Structuring and Restructuring Sovereign Debt: The Role of Seniority[*]

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Abstract

We show how the willingness-to-pay problem and lack of exclusivity in sovereign lending may result in an equilibrium sovereign debt structure that is excessively difficult to restructure. A bankruptcy regime for sovereigns can alleviate this inefficiency but only if it is endowed with far-reaching powers to enforce seniority and subordination clauses in debt contracts. A bankrupcty regime that makes sovereign debt easier to restructure without enforcing seniority may decrease welfare.

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1 Introduction

Sovereign debt restructuring has been a major policy issue for the international community since the mid 1990s. A new source of concern that has emerged, in particular, is that orderly debt restructuring has been made more difficult by the greater dispersion of debt holdings among a large number of small investors around the world. The nature of these coordination problems has been dramatically illustrated by the 2001 Argentine sovereign default.[1] Due to the perceived greater complexity in coordinating negotiations between debtholders and sovereigns a number of prominent commentators and the international community have advocated ex-post policy interventions to facilitate debt restructuring.[2]

The increase in debt dispersion has been largely brought about by a greater reliance on bond issues by sovereign borrowers. In the debt crises of the 1980s, most of sovereign debt was composed of syndicated bank loans and official loans. Although creditor coordination problems were not absent, it was possible for creditor banks and central bankers to negotiate with debtors and the IMF and to work out a debt restructuring agreement. The resolution of the debt crises of the 1980s also gave rise to a new framework for sovereign debt restructuring, with institutions such as the Paris Club and the London Club that helped coordinate creditors and set certain rules of the game for sovereign debt restructuring. This framework, however, is ill-equipped to deal with the more recent sovereign debt crises, which often involve much more severe coordination problems between a large number of small bondholders.

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[1] After three years of halfhearted negotiations, the Argentine government launched a global debt exchange for 152 domestic and foreign securities amounting to 60 percent of its GDP. Although Argentina was able to successfully exchange its existing debts for lower face-value claims with a majority of creditors, it continued and still continues to face a significant fraction of holdouts as well as a large number of law suits whose execution is still pending. Looking forward, no framework for sovereign debt restructuring has been put in place to deal with sovereign defaults similar to Argentina's in the future. See Blustein (2005) for a detailed account of the Argentina debt crisis and also Bolton and Skeel (2005) Sturzenegger and Zettelmeyer (2007) and Gelpern and Gulati (2007) for an analysis of the Argentine debt exchange of 2004.

[2] See Sturzenegger and Zettelmeyer (2007) for a review of the main proposals.

What would be the optimal framework for sovereign debt restructuring in the new financial environment? It is tempting to think about this question by analogy with corporate finance. Indeed, the US corporate bankruptcy regime, which grew out of *equity receiverships* set up to deal with the restructuring of failed railroad bonds in the 19th century, addresses essentially the same issues encountered today in sovereign defaults (Bolton, 2003). At the same time, it is also important to keep in mind the dimensions along which sovereign debt differs from corporate debt, in particular the much weaker contractual enforcement resulting from national sovereignty. Unlike firms, sovereigns cannot be liquidated and there is very little income or collateral that they can credibly pledge in repayment to creditors.

Because of this weaker contractual enforcement some economists have argued in favor of maintaining the status quo (Dooley, 2000; Shleifer, 2003). They contend that the structure of sovereign debt has been deliberately designed to make debt-restructuring more difficult, partly in response to the debt crises and restructurings of the 1980s, which had revealed the full extent of the willingness-to-pay problem.[3] This view leads to the Panglossian conclusion that sovereign debt restructuring should not be made easier: a policy intervention that aims to reduce the costs of restructuring sovereign debt, while improving ex-post efficiency, will undermine ex-ante efficiency by raising the cost of borrowing and reducing the amount of lending to emerging market countries.

