

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

Adrien Wicht

European University Institute

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Abstract

Sovereign countries do not necessarily repay all its creditors. There is a clear pecking order in which official multilateral lenders – i.e. mainly 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 source and the consequences of the *de facto* seniority of official multilateral lenders. Empirically, I present evidence that defaults involving such lenders are infrequent, last relatively longer and are associated with greater private creditors' losses. To rationalize those findings, I build a model of endogenous defaults and renegotiations with heterogeneous lenders. I find that the key component behind the *de facto* seniority is the typical policy of non-toleration of arrears adopted by official multilateral lenders. Combined with the default penalty, this policy rationalizes the aforementioned empirical facts, generates important spillovers on other creditors and is a source of fiscal discipline. The borrower values the use of official multilateral debt and would not necessarily prefer other seniority regimes.

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

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

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

1 Introduction

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

I begin this inquiry by establishing new empirical facts on multilateral creditors based on 187 episodes of external debt’s default from 1970 to 2014.² First and foremost, defaults involving multilateral creditors are infrequent. In the sample at hand, such events represent around 18% of all reported episodes. Second, they usually last longer than other defaults taking roughly 9 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 59%, while it falls to 33% otherwise. Finally, multilateral lenders always lend at preferential rates. All these facts hold after controlling for the default’s and the country’s characteristics.

Having identified the main empirical facts linking defaults with multilateral creditors, I build a model capable of rationalizing them. For this purpose, I augment the standard model of Eaton and Gersovitz (1981) with heterogenous lenders and endogenous restructurings. Most notably, I assume the existence of a continuum of competitive private lenders and one multilateral lender. There is limited enforcement in repayment and the sovereign can decide to default either on private creditors – *partial* default – or on both creditors – *full* default. Each default is followed by a complete market exclusion and an output penalty. In a *partial* default, the sovereign continues to service the multilateral debt while being in autarky.

A central idea in my theory is that the multilateral lender has a greater enforcement power than the private lenders. On the one hand, defaulting on the multilateral debt entails a greater output penalty than defaulting on the private debt. On the other hand, the

¹See Appendix A for a breakdown of the world sovereign debt between 1970 and 2020.

²Default’s dates come from Asonuma and Trebesch (2016) and haircuts from Cruces and Trebesch (2013). I then identify the creditors involved in each default using the database of Beers et al. (2022).

multilateral lender does not lend when the sovereign is in arrears and the outstanding multilateral debt has not been repaid in full.³ This second element corresponds to a policy of non-toleration of arrears characteristic of the IMF's and the WB's practice. The greater enforcement power implies that the multilateral debt is *de facto* senior to private debt.⁴ The policy of non-toleration of arrears safeguards the preferential rate of multilateral lending, whereas the output penalty controls the frequency of multilateral debt's defaults.⁵

The key feature in the model is that the *de facto* seniority of multilateral debt generates important spillovers on private lenders. On the one hand, the private debt is subordinated meaning that private creditors receive what is left after the full repayment of multilateral debt in a restructuring. Hence, in a *full* default, the level of multilateral debt directly affects the private debt's recovery value. On the other hand, a larger stock of multilateral debt reduces the value of a *partial* default 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.

Given this, the *de facto* seniority impacts the sovereign borrowing, the default's decision and the restructuring's process. In terms of borrowing, the multilateral debt is less sensitive to the default risk but at the cost of subordinating private debt. Thus, more multilateral debt may or may not increase the marginal benefit of debt issuance. In the former case there is a seniority benefit, while in the latter a seniority cost to the repayment incentive. I find that the seniority benefit usually manifests when the stock of multilateral debt is relatively small. In addition, the reduced sensitivity to the default risk renders the multilateral debt less prone to dilution than the private debt. The possibility to dilute private debt reduces the marginal cost of debt issuance as it reduces the future debt burden. This is what I call the subordination benefit. There is therefore a tradeoff between insurance and incentive shaping the seniority structure similar to the one shaping the maturity structure.

Regarding the default's decision, there are two effects. On the one hand, more multilateral debt reduces the value of a *partial* default 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, regarding the debt restructuring's process, the model predicts larger haircuts

³In a default, there is no accumulation of arrears. Missed coupon payments are forgone.

⁴We say that seniority is *de jure* when enforced by *ex ante* contractual requirements. This is not the case in my analysis as seniority emerges from *ex post* sanctions.

⁵Notice that I abstract from conditionality in my analysis which is another feature of multilateral lending.

and longer default's durations when multilateral lenders are involved. This is a consequence of the non-toleration of arrears which renders restructurings more costly. In particular, the sovereign can issue new multilateral debt only after clearing arrears (i.e. after the restructuring). This combined with the full repayment of outstanding multilateral debt reduces the sovereign's value of restructuring which in turns increases both the private creditors' loss and the default's length. Thus, what is at the source of the *de facto* seniority also explains the greater default's lengths and haircuts observed in the data.

The model is calibrated to match moments related to Argentina. Except for the share of *full* defaults, none of the aforementioned empirical facts is directly targeted. I find that the model fits the data particularly well. It is capable of generating the observed default's lengths and haircuts depending on the different types of creditors involved. In a *full* default, the larger haircut can be attributed to the two building blocks of the policy of non-toleration of arrears: the full repayment of the multilateral debt and the inability to issue new multilateral debt at the restructuring. The longer duration mainly comes from a greater private debt accumulation triggered by the second aforementioned component.

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

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

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

2 Literature Review

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

In the empirical literature on sovereign restructurings, [Benjamin and Wright \(2013\)](#) are one of the first to document the main statistics on sovereign debt renegotiations.⁶ Building a more comprehensive dataset, [Cruces and Trebesch \(2013\)](#) refine the previous analysis and present evidence that haircuts impact the bond spreads and the market exclusion’s length. Similarly, [Asonuma and Trebesch \(2016\)](#) show that preemptive restructurings are associated with shorter durations and lower creditors’ losses relative to post-default restructurings. In addition, [Asonuma and Joo \(2020\)](#) present evidence that the economic conditions on the side of foreign creditors largely influence the length and the terms of a restructuring. Closer to my analysis, [Asonuma et al. \(2023\)](#) document that haircuts are greater on short-term than on long-term bondholders. I contribute to this literature by showing that haircuts and default duration also depend on the type of creditors involved in the default episode.

The starting point of the theoretical literature on sovereign debt and default is the study of [Eaton and Gersovitz \(1981\)](#), [Aguiar and Gopinath \(2006\)](#) and [Arellano \(2008\)](#).⁷ To replicate the characteristics of emerging economies, the original model has been expanded in five main dimensions. First, [Hatchondo and Martinez \(2009\)](#) and [Chatterjee and Eyigungor \(2012\)](#) introduced long-term debt. Subsequently, [Arellano and Ramanarayanan \(2012\)](#) and [Niepelt \(2014\)](#) included mixed maturities. Third, [Mendoza and Yue \(2012\)](#) endogenized the income process and the default cost. Fourth, [Arellano et al. \(2023\)](#) introduced partial defaults to account for arrears accumulation. 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 lenders and the borrower.⁸ All aforementioned studies assume that haircuts and default durations are symmetric across creditors. This paper first documents that this assumption is not supported by the data. It then introduces two creditors with different enforcement power to address this matter.

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

⁶See 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 \(2011\)](#).

⁷See also [Aguiar and Amador \(2014\)](#) and [Aguiar et al. \(2016\)](#) and [Aguiar and Amador \(2021\)](#).

⁸Their 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, by [Asonuma and Joo \(2020\)](#) to introduce risk-averse creditors and by [Fourakis \(2021\)](#) to account for reputation.

foreign creditors when defaulting. Among foreign creditors, [Schlegl et al. \(2019\)](#) show that the seniority is mostly *de facto* and that multilateral lenders enjoy the highest seniority. Theoretical models only partially addressed this issue, though. While many studies take the seniority structure as given,⁹ 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 in lending. Instead, I focus on the ability of the lenders to enforce repayment through the output penalty and the renegotiation upon default. This generates a tradeoff between multilateral and private debts similar to the one between short-term and long-term debts present in [Arellano and Ramanarayanan \(2012\)](#) and [Niepelt \(2014\)](#). The main difference is that more multilateral debt does not always increase the incentive to repay.

Finally, the paper also connects to the literature on official lending. Building on [Ábrahám et al. \(2019\)](#), [Liu et al. \(2020\)](#) find that the seniority of a multilateral lending institution is not necessarily preferable to a *pari passu* regime.¹⁰ In opposition, I show that 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 funds if the IMF support is sufficiently large. I find a similar effect. Furthermore, I present evidence that the *de facto* seniority provides a source of fiscal discipline that other seniority regimes do not. Finally, similar to [Cordella and Powell \(2021\)](#), I stress the importance of the policy of non-toleration of arrears in shaping the *de facto* seniority.

⁹For example, [Hatchondo et al. \(2017\)](#) consider the case of adding a non-defaultable bonds beside traditional defaultable bonds. Similarly, [Gonçalves and Guimarães \(2014\)](#) 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.

¹⁰Relatedly, focusing on self-fulfilling debt crises, [Galli \(2021\)](#) argues that the seniority of the IMF can give rise to more coordination failures among private lenders than a *pari passu* clause.

¹¹See 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 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 A.3 in Appendix A, the IMF and on the International Bank for Reconstruction and Development (IBRD) never represented more than 4% of the total amount of debt in default over the years. Similarly, from Figure A.4, the two institutions combined never accounted for more than 11% of the countries in default. None of the other reported creditors such as the Paris

¹²Even 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 repayment. 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).

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

¹⁴The only exception relates to the program with Spain which was not senior only because of a transitional agreement with the European Financial Stability Facility.

¹⁵This 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 Mavallwalla, 2018). Subsequently, in the 1970s and until the late 1980s, multiple countries started to accumulate substantial arrears with respect to crisis loans the IMF provided (Reinhart and Trebesch, 2016; Schlegl et al., 2019). This resulted to the official endorsement of the preferred creditor status at the end of the 1980s (IMF, 1988). Regarding the WB, the IBRD's and the International Development Association's (IDA) loans were initially meant to be subordinated to private claims (Raffer, 2009). Moreover, the major credit agencies waited more than a decade after the WB's creation to attribute it the highest rating. Nonetheless, publicly mentioning its preferred creditor status throughout the 1980s, the WB seems to have endorsed its role of privileged creditor earlier than the IMF. 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 policy of non-toleration of arrears consisting of two main lines of conduct.¹⁶ 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). More precisely, countries need to clear arrears to regain access to IMF lending. 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).¹⁷

When building the model, I will assume that the multilateral lenders adopt a (simplified) version of the aforementioned policy of non-toleration of arrears. In particular, the multilateral lender refrains from lending into arrears as in Cordella and Powell (2021) and requests full repayment. As one will see, this safeguards the preferential rates of multilateral lending. It is also at the source of a longer defaults and greater private creditors' losses.

¹⁶The IMF's policy of non-toleration of arrears has evolved over time. Moreover, as noted by Reinhart and Trebesch (2016), the IMF applies this policy with some degrees of freedom. See Buchheit and Lastra (2007) for the history of the policy and Erce (2014) for a critical appraisal.

¹⁷See 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.¹⁸ My analysis relies on 187 default episodes from 1970 to 2014, which all involve external debt and private creditors.

Data on default durations and haircuts come from [Asonuma and Trebesch \(2016\)](#) and [Cruces and Trebesch \(2013\)](#), respectively. I then identify the different creditors involved in each default episode using the database of [Beers et al. \(2022\)](#). In particular, I focus on multilateral lenders which consist of the IMF, the IBRD and the IDA. A default episode *with* multilateral lenders consists of an episode in which a country defaults on at least one of the these three lending institutions.¹⁹ The alternative case corresponds to a default *without* multilateral lenders. Appendix [B](#) gives a detailed overview of the data used in this section. In particular, Table [B.1](#) presents the sample used and Table [B.2](#) specifies the source.

Table 1: Duration and Haircut Statistics

	Mean	Median	Min	Max	Std. Dev.	Obs.
Default Duration (year)						
Overall	3.6	1.6	-0.2	27.4	4.71	187
With multilateral creditors	8.5	7.6	0.3	27.4	6.98	33
Without multilateral creditors	2.6	1.3	-0.2	18.2	3.25	154
SZ Haircut on Private Lenders (%)						
Overall	37.5	32.5	-9.8	97.0	27.93	187
With multilateral creditors	59.0	55.2	12.3	97.0	27.68	33
Without multilateral creditors	32.9	29.0	-9.8	97.0	25.83	154

Note: The table depicts the default duration in years and the haircut on private lenders in percent for all the defaults in the sample (overall) and separately for defaults with and without multilateral lenders. SZ haircuts are computed according to [Sturzenegger and Zettelmeyer \(2008\)](#).

Source: Default dates are from [Asonuma and Trebesch \(2016\)](#) and the haircuts are from [Cruces and Trebesch \(2013\)](#). See Appendix [B](#) for more details.

Table [1](#) presents the main figures related to the default’s duration and private creditors’ haircut. For each statistic, I distinguish between defaults with and without multilateral lenders. Overall, I identify four main empirical facts. The first one states that defaults on multilateral creditors are infrequent. Out of the 187 default episodes presented here only 33 are with multilateral creditors.²⁰

¹⁸The analysis in this section and in Appendix [C](#) are not necessarily causal.

¹⁹As noted by [Cordella and Powell \(2021\)](#), multilateral lenders do not identify these episodes as defaults but simply as arrears because they eventually expect full repayment. I nevertheless use the term default as it corresponds to a missed payment consistent with the definition of [Cruces and Trebesch \(2013\)](#).

²⁰See also the discussion in Section [3](#) and the related Figures [A.3](#) and [A.4](#) in Appendix [A](#).

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

In addition, I find that sovereign defaults take between 3 and 4 years to be resolved. More importantly, if one conditions the length on the type of creditors involved, a default with multilateral creditors takes roughly 9 years to be resolved. In opposition, a default without such lenders takes on average 3 years to be resolved. Looking at the median the wedge between the two statistics is even larger. Hence, defaults on multilateral creditors are associated with a doubling of the length of default on average. The second fact is thus:

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

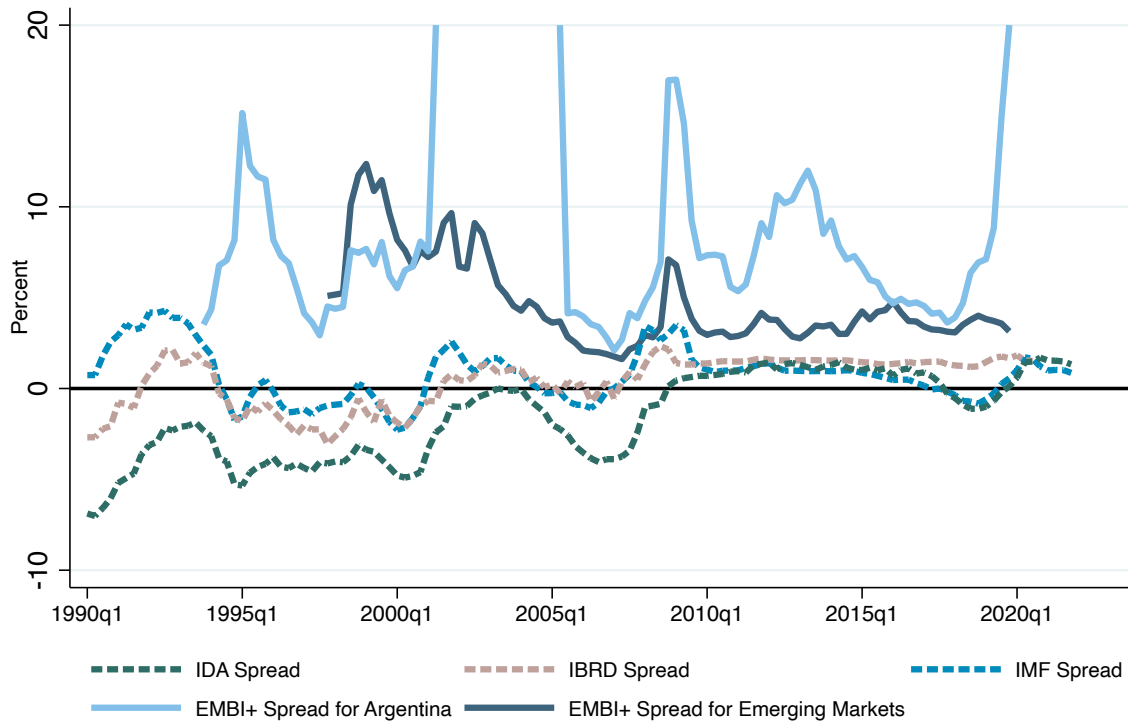
To go beyond the analysis of simple stylised facts, I conduct a more comprehensive econometric analysis. However, for the continuity of the argument, I only highlight here the main findings. The detailed regression analysis is presented in Appendix C. To gauge the robustness of Fact II, I conduct two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

The outcome of the OLS duration regressions is depicted in Table C.3. There is a strong and positive association between defaults on multilateral creditors and the length of the default duration. Particularly, a default on multilateral debt is associated with a default's duration between 3 and 7 additional years depending on the model's specification. I draw similar conclusions from the outcome of the Cox model presented in Table C.4. Notably, a default on multilateral creditors is associated with a reduction of the probability of exiting default between 36% and 69% depending on the model's specification. In view of those results, it seems that this newly established fact is relatively robust. Controlling for the specificity of each default episode and the countries' characteristics does not undermine the 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 38% on average. However, for default episodes with multilateral creditors, the average haircut raises to 59%, while it falls to 33% otherwise. Looking at the median the wedge between the two statistics is of similar magnitude. Thus, the private creditors' loss is on average greater in the case of a default with multilateral creditors. This leads to the third empirical fact:

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

However, the association between large haircuts and defaults on multilateral creditors might simply be a by-product of other factors not necessarily related to the creditor's identity. Thus, I conduct an 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 country in default, like I did for Fact II.



