \tilde{b}_m > b_m^2$,

$$V_p^{DS}(z, b_m^1, b_p) > V^{DF}(z, b_m^1, b_p) \quad \text{and} \quad V_p^{DS}(z, b_m^2, b_p) < V^{DF}(z, b_m^2, b_p).$$

The upper bound of the interval for a given (z, b_p) is therefore such that

$$V^P(z, \bar{b}_m, b_p) > V_p^{DS}(z, \bar{b}_m, b_p) > V^{DF}(z, \bar{b}_m, b_p).$$

More precisely, one can either have $\bar{b}_m \geq 0$ or $\bar{b}_m < 0$. In the latter case one has for $b_m^1 > \bar{b}_m > b_m^2$,

$$V_p^{DS}(z, b_m^1, b_p) > V^P(z, b_m^1, b_p) \quad \text{and} \quad V_p^{DS}(z, b_m^2, b_p) < V^P(z, b_m^2, b_p).$$

Conversely the lower bound is such that

$$V^P(z, \underline{b}_m, b_p) \geq V_p^{DS}(z, \underline{b}_m, b_p) \geq V^{DF}(z, \underline{b}_m, b_p),$$

where for $b_m^1 > \underline{b}_m > b_m^2$

$$V^P(z, b_m^1, b_p) > V^{DF}(z, b_m^1, b_p) \quad \text{and} \quad V^P(z, b_m^2, b_p) < V^{DF}(z, b_m^2, b_p).$$

I start with the upper bound and conduct a proof by contraction. First observe that if $\bar{b}_m \geq 0$, then for the state under consideration, the sovereign never finds optimal to enter in *selective* default. Hence, the relavant case is when $\bar{b}_m < 0$. Consider by contradiction that for $b_m^1 > \bar{b}_m > b_m^2$,

$$V_p^{DS}(z, b_m^1, b_p) < V^P(z, b_m^1, b_p) \quad \text{and} \quad V_p^{DS}(z, b_m^2, b_p) > V^P(z, b_m^2, b_p).$$

It then implies that for all $b_m < \bar{b}_m$, $V^P(z, b_m, b_p) < V^{DS}(z, b_m, b_p)$. However, given the definition of the lower bound, $\underline{b}_m$, this would imply that the value function under repayment crosses the value under *full* default at a larger debt level than when the value function under *selective* default crosses the value function under *full* default. Hence, either $\underline{b}_m = \bar{b}_m$, or one reaches a contradiction.

Regarding the lower bound, assume by contradiction that $b_m^1 > \underline{b}_m > b_m^2$

$$V^P(z, b_m^1, b_p) < V^{DF}(z, b_m^1, b_p) \quad \text{and} \quad V^P(z, b_m^2, b_p) > V^{DF}(z, b_m^2, b_p).$$

It then implies that for all $b_m < \underline{b}_m$, the default set is empty as $V^P(z, b_m, b_p) > V^{DF}(z, b_m, b_p)$ which contradicts the fact that $\underline{b}_m$ is the lower bound of the interval. $\square$

I now pass to the proof of the main proposition in the text.

Proof of Proposition 1.
From Proposition D1 Part I, in a given state (z, b_m), for all $b_p^1 > b_p^2$, if $D_p(z, b_m, b_p^1) = 1$ it must be that $D_p(z, b_m, b_p^2) = 1$. Similarly, from Part II one has that, in a given state (z, b_p), for all $b_m^1 > b_m^2$, if $D_m(z, b_m^1, b_p) = 1$ it must be that $D_m(z, b_m^2, b_p) = 1$. Furthermore, the price of one unit of private and multilateral debt is given by respectively,

$$q_p(z, b'_m, b'_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - D_p(z', b'_m, b'_p))(1 - \delta + \delta\kappa + \delta q_p(z', b''_m, b''_p)) + D_p(z', b'_m, b'_p)q_p^D(z', b'_m, b'_p)\big].$$

$$q_m(z, b'_m, b'_p) = \frac{1}{1+r}\mathbb{E}_{z'|z}\big[(1 - D_m(z', b'_m, b'_p))(1 - \delta + \delta\kappa + \delta q_m(z', b''_m, b''_p)) + D_m(z', b'_m, b'_p)q_m^D(z', b'_m, b'_p)\big],$$

In this proof, I restrict my attention to states in which the private and multilateral bond policy functions decrease with additional private and multilateral debt. I therefore do not need to care about the continuation price.