Against this background, our article aims to spell out the conditions under which a new framework for sovereign debt restructuring would be desirable, as well as the essential features of such a framework. Our analysis is based on a stylized model of sovereign debt, whose main features and implications can be

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[3] This is, of course, unlikely to be the only reason for the shift from bank loans to bonds in sovereign finance. To some extent, this shift is part of a wider trend towards securitization. Still, there is evidence that market participants viewed bonds as more secure than bank loans because they were more difficult to restructure (Bolton and Jeanne, 2005).

summarized as follows.

First, in line with the literature on the willingness-to-pay problem, we consider an environment with very weak contractual enforcement of sovereign debt contracts. We assume that the sovereign cannot credibly pledge domestic output or domestic assets in repayment of its debt, and repays only to avoid certain default costs.

Second, the sovereign must borrow from multiple lenders and cannot commit to a given overall debt structure. This assumption— referred to as the "non-exclusivity" problem in financial contracting theory—reflects a form of contractual incompleteness. The contract between the sovereign and a given lender cannot be made contingent on the contracts with all the other lenders, in particular the future lenders who have not yet lent to the sovereign.[4]

Third, we assume that the sovereign can issue different forms of debt, some of which are more difficult to restructure than others. By choosing the structure of its debt ex ante the government can make it more or less difficult to restructure ex post.

The first two assumptions are standard in the sovereign debt literature, and reflect the relative incompleteness of sovereign debt contracts compared with other forms of debt.[5] The third assumption is a logical necessity in a model that endogenizes the "renegotiability" of debt as the outcome of a market equilibrium.

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[4] We discuss the underlying reasons for this form of contract incompleteness at the end of section 2. Non-exclusivity will be endogenized as the result of monitoring costs in section 9.

[5] In contrast to corporate debt, for which courts can enforce creditors' subordination priorities, there is no easy way of enforcing priority covenants for sovereign debt. There is a large corporate finance and legal literature, as well as a large body of case law, on debt seniority and priority covenants as instruments aimed at reducing the risk of debt dilution. The insights from the corporate finance literature cannot be directly transposed to sovereign debt. The seniority of corporate debt is explicit, contractually specified and enforced by courts. It is based to a large extent on collateral. In contrast, there is very little collateral that sovereigns can offer to creditors. Of the 79 developing and emerging market countries that had at least one public sector international loan or bond outstanding on January 1, 2003, the face value of collateralized debt was only 6.2 percent of the face value of total outstanding debt (Zettelmeyer, 2003).

We then show that under this set of assumptions, sovereign debt will in general be excessively difficult to restructure in equilibrium. The reason is that, at any given point in time the sovereign may be tempted to lower the interest rate at which it borrows by diluting its outstanding debt with new debt that is more difficult to restructure. Lenders, of course, anticipate this behavior and try to protect themselves against future dilution by making their claims hard to restructure. The laissez-faire equilibrium thus results in an inefficient debt structure, in the sense that deadweight default costs will be paid more often than would be the case if a social planner determined the structure of the sovereign's debt.

One concept that plays a key role in our analysis is *de facto* seniority in selective defaults. The sovereign will in certain states of nature default selectively on parts of its debts that are easier to renegotiate—that is, default only on renegotiable debt, and not on the debt that is harder to renegotiate. This gives rise to a form of effective seniority of less renegotiable debt over more renegotiable debt. This seniority is de facto (as opposed to *de jure*) because it is the result of the ex post power of nuisance of the parties rather than the implementation of clauses in ex ante debt contracts.