Note: The figure depicts the spread for different types of sovereign debt. The EMBI+ spread series track the spread on emerging market fixed and floating-rate sovereign debt instruments. The EMBI+ series for Argentina has been truncated to 20% for expositional reasons. The IMF spread corresponds to the adjusted rate of charge minus the yield on 1-year US government bonds. The IBRD spread corresponds to the lending rate minus the yield on 1-year US government bonds. The IDA spread corresponds to the service charge minus the yield on 1-year US government bonds.

Source: See Appendix B.

Figure 1: Spreads on Sovereign Debt

Table C.5 in Appendix C presents the results of the haircut regressions. The coefficient related to multilateral lenders is economically important although the statistical significance is less pronounced than for Fact II. Defaulting on such creditors is associated with an increase of the private creditors' haircut between 8 and 15 percentage points for the SZ haircut depending on the model's specification. I therefore conclude that the third empirical fact is relatively robust as well. Controlling for specific components such as the default duration, IMF programs, WB loans or the HIPC initiative does not undermine the association between

the private creditors' loss and multilateral creditors.²¹

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

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

Figure 1 depicts the spread of the IMF adjusted rate of charge as well as the IBRD lending rate and the IDA service charge with respect to the yield on 1-year US government bonds. It also presents the EMBI+ spread for Argentina and emerging economies to have a sense of the premium charged by the market in general. As it is clear, multilateral lenders always charge a rate close to the risk-free one.²² Boz (2011) already highlighted this particularity for the IMF lending.

5 Environment

Having established new empirical facts, the following sections aim at building a model capable of rationalizing them. I consider a small open economy in infinite discrete time $t = \{0, 1, \dots\}$ with a single homogenous good. The small open economy is populated by a benevolent government a continuum of competitive private lenders and one (official) multilateral lender.

The sovereign acts as a representative agent and takes the decision on behalf of the small open economy. Preference over consumption is given by $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$ where $\beta \in (0, 1)$ is the discount factor and c_t denotes the consumption at time t . The instantaneous utility function $u(\cdot)$ is differentiable, strictly increasing and strictly concave. Moreover, I assume that the sovereign is relatively impatient meaning that $\beta < 1/(1+r)$ where r is the exogenous risk-free rate. Each period the sovereign receives an exogenous endowment, $y(z)$, which follows a first-order Markov process with a compact support $Z = \{z_1, z_2, \dots, z_n\}$.

The sovereign faces two funding opportunities. On the one hand, it can issue private debt, b'_p , at the unit price $q_p(z, b'_m, b'_p)$. On the other hand, it can issue multilateral debt, b'_m , at the unit price $q_m(z, b'_m, b'_p)$. I consider that $b_i < 0$ denotes a debt, while $b_i > 0$ denotes an asset for all $i \in \{m, p\}$. 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 . Both

²¹In 1996, the IMF and the WB started the Heavily Indebted Poor Countries (HIPC) which aims at providing immediate debt relief to poor countries.

²²The average IMF, IBRD and IDA spreads are 0.76%, 0.30% and -1.78% , respectively. In opposition, the EMBI+ spread for Argentina and emerging economies amount to and 13.51% and 4.72%, respectively.

types of bonds have the same (κ, δ) and the risk-free return is given by $\bar{q} \equiv \frac{1-\delta+\delta\kappa}{1+r-\delta}$. The financial market is incomplete as bonds do not discriminate the returns across z .

There is limited enforcement in repayment. The sovereign has two default options: *partial* or *full* default. In the former case, the sovereign solely defaults on its private debt, whereas in the latter case it defaults its entire debt position.²³ Both types of default are followed by a complete bond market exclusion and an output penalty. I denote $y^{DP}(z)$ and $y^{DF}(z)$ as the endowment upon a *partial* and *full* default, respectively.

The private lenders are risk-neutral and competitive. Similarly, the multilateral lender is risk-neutral and breaks even in expectation. Nevertheless, the multilateral lender has a greater enforcement power than the private lenders. First, defaulting on the multilateral debt entails greater output cost – i.e. $y \geq y^{DP} > y^{DF}$.²⁴ Second, following the discussion in Section 3, the multilateral lender follows a stringent policy of non-toleration of arrears which consists of two main components. First, repayment of outstanding multilateral debt is always in full. Second, the multilateral lender does not provides new debt until arrears have been completely cleared. For tractability, missed coupon payments are nevertheless forgone.

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

$$\mathbf{b}_p = [\underbrace{B_p, \dots, B_p}_{\mathcal{M} \text{ times}}] \quad \text{and} \quad \mathbf{b}_m = [\underbrace{b_{m,1}, \dots, b_{m,1}}_{\mathcal{P} \text{ times}}, \underbrace{b_{m,2}, \dots, b_{m,2}}_{\mathcal{P} \text{ times}}, \dots, \underbrace{b_{m,\mathcal{M}}, \dots, b_{m,\mathcal{M}}}_{\mathcal{P} \text{ times}}]$$

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

In this environment, the sovereign faces two problems. On the one hand, it decides whether to repay or not. This is the repayment problem in which the sovereign takes the prices and the outcome of the renegotiation problem as given to determine whether it is optimal to default. On the other hand, under default, the sovereign has to renegotiate its debt. There the sovereign has to bargain directly with the lenders to determine the recovery

²³The sovereign does not have the possibility of solely defaulting on the multilateral debt. This is consistent with the fact that, in the empirical analysis, default episodes always involve private creditors.

²⁴The larger default penalty may not be interpreted *stricto sensu*. In this class of model, this assumption is isomorphic to a larger utility cost upon default.

value of debt taking the prices and the outcome of the repayment problem as given.

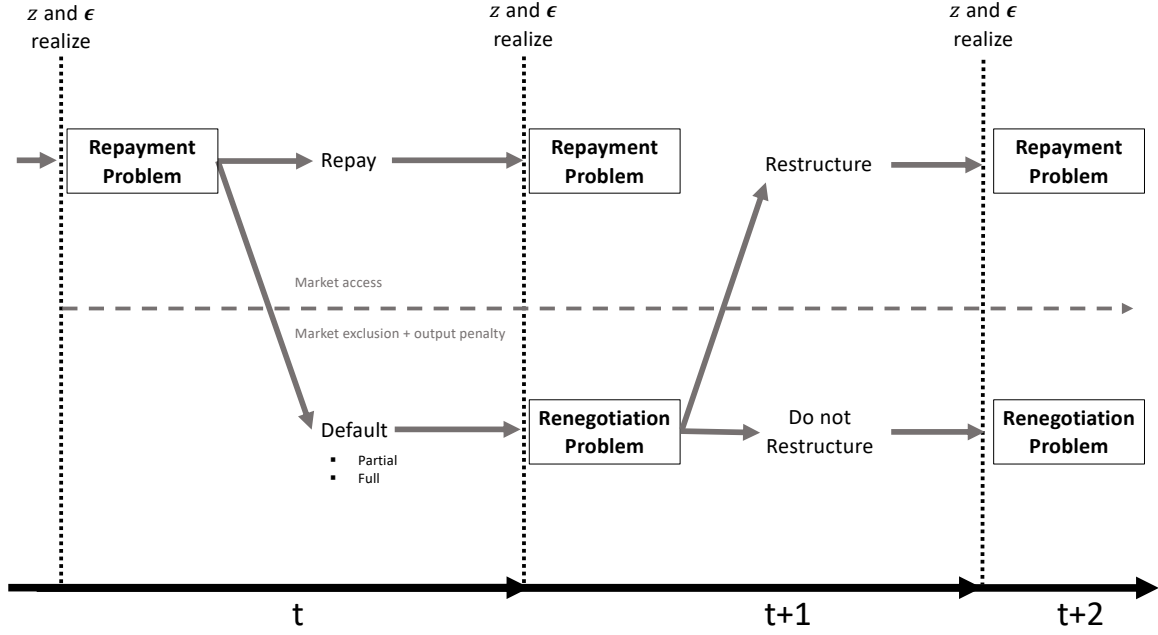


Figure 2: Timing and Problems

The timing of the model is depicted in Figure 2. In the repayment problem, given the realization of (z, ϵ) , the sovereign decides whether to repay or not. If it repays, it maintains its market access, determines its prospective borrowing and faces the repayment problem again in the next period. 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 restructuring, the sovereign regains access to the market and faces the repayment problem in the next period. Otherwise, the sovereign remains in autarky and the renegotiation problem repeats next period.

6 The Repayment Problem

This section develops the repayment problem. Given the prices, the outcome of the renegotiation problem, the realisation of (z, ϵ) and the current stock of debt, the sovereign decides whether to repay. When deciding to default, the sovereign can choose to enter into *partial*

or *full* default. The overall beginning of the period value function is then given by

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

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

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

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

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

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

The continuation value $V^{RP}(\cdot)$ is the expected payoff from the renegotiation process with the private creditors and is specified in the next section. Consistent with the policy of non-toleration of arrears, there is no multilateral lending, while the sovereign continues to service its multilateral debt which decays at the rate δ .²⁵ Hence, the larger is $-b_m^i$, the less attractive is this type of default. Moreover, in the case of one-period debt (i.e. $\delta = 0$), the debt is repaid in one instalment. This further renders the *partial* default unappealing. In opposition, the longer is the average maturity (i.e. $\delta \rightarrow 1$), the lower is the debt service incurred every period.

Finally, if the sovereign decides to enter into *full* default, it is excluded from the international bond market and receives an output penalty, $y^{DF} < y^{DP} \leq y$. The Bellman equation

²⁵The absence of multilateral lending is for tractability. There are occurrence in the data in which multilateral lenders continue to lend when the sovereign is in arrears with respect to the private sector. In light of this, my model adopts a stringent interpretation of the policy of non-toleration of arrears.

in the case of *full* default reads as follows

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

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

7 The Renegotiation Problem

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

7.1 Partial default

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

With probability ϕ the private lenders have the opportunity to propose and if so the sovereign decides whether to accept the offer. Conversely, with probability $1-\phi$, the sovereign can propose and if so the private lenders decide whether to accept the offer. The probability ϕ directly reflects the private lenders' bargaining power as it represents the probability of having the first-mover advantage (Merlo and Wilson, 1995).

An offer states the value of the restructured private debt, W . If the proposer does not propose or the recipient does not accept the offer W , the renegotiation is delayed, the sovereign stays in autarky and the game repeats next period. Otherwise, the negotiating parties settle, the game ends and the sovereign can return to the repayment problem. Formally, the value under renegotiation is given by

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

$\Omega^{RP}(\cdot)$ is the value derived from a specific offer and W_l^{RP} and W_b^{RP} represent the offer made

by the private lenders and the sovereign, respectively.

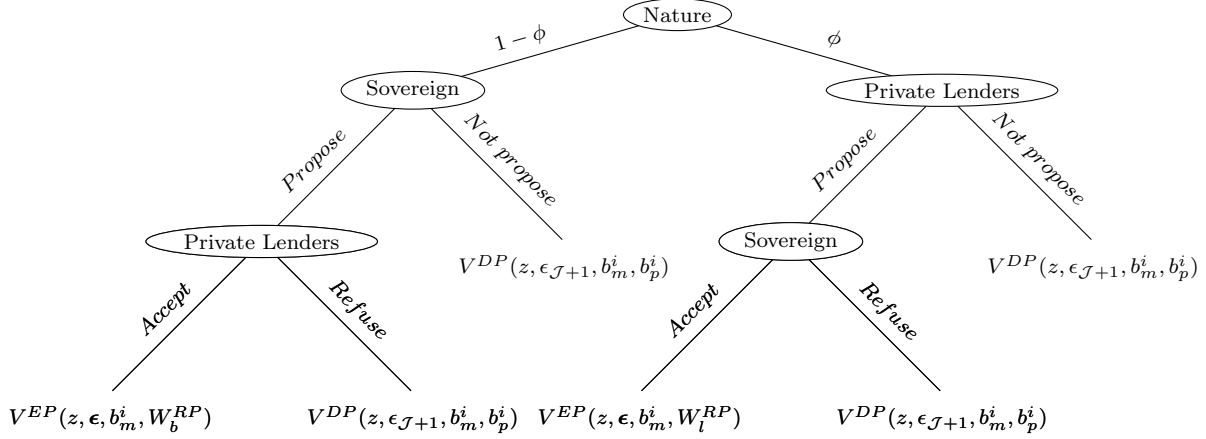


Figure 3: Renegotiation Game Tree in Partial Default

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

$$\Omega^{RP}(z, \epsilon, b_m^i, b_p^i, W) = \max \left\{ V^{DP}(z, \epsilon_{J+1}, b_m^i, b_p^i), V^{EP}(z, \epsilon, b_m^i, W) \right\}, \quad (6)$$

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

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

During the restructuring, the sovereign repays the value of the restructured debt, W , and gets rid of the output penalty. As in [Dvorkin et al. \(2021\)](#), the value of restructured debt has to be financed by new debt issuance (i.e. $\tau \geq 0$). Note that the sovereign cannot issue new multilateral debt yet. The complete re-access to the market arises after the restructuring.

The haircut corresponds to $1 - \frac{W}{-b_p^i \bar{q}}$. The numerator in the fraction corresponds to the present value of restructured debt, whereas the denominator is the present value of the

defaulted debt.

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

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

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

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

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

In words, the private lenders seek to maximize the recovery value the sovereign is willing to accept under the constraint that the proposed restructuring does not exceed the initial present value of the private debt.

Figure 4b depicts the private lenders' offer and Figure 4a the sovereign's acceptance probability. As one can see, W decreases in the level of private debt and in the level of endowment. Regarding the acceptance probability, delays are more likely in low endowment states and with larger levels of debt.

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

value of debt is very low. However, as the default risk diminishes, the private lenders can recover more from the sovereign.

As in [Benjamin and Wright \(2013\)](#), delays therefore originate from the limited enforcement in repayment. In other words, delays in the renegotiation emanate from the same force that generates the default itself.

7.2 Full default

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

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

where W_b^{RF} and W_l^{RF} represent the offer for the private debt made by the sovereign and the two types of lenders, respectively. Consistent with the policy of non-toleration of arrears, irrespective of the proposer, the multilateral debt is always repaid in full – i.e. $-b_m^i \bar{q}$. Nevertheless, the multilateral lender forgoes the missed coupon payments. In other words, there is no accumulation of arrears.

Following the same logic as before, the stopping function $A^{RF}(z, \epsilon, b_m^i, b_p^i, W - b_m^i \bar{q})$ is the result of

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

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

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

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

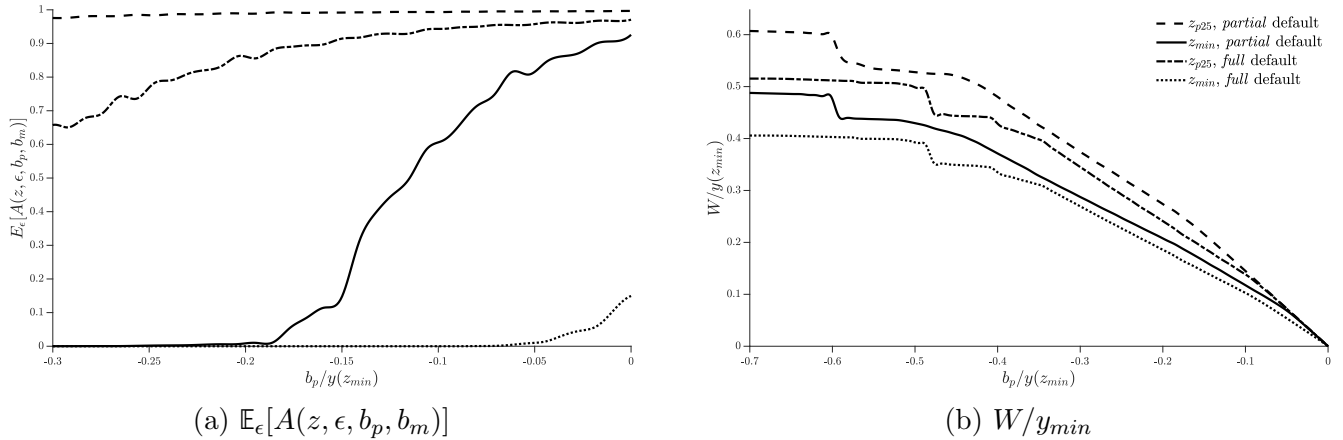
Upon restructuring, the sovereign repays the value of the restructured debt, $W - b_m^i \bar{q}$, and gets rid of the output penalty. In addition, due to the policy of non-toleration of arrears, the sovereign cannot access multilateral funds as it is clearing its arrears in the current period. The sovereign's offer for the private debt is given by

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

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

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

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



Note: The figure depicts the sovereign's acceptance probability and the optimal offer from the private lenders in *partial* and *full* defaults as a function of b_p fixing (z, b_m) . The different lines correspond to different levels of endowment and b_m is set to the largest level of debt in the grid. z_{pX} corresponds to the X^{th} percentile of the endowment.

Figure 4: Acceptance Probability and Private Lender's Offer

How is this setting supposed to generate additional delay? If the multilateral lender were not requesting full repayment, the sovereign could offer $q_m^{DF}(z, b_m^i, b_p^i)(-b_m^i)$ with $q_m^{DF}(z, b_m^i, b_p^i) \leq \bar{q}$ instead of $\bar{q}(-b_m^i)$. In words, the complete repayment of the multilateral debt renders the debt restructuring more costly for the sovereign which prefers to wait that the endowment state *majorly* improves before settling. In addition, compared to a *partial* default, the value of staying in default may be larger in a *full* default as the sovereign does not need to service the multilateral debt in autarky. This generates additional delays. Figure 4a depicts the

acceptance probability in *partial* and *full* defaults. A successful restructuring is always less likely in *full* defaults for a given state.