Let's start with the private bond. Given that I have an endogenous renegotiation process, the recovery value is not independent of the level of private debt. I therefore need to establish how the recovery value $q_p^D(z', b'_m, b'_p)$ evolves when the level of private debt increases. I start with the case of *selective* default. From the optimal private lender's offer, I know that in a given state (z, b_m) for any $0 > b_p^1 > b_p^2$,

$$W_{l,p}^{RS}(z, b_m, b_p^2) \geq W_{l,p}^{RS}(z, b_m, b_p^1).$$

When constraint $W_{l,p}^{RS} \leq -b_p$ binds, one has

$$\frac{W_{l,p}^{RS}(z, b_m, b_p^2)}{-b_p^2} = \frac{W_{l,p}^{RS}(z, b_m, b_p^1)}{-b_p^1} = 1,$$

whereas when it does not bind

$$\frac{W_{l,p}^{RS}(z, b_m, b_p^2)}{-b_p^2} < \frac{W_{l,p}^{RS}(z, b_m, b_p^1)}{-b_p^1}.$$

As a result,

$$q_p^{DS}(z, b_m, b_p^1) \geq q_p^{DS}(z, b_m, b_p^2),$$

which together with Proposition I implies that

$$q_p(z, b_m, b_p^1) \geq q_p(z, b_m, b_p^2).$$

Moreover, in light of Proposition D2, in the interval I_m, additional multilateral debt does not increase the risk of default. Hence, for some additional level of multilateral debt, q_p does not necessarily sink. Note nonetheless that despite the fact that the probability of defaulting does not immediately increase, q_p can decrease owing to the impact of additional multilateral borrowing on q_p'.

Turning now to the price of multilateral debt, one has, given the *de facto* seniority assumption, for a given state (z, b_p) and for all b_m,

$$W_{l,m}(z', b_m, b_p) = -b_m.$$

Applying the same reasoning as before and given Proposition D1 Part II, one gets for any $0 > b_m^1 > b_m^2$,

$$q_m(z, b_m^1, b_p) \geq q_m(z, b_m^2, b_p).$$

Similarly, for any $0 > b_p^1 > b_p^2$

$$q_m(z, b_m, b_p^1) \geq q_m(z, b_m, b_p^2).$$

□

E Numerical Solution

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. For the output, I adopt a 6-state Markov chain on top of which I add 4 i.i.d shocks to ensure converge of the long-term bond prices (Chatterjee and Eyigungor, 2012). The private and multilateral debt grids possess 80 points each.

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). The optimal bond holdings is computed according to a grid search for both multilateral and private debts. Once the optimal levels of debts are found, I refine the two bond grids around the chosen optimal grid points to allow for off-grid search (Hatchondo et al., 2010). This alongside the i.i.d. shocks facilitates the convergence of the price schedules.[61]

For the autarky values (3)-(5), I first solve the optimal lender's offer over a W-grid of 1200 grid points. For each point on the W-grid, I determine the value of reentering the market given in (8), (11) and (14) by means of a grid search.[62] I subsequently generate the value of autarky by comparing the value of remaining in autarky with the value of restructuring. For this purpose, I use equations (6), (10) and (12). Out of this, I also compute the different sovereign's acceptance policies from equations (7), (9) and (13).

Having calculated the value under repayment and the value under default, I retrieve the default decision and the new value of V from equation (1) and generates the different default policies. I also keep track of the transition between *selective* and *full* defaults.

With the acceptance policy and the lender's offer, I can calculate the recovery price for each debt instrument and for each default case as specified in Section 8. Once this is done, I compute the new bond prices q_p and q_m by means of equations (15) and (16), respectively.

Subsequently, I compare the initial guesses with the new outcome. Particularly, I compute the distance between the newly-computed and previously-computed prices of private and multilateral debts using the relative norm. The same is done for the value V. Convergence is attained as soon as the price's errors are below 10^{-4} and the value function's errors are below 10^{-5}. As long as this is not the case, the guesses are updated using a relaxation parameter and the whole process starts again.

Once the model is solved, it is subsequently simulated for $10'000$ countries and 400 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 moment 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 $\{c(s^t)\}$ starting

[61] See Chatterjee and Eyigungor (2012) for a discussion on that matter.

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

from an initial state at $t=0$ as

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

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 $\{c^b(s^t)\}$ and the consumption allocation in the alternative model by $\{c^a(s^t)\}$. The sovereign's value in the benchmark model in state (s, b_m, b_p) is given by

$$V_b^P(s, b_m, b_p) := V^P(\{c^b(s^t)\}),$$

Conversely, the sovereign's value under the alternative model in the exact same state (s, b_m, b_p) reads

$$V_a^P(s, b_m, b_p) := V^P(\{c^a(s^t)\}).$$

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

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

Given the functional form of the instantaneous utility one obtains

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

The welfare gain therefore boils down to

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

Turning to the lenders, I define the private lender's consumption allocation in the benchmark model by $\{c_p^b(s^t)\}$ and the consumption allocation in the alternative model by $\{c_p^a(s^t)\}$. In a given state (s, b_m, b_p), the private lender's value in the benchmark and the alternative models respectively reads

$$V_b^{lp}(s, b_m, b_p) := V^{lp}(\{c_p^b(s^t)\}) = \sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t c_p^b(s^t),$$

$$V_a^{lp}(s, b_m, b_p) := V^{lp}(\{c_p^a(s^t)\}) = \sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t c_p^a(s^t).$$

The the consumption-equivalent welfare gain of the alternative model with respect to the benchmark model is given by χ_p such that

$$V^{lp}(\{(1+\chi_p)c_p^b(s^t)\}) = V^{lp}(\{c_p^a(s^t)\}).$$

Given the risk neutrality of the private lenders, the welfare gains simply reads

$$\chi_p(s, b_m, b_p) = \frac{V_a^{lp}(s, b_m, b_p)}{V_b^{lp}(s, b_m, b_p)} - 1.$$