This feature of the model is consistent with the experience of sovereign debt restructuring over the past twenty years. Selective defaults on sovereign debt are a common occurrence in the real world. During most of the 1990s the differential treatment of sovereign claims has followed a pattern that suggests de facto seniority of international bonds over bank loans. Sovereigns have often defaulted on their bank debt while staying current on their bonded liabilities.[6]

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[6] Based on Standard & Poors data on 38 rated sovereigns over the period 1975-2003 (reported in Beers and Chambers, 2003), the probability of being in default on bonds conditional on a default on bank loans is only 6.4 percent. The restructuring of Russian sovereign debt (August 1998-August 2000) is typical of this pattern. Domestic debt and Soviet era London and Paris Club debts have been restructured, while Eurobonds have been left untouched. Market participants have viewed this latest Russian debt restructuring episode as further corroboration of the sovereigns' tendency of treating creditors differently according to their power

Market participants were also well aware that such behavior resulted in an implicit seniority structure affecting the pricing and valuation of debt.[7]

Our paper argues that there is, therefore, a role for policy intervention in sovereign lending that would improve both ex-ante and ex-post efficiency. This policy intervention should take the form of enforcing a *de jure* priority rule by either facilitating the enforcement of priority covenants or by facilitating the restructuring of junior debts issued by the sovereign. A bankruptcy regime for sovereigns could mitigate the inefficiency associated with the race to seniority by enforcing a default seniority rule or *first-in-time rule*.[8] We argue, furthermore, that to enforce this seniority rule the bankruptcy regime would not require more powers of enforcement on sovereigns than under the status quo. On the contrary, the intervention could take the form of weakening enforcement of junior debts by facilitating their restructuring.

While our conclusions are less Panglossian than our premises, it is important to emphasize that they do not provide unconditional support for any form of intervention that facilitates debt restructuring. Such policy interventions, if poorly designed, could easily be welfare-reducing. In particular, a sovereign debt restructuring regime that simply solves coordination failures between creditors ex post may well reduce welfare in our model. The main benefits of a bankruptcy regime for sovereigns, in our view, arise from the establishment of a legal seniority rule between creditors.[9] Our emphasis on the need to differen-

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of nuisance.

[7] Bolton and Jeanne (2005) report a number of quotes by market participants suggesting that this was the case.

[8] The first-in-time rule has been advocated for corporate debt, among others, by White (1980) and Schwartz (1989). Bolton and Skeel (2004) outline how a bankruptcy procedure for sovereigns could be designed to legally enforce such a priority rule.

[9] Other authors have emphasized the importance of seniority in sovereign debt. Roubini and Setser (2004), for example, downplay the importance of creditor coordination problems but view "the absence of an enforceable priority structure for the sovereign's own debt" as "one of the basic problems [...] that arise in a debt restructuring". Tirole (2002, chapter 4) discusses the contracting externalities that may arise in the issuance of sovereign debt and mentions seniority as a possible solution to this problem.

tiate across creditors in the debt restructuring process contrasts in particular with the conventional wisdom that creditors should be treated equally in debt restructuring agreements (G-10, 1996; G-22, 1998).

Our paper is related to several lines of literature on sovereign debt and corporate finance. The idea that it may be desirable to create a debt structure that is difficult to renegotiate under limited enforcement is a familiar theme in corporate finance. See, for example Hart and Moore (1995), Dewatripont and Maskin (1995), Bolton and Scharfstein (1996), Diamond and Rajan (2001) and Diamond (2004). The inefficiencies resulting from non-exclusivity in debt contracts have also long been noted in the corporate finance literature. Fama and Miller (1972, chapter 4) provide an early discussion of how lenders can protect themselves from dilution by making their loans senior (see also White, 1980 and Schwartz, 1989). Bizer and DeMarzo (1992) show however that seniority is not always a perfect antidote to the non-exclusivity problem in the presence of debtor's moral hazard, and Bisin and Rampini (2006) establish that bankruptcy law improves welfare to the extent that it imposes exclusivity by enforcing the seniority of early lenders.