Given additional delays, the absence of multilateral debt issuance is necessary to generate haircuts in line with Fact III. In this bargaining game, the haircut is shaped by two opposing forces as shown in Figure 4b. 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 lower default risk. As mentioned above, in the case of a *full* default, delays in the renegotiation process are more pronounced which mechanically lead to lower haircuts. The restriction on multilateral debt issuance is thus necessary to counterbalance this effect. As one can see in Figure 4b, for a given state, the private lenders' offer in *full* default is always strictly lower than in *partial* default.

8 Prices and Debt Structure

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

8.1 Bond prices

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

$$q_p(z, b_m^j, b_p^j) = \frac{1}{1+r} \mathbb{E}_{z'|z} \mathbb{E}_{\epsilon'} \left[(1 - D^{DP}(z', \epsilon', b_m^j, b_p^j) - D^{DF}(z', \epsilon', b_m^j, b_p^j)) \times \right. \quad (10)$$

$$(1 - \delta + \delta\kappa + \delta q_p(z', b_m(z', \epsilon', b_m^j, b_p^j), b_p(z', \epsilon', b_m^j, b_p^j))) +$$

$$D^{DP}(z', \epsilon', b_m^j, b_p^j) q_p^{DP}(z', b_m^j, b_p^j) +$$

$$\left. D^{DF}(z', \epsilon', b_m^j, b_p^j) q_p^{DF}(z', b_m^j, b_p^j) \right].$$

If the sovereign decides to repay, the private lenders receive the fraction of bond maturing,

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

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

$$q_p^{DP}(z, b_m^i, b_p^i) = \frac{1}{1+r} \mathbb{E}_{z'|z} \mathbb{E}_{\epsilon'} \left[(1 - \phi A^{RP}(z', \epsilon', \delta b_m^i, b_p^i, W_l^{RP})) q_p^{DP}(z', \delta b_m^i, b_p^i) + \phi A^{RP}(z', \epsilon', \delta b_m^i, b_p^i, W_l^{RP}) \frac{W_l^{RP}(z', \delta b_m^i, b_p^i)}{-b_p^i} \right].$$

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

$$q_p^{DF}(z, b_m^i, b_p^i) = \frac{1}{1+r} \mathbb{E}_{z'|z} \mathbb{E}_{\epsilon'} \left[(1 - \phi A^{RF}(z', \epsilon', b_m^i, b_p^i, W_l^{RF})) q_p^{DF}(z', b_m^i, b_p^i) + \phi A^{RF}(z', \epsilon', b_m^i, b_p^i, W_l^{RF}) \frac{W_l^{RF}(z', b_m^i, b_p^i)}{-b_p^i} \right].$$

I can now pass to the price of multilateral debt. Given the risk neutrality and the break-even assumption, the price formula is similar to the one of private debt,

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

As the multilateral lender is always repaid in full, the recovery value upon *full* default is

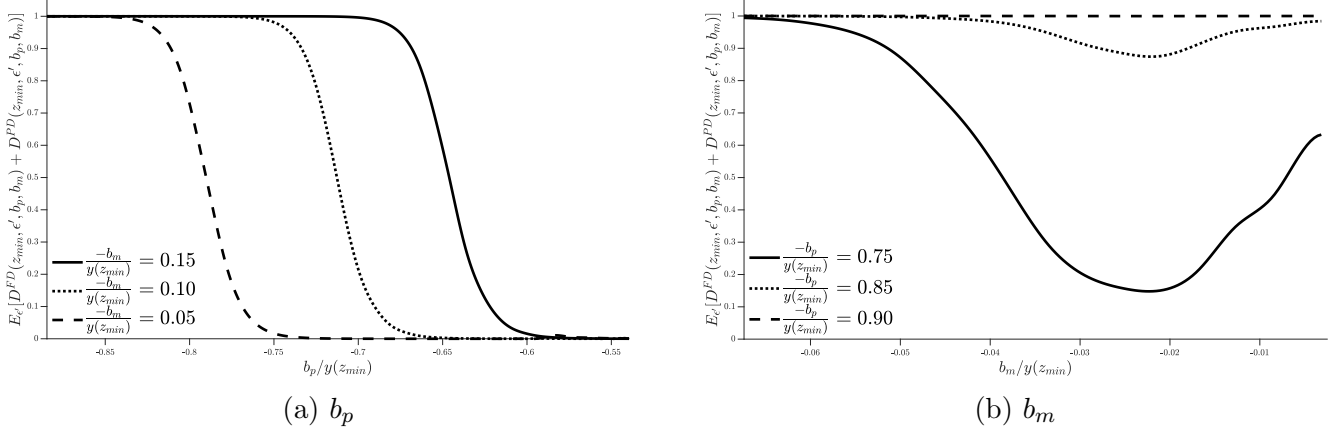
$$q_m^{DF}(z, b_m^i, b_p^i) = \frac{1}{1+r} \mathbb{E}_{z'|z} \mathbb{E}_{\epsilon'} \left[(1 - A^{RF}(z', \epsilon', b_m^i, b_p^i, W_l^{RF})) q_m^{DF}(z', b_m^i, b_p^i) + A^{RF}(z', \epsilon', b_m^i, b_p^i, W_l^{RF}) \bar{q} \right].$$

The potential wedge between q_m^{DF} and \bar{q} is solely due to the fact that the multilateral lender forgoes the missed coupon payments. Thus, unlike [Cordella and Powell \(2021\)](#), the multilateral lender does not necessarily lend at the risk-free rate.

In what follows, I highlight three main features of the bond prices. First, the multilateral

debt price is higher than the private bond price and that for two reasons. First, the default probability on the multilateral debt is lower than on the private debt owing to the greater output penalty. Second, the recovery value for the multilateral debt is higher than the recovery value of private debt due to the policy of non-toleration of arrears.

Second, with monotonic bond policy functions, the private (multilateral) debt price decreases in the amount of private (multilateral) debt. This follows the standard argument of [Chatterjee and Eyigungor \(2012\)](#).



Note: The figure depicts the overall default probability as a function of the debt level. Figure 5a plots the overall default probability as a function of b_p where I fix z at z_{min} and b_m at respectively 15%, 10% and 5% of output. Figure 5b plots the overall default probability as a function of b_m where I fix z at z_{min} and b_p at respectively 75%, 80% and 85% of output.

Figure 5: Overall Default Probability

Third, the effect of the multilateral debt on the private debt price is ambiguous. The reason is that the multilateral debt has two opposite effects on the default risk. On the one hand, in a *partial* default, the sovereign continues to service its multilateral debt. More multilateral debt therefore reduces the probability of a *partial* default. On the other hand, more multilateral debt increases the probability of a *full* default. Thus, if additional multilateral debt decreases the probability of a *partial* default without a one-to-one increase in the probability of *full* default, the overall default risk effectively decreases.²⁷ Otherwise, the opposite holds true and the overall default risk increases. Figure 5b depicts the default probability as a function of b_m and shows it is indeed U-shaped in some states. In opposition, Figure 5a depicts the same statistic as a function of b_p and shows no such pattern.

In particular, the effect of the multilateral debt on the private bond price depends on the interaction between the default and the subordination risks. The multilateral debt increases the subordination risk of private debt. As seen in Figure 4b, in a *full* default, absolute priority is given to the repayment of the multilateral debt and the private lenders receive what is

²⁷This is possible given that $y \geq y^{DP} > y^{DF}$.

left. Hence, if additional multilateral debt increases the default probability, then the private bond price unambiguously decreases in the amount of multilateral debt as the default and subordination risks go in the same direction. In opposition, if additional multilateral debt decreases the default probability, the private debt price may not necessarily decrease. The reduction in the default probability might be sufficiently large to compensate the reduction in the recovery value of private debt and potential future dilutions. Figure 5b suggests that this can only happen when the level of multilateral debt is not too large.

8.2 Optimal seniority structure

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

To understand the tradeoff involved in the borrowing decision, I analyze the optimality conditions for the sovereign. I adopt a heuristic approach relying on three main assumptions. First, the bond choices have a continuous and compact support $B_p = [b_p^1, b_p^P]$ and $B_m = [b_m^1, b_m^M]$. Second, I disregard buybacks and consider the case in which $b'_j - \delta b_j < 0$ for all $j \in \{m, p\}$. Third, as [Arellano and Ramanarayanan \(2012\)](#) and [Arellano et al. \(2023\)](#), I assume that the bond price functions $q_m(\cdot)$ and $q_p(\cdot)$ and the value of repayment $V^P(\cdot)$ are differentiable everywhere.²⁸ I then derive the first-order necessary conditions of the sovereign's problem given in (2) with respect to b'_m ,

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

and with respect to b'_p ,

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

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

²⁸Note that I assume that those objects are differentiable everywhere. However, [Mateos-Planas et al. \(2022\)](#) show that this is generally not the case.

the previous subsection, one has

$$\frac{q_m}{q_p} \geq 1, \quad \frac{\partial q_p}{\partial b'_p} \geq 0, \quad \frac{\partial q_m}{\partial b'_m} \geq 0 \quad \text{and} \quad \frac{\partial q_p}{\partial b'_p} \leq \frac{\partial q_p}{\partial b'_m}.$$

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

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

The numerator (denominator) corresponds to the marginal impact of issuing multilateral (private) debt on the incentive to repay. Whether there is a seniority benefit or a seniority cost depends on the relative sensitivity of the private bond price with respect to the two types of debt. Given that the multilateral debt is eventually repaid in full, one would expect that $\frac{\partial q_m}{\partial b'_m} \approx \frac{\partial q_m}{\partial b'_p}$. Thus, if $\frac{\partial q_p}{\partial b'_p} > \frac{\partial q_p}{\partial b'_m}$, the sovereign has a greater incentive to repay when it issues multilateral debt. As argued before, this typically happens when $-b'_m$ is relatively small. In this case there is a seniority benefit to the repayment incentive. Conversely, when $\frac{\partial q_p}{\partial b'_p} < \frac{\partial q_p}{\partial b'_m}$, there are two cases. If $\frac{q_m}{q_p}$ is sufficiently large, there is still a seniority benefit. Otherwise, the sovereign has a lower incentive to repay when it issues multilateral debt and there is therefore a seniority cost.

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

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

which one can reformulate as

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

Owing to the *de facto* seniority, 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 close to \bar{q} due to the high recovery value, while q'_p can get closer to 0. 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 $\text{cov}(u_c(c'), q'_p) \leq \text{cov}(u_c(c'), q'_m) < 0$ and $\mathbb{E}_{z'|z}[q'_m] \geq \mathbb{E}_{z'|z}[q'_p]$. 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 reduces the future debt burden.

All in all, the multilateral debt has a dual effect. In small amount, it can generate a large value at the issuance, whereas, in large amount, it overly depresses the value of private debt issuance owing to subordination. In addition, it is less prone to dilution than private debt making it more costly to repay at the maturity. This shapes the borrowing choice of the sovereign. In particular, the optimal seniority structure is determined such that the seniority benefit or cost equates the subordination benefit.

This tradeoff closely relates to the one in [Arellano and Ramanarayanan \(2012\)](#) and [Niepelt \(2014\)](#), where the sovereign has to choose between short-term and long-term debts. The former debt instrument has to be repaid in the next period, while only a fraction of the latter matures. The price of long-term bonds therefore includes the prospective value of the debt rendering it more sensitive to the default risk. As a result, the short-term debt has beneficial effects on the incentive to repay – what the authors call incentive benefits, whereas the long-term debt provides an hedge against future low productivity shocks – what the authors call hedging benefits. In my model, the tradeoff is similar with the main exception that more multilateral debt does not always increase the incentive to repay.

The spillover effect of multilateral debt on private debt addresses the catalytic function of official multilateral lending. As noted 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.

9 Calibration and Model Evaluation

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

9.1 Calibration and targeted moments

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

I calibrate the model to Argentina for the period 1970 to 2018 with a yearly frequency. Table 2 summarizes the main parameters of the model. The utility function takes the constant relative risk aversion (CRRA) form,

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

where the risk aversion parameter, ϱ , is set to the standard value of 2 adopted in the real business cycle literature. The risk-free rate is 4.2% to match the average real 10-year US Treasury bonds yield (Dvorkin et al., 2021).²⁹ Finally, the stochastic process follows a log-normal AR(1) process,

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

Following the estimation of Aguiar and Gopinath (2006) for Argentina, the persistence of the endowment shock ρ is set to 0.9 and the standard deviation σ_ε to 0.034.³⁰ The stochastic process is discretized into a 8-state Markov chain following the approach of Tauchen (1986).

Table 2: Parameters

Parameter	Value	Description	Targeted Moment	Target	Model
A. Based on Literature					
ϱ	2	Risk aversion			
B. Direct Measure from the Data					
r	0.042	Risk-free rate	Average 10-year US real Treasury yield		
δ	0.9	Reciprocal of average maturity	Average maturity structure		
κ	0.12	Coupon payments	Average coupon rate		
ρ	0.9	Output persistence			
σ_ε	0.034	Standard deviation	Argentina GDP		
C. Based on Model solution					
β	0.9415	Discount factor	Debt-to-GDP ratio (%)	41.58	39.86
\mathcal{A}	-0.1	Multilateral borrowing limit	Multilateral-debt-to-GDP ratio (%)	5.89	6.49
ϕ	0.52	Bargaining power	Average SZ haircut (%)	37.50	36.00
ψ	0.882	General default cost	Average default duration (year)	3.60	3.72
χ^{DP}	0.8895	Initial <i>partial</i> default cost	Default rate (%)	2.50	2.25
χ^{DF}	0.85455	Initial <i>full</i> default cost	Share <i>full</i> default (%)	17.65	19.48
α_1	0.0001	Portfolio adjustment cost	Average issuance costs (%)	0.20	0.12
α_2	30	Portfolio adjustment cost	Debt increase prior to default (percentage point)	22.00	23.85
ω	0.0075	Utility shock variance parameter	Standard deviation debt-to-GDP ratio	8.00	9.26
v	0.14	Utility shock correlation parameter	Standard deviation duration	4.67	4.46

Following Chatterjee and Eyigungor (2012), I set $\kappa = 0.12$ to directly match the average coupon rate of Argentina. I choose $\delta = 0.9$ to match the average maturity which I estimate as the ratio of the external debt over the external debt service.³¹ I subsequently select the value of the discount factor, β , to match the average external debt-to-GDP ratio of

²⁹Average 10-year US Treasury bond rate minus PCE inflation between 1980 and 2010.

³⁰Note that I consider a mean of log output equal to zero, while Aguiar and Gopinath (2006) set it to $-0.5\sigma_\varepsilon^2$ so that average output is standardized to one.

³¹Based on Broner et al. (2013), many studies target an average maturity of 5 years for Argentina. My

Argentina. I obtain $\beta = 0.9415$ which is within the bounds admitted in the real business cycle and sovereign debt literature. In addition, the bargaining power is set so as to match the overall average SZ haircut. The value of 0.52 is above the one of 0.51 chosen by [Benjamin and Wright \(2013\)](#) and below the one of 0.55 chosen by [Dvorkin et al. \(2021\)](#). Note that the average haircut for defaults with multilateral creditors (i.e. *full* defaults) is not targeted.

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

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

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

Owing to the positive recovery value of debt, this model is subject to large increases in indebtedness and consumption boom prior to default. This problem is further reinforced by the fact that additional multilateral debt can largely dilute private debt. There are different ways of dealing with this problem. [Hatchondo et al. \(2016\)](#) impose a limit on the private bond spread, [Dvorkin et al. \(2021\)](#) set a transaction cost on portfolio adjustments and [Fourakis \(2021\)](#) adds a premium related to the default risk. To avoid to distort too much the tradeoff between private and multilateral debt and the choice between *partial* and *full* default, I adopt a transaction cost similar to [Dvorkin et al. \(2021\)](#),

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

The parameter α_1 commands the intercept, while α_2 gives the slope of the transaction cost. The former is calibrated to match issuance cost of 0.2% and the latter to match the increase of the debt ratio prior to default.

target of 10 years diverges from this benchmark as [Broner et al. \(2013\)](#) estimate the maturity using private bonds, while my estimate takes into account the total external debt.

I introduce an exogenous limit $\mathcal{A} \leq 0$ to multilateral debt and that for two reasons. First, without this, the sovereign would accumulate mostly multilateral debt and very little private debt. Second, a borrowing limit is consistent with the fact that the IMF and the WB impose lending quotas. I calibrate \mathcal{A} to match the multilateral debt-to-GDP ratio of Argentina.

Finally, I calibrate the variance and the correlation parameters of the utility shocks to match the standard deviation of the debt-to-GDP ratio and the standard deviation of the duration, respectively. In Appendix F, I show that with this calibration, the utility shocks do not significantly impact the default rate, the haircuts, the duration or the debt choices.

9.2 Facts and other non-targeted moments

In terms of non-targeted moments, I first assess how the model matches the empirical facts of Section 4. As one can see in Table 3, without directly targeting such moments, the model generates haircuts and durations that are in line with the empirical evidence and that for defaults with and without multilateral creditors. The model nonetheless underestimates the average length and haircut of defaults implicating multilateral creditors. Finally, the multilateral lender lends at a rate very close to the risk-free rate.

Table 3: Empirical Facts

	Data	Model
Default length (year) (with multilateral lenders)	8.50	5.89
Default length (year) (without multilateral lenders)	2.60	3.22
Private creditors' haircut (%) (with multilateral lenders)	59.00	50.28
Private creditors' haircut (%) (without multilateral lenders)	32.90	32.32
Share <i>full</i> default (%)	17.65	19.48
Multilateral debt spread (%)	0.25	0.42

Note: Data moments come from Table 1. To correct for the concessional lending from the IDA, the multilateral debt spread corresponds to the quarterly median spread between the IMF, the IBRD and the IDA.