The non-exclusivity problem has also received some attention in the literature on sovereign debt. Early contributions include Kletzer's (1984) analysis of the sovereign debt market when creditors do not observe the borrower's total indebtedness, and Cohen's (1991, chapter 4) model of sovereign debt dilution. Bi (2007) endogenizes the maturity structure of sovereign debt in a dynamic stochastic general equilibrium model of sovereign debt with dilution. However, most papers in the sovereign debt literature circumvent the non-exclusivity problem by assuming it away in one way or another. For example, Kletzer and Wright (2000) assume a partial form of exclusivity by imposing a "moratorium" on new debt until the sovereign repays its outstanding creditors. Kovrijnykh and Szentes (2007) go even further and explicitly assume seniority of outstand-

ing creditors relative to new lenders. Another approach in Wright (2005) is to restrict entry by assuming that the sovereign must borrow from a given pool of lenders.In this paper we assume free entry by a large number of competitive lenders.

Other recent contributions that focus on sovereign debt restructuring are Ghosal and Miller (2003) and Jeanne (2008) who show how a bankruptcy regime for sovereigns might improve welfare by completing existing incomplete sovereign debt contracts. Similarly, Haldane et al. (2005) and Weinschelbaum and Wynne (2005) compare the merits of a statutory bankruptcy regime with collective action clauses in sovereign bond contracts. Also, Pitchford and Wright (2007) endogenize the cost of restructuring in the form of an inefficient delay in bargaining between the sovereign and its creditors, and evaluate the welfare impact of collective action clauses. None of these studies look at ex ante contractual externalities between lenders or discuss issues related to seniority. Finally, our paper is related to the companion article Bolton and Jeanne (2007), in which sovereign debt may also be excessively difficult to restructure under laissez-faire because of a contractual externality. However, the mechanisms emphasized in the present paper are different and focus on dilution dynamics and their implications for seniority in sovereign debt.

The remainder of our paper is structured as follows. Section 2 gives the main assumptions of the model. Section 3 shows how the non-renegotiability of debt can make it effectively senior. Sections 4 and 5 compare the cases when the sovereign respectively can and cannot commit not to dilute its debt. Section 6 shows how non-renegotiable debt can be used to forestall dilution, as well as the efficiency costs involved. Section 7 characterizes the equilibrium. Section 8 draws some normative implications from the theory, highlighting in particular the welfare benefits of establishing *de jure* seniority in sovereign debt. Finally, Section 9 presents some extensions of the model, and Section 10 concludes with

thoughts on possible directions for further research.

2 The model: assumptions

We consider a small open economy over three periods with a single homogenous good that can be consumed or invested. The representative resident of this economy may raise funds from the rest of the world by issuing (sovereign) debt in the first two periods ($t = 0, 1$). This debt is to be repaid in the last period ($t = 2$). The funds raised in the first two periods can be used for consumption or investment purposes. For simplicity we shall assume that the expenditure is indivisible and that it has the same level g in periods 0 and 1.

To keep the analysis as tractable as possible we specify the following simple form for the utility function of the representative resident:

$$U = \delta_0 V_0 + \delta_1 V_1 + c$$

where,

1. c denotes the consumption level of the representative resident in period 2, and

2. δ_t is an indicator variable that is equal to 1 if the expenditure is made in period $t = 0, 1$, and V_t represents the utility value of the expenditure. This value may be generated through additional consumption or through public investment in infrastructure, health, schooling, etc. These expenditures may be efficient or not (V_t may be higher or lower than g).

The representative resident produces stochastic output y in period 2. The probability distribution over output is denoted by $f(\cdot)$. For simplicity we normalize period 0 and 1 output to zero—this assumption will be relaxed later and

does not matter for our main results. Finally, the sovereign is assumed to act on behalf of the representative resident and maximizes her welfare.

Under autarky this representative resident would only be able to achieve a welfare level of

$$E_0(U) = E_0(y).$$

By borrowing from the rest of the world she may be able to enhance her welfare. We shall take it that the sovereign debt market is perfectly competitive and that the equilibrium riskless interest rate is equal to zero. But that is not to say that the sovereign debt market is perfectly efficient. Indeed, as we already hinted at, two forms of *moral hazard* limit the efficiency of the sovereign debt market in our model: the classical *willingness-to-pay problem* in sovereign lending (Eaton and Gersovitz, 1981) and, *debt dilution* where the sovereign reduces the value of outstanding debt by taking out new risky debt.

If sovereign debt markets were perfectly efficient and the sovereign were able to perfectly commit to repaying its debts, then it would raise g in period $t = 1, 2$ if and only if this increased domestic welfare ($V_t > g$). The Modigliani-Miller theorem tells us that the first-best efficient repayment stream is indeterminate and that any agreed repayment stream, with an expected value of $(\delta_0 + \delta_1)g$ would be equivalent.

We assume that the sovereign enters debt contracts with foreign lenders (we will consider more general contracts later). There is a large number of lenders in periods 0 and 1, each one with an amount g of loanable funds. Thus the sovereign will have to borrow from at least two different lenders in period 0 and in period 1. All lenders are risk neutral and require the same expected return, which is normalized to 0. There is perfect competition between lenders, so that the sovereign can extract all the surplus from the lending relationships.

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To be able to model a heterogeneous sovereign debt structure we also assume that there are two types of lenders: one type with whom the sovereign can renegotiate the repayment of the debt (type r) and one type with whom renegotiation is impossible (type n). We shall call the loans from the two types of lenders respectively renegotiable debt (or r-debt) and non-renegotiable debt (or n-debt). Renegotiable debt and non-renegotiable debt can be interpreted as respectively syndicated bank loans and bonds without collective action clauses (Gertner and Scharfstein, 1991; Lipworth and Nystedt, 2001).[10]

Debt repayments take place in period 2, when domestic output becomes available. We denote by D_0 the period-2 repayment promised to the first lender in period 0, and by D_1 the promised repayments on debt issued in period 1. The sovereign's debt structure, thus, is characterized by two pairs $(\theta_t, D_t)_{t=0,1}$, where $\theta_t = r, n$ is an indicator variable for the type of the lender in period t.

In period 2 the sovereign's total liabilities coming to maturity are:

$$D = D_0 + D_1.$$

There is a mixture of r-debt and n-debt if the sovereign has not issued the same type of debt in the first two periods. We respectively denote by D_r and D_n the amounts of r-debt and n-debt to be repaid in period 2.

The promise to repay D is credible only if it is in the sovereign's interest to repay ex post. We follow the sovereign debt literature by assuming that the sovereign repays its debts only as a way of avoiding a costly default. As in Sachs and Cohen (1982) and Obstfeld and Rogoff (1996, chapter 6), we model the cost of default as a proportional output loss, γy.[11] Obstfeld and Rogoff

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[10] In the latter case, a type-n lender consists of a pool of uncoordinated small bondholders. Of course, the loan could be originated by a syndicate of underwriting banks before it is distributed to small investors, and what matters is the structure of the debt at the time of repayment, not at the time of issuance.

[11] The literature on sovereign debt and the willingness-to-pay problem puts forward several explanations for why sovereigns repay their debts, ranging from the fear of market exclusion (Eaton and Gersowitz, 1981) to creditor sanctions (Bulow and Rogoff, 1989) and to the costs

(1996) interpret this cost as a sanction, but in our context it is best to interpret default costs as costs arising from the loss of market access during protracted debt restructuring negotiations or uncoordinated legal actions by individual creditors.[12]

Whether creditors can be persuaded to lift the sanctions depends on whether debt is of the renegotiable or non-renegotiable type. We assume that the holders of renegotiable debt (the r-creditors for short) can be coordinated at no cost around a debt restructuring agreement in which they consent to lift the cost γy in exchange of a payment η. In contrast, such an agreement is impossible to reach with the holders of n-debt (the n-creditors), since they are widely dispersed and the debt contract does not include any mechanism allowing them to collectively agree to a debt restructuring plan. The n-creditors automatically impose the sanction if they are not fully repaid. This inefficiency captures the idea that when debt holders are widely dispersed it will be difficult to reach an agreement acceptable to everyone in a timely fashion and to avoid free riding by hold-out creditors.