I also gauge how the model matches non-targeted business cycles moments presented in Table 4. I find that it replicates moments related to consumption in an accurate way except maybe for the relative volatility which is below 1. For the trade balance, the model indicates a surplus as in the data. However, it fails to generate countercyclical trade balance. In addition, the model can reproduce neither the mean nor the volatility of the private debt spread. Nevertheless, the maximum private debt spread amounts 31% which is in-between the maximum observed in Argentina and emerging economies. The spread on multilateral debt is 0.42% which is close to the IMF's and the IBRD's spread. Besides this, it is roughly three times smaller than the private spread. The same holds true for the relative volatility which is around 0.71 for the private debt, but only amounts 0.22 for the multilateral debt.

Table 4: Selected Business-Cycle Moments

x	Mean(x)	Max(x)	Min(x)	Std(x)	Std(x)/Std(y)	Corr(x, y)
c						
Model	97.81	120.76	89.52	0.03	0.94	0.97
Argentina	75.27	86.08	63.79	0.04	1.17	0.98
$(y - c)/y$						
Model	2.19	10.48	-20.76	0.01	0.25	0.38
Argentina	1.83	9.11	-2.90	0.01	0.31	-0.90
$r_p - r$						
Model	1.13	31.15	0.00	0.02	0.71	-0.32
EMBI+ Spread for Emerging Markets	4.72	12.36	1.62	0.02	0.74	-
EMBI+ Spread for Argentina	13.51	57.23	3.20	0.16	4.77	-0.63
$r_m - r$						
Model	0.42	7.89	0.00	0.01	0.22	-0.34
IMF Spread	0.76	4.13	-1.76	0.01	0.43	-0.21
IBRD Spread	0.30	1.96	-2.41	0.01	0.41	-0.20
IDA Spread	-1.78	1.31	-6.63	0.02	0.70	-0.31

Note: The sample runs from 1970 to 2018. Consumption mean, min and max are with respect to output. Output, consumption and the trade balance are detrended with the Hodrick-Prescott filter with a smoothing parameter of 6.25. The IMF, the IBRD and the IDA spreads correspond respectively to the IMF adjusted rate of charge, the IBRD lending rate and the IDA service charge from which is deducted the yield on 1-year US government bonds. See Appendix B for more details.

In comparison to previous studies, the present model matches relatively well moments related to emerging economies. [Dvorkin et al. \(2021\)](#) report an average spread of 1.01% overall and 1.37% in bad time. They also cannot generate a countercyclical trade balance. Calibrating a model with long-term bonds and exogenous restructuring to Argentina, [Chatterjee and Eyigungor \(2012\)](#) report an average spread of 8.15% with a standard deviation of 0.04.³² Moreover, they obtain a correlation between consumption and output of 0.99 and

³²I 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.

a correlation between the trade balance (over output) and output of -0.44 . Finally, they report a volatility of consumption relative to output of 1.11 and a volatility of the trade balance (over output) relative to output of 0.2. Hence, except for the countercyclical trade balance and the spread moments, my model generates statistics very close the aforementioned ones. Especially, [Chatterjee and Eyigungor \(2012\)](#) obtain a better fit for the spread for two reasons. First, they assume a recovery value of zero, while the present model generates strictly positive recovery values. Second, they use a quadratic default penalty function to match the volatility of spread, while I adopt the standard asymmetric penalty.

10 Quantitative Analysis

In this section, I first study the dynamic of default through an event analysis. I then conduct counterfactual analyses regarding the seniority assumption and assess the changes in welfare.

10.1 Default dynamic

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

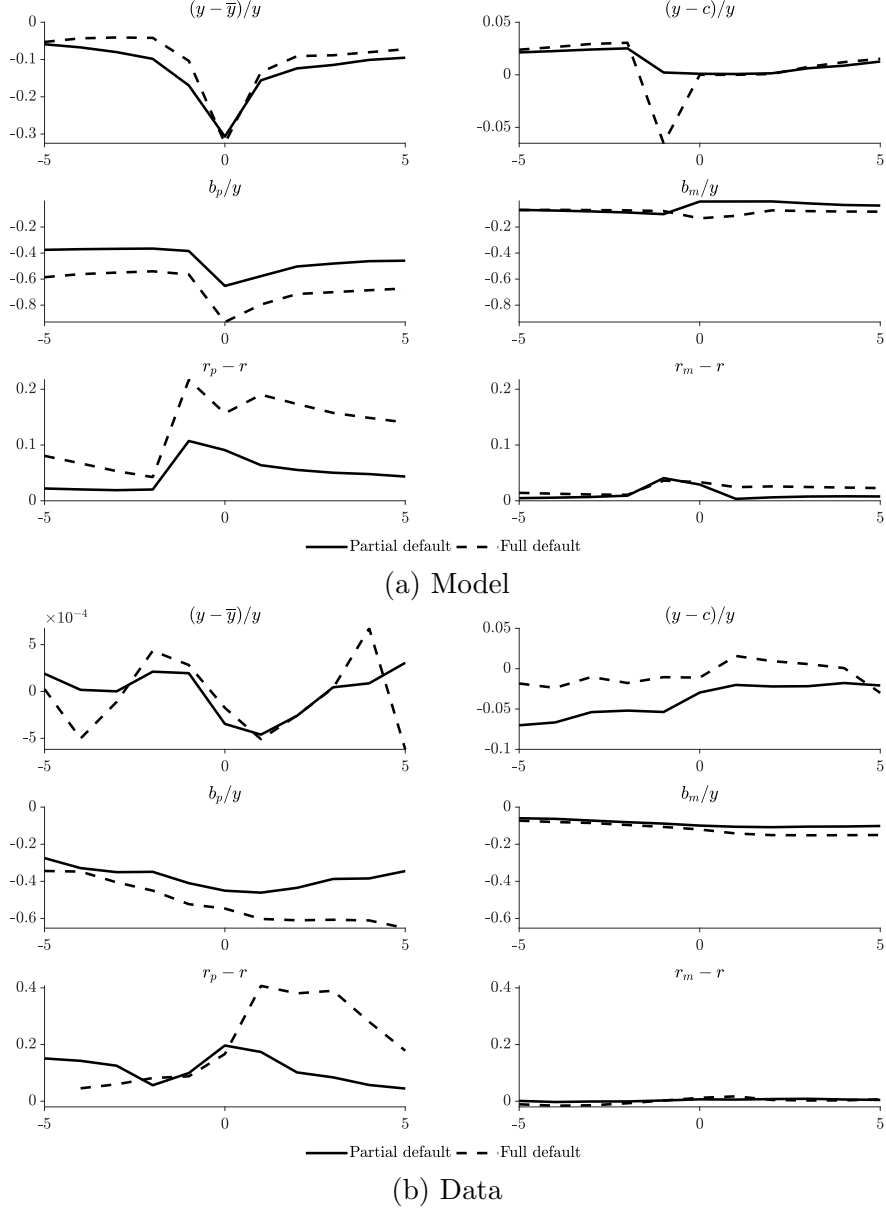
Table 5: Endowment and Debt Around Default

		Endowment (percent of mean y)	Private debt (percent of y)	Multilateral debt (percent of y)	Total debt (percent of y)
<i>Partial</i> default	Before	85.3	38.9	8.8	47.7
	At	76.3	65.3	0.4	65.8
	After	91.5	43.1	0.3	43.4
<i>Full</i> default	Before	89.7	56.3	7.2	63.5
	At	75.0	93.2	13.4	106.6
	After	97.5	62.5	0.0	62.5

Note: The table depicts the average endowment and debt around *partial* and *full* defaults. The averages come from simulation over 2000 economies for 500 periods where the initial 100 periods are discarded.

Table 5 depicts the main statistics of the model around defaults. The general dynamic is consistent with the empirical findings of [Benjamin and Wright \(2013\)](#). First, default's settlements usually arise when the sovereign's economic situation recovers. Most notably, defaults tend to start when the sovereign's GDP is below trend, whereas it usually ends when the sovereign's GDP settles back on the trend. Second, default's resolutions are not

associated with a substantial reduction of indebtedness.³³ Third, the sovereign does not necessarily accumulate the same level of debt depending on the type of default. Particularly, *partial* defaults are associated with lower levels of debt than *full* defaults.



Note: The figure depicts the evolution of endowment, trade balance, debt and spreads around *partial* and *full* defaults. Period 0 corresponds to the occurrence of default. In the model, the five-year window averages come from simulation over 2000 economies for 500 periods where the initial 100 periods are discarded. In the data, averages come from the entire sample used in Section 4. The variable \bar{y} corresponds to the average output in the model. In the data, $(y - \bar{y})/y$ corresponds to the deviation from the GDP trend using the HP filter with a smoothing parameter of 6.25. See Appendix B for more details.

Figure 6: Event Analysis

To construct the event analysis, I simulate 2000 economies for 500 periods. To make

³³Nevertheless, as noted by Arellano et al. (2023), the model does not generate a larger indebtedness at the end of default compared to the beginning of default.

sure that the initial conditions do not matter, I discard the first 100 periods. I then identify the five periods preceding and succeeding a default and take the average over the simulated panel. I discriminate between *partial* and *full* defaults both in the model and in the data.

Figure 6a depicts the event analysis for some selected variables in the model.³⁴ Period 0 corresponds to the occurrence of default. The solid line relates to a *partial* default, while the dashed line corresponds to a *full* default. As one can clearly see, *full* defaults are preceded by a rapid output contraction and a greater accumulation of debt. Furthermore, the sovereign country records a trade balance reversal at time 0. In the years before a *full* default, the trade balance becomes negative and suddenly reverts with the default. Finally, the private bond spread experiences a sudden and very large increase shortly before the occurrence of default. The multilateral debt spread also reacts but in a negligible manner.

In opposition, *partial* defaults are related to a slower output contraction. The average endowment at time 0 is similar to the one in *full* defaults. Moreover, there is a relatively limited trade balance reversal in the vicinity of default. Besides this, one observes a reduction of multilateral indebtedness on the default path. Most of the indebtedness comes from the private sector. The private bond spread increases as the economy approaches default but far less than in the case of *full* defaults. Consistent with what has been said before, the multilateral debt spread remains relatively modest in comparison to the private debt spread.

Figure 6b depicts the event analysis for some selected variables in the data. As in the model, a *full* default arises after sudden and sharp reduction in output, when the level of indebtedness is large. The average output at time 0 is similar to the one in *full* defaults. In addition, the private debt spread reacts more than in a *partial* default. The trade balance reversal is nonetheless less marked in the data. Thus, except for the trade balance, the models replicates very closely the movements in the data.

10.2 Output penalty and de jure seniority

This subsection analyzes the role of the output penalty. In the calibration, I assumed that the output penalty differs between *partial* and *full* defaults only when entering default. I therefore consider two extreme cases. First, I equalize \varkappa^{DF} and \varkappa^{DP} to show that this mainly affects the share of *full* default. Second, I set $\varkappa^{DF} = 0$ which, given the form of utility function, implies a *de jure* seniority on multilateral debt.

Table 6 depicts the moments related to the model with different output penalties alongside the benchmark model and the data moments. In the case of equal output penalty – i.e. $\varkappa^{DF} = \varkappa^{DP} = 0.854$ – the share of *full* default becomes 100%. However, the default's

³⁴See Figure A.5 for the median instead of the average over the simulated panel.

Table 6: Alternative Settings

	Benchmark	$\kappa^{DF} = \kappa^{DP}$	<i>de jure</i>	<i>pro rata</i>	$b_m^i < 0$	<i>pari passu</i>	$\delta_s = 0.85$	$\delta_p = 0.91$	$\mathcal{A} = 0$
Default length (year) (with multilateral lenders)	5.89	6.19	-	4.98	5.91	5.98	5.16	6.55	-
Default length (year) (without multilateral lenders)	3.22	-	5.88	3.08	5.74	5.89	2.99	2.72	5.87
Private creditors' haircut (%) (with multilateral lenders)	50.28	49.47	-	36.80	28.07	27.27	41.45	53.12	-
Private creditors' haircut (%) (without multilateral lenders)	32.32	-	23.36	31.07	23.64	24.93	32.48	33.88	24.17
Share <i>full</i> default (%)	19.48	100.00	0.00	23.43	62.99	38.97	34.34	48.06	-
Default rate (%)	2.25	2.57	3.94	2.77	3.93	3.91	2.84	2.51	3.99
Total debt increase (percentage point) (prior to default)	23.85	44.08	20.77	23.54	26.71	25.97	25.78	31.11	22.34
Total debt to GDP (%)	39.86	47.10	70.69	42.75	69.68	67.05	44.18	40.80	64.46
Multilateral debt to GDP (%)	6.49	6.19	5.41	6.14	5.36	4.12	5.91	6.11	-
Private debt spread (%)	1.13	1.93	1.61	1.14	1.75	1.81	1.33	1.50	1.69
Multilateral debt spread (%)	0.42	0.52	0.00	0.98	0.77	1.56	0.51	0.47	-

length and the haircut remain on average close to the benchmark prediction. As seen in the previous subsection, *full* defaults are associated with larger indebtedness. This explains the greater average debt ratio. Moreover, the private bond spread is larger as the private debt is subordinated in *full* defaults. Nonetheless, despite the more frequent occurrence of *full* defaults, the multilateral debt spread remains stable. This is because multilateral debt always gets repaid in full eventually.

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

Turning to the case in which $\kappa^{DF} = 0$, the multilateral debt becomes *de jure* senior. The model is similar to the one of Hatchondo et al. (2017) with the difference that the default's length and the haircut are endogenous. As one can see in Table 6, the default's duration becomes more pronounced, while the average haircut reduces relative to the benchmark case. Furthermore, the default rate, the private bond spread and the private debt ratio increase, while the average holdings of multilateral debt decreases. I come back later on why the default's duration and the total indebtedness increase so much.

10.3 Towards a *pari-passu* clause

I introduce a *pari passu* clause between the multilateral and private lender. A *pari passu* clause consists of two components. On the one hand, there is a net multilateral debt issuance (i.e. $b_m^j < 0$) upon restructuring. On the other hand, the multilateral and private lenders make a common offer W which is split *pro rata*. That is the multilateral lender is not anymore repaid in full. To identify the impact of each of these two components, I consider them separately before joining them together.

To analyze the *pro rata* split, consider that the two types of lenders make a joint offer X for the entire debt. Formally, the value of a restructuring upon *full* default reads

$$V^{RF}(z, \epsilon, b_m^i, b_p^i) = \phi \Omega^{RF}(z, \epsilon, b_m^i, b_p^i, X_l^{RF}) + (1 - \phi) \Omega^{RF}(z, \epsilon, b_m^i, b_p^i, X_b^{RF}).$$

where the sovereign's offer is given by

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

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

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

Finally, the transfer upon restructuring is given by

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

where the private lenders get a share $\frac{b_p^j}{b_p^j + b_m^j}$ of X upon restructuring and the multilateral lender the remaining part. There is no multilateral debt issuance upon restructuring yet.

Table 6 presents the result of the *pro rata* split. A *full* default still lasts longer than a *partial* default. However, the average haircut in a *full* default largely decreases and comes closer to the one in a *partial* default. Moreover, despite similar debt ratios and default rates, one observes a greater share of *full* default and a larger multilateral debt spread compared to the benchmark case. Thus, the *pro rata* split does weaken the *de facto* seniority of multilateral lenders. More precisely, the full repayment of multilateral lending institutions is a prerequisite to safeguard lending at preferential rates. However, this comes at the cost of private debt subordination implying a larger spread and haircut on the private debt.

Having shown the impact of relaxing the full repayment of multilateral lenders, I now consider that upon restructuring, there is a net multilateral debt issuance (i.e. $b_m^j < 0$). Formally, one has that

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

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

Table 6 presents the result of introducing multilateral debt issuance upon restructuring. The multilateral lender is still repaid in full here – i.e. $-b_m^i \bar{q}$. A *full* default lasts on average 5 years similar to what the benchmark model predicts. However, *partial* and *full* defaults have now comparable average duration and haircut. The multilateral debt spread increases but to a lesser extent than in the case of a *pro rata* split. This comes from the larger default rate combined with the greater share of *full* default. Thus, the inability to issue new multilateral debt at the restructuring largely impacts the private creditors' haircut – like the *pro rata* split – and the default duration – unlike the *pro rata* split.

Joining the multilateral debt issuance together with the *pro rata* split, I obtain a *pari passu* clause between the two types of lenders.³⁵ The renegotiation process under *full* default is now isomorphic to the one under *partial* default.³⁶ As shown in Table 6, the two types of default have analogous average haircut and duration. Moreover, the multilateral debt spread largely increases and comes closer to the private one. Private and multilateral debt become therefore closer substitutes. As a result, the sovereign accumulates more private debt and less multilateral debt than in the benchmark case. This exercise therefore shows the role of the policy of non-toleration of arrears in generating the *de facto* seniority.

10.4 Debt, duration and haircut

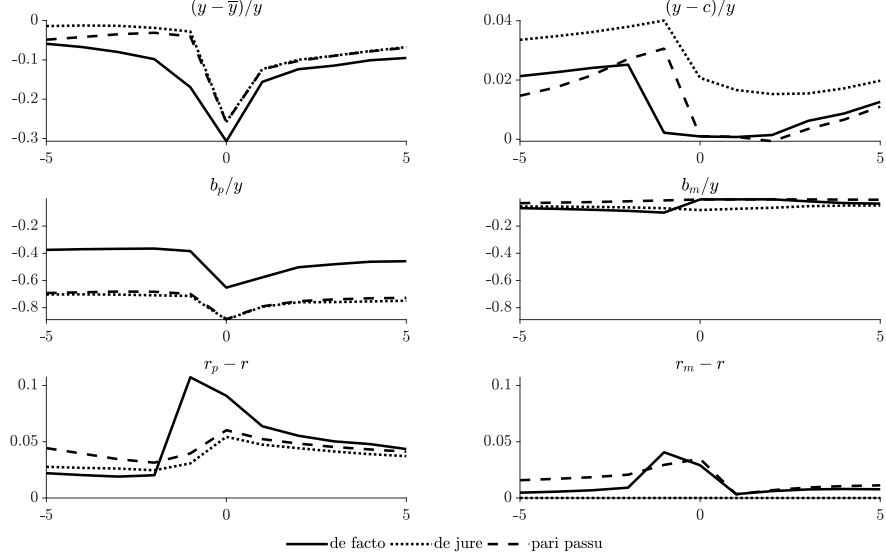
The comparison between the *de facto*, *de jure* and *pari passu* regimes is instructive on what is the source of longer durations and larger haircuts in the benchmark model.

Regarding the haircut, it is clear from Table 6 that the policy of non-toleration of arrears

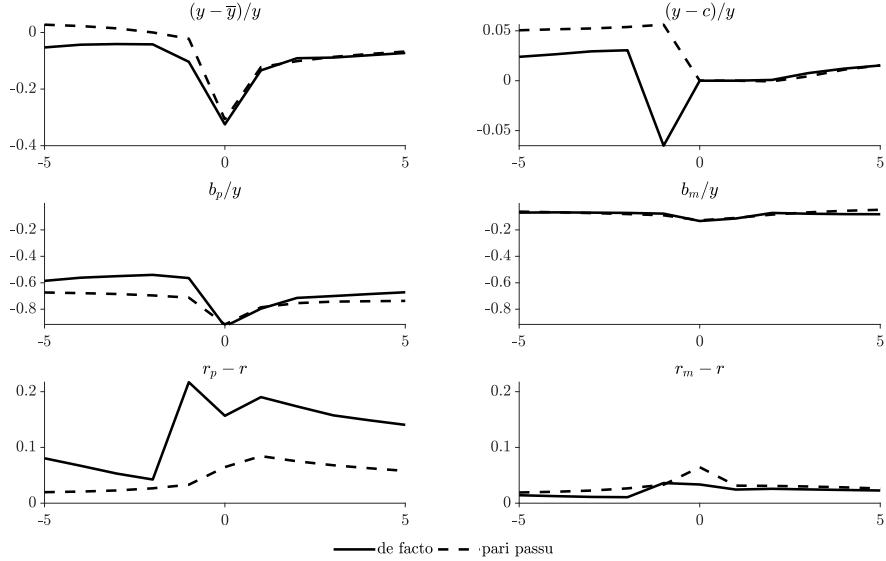
³⁵In this case, the transfer upon restructuring is given by $\tau = q_m(z, b_m^j, b_p^j)(-b_m^j) + q_p(z, b_m^j, b_p^j)(-b_p^j) - W \geq 0$, where W is split *pro rata*.

³⁶The only difference is the value of autarky. Under *partial* default, the sovereign continues to pay the multilateral debt in autarky.

is the key component behind larger private creditors' losses. Once one removes either the full repayment of multilateral debt (i.e. the *pro rata* split) or the non-access of multilateral borrowing upon restructuring (i.e. $b_m^j < 0$), the haircut in a *full* default drastically decreases and gets closer to the one in a *partial* default. In particular, Table 7 shows that the *de facto* seniority always generates the largest haircuts in a *full* default.



(a) Partial default



(b) Full default

Note: The figure depicts the evolution of endowment, trade balance, debt and spreads around defaults for the different seniority regimes. The five-year window averages come from simulation over 2000 economies for 500 periods where the initial 100 periods are discarded. Period 0 corresponds to the occurrence of default. The variable \bar{y} corresponds to the average output in the model.

Figure 7: Event Analysis in Partial and Full Defaults

Regarding the duration, what mainly explains the differential between a *full* and a *partial*

default in the benchmark model is the private debt accumulation. Notably, larger total indebtedness mechanically produces longer defaults as the sovereign waits that the default risk reduces before restructuring. In addition, as I consider an exogenous borrowing limit \mathcal{A} , the multilateral debt has a limited impact on the total indebtedness – and therefore on the duration – when the stock of private debt is relatively large. As one can see in Figure 7a, in the vicinity of a *partial* default, the sovereign accumulates less private debt under the *de facto* seniority than under the other two regimes. This translates into lower average duration of a *partial* default in the benchmark model. Similarly, as shown in Figure 7b, the sovereign accumulates a similar amount of private debt in the vicinity of a *full* default. As a result, the length of a *full* default is similar under a *de facto* and a *pari passu* regime.

To disentangle the effect of the larger private debt accumulation relative to the multilateral debt stock, I compute the default duration for private debt levels around \mathcal{A} at z_{min} for the different seniority regimes. In the benchmark model, a *full* default is always related to a longer average duration than a *partial* default. Moreover, the wedge is more pronounced when the multilateral debt is high. Besides this, under the *pari passu* regime, durations are never higher than in the benchmark case. Notice that the larger duration in a *full* compared to a *partial* default in the *pari passu* regime can be solely attributed to the repayment of multilateral debt in autarky during a *partial* default.

Table 7: Duration and Haircut in Partial and Full Defaults

	Private debt	Multilateral debt	Average duration (year)		Average haircut (%)	
			<i>Partial</i> default	<i>Full</i> default	<i>Partial</i> default	<i>Full</i> default
<i>de facto</i>	\mathcal{A}	\mathcal{A}	2.0	6.2	5.7	8.1
	\mathcal{A}	$\mathcal{A}/3$	1.0	6.2	5.4	6.3
	$\mathcal{A}/3$	\mathcal{A}	1.0	6.2	4.6	5.9
	$\mathcal{A}/3$	$\mathcal{A}/3$	1.0	1.0	4.5	5.0
<i>de jure</i>	\mathcal{A}	\mathcal{A}	1.0	-	5.6	-
	\mathcal{A}	$\mathcal{A}/3$	1.0	-	5.3	-
	$\mathcal{A}/3$	\mathcal{A}	1.0	-	4.6	-
	$\mathcal{A}/3$	$\mathcal{A}/3$	1.0	-	4.5	-
<i>pari passu</i>	\mathcal{A}	\mathcal{A}	1.0	6.2	5.6	7.0
	\mathcal{A}	$\mathcal{A}/3$	1.0	3.5	5.5	6.0
	$\mathcal{A}/3$	\mathcal{A}	1.0	1.9	4.6	5.2
	$\mathcal{A}/3$	$\mathcal{A}/3$	1.0	1.0	4.5	4.6

Note: The table depicts the average duration and haircut in *partial* defaults for the different seniority regimes. The averages come from simulation over 2000 economies for 500 periods where the initial 100 periods are discarded. I fix the endowment at z_{min} . \mathcal{A} corresponds to the multilateral borrowing limit.

Thus, in my specific calibration, the longer duration of a *full* default in the benchmark model comes from the larger private debt accumulation. The borrowing limit \mathcal{A} is too tight

relative to the total stock of private debt for the multilateral debt to affect the default duration directly.

Having said that, the larger private debt accumulation in a *full* defaults relative to a *partial* default is a consequence of the *de facto* seniority. The larger debt ratio, default rate and private debt spread observed in both the *de jure* and the *pari passu* regime indicate that the *de facto* seniority forces the sovereign to adopt a more rigorous debt management. In other words, it generates a credible threat capable of disciplining the accumulation of debt. Under a *de jure* seniority regime, the threat fades as the *full* default option does not exist anymore. Similarly, under a *pari passu* clause, the renegotiation process under a *full* default becomes isomorphic to the one under *partial* default. As noted previously, what seems to matter in the *pari passu* clause is the access to multilateral debt upon restructuring. Thus, the effect of multilateral debt on the *full* default duration is indirect.

10.5 Maturity and multilateral debt

In this subsection, I first allow the maturity to differ between the private and multilateral debt. I then remove the multilateral debt from the model.

Regarding the maturity, the benchmark model assumes that the same maturity for the private and the multilateral debt. I now relax this assumption and consider that the multilateral debt has a maturity δ_m , while the private debt has a maturity δ_p . In particular, I consider two settings: $\delta_m = 0.85 < 0.9 = \delta_p$ and $\delta_m = 0.9 < 0.91 = \delta_p$.

Allowing for a shorter maturity of the multilateral debt has one main consequence. As argued in Section 6, when $\delta_m \rightarrow 0$, a *partial* default becomes less attractive because the multilateral debt service is greater in the first few periods spent in autarky. Especially, when $\delta_m = 0$, the multilateral debt has to be repaid in one instalment at the beginning of the *partial* default. In light of this, as depicted in Table 6, the share of *full* default almost doubles when one lowers δ_m to 0.85. The default rate also increases.

Allowing for a longer maturity of the private debt reinforces the seniority cost to the repayment incentive. On the other hand, longer maturities are more sensitive to the default risk as argued by [Arellano and Ramanarayanan \(2012\)](#) and [Niepelt \(2014\)](#). On the other hand, more multilateral debt continues to depress the recovery value under a *full* default because of subordination. As one can see, when I set $\delta_p = 0.91$, the private debt spread increases. Especially, the wedge with the multilateral debt spread gets larger even though the default rate and the share of *full* default are below the ones when $\varkappa^{DF} = \varkappa^{DP}$.

Besides the maturity, I also consider the case in which the sovereign has only access to private debt – i.e. $\mathcal{A} = 0$. This brings my analysis closer to the one of [Benjamin and Wright](#)

(2013). As one can see in Table 6, the model without the multilateral lender generates predictions very close to the case of *de jure* seniority in terms of haircut, default length, default rate and spread. However, it produces unrealistic default durations compared to the ones reported in Table 1. Hence, even though multilateral debt represents a small portion of the total debt and *full* defaults are infrequent, the presence of multilateral lenders directly affect the average haircut and duration. The coexistence of multilateral and private debt seem therefore a key element explaining the dynamic of emerging economies.

10.6 Welfare Analysis

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

Table 8: Welfare Gains Relative to Benchmark

Endowment state	Private debt	Multilateral debt	Welfare gains (%)							
			$\kappa^{DF} = \kappa^{DP}$	<i>de jure</i>	<i>pro rata</i>	$b_m^j < 0$	<i>pari passu</i>	$\delta_m = 0.85$	$\delta_p = 0.91$	$\mathcal{A} = 0$
z_{min}	High	High	-0.03	-1.07	-0.19	-0.48	-0.40	-0.19	0.01	-
	High	Zero	-0.32	-0.16	-0.22	-0.17	-0.19	-0.18	0.01	-0.12
	Zero	High	0.07	0.06	0.04	-0.01	-0.04	0.11	-0.03	-
	Zero	Zero	0.05	0.08	-0.02	-0.03	-0.10	0.01	-0.02	-0.09
z_{max}	High	High	-0.00	0.12	0.03	0.09	0.07	0.09	-0.16	-
	High	Zero	-0.01	0.09	0.01	0.06	0.03	0.01	-0.16	0.08
	Zero	High	-0.02	-0.01	0.01	-0.03	-0.05	0.07	-0.01	-
	Zero	Zero	-0.02	-0.01	0.01	-0.03	-0.05	0.01	-0.01	0.01
average	High	High	-0.02	-0.32	-0.14	-0.24	-0.24	-0.11	-0.03	-
	High	Zero	-0.05	0.01	-0.19	-0.04	-0.09	-0.13	-0.06	-0.02
	Zero	High	-0.04	-0.02	0.02	-0.05	-0.07	0.09	-0.03	-
	Zero	Zero	-0.03	-0.00	0.01	-0.05	-0.07	0.01	-0.02	-0.05

Note: The computation of the welfare is exposed in Appendix G. A high level of debt corresponds to the largest level of debt in the grid for both the private and the multilateral debt.

As shown in Table 8, an equal output penalty is associated with mostly welfare losses. This is because the sovereign does not have access to a “cheap” *partial* default in which it would get a lower output penalty. One observes a similar picture in the case of a *de jure* seniority. In regions in which debt crises occur – i.e. low endowment states with a large level of debt – there are major welfare losses as the sovereign can only enter in *partial* default in which it continues to repay the multilateral lender. The debt service of multilateral debt directly increases the cost of default generating the welfare losses. There are some minor welfares gains in some states, though.

Regarding the *pari passu* clause, I find welfare losses in most states. Hence, as already argued by Hatchondo et al. (2017), the sovereign highly values the use of last-resort funds

at a near risk-free rate. The *pari passu* clause weakens the *de facto* seniority of multilateral debt which is particularly valued in bad times when the default risk is high. The same holds true when I completely remove the multilateral lenders – i.e. $\mathcal{A} = 0$.

Regarding the maturity, increasing δ_p results in welfare losses due to the increased seniority cost to the repayment incentive. Similarly, reducing δ_m brings welfare losses in states of debt crises owing to the larger debt service in the first periods of a *partial* default.

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

11 Conclusion

This paper uncovers the source and the consequences of the *de facto* seniority of (official) multilateral lenders – i.e. mainly the International Monetary Fund (IMF) and the World Bank (WB). I first present evidence that defaults involving such lenders are infrequent, last relatively longer and are associated with greater private haircuts.

To rationalize these findings, I augment the standard model of [Eaton and Gersovitz \(1981\)](#) with heterogenous creditors and endogenous renegotiations. The key assumption is that the multilateral lender has a greater enforcement power than the private lenders. This greater power emanates from the larger output penalty upon default and a stringent policy of non-toleration of arrears in the spirit of the one adopted by the IMF and the WB.

Given this, the multilateral debt has an important impact on the price of private debt. On the one hand, the multilateral debt drastically reduces the private debt's recovery value owing to its repayment priority upon default. On the other hand, it can increase the sovereign's willingness to repay by rendering a *partial* default on private debt more costly. Thus, while the multilateral debt raises the subordination risk of private liabilities, it can reduce the default risk up to a certain point.

The model quantitatively matches the empirical regularities relating to the default durations, the multilateral lending rate and private creditors' haircuts. The policy of non-toleration of arrears is behind most of the model's dynamic. Such policy ensures that multilateral creditors can lend at preferential rates. Coupled with the larger output penalty, it generates a threat capable of enforcing greater fiscal discipline than other seniority regimes. I find that the borrower values the use of official multilateral debt and would not necessarily prefer other seniority regimes.

My analysis focuses on multilateral lending institutions and abstracts from the Paris

Club, which is a major player in the sovereign debt renegotiation game. Very few studies analyze this entity which does not properly enjoy a preferred creditor status but largely impacts the private haircuts and imposes a comparability of treatment among creditors. I leave this inquiry for future work.

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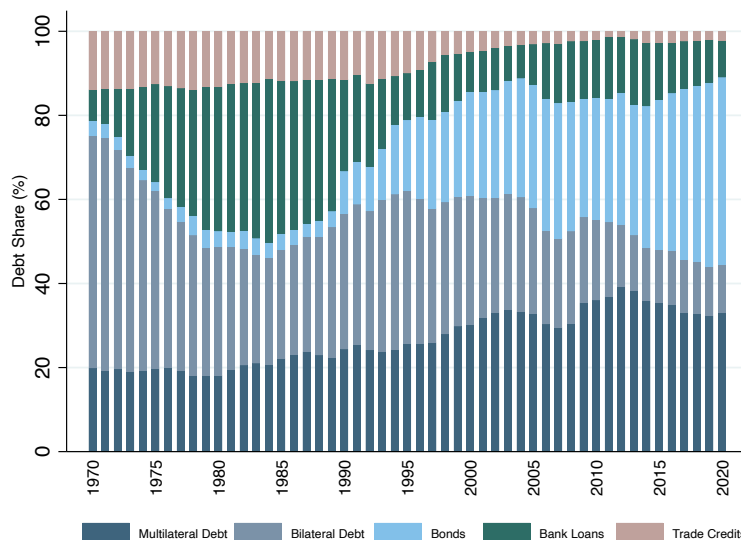
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Appendix

A Additional Tables and Figures

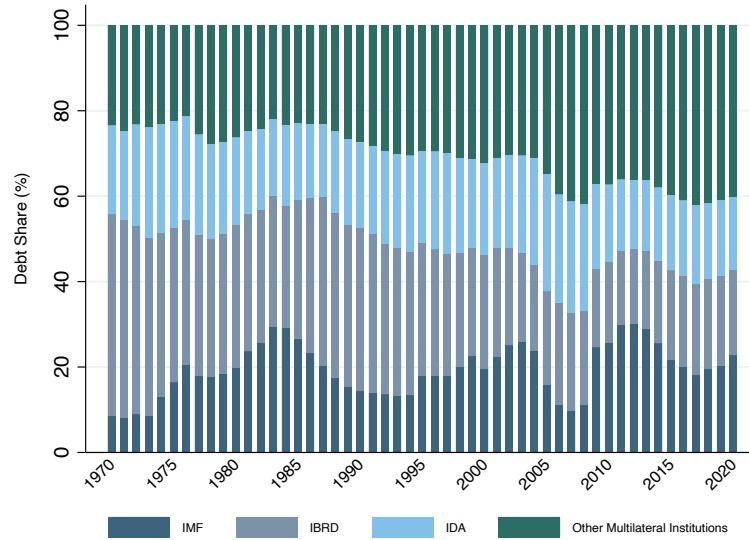
This section presents additional tables and figures. Figure A.1 presents the composition of the sovereign debt excluding advanced economies. One observes significant changes over the years. While in the 1970s, bilateral loans represented the biggest share of the pie, it is now the smallest with bank loans and trade credits. In opposition, bonds which were rare in the 1970s are now the largest part of the sovereign debt. The switch appeared in the 1990s after the numerous defaults on bank loans especially in Latin American and the emergence of Brady bonds. 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 roughly 35% of the total sovereign debt.