More formally, we capture the creditor coordination problem by assuming that there is a very small amount of domestic assets, ε, that creditors may try to seize in a sovereign default. Creditors attempt to get hold of those assets by litigating in court, which prevents the default from being cured and imposes the default cost γy on the sovereign. The key point is that although the value of seizable assets ε is very small it is sufficient to fully repay a small number of atomistic creditors. This implies that in a Nash equilibrium, all the

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of collateral disruption induced by sovereign defaults (Broner and Ventura, 2006). Recently Aguiar and Gopinath (2006) have argued that the observed levels of outstanding sovereign debt and debt repayments can only be explained if one assumes that sovereign defaults result in significant output cost.

   [12] The loss of market access comes from trigger strategy punishments in models a la Eaton and Gersowitz (1981). In the real world, potential new lenders are also concerned that litigating holdout creditors could attach the repayments in court. The loss of access, in that case, lasts as long as the debt has not been successfully restructured with all creditors.

creditors litigate because of the same free-rider problem as in Diamond and Rajan (2001) or Jeanne (2008).[13] This coordination problem can be solved if there is a mechanism that protects the sovereign from decentralized litigation and lets the sovereign negotiate with a representative of all creditors.

The sequence of actions in period 2 is as depicted in Figure 1. First, the government decides whether to repay its debts fully or default. Following a default, the r-creditors make a take-or-leave repayment demand of $\eta \leq D_r$. The government then accepts or rejects the r-creditors' demand. Acceptance implies a partial default on r-debt, in which the r-creditors receive a fraction η/D_r of their claims and the n-creditors are fully repaid. Rejection implies a full default in which the government repays nothing to its r-and n- creditors and incurs the cost γy. Figure 1 gives the payoffs of the government and its creditors under full repayment, and partial and full default.

The difference between the two types of creditors relates to their ability to act collectively, not in the size of the cost they can impose on the debtor or in their bargaining power. The n-creditors, as a group, cannot negotiate a debt reduction with the sovereign. By contrast, the r-creditors can bargain collectively. They have all the bargaining power, since they make a take-or-leave offer. They will ask for a full repayment, $\eta = D_r$, whenever possible, and for a lower repayment only to preempt a costly sovereign default that reduces the total repayment (to zero in our model).

This formulation captures in a simple way the fact that some types of sovereign debt are more difficult to restructure than others because of coordination problems between creditors. Here, we simplify the situation in the extreme by assuming that n-debt is *impossible* to restructure. This assumption trivially implies that debt restructuring, if it occurs, involves r-debt only. This is a simple

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[13]All the creditors litigate if litigation is free. If litigation is costly the equilibrium number of litigating creditors will be such that the payoff from litigation is equal to its cost.

representation of the selective defaults which, as mentioned in the introduction, are one way that sovereigns discriminate between different classes of creditors in the real world.

To summarize, the timing of moves and events starting from period 0 is as follows. In period 0 the r-lenders and n-lenders make competitive bids to lend g to the sovereign in the form of debt repayable in period 2. In period 1 the lenders bid again to lend g to the sovereign. We assume that the sovereign's borrowing decisions are made sequentially and that the sovereign cannot commit to its future debt management in period 0. This assumption seems reasonable as a benchmark, since in the real world there is no obvious way a sovereign can commit not to issue debt in the future. In period 2 output y is realized and debts are repaid (or not). In case of a default the debt restructuring continuation game described above is triggered. Finally, the representative resident consumes the remaining output and the game ends.

We conclude this section with an important remark about the role of contract incompleteness in our analysis. We have assumed that the sovereign enters debt contracts with foreign lenders, which are promises to repay fixed amounts. Restricting the attention to debt contracts means that the feasible financial contracts