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

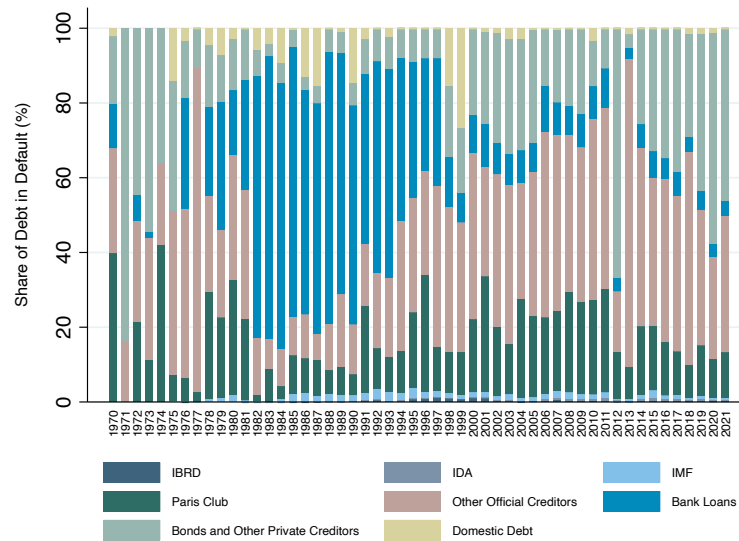
Figure A.1: Structure of Sovereign Debt

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



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

Figure A.2: Structure of Multilateral Sovereign Debt

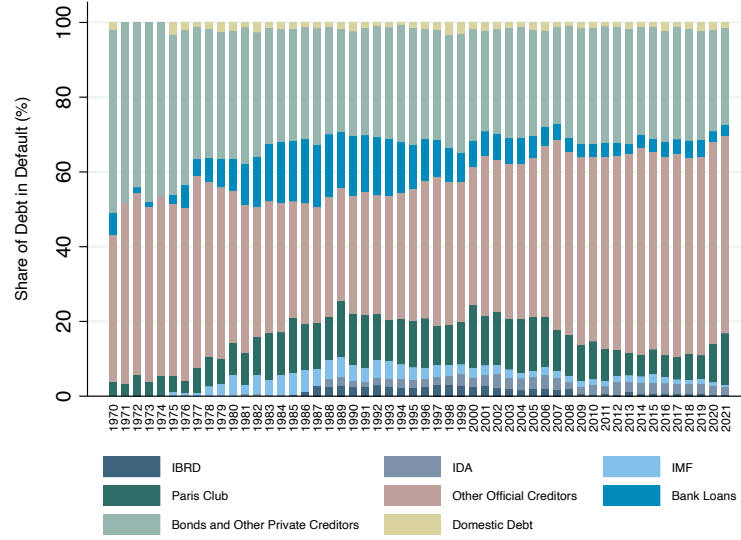


Source: [Beers et al. \(2022\)](#), author's calculation.

Figure A.3: Debt in Default by Creditors

Figure A.3 presents the breakdown of debt in default by creditors. One directly sees that the IMF and the WB 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.



Source: [Beers et al. \(2022\)](#), author's calculation.

Figure A.4: Countries in Default by Creditors

Figure A.4 presents the breakdown of countries in default by creditors. As in the previous figure, I note very few countries in default on the IMF and the IBRD. The two institutions combined never accounted for more than 11% 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.

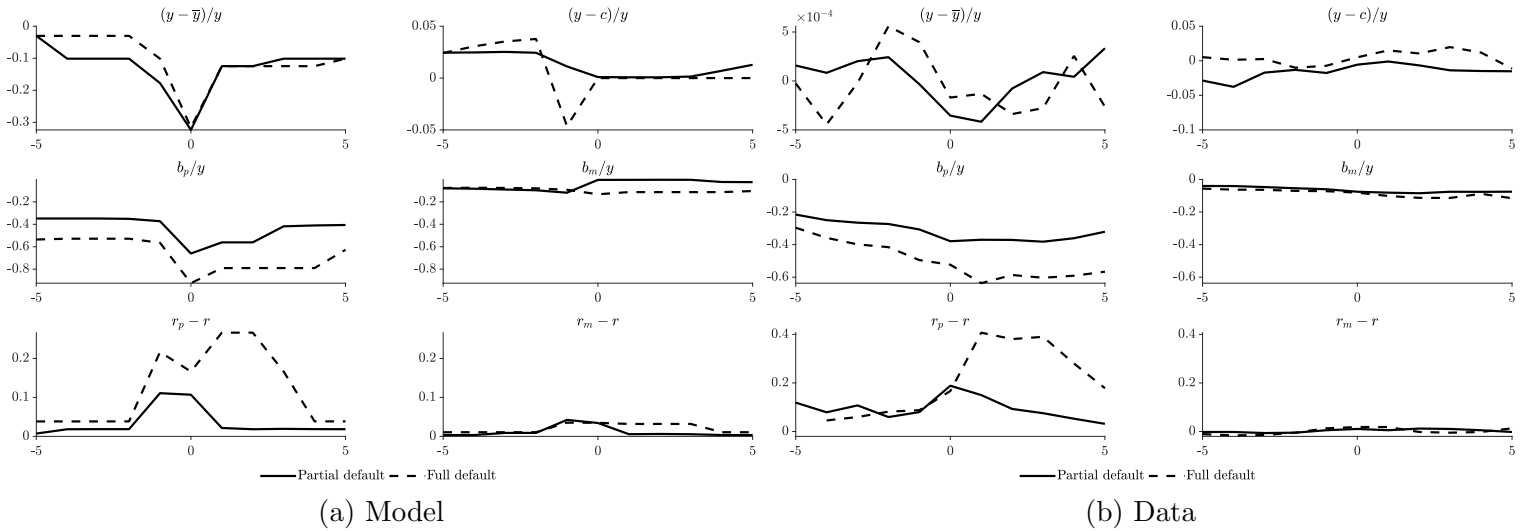


Figure A.5: Event Analysis – Median

Figure A.5 presents the event analysis described in Section 10 where I take the median instead of the average. The dynamic is similar to the one depicted in Figure 6 for both the model and the data.

B Data

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

First, to find the duration of the default, I rely on the restructurings' dates contained in Asonuma and Trebesch (2016). A restructuring starts whenever a sovereign misses some payments beyond any contract-specified grace period, or if the sovereign undergoes renegotiations of the original debt contract.³⁷ Conversely, a restructuring ends with the official settlement announcement or the implementation of the debt exchange.³⁸

Second, given the above default duration, I retrieve the creditors involved in each default by means of the database of Beers et al. (2022). The dataset specifies 9 types of foreign creditors: the IMF, the IBRD, the IDA, the Paris Club, China, other official creditors, banks, bondholders and other private creditors. I merge the IMF, the IBRD and the IDA together under the label of multilateral creditors. I also group China together with other official creditors. Finally, I add bondholders and other private creditors together.³⁹ I therefore end up with 5 dummies: multilateral creditors, Paris Club, other official creditors, bank loans and bonds and other private creditors. Table B.1 indicates the default episodes with multilateral lenders.

Finally, haircut statistics on private creditors are retrieved from Cruces and Trebesch (2013).⁴⁰ 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 187

³⁷This definition follows the one of Standard & Poor's (Beers and Chambers, 2006).

³⁸This definition may differ from the one of Standard & Poor's which defines the end of a restructuring when a settlement occurs with no prospects of further resolutions (Beers and Chambers, 2006).

³⁹Results do not significantly change if I consider those two categories separately.

⁴⁰I use the database updated in 2014. In addition to revised computations, the update contains new default cases. Note that the haircut of Greece follows the estimation of Zettelmeyer et al. (2014).

default episodes between 1970 and 2014. Furthermore, for each default episode, I identify which types of creditor is involved. I find that overall 33 default episodes implicate multi-lateral creditors. Table B.1 depicts the sample used in the analysis.

Table B.1: Sample

Country	Default Start	Default End	Duration	SZ Haircut	Multilateral Creditor Default	Country	Default Start	Default End	Duration	SZ Haircut	Multilateral Creditor Default	Country	Default Start	Default End	Duration	SZ Haircut	Multilateral Creditor Default
Albania	01.11.1991	31.08.1995	3.8	80.4	No	Honduras	01.06.1981	01.10.1989	8.4	73.2	Yes	Philippines	01.07.1988	01.02.1990	1.7	42.8	No
Algeria	01.10.1990	01.03.1992	1.5	8.7	No	Honduras	01.06.1990	01.08.2001	11.3	82.0	Yes	Philippines	01.07.1990	01.12.1992	2.5	25.4	No
Algeria	01.12.1993	17.07.1996	2.7	23.5	No	Iraq	01.09.1986	01.01.2006	19.4	89.4	Yes	Poland	01.03.1981	06.04.1982	1.2	40.6	No
Argentina	01.07.1982	27.08.1985	3.2	30.3	No	Jamaica	01.06.1977	01.09.1978	1.3	2.2	No	Poland	01.01.1982	04.11.1982	0.9	62.9	No
Argentina	01.08.1985	21.08.1987	2.1	21.7	No	Jamaica	01.05.1978	01.04.1979	1.0	3.5	No	Poland	01.12.1982	04.11.1983	1.0	32.5	No
Argentina	01.01.1988	07.04.1993	5.3	32.5	No	Jamaica	01.03.1980	20.06.1981	1.3	12.2	No	Poland	01.12.1983	13.07.1984	0.7	26.9	No
Argentina	01.11.2001	10.06.2005	3.7	76.8	Yes	Jamaica	01.06.1983	01.06.1984	1.1	18.1	Yes	Poland	01.01.1986	01.09.1986	0.8	37.5	No
Belize	02.08.2006	20.02.2007	0.6	23.7	No	Jamaica	01.07.1984	01.09.1985	1.3	31.7	No	Poland	01.10.1986	20.07.1988	1.8	24.4	No
Belize	31.08.2012	01.01.2013	0.7	31.5	No	Jamaica	01.09.1986	07.05.1987	0.8	32.8	No	Poland	01.08.1988	01.07.1989	1.0	12.0	No
Bolivia	01.09.1980	17.03.1988	7.6	92.7	Yes	Jamaica	01.01.1990	26.06.1990	0.5	44.0	No	Poland	01.10.1989	27.10.1994	5.1	49.0	No
Bolivia	01.04.1988	01.04.1993	5.1	78.5	Yes	Jordan	01.02.1989	23.12.1993	4.9	54.6	No	Poland	01.06.1983	27.02.1988	4.8	42.3	No
Bosnia & Herzegovina	01.06.1992	09.12.1997	5.6	89.6	Yes	Kenya	01.01.1992	02.06.1998	6.5	45.7	No	Rep. Of Congo (Brazzaville)	01.03.1988	14.12.1997	19.8	96.8	Yes
Brazil	01.12.1982	25.02.1983	0.3	-9.8	No	Liberia	01.11.1980	01.12.1982	2.2	35.7	No	Romania	01.09.1941	07.12.1982	1.3	32.9	Yes
Brazil	01.01.1983	27.01.1984	1.1	1.7	No	Liberia	01.12.1981	01.04.2009	27.4	97.0	Yes	Romania	01.01.1983	20.06.1983	0.5	31.7	No
Brazil	01.06.1984	05.09.1986	2.3	19.2	No	Macdonia	01.05.1992	26.03.1997	4.9	34.6	Yes	Romania	01.09.1986	01.09.1986	0.3	12.3	Yes
Brazil	01.09.1986	11.11.1988	2.3	18.4	No	Madagascar	01.05.1981	01.11.1981	0.6	19.0	No	Russia	01.08.1991	01.12.1997	6.4	26.2	No
Brazil	01.06.1989	20.11.1992	3.5	77.0	No	Madagascar	01.06.1982	25.10.1984	2.4	41.3	No	Russia	17.08.1998	07.05.1999	0.8	46.0	No
Brazil	01.06.1989	15.04.1994	4.9	29.3	No	Madagascar	01.06.1985	15.06.1987	2.1	13.7	No	Russia	20.11.1998	25.08.2000	1.8	50.8	No
Bulgaria	01.03.1990	29.06.1994	4.3	56.3	No	Madagascar	01.06.1987	10.04.1990	2.9	52.7	No	Russia	20.04.1999	03.02.2000	0.9	51.5	No
Cameroon	01.06.1985	01.08.2003	18.3	85.5	No	Malawi	12.07.1982	04.03.1983	0.8	28.5	No	Senegal	01.05.1981	01.02.1984	2.8	28.8	No
Chile	01.01.1983	01.11.1983	0.9	0.7	No	Malawi	01.08.1987	04.10.1988	1.3	39.2	No	Senegal	01.06.1985	07.05.1985	0.1	31.3	No
Chile	01.01.1983	25.01.1984	1.1	8.4	No	Mauritania	01.06.1992	01.08.1996	4.3	90.0	No	Senegal	01.06.1990	28.09.1990	0.3	35.7	No
Chile	01.08.1984	14.04.1986	1.8	31.7	No	Mexico	01.08.1982	27.08.1983	1.1	40.2	No	Senegal	01.06.1992	18.12.1996	4.6	92.0	No
Chile	01.10.1986	17.06.1987	0.8	14.3	No	Mexico	01.05.1984	29.03.1985	0.9	2.2	No	Serbia	01.06.1992	22.07.2004	12.2	70.9	Yes
Chile	01.04.1990	12.12.1990	0.8	17.0	No	Mexico	01.05.1984	29.08.1985	1.3	5.4	No	Seychelles	01.07.2008	11.02.2010	1.7	56.2	No
Costa Rica	15.07.1981	10.09.1983	2.3	39.4	No	Mexico	02.09.1986	01.03.1987	0.6	18.1	No	Slovenia	01.06.1980	01.06.1995	15.3	88.6	Yes
Costa Rica	01.10.1984	27.05.1985	0.7	35.6	No	Mexico	01.08.1987	01.03.1988	0.7	56.3	No	Slovenia	01.06.1992	12.03.1996	3.8	3.3	No
Costa Rica	01.05.1986	21.05.1990	4.1	71.9	No	Mexico	01.12.1988	04.02.1990	1.3	20.5	No	South Africa	01.09.1982	24.03.1987	1.6	8.5	No
Croatia	01.12.1991	31.07.1996	4.7	11.0	No	Moldova	01.06.2001	17.06.2004	3.1	56.3	No	South Africa	01.06.1989	18.10.1989	0.4	12.7	No
Cuba	01.09.1983	30.12.1983	0.3	42.9	No	Moldova	12.06.2002	29.10.2002	0.4	36.9	No	South Africa	01.01.1992	27.09.1993	1.8	22.0	No
Cuba	01.01.1981	24.12.1984	1.0	44.2	No	Morocco	25.08.1983	01.02.1986	2.6	23.5	No	St. Kitts & Nevis	01.06.2011	01.04.2012	0.9	62.9	No
Cuba	01.01.1985	19.09.1985	0.8	49.5	No	Morocco	22.10.1985	23.09.1987	2.0	21.3	No	Sudan	01.06.1975	01.10.1985	10.4	54.6	No
Côte d'Ivoire	01.06.1983	01.03.1998	14.8	62.8	No	Morocco	01.02.1989	01.09.1990	1.7	40.3	No	Sao Tomé and Príncipe	01.06.1984	01.08.1994	10.3	96.0	No
Côte d'Ivoire	01.03.2000	16.04.2010	10.2	55.2	No	Mozambique	01.06.1983	27.12.1991	8.6	90.0	No	Tanzania	01.06.1981	01.01.2004	22.7	40.0	Yes
Côte d'Ivoire	31.01.2011	12.11.2012	1.9	6.1	No	Mozambique	01.03.1993	01.09.2007	14.6	19.0	No	Togo	01.06.1987	01.05.1988	1.0	46.0	No
Dem. Rep. of Congo (Kinshasa)	01.06.1975	12.04.1980	4.9	29.6	Yes	Nicaragua	01.09.1978	01.12.1980	2.3	26.1	No	Togo	01.06.1991	01.12.1997	6.6	92.3	No
Dem. Rep. of Congo (Kinshasa)	01.04.1982	29.01.1983	0.8	36.2	Yes	Nicaragua	01.06.1981	01.12.1981	0.6	48.5	No	Trinidad & Tobago	01.09.1988	20.12.1989	1.3	15.5	No
Dem. Rep. of Congo (Kinshasa)	01.02.1983	01.06.1984	1.4	30.1	Yes	Nicaragua	01.06.1982	01.03.1982	-0.2	56.3	No	Turkey	01.12.1976	01.06.1979	2.6	22.2	No
Dem. Rep. of Congo (Kinshasa)	01.09.1984	01.05.1985	0.8	37.0	No	Nicaragua	01.03.1983	01.02.1984	1.0	41.7	Yes	Turkey	01.12.1976	22.08.1979	2.8	19.5	No
Dem. Rep. of Congo (Kinshasa)	01.06.1985	01.05.1986	1.0	35.4	No	Nicaragua	01.04.1985	01.11.1995	10.7	92.0	No	Turkey	01.01.1981	01.08.1981	0.7	8.6	No
Dem. Rep. of Congo (Kinshasa)	01.06.1986	20.05.1987	1.0	26.8	No	Nicaragua	01.01.1995	01.12.2007	13.0	95.5	No	Turkey	01.01.1981	13.03.1982	1.3	17.0	No
Dominica	01.06.1987	01.06.1989	2.1	56.6	Yes	Niger	01.06.1983	09.03.1984	0.8	37.4	No	Uganda	01.06.1979	20.02.1993	13.8	88.0	No
Dem. Rep. of Congo (Kinshasa)	01.07.2003	15.06.2004	1.0	54.0	No	Niger	01.06.1984	01.04.1986	1.9	55.8	No	Ukraine	12.08.1998	21.09.1998	0.2	11.8	No
Dominican Republic	01.06.1982	24.02.1986	3.8	49.9	No	Niger	01.06.1986	08.03.1991	4.8	82.0	No	Ukraine	12.08.1998	20.10.1998	0.3	14.7	No
Dominican Republic	01.06.1987	30.06.1994	7.3	50.5	No	Nigeria	01.08.1982	01.07.1983	1.0	2.1	No	Ukraine	18.05.1999	20.08.1999	0.3	-4.3	No
Dominican Republic	01.04.2004	11.05.2005	1.2	4.7	No	Nigeria	01.08.1982	01.09.1983	1.2	1.2	No	Ukraine	01.01.2000	07.04.2000	0.3	18.0	No
Dominican Republic	01.08.2004	18.10.2005	1.3	11.3	No	Nigeria	01.10.1983	01.04.1984	0.6	-2.8	No	Uruguay	01.01.1983	29.07.1983	0.6	0.7	No
Ecuador	08.10.1982	14.10.1983	1.1	6.3	No	Nigeria	01.01.1986	23.11.1987	1.9	19.3	No	Uruguay	01.04.1985	10.07.1986	1.3	24.3	No
Ecuador	01.12.1983	09.08.1984	0.8	5.7	No	Nigeria	01.10.1987	01.01.1988	0.3	41.5	No	Uruguay	01.05.1987	04.03.1988	0.9	20.3	No
Ecuador	01.08.1984	11.12.1985	1.4	15.4	No	Nigeria	01.03.1988	01.06.1989	1.3	30.1	No	Uruguay	01.07.1989	31.01.1991	1.6	26.3	No
Ecuador	01.08.1986	28.02.1995	8.6	42.2	No	Nigeria	01.06.1989	20.12.1991	2.6	40.1	No	Uruguay	11.03.2003	29.05.2003	0.3	9.8	No
Ecuador	28.01.1999	23.08.2000	1.7	38.3	No	Pakistan	01.05.1988	12.12.1999	11.5	11.6	No	Venezuela	01.03.1983	27.02.1986	3.0	9.9	No
Ecuador	14.11.2008	03.06.2009	0.7	67.7	No	Pakistan	30.01.1999	13.12.1999	1.0	15.0	No	Venezuela	24.04.1986	18.09.1987	1.5	4.3	No
Ethiopia	01.06.1980	16.01.1996	5.7	92.0	No	Panama	01.11.1984	01.10.1985	1.0	12.0	No	Venezuela	12.01.1989	05.12.1990	2.0	36.7	No
Gabon	15.09.1986	01.12.1987	1.3	7.9	No	Panama	01.03.1987	01.08.1994	7.5	15.1	Yes	Vietnam	01.01.1982	05.12.1997	16.0	52.0	Yes
Gabon	01.06.1989	16.02.1994	5.0	16.2	No	Panama	01.03.1987	17.04.1996	9.2	34.9	Yes	Yemen	01.06.1983	01.02.2001	17.8	97.0	No
Gambia	01.06.1984	15.02.1988	3.8	49.3	No	Paraguay	01.01.1986	01.07.1993	7.6	29.2	No	Yugoslavia	01.01.1983	09.02.1983	0.8	14.5	No
Greece	01.07.2011	13.03.2012	0.8	64.6	No	Peru	01.03.1976	01.12.1978	2.8	-7.2	No	Yugoslavia	01.09.1983	16.05.1984	0.8	-7.5	No
Guinea	01.10.2004	16.11.2005	1.2	23.9	No	Peru	01.09.1979	01.01.1980	0.4	-4.0	No	Yugoslavia	01.06.1984	18.12.1985	1.6	14.5	No
Guinea	01.06.1985	20.04.1988	2.9	26.1	No	Peru	01.03.1983	01.07.1983	0.4	6.3	No	Yugoslavia	01.07.1987	21.09.1988	1.3	19.7	No
Guinea	01.06.1991	01.12.1998	7.6	87.0	No	Peru	01.06.1984	07.03.1997	12.8	63.9	Yes	Zambia	07.01.1983	14.09.1994	11.8	89.0	Yes
Guinea	01.06.1982	24.11.1992	10.5	89.2	Yes	Philippines	01.01.1983	01.04.1986	2.6	42.6	No						
Guinea	01.01.1993	01.12.1999	7.0	91.0	No	Philippines	01.09.1986	01.12.1987	1.3	15.4	No						

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

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

articles from the New York Times archives.⁴¹

Table B.2: Data Source

[illegible]

As the focus of the analysis is the IMF and the WB, it is important to account for their respective programs and projects financing in the sample countries. For this purpose, I extend the dataset of [Dreher and Gassebner \(2012\)](#) by means on the IMF MONA database and the WB Projects & Operations listing.⁴² The two aforementioned authors propose three

⁴¹Multilateral debt in newspaper articles are for the following countries: Cuba (1983-1985), Iraq (1986-2006), Poland (1981-1994) and all the former republics of Yugoslavia (1983-1988 and 1992-1997).

⁴²Link to the WB Projects & Operations listing is available [here](#).

variables. The first one is a dummy taking value one if the sovereign is under a IMF’s Structural Adjustment Facility (SAF) or Poverty Reduction and Growth Facility (PRGF) program for at least five months. The second variable is also a dummy taking value one if the sovereign is under a IMF’s Stand-by Agreement (SBA) program for at least five months. I merge those two dummies together under the label of IMF program. Finally, the two authors propose a variables counting the number of WB’s loans given for structural adjustment in effect for at least five months. I label this variable as WB adjustment loan.

Regarding the IMF’s and WB’s charged interest rate, I retrieve the IMF adjusted rate of charge and the IDA service charge directly from the IMF and the WB. For the IBRD lending rate, I gather the historical data on IBRD Statement Of Loans. I take the average rate over the entire set of loans. For loans which do not report interest rates, I take the 5-year Libor rate to which I add the standard front-end fee of 0.25%, the commitment fee of 0.25%, the contractual spread of 0.50% and the excess borrowing charge of 0.50%. Spreads are calculated as the rate charged minus 1-year US government bonds yield.

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

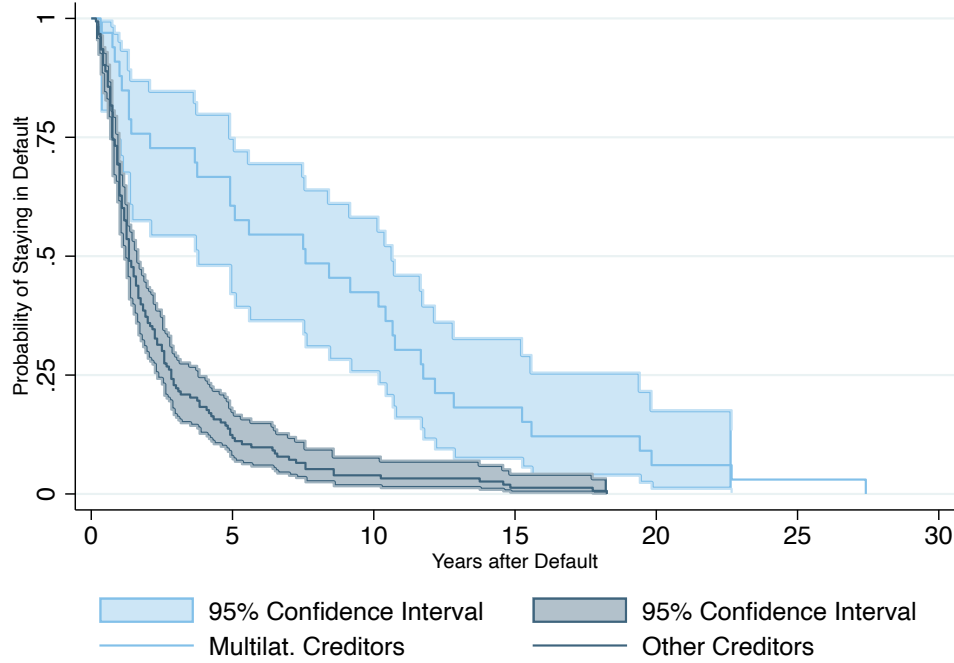
C Regression Analysis

This section assesses the robustness of the empirical facts presented in Section 4. While Facts I and IV can be directly imputed to the multilateral creditors, Facts II and III might be associated to different factors.⁴³

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

The non-parametric estimate of the survival function is presented in Figure C.6. It

⁴³The following regression analyses are not necessarily causal.



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

Figure C.6: Non-Parametric Survival Function

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 to 4 years, while for defaults implying multilateral creditors this same probability amounts roughly 25%.

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 $k \in \{\text{A\&P, S\&P}\}$ defined momentarily, \mathbf{D} is a vector of 5 dummy variables accounting for the type creditors involved in the default (multilateral creditors, Paris Club, other official creditors, banks and bonds and other private creditors), \mathbf{X} is a vector of controls, α is a constant and the remaining variable is the error term, v .

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

For the choice of control variables I follow the literature on the determinants of default.⁴⁴ 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 variable taking value one in case of a Brady deal and the private creditors' SZ haircut.

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

The last set of control variables accounts for the political situation of the country under default. A default often coincides with a major political disruption or the outbreak of a war. Hence, I add a batterie of dummy variables accounting for such events.⁴⁵ 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. For the political system, I add a set of dummy variables accounting for whether the defaulting country is a communist regime, whether it is a dictatorial regime, whether it changed to a dictatorial regime the year of the default or the year preceding it, whether there has been legislative elections or those elections have been postponed in the

⁴⁴See for instance [Dell'Ariccia et al. \(2006\)](#), [Trebesch \(2008\)](#), [Cruces and Trebesch \(2013\)](#), [Asonuma and Trebesch \(2016\)](#) and [Asonuma and Joo \(2020\)](#).

⁴⁵Ideally 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.

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.⁴⁶

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

Table C.3: OLS Duration Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	A&T	A&T	A&T	A&T	A&T	S&P	S&P	S&P	S&P	S&P
Multilateral Creditors	5.32*** [1.32]	3.31*** [1.05]	2.90*** [1.01]	2.98*** [1.06]	3.18*** [1.05]	6.66*** [1.66]	4.53*** [1.49]	3.77** [1.57]	4.01** [1.62]	5.27*** [1.73]
Paris Club	0.85 [0.58]	-0.23 [0.54]	-0.29 [0.54]	0.13 [0.53]	0.09 [0.60]	-0.52 [1.73]	-0.82 [1.58]	-1.12 [1.47]	-0.82 [1.41]	-1.00 [1.35]
Other Official Creditors	1.83*** [0.59]	0.25 [0.54]	-0.12 [0.64]	-0.25 [0.66]	-0.41 [0.72]	4.32** [1.79]	1.65 [1.57]	1.34 [1.78]	1.27 [1.72]	1.75 [2.11]
Bank Loans	-1.22 [0.85]	-3.09*** [1.12]	-2.78** [1.09]	-4.03*** [1.33]	-4.16*** [1.46]	-2.00 [1.86]	-4.03** [1.86]	-3.97* [2.05]	-6.35*** [2.13]	-6.77*** [2.06]
Bonds and Other Private Creditors	0.27 [0.68]	0.88 [0.56]	1.12* [0.64]	1.27* [0.66]	1.33* [0.74]	1.19 [2.00]	0.41 [1.49]	-0.14 [1.60]	0.91 [1.54]	0.86 [1.73]
Debt Restructured		0.00*** [0.00]	0.00** [0.00]	0.00 [0.00]	0.00* [0.00]		0.00* [0.00]	0.00 [0.00]	0.00 [0.00]	-0.00 [0.00]
SZ Haircut		0.08*** [0.01]	0.09*** [0.02]	0.10*** [0.02]	0.10*** [0.02]		0.09*** [0.02]	0.11*** [0.03]	0.11*** [0.03]	0.11*** [0.03]
Brady Deal		2.79*** [1.04]	2.66*** [0.95]	2.45** [0.97]	2.19** [1.03]		3.21** [1.46]	2.50* [1.36]	2.65* [1.57]	3.24* [1.68]
HIPC or IDA Eligibility			-1.62 [1.04]	-0.95 [1.10]	-0.57 [1.15]			-0.86 [1.64]	0.96 [1.79]	0.76 [1.92]
Real GDP per Capita Growth, Start			-0.54 [0.36]	-0.70* [0.37]	-0.82** [0.36]			-1.05* [0.57]	-1.33** [0.65]	-1.35** [0.59]
Real GDP Growth, Start			0.50 [0.34]	0.69* [0.36]	0.83** [0.36]			0.92* [0.54]	1.22* [0.62]	1.31** [0.58]
Federal Fund Rate, Start			1.69*** [0.56]	1.85*** [0.56]	1.77*** [0.62]			2.08** [0.84]	2.56*** [0.86]	1.93** [0.79]
Serial Defaulter			0.73 [1.03]	1.04 [1.03]	0.98 [1.03]			-1.64 [1.25]	-0.93 [1.27]	-1.46 [1.35]
Inflation, Start			0.01 [0.02]	0.00 [0.02]	0.00 [0.02]			0.08* [0.04]	0.06 [0.04]	0.07 [0.04]
Trade Openness, Start			0.02* [0.01]	0.02** [0.01]	0.02** [0.01]			0.02 [0.02]	0.02 [0.02]	0.02 [0.02]
Net Exports (% GDP), Start			0.01 [0.02]	0.01 [0.02]	0.01 [0.02]			0.03 [0.03]	0.05 [0.04]	0.03 [0.04]
IMF Program, Start			-1.49 [1.46]	-2.01 [1.49]	-2.01 [1.49]			-1.00 [1.12]	-0.59 [1.24]	-0.59 [1.24]
WB Adjustment loans, Start			0.07 [0.21]	0.08 [0.24]	0.08 [0.24]			-0.11 [0.34]	-0.25 [0.35]	-0.25 [0.35]
IMF Debt (% GDP), Start			-0.03 [0.06]	-0.03 [0.06]	-0.03 [0.06]			0.02 [0.10]	-0.07 [0.10]	-0.07 [0.10]
WB Debt (% GDP), Start			-0.14** [0.06]	-0.17** [0.07]	-0.17** [0.07]			-0.29** [0.14]	-0.34** [0.16]	-0.34** [0.16]
Regime Change to Dictatorship, Start				-2.94 [2.30]	-2.94 [2.30]				-5.70 [3.99]	-5.70 [3.99]
Dictatorial Regime, Start				-0.10 [0.68]	-0.10 [0.68]				2.19 [1.39]	2.19 [1.39]
War, Start				1.16 [1.20]	1.16 [1.20]				1.45 [1.76]	1.45 [1.76]
Civil War, Start				-2.42* [1.37]	-2.42* [1.37]				-0.02 [3.58]	-0.02 [3.58]
Legislative Election, Start				-0.39 [0.61]	-0.39 [0.61]				0.32 [1.48]	0.32 [1.48]
Postponed Legislative Election, Start				2.77 [1.80]	2.77 [1.80]				5.32 [3.40]	5.32 [3.40]
Coup, Start				0.65 [1.23]	0.65 [1.23]				2.16 [2.18]	2.16 [2.18]
Communist Regime, Start				-0.36 [1.03]	-0.36 [1.03]				-3.32 [2.60]	-3.32 [2.60]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	187	187	187	187	187	104	104	104	104	104
R ² adjusted	0.34	0.56	0.58	0.59	0.59	0.42	0.60	0.63	0.65	0.65

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

⁴⁶There is no transition to a communist regime in the sample at hand. I therefore do not include a dummy for that.

The outcome of the OLS duration regressions is depicted in Table C.3. There is a strong and positive association between defaults on multilateral creditors and the length of the default duration. A default on multilateral debt is associated with a default's duration between 3 and 7 additional years depending on the model's specification. In opposition, the association between defaults on the Paris Club and the default's length is ambiguous as it reverses across the different specifications. The same holds true for other official creditors. Regarding private creditors, it seems 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 involved in a Brady deal record a longer default's duration. However, there is mixed evidence regarding WB adjustment loans and HIPC or IDA programs, while IMF programs are associated with shorter default duration. Interestingly, the WB debt is related to a reduced default length, while there is almost no effect associated with the IMF debt.

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

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

where i refers to a specific default 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 $k \in \{\text{A\&P}, \text{S\&P}\}$.⁴⁷ Using the duration jargon, a failure corresponds to the moment in which the country exits the default state. That is, the dependent variable is a dummy taking value 1 if the country exits the default and zero otherwise. The period of observation spans from the moment the country enters the default to the moments it exits. As I solely consider settled default episodes, there is no censoring.

In terms of controls, I use the same sort of variables as before. The major difference with the OLS regression is that most control variables are time-varying. The only exceptions are the IMF-debt-to-GDP ratio and the WB-debt-to-GDP ratio as the time series are incomplete for many countries. I therefore integrate those two variable as constant over time and add

⁴⁷The 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.

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 year and region fixed effects.

Table C.4: Cox Duration Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	A&T	A&T	A&T	A&T	A&T	S&P	S&P	S&P	S&P	S&P
Multilateral Creditors	0.37*** [0.20]	0.52*** [0.21]	0.63*** [0.21]	0.63*** [0.22]	0.64* [0.23]	0.31*** [0.24]	0.39*** [0.26]	0.42*** [0.27]	0.43*** [0.30]	0.42*** [0.31]
Paris Club	0.82 [0.17]	0.94 [0.17]	0.95 [0.19]	0.81 [0.20]	0.82 [0.20]	0.65* [0.26]	0.69 [0.28]	0.68 [0.29]	0.68 [0.31]	0.75 [0.32]
Other Official Creditors	0.69** [0.19]	0.93 [0.23]	1.05 [0.25]	1.08 [0.23]	1.08 [0.24]	0.67 [0.32]	0.85 [0.38]	0.78 [0.43]	0.88 [0.41]	0.94 [0.42]
Bank Loans	1.23 [0.30]	2.21** [0.37]	2.56** [0.40]	2.56** [0.39]	2.66*** [0.36]	1.03 [0.35]	1.54 [0.43]	1.47 [0.43]	1.85 [0.46]	1.93 [0.43]
Bonds and Other Private Creditors	0.89 [0.16]	0.89 [0.18]	0.85 [0.17]	0.81 [0.16]	0.80 [0.17]	0.49*** [0.27]	0.71 [0.31]	0.89 [0.34]	0.66 [0.33]	0.54* [0.35]
SZ Haircut		0.98*** [0.00]	0.97*** [0.00]	0.97*** [0.00]	0.97*** [0.00]		0.98*** [0.00]	0.98*** [0.01]	0.97*** [0.01]	0.97*** [0.01]
Debt Restructured		1.00 [0.00]	1.00** [0.00]	1.00*** [0.00]	1.00*** [0.00]		1.00 [0.00]	1.00 [0.00]	1.00 [0.00]	1.00 [0.00]
Brady Deal		0.72 [0.26]	0.73 [0.24]	0.70 [0.25]	0.69 [0.26]		0.52** [0.30]	0.48*** [0.27]	0.44*** [0.30]	0.44*** [0.30]
HIPC or IDA Eligibility			0.91 [0.25]	0.89 [0.29]	0.80 [0.30]			0.71 [0.30]	0.48* [0.38]	0.53 [0.42]
Serial Defaulter			1.08 [0.23]	1.19 [0.23]	1.16 [0.24]			1.11 [0.27]	1.08 [0.27]	1.10 [0.28]
Federal Funds Rate			0.01*** [0.06]	0.01*** [0.06]	0.01*** [0.07]			0.01*** [0.07]	0.01*** [0.08]	0.01*** [0.09]
Real GDP per Capita Growth			1.03 [0.04]	1.02 [0.04]	1.03 [0.04]			1.01 [0.06]	0.97 [0.06]	0.97 [0.06]
Real GDP Growth			0.98 [0.04]	0.98 [0.04]	0.98 [0.04]			0.99 [0.06]	1.02 [0.06]	1.03 [0.06]
Net Exports (% GDP)			0.99 [0.00]	0.99 [0.00]	0.99 [0.01]			0.99* [0.01]	0.99* [0.01]	0.99* [0.01]
Inflation			1.00 [0.00]	1.00 [0.00]	1.00 [0.00]			1.00 [0.01]	1.00 [0.01]	1.00 [0.01]
Trade Openness			0.38*** [0.27]	0.31*** [0.32]	0.31*** [0.33]			0.54** [0.31]	0.54** [0.32]	0.54** [0.32]
IMF Debt (% GDP), Start				1.03** [0.01]	1.03** [0.01]				1.03* [0.02]	1.03* [0.02]
WB Debt (% GDP), Start				0.99 [0.02]	0.99 [0.02]				0.99 [0.02]	0.98 [0.03]
IMF Debt (% GDP), End				1.00 [0.01]	1.00 [0.01]				1.01 [0.01]	1.01 [0.01]
WB Debt (% GDP), End				1.00 [0.01]	1.00 [0.01]				1.02 [0.02]	1.03 [0.02]
IMF Program				1.54*** [0.14]	1.58*** [0.15]				2.29*** [0.25]	2.31*** [0.27]
WB Adjustment loans				1.04 [0.05]	1.05 [0.05]				1.05 [0.05]	1.05 [0.05]
Coup					1.28 [0.32]					1.72 [0.60]
Communist Regime					1.21 [0.24]					1.31 [0.49]
Dictatorial Regime					1.08 [0.19]					0.98 [0.33]
Postponed Legislative Election					0.84 [0.57]					1.15 [0.84]
Legislative Election					0.83 [0.14]					1.08 [0.21]
War					0.78 [0.74]					1.20 [0.64]
Civil War					1.07 [0.22]					0.67 [0.35]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	654	654	654	654	654	670	670	670	670	670
Episodes	160	160	160	160	160	98	98	98	98	98
Pseudo R ²	0.06	0.09	0.09	0.10	0.10	0.15	0.16	0.17	0.19	0.19

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

Note that the cox model cannot account for defaults starting and ending in the same year as the failure coincides with the observation’s start. I therefore lose 6 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 C.4. I find similar results as in the OLS estimation. Nevertheless, the interpretation of the coefficient is here different as I report the hazard ratios. An hazard ratio above one means that the variable is associated with a greater probability of exiting default, while a ratio below one indicates the opposite. As before, a default implicating multilateral creditors is related to a longer default. More precisely, such event is associated with a reduced probability of exiting default between 36% and 69% depending on the model’s specification. Moreover, defaults involving the Paris Club and other official creditors seem to reduce the probability of exiting default, but the coefficients lack robustness. Regarding private creditors, it seems that defaults on bank loans are settled more quickly. However, the magnitude and the statistical significance of the coefficients vary a great deal across the different specifications.

Regarding the control variables, greater haircuts are associated with a reduced probability of exiting the default state. The same holds true for the HIPC or IDA eligibility and Brady deals. The IMF debt is associated to an increasing probability of ending default – at least at the default’s start – while there is little effects related to the WB debt. Finally, the participation to both an IMF program or a WB adjustment loan are associated to an increasing probability of ending default. Only the former is economically and statistically significant, though.

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

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

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

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

I consider two specifications of the haircut. The first one is the market haircut, H^M , and is the one computed by rating agencies and official lenders. It however tends to overestimate the level of creditor’s losses. That is why I consider a second haircut specification based on

the estimation method of [Sturzenegger and Zettelmeyer \(2008\)](#), H^{SZ} .

Table C.5: Haircut Regressions

	(1) H ^M	(2) H ^M	(3) H ^M	(4) H ^M	(5) H ^M	(6) H ^{SZ}	(7) H ^{SZ}	(8) H ^{SZ}	(9) H ^{SZ}	(10) H ^{SZ}
Multilateral Creditors	15.19*** [5.27]	9.13* [5.48]	9.05** [4.36]	9.07* [4.64]	9.60* [4.89]	15.25*** [5.38]	7.97 [5.29]	7.68* [4.27]	8.18* [4.41]	8.93* [4.62]
Paris Club	8.37** [4.04]	7.49* [3.97]	7.97*** [3.04]	5.98** [2.84]	5.71** [2.84]	7.74* [4.09]	6.89* [3.90]	7.56** [3.09]	5.66* [2.97]	5.29* [2.91]
Other Official Creditors	9.26** [4.64]	9.06* [4.79]	10.15** [4.55]	9.86** [4.15]	11.83*** [4.32]	7.93* [4.62]	7.82* [4.70]	8.71* [4.59]	8.20* [4.22]	10.59** [4.49]
Bank Loans	21.53** [8.50]	13.48 [8.25]	4.27 [8.30]	14.14* [7.17]	15.56** [7.21]	25.01*** [8.54]	14.94* [8.61]	6.07 [8.32]	16.18** [7.46]	18.02** [7.61]
Bonds and Other Private Creditors	-10.02** [4.46]	-10.53** [4.62]	-11.41*** [4.29]	-10.94*** [4.12]	-11.09*** [4.22]	-8.54* [4.63]	-9.15** [4.61]	-9.83** [4.42]	-9.36** [4.43]	-9.46** [4.54]
Private Debt Restructured		0.00 [0.00]	0.00 [0.00]	0.00* [0.00]	0.00** [0.00]		0.00 [0.00]	0.00 [0.00]	0.00 [0.00]	0.00* [0.00]
Default Duration		1.74*** [0.64]	1.35*** [0.49]	1.17** [0.47]	1.04** [0.51]		2.06*** [0.66]	1.70*** [0.52]	1.54*** [0.48]	1.38*** [0.52]
Brady Deal		-9.85 [6.92]	-4.81 [5.40]	4.93 [4.96]	3.83 [5.17]		-15.96** [7.19]	-10.94* [6.09]	-1.27 [5.77]	-2.78 [6.06]
HIPC or IDA Eligibility			26.54*** [5.10]	16.53*** [5.05]	13.99** [5.50]		24.74*** [5.30]	14.41*** [5.35]	11.45** [5.69]	
Serial Defaulter			8.45 [5.23]	5.38 [5.04]	3.96 [5.28]		9.30* [5.55]	6.80 [5.41]	5.21 [5.67]	
Federal Funds Rate, End			-6.32*** [1.80]	-8.41*** [1.71]	-8.01*** [1.82]		-7.06*** [1.81]	-9.00*** [1.83]	-8.44*** [1.89]	
Real GDP Growth, End			-4.71** [1.90]	-4.88** [1.92]	-4.70** [1.95]		-4.77** [1.96]	-5.12** [1.97]	-4.86** [2.00]	
Real GDP per Capita Growth, End			5.36*** [1.88]	5.43*** [1.92]	5.27*** [1.92]		5.42*** [1.94]	5.67*** [1.96]	5.44*** [1.96]	
Net Exports (% GDP), End			-0.11 [0.12]	-0.04 [0.10]	-0.06 [0.10]		-0.13 [0.12]	-0.06 [0.10]	-0.08 [0.10]	
Inflation, End			0.19** [0.08]	0.15* [0.08]	0.17** [0.09]		0.18** [0.08]	0.14 [0.09]	0.17* [0.09]	
Trade Openness, End			-0.16*** [0.05]	-0.16*** [0.04]	-0.15*** [0.05]		-0.14** [0.05]	-0.12*** [0.05]	-0.12** [0.05]	
IMF Program, End				0.35 [2.83]	1.09 [2.85]		0.49 [3.05]	1.32 [3.08]		
WB Adjustment loans, End				-1.50* [0.90]	-1.53* [0.88]		-1.05 [0.97]	-1.08 [0.94]		
IMF Debt (% GDP), End				-0.32* [0.16]	-0.27 [0.19]		-0.44*** [0.16]	-0.39** [0.19]		
WB Debt (% GDP), End				1.40*** [0.23]	1.40*** [0.24]		1.44*** [0.25]	1.42*** [0.25]		
Communist Regime, End					2.73 [4.99]				3.53 [5.71]	
Dictatorial Regime, End					2.25 [3.69]				2.40 [3.75]	
Legislative Election, End					-3.51 [3.10]				-4.55 [3.19]	
Postponed Legislative Election, End					-4.58 [7.20]				-2.26 [8.40]	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	187	187	187	187	187	187	187	187	187	187
R ² adjusted	0.46	0.50	0.64	0.70	0.70	0.44	0.49	0.61	0.68	0.68

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

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

characteristics and timing issues.

Table C.5 presents the results of the haircut regressions. The coefficient related to multilateral defaults is economically important. Defaulting on multilateral creditors is associated with an increase of the private creditors' haircut between 8 and 15 percentage points depending on the model's specification. However, the statistical significance is not the highest. Defaults involving the Paris Club creditors are also associated with larger haircuts. The same holds true for the other official creditors with a greater magnitude and significance than for multilateral creditors. Regarding private creditors, defaults on bonds and other private creditors are associated with lower haircuts, while the opposite holds true for bank loans.

Regarding the control variables, one observes many significant results. Especially, the duration has a strong and positive association with the private haircut. Once added to the regression, the effect attributed to the multilateral lenders decreases. 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. Besides this, the coefficients attached to the real GDP growth, the Federal Funds Rate and the trade openness 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. Even though the statistical significance is less pronounced than for Fact II, the economic significance of this link is important and remains relatively stable across the different specifications.

D Competitive Equilibrium

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

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

- Policy functions for the sovereign's consumption, $c(z, \epsilon, b_m^i, b_p^i)$, private bond holdings, $b_p(z, \epsilon, b_m^i, b_p^i)$, multilateral bond holdings, $b_m(z, \epsilon, b_m^i, b_p^i)$, default, $D^{DP}(z, \epsilon, b_m^i, b_p^i)$ and $D^{DF}(z, \epsilon, b_m^i, b_p^i)$, proposed settlement, $W_b^{RP}(z, \epsilon, b_m^i, b_p^i)$ and $W_b^{RF}(z, \epsilon, b_m^i, b_p^i)$, and stopping functions, $A^{DP}(z, \epsilon, b_m^i, b_p^i, W)$ and $A^{DF}(z, \epsilon, b_m^i, b_p^i, W)$.
- Policy functions for the lenders' proposed settlement, $W_l^{RP}(z, \epsilon, b_m^i, b_p^i)$ and $W_l^{RF}(z, \epsilon, b_m^i, b_p^i)$.
- Price schedules for the multilateral debt, $q_m(z, b_m^i, b_p^i)$, and the private debt, $q_p(z, b_m^i, b_p^i)$.

such that

1. Taking the above prices as given,

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

(b) and taking the solution to the repayment problem as given, the policy functions $W_l^{RP}(z, \epsilon, b_m^i, b_p^i)$, $W_b^{RP}(z, \epsilon, b_m^i, b_p^i)$, $W_l^{RF}(z, \epsilon, b_m^i, b_p^i)$, $W_b^{RF}(z, \epsilon, b_m^i, b_p^i)$, $A^{DP}(z, \epsilon, b_m^i, b_p^i, W)$ and $A^{DF}(z, \epsilon, b_m^i, b_p^i, W)$ solve the sovereign's renegotiation problem in (5)-(9).

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

E Numerical Solution

In this section, I present the different value functions, policies and prices after taking the expectations over the utility shock ϵ . I then describe how the model is solved.

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

$$\begin{aligned}
 V(z, b_m^i, b_p^i) = & \omega \ln \left\{ \left(\sum_{j=1}^J \exp(u(c_{i,j}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j)) \right)^{\frac{1}{\omega\nu}} \right. \\
 & + \left(\exp(u(y^{DP}(z) + (1 - \delta + \delta\kappa)b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)) \right)^{\frac{1}{\omega}} \\
 & \left. + \left(\exp(u(y^{DF}(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^i, b_p^i)) \right)^{\frac{1}{\omega}} \right\} \\
 \text{s.t. } c_{i,j} = & y(z) + [1 - \delta + \delta\kappa] (b_m^i + b_p^i) - q_m(z, b_m^j, b_p^j) (b_m^j - \delta b_m^i) - q_p(z, b_m^j, b_p^j) (b_p^j - \delta b_p^i).
 \end{aligned} \tag{E.1}$$

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

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

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

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

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

where

$$\mathcal{X}(z, b_m^i, b_p^i) = \exp\left(u(y^{DP}(z) + (1 - \delta + \delta\kappa)b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)\right)^{\frac{1}{\omega}},$$

$$\mathcal{Y}(z, b_m^i, b_p^i) = \exp\left(u(y^{DF}(z)) + \beta \mathbb{E}_{z'|z} V^{RF}(z', b_m^i, b_p^i)\right)^{\frac{1}{\omega}},$$

$$\mathcal{Z}(z, b_m^i, b_p^i) = \left(\sum_{k=1}^{\mathcal{J}} \exp\left(u(c_{i,k}) + \beta \mathbb{E}_{z'|z} V(z', b_m^k, b_p^k)\right)^{\frac{1}{\omega\nu}}\right)^{\nu}.$$

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

$$V^{RP}(z, b_m^i, b_p^i) = \omega\phi \ln \left\{ \left(\sum_{j, \tau_j \geq 0, b_m^j = \delta b_m^i} \exp\left(u(c_{i,j}(W_l^{RP}) + \beta \mathbb{E}_{z'|z} V(z', b_m^j, b_p^j)\right)^{\frac{1}{\omega\nu}} \right)^{\nu} \right. \quad (\text{E.3})$$

$$\left. + \exp\left(u(y^{DP}(z) + (1 - \delta + \delta\kappa)b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)\right)^{\frac{1}{\omega}} \right\}$$

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

$$\left. + \exp\left(u(y^{DP}(z) + (1 - \delta + \delta\kappa)b_m^i) + \beta \mathbb{E}_{z'|z} V^{RP}(z', b_m^i, b_p^i)\right)^{\frac{1}{\omega}} \right\}$$

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

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

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

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

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

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

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

The private bond price therefore reduces to

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

with recovery value

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

and

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

Conversely, the multilateral debt price reduces to

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

with recovery value

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

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

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

For the autarky values (3)-(4), I first solve the optimal lenders' offer over a W-grid. For each point on the W-grid, I determine the value of reentering the market given in (7) and (9) by means of a grid search.⁴⁸ I subsequently generate the values of renegotiation using

⁴⁸For computational efficiency, this step takes place at the same stage as the grid search for the repayment value.

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

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

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

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

Once the model is solved, I run simulations for 2000 countries and 500 years. The first 100 years are discarded to ensure that the initial conditions do not matter. The model-generated moments are computed as averages across countries. Business cycle moments are HP filtered with a smoothing parameter of 6.25.

F Sensitivity to Utility Shocks

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

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

As one can see in Table F.6, changes in ω and ν affect the main moments of the model in a negligible manner. Most notably, the variance parameter seems to affect the default duration and the debt dynamic. Conversely, the correlation parameter affects the duration and the default dynamic. The share of *full* default seems also to be sensitive to changes in both ω and ν .

G Welfare Analysis

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

Table F.6: Sensitivity to ω and ν

	Baseline	$\omega \times 0.85$	$\omega \times 1.125$	$\nu \times 0.85$	$\nu \times 1.15$
Default length (year) (with multilateral lenders)	5.9	5.2	5.7	5.3	6.7
Default length (year) (without multilateral lenders)	3.2	2.9	2.6	3.2	3.2
Private creditors' haircut (%) (with multilateral lenders)	50.3	51.6	50.3	50.7	49.8
Private creditors' haircut (%) (without multilateral lenders)	32.3	35.2	34.4	34.3	32.0
Debt-to-GDP ratio (%)	39.9	40.5	40.1	40.3	40.2
Multilateral-debt-to-GDP ratio (%)	6.5	6.2	5.5	6.5	6.4
Share <i>full</i> default (%)	19.5	22.8	11.1	14.2	20.1
Default rate (%)	2.3	2.7	3.2	2.4	2.2
Debt increase prior to default (percentage point)	23.9	27.5	23.7	25.1	23.6
Standard deviation debt-to-GDP ratio	9.3	10.3	9.7	9.3	9.3
Standard deviation duration	4.5	4.3	3.7	4.1	4.6

an initial state at $t = 0$ as

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

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

$$V_b(z, \epsilon, b_m^i, b_p^i) \equiv V(\{c^b(z^t, \epsilon^t)\}),$$

Conversely, the sovereign's value under the alternative model in the exact same state $(z, \epsilon, b_m^i, b_p^i)$ reads

$$V_a(z, \epsilon, b_m^i, b_p^i) \equiv V(\{c^a(z^t, \epsilon^t)\}).$$

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

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

Given the functional form of the instantaneous utility one obtains

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

The welfare gain therefore boils down to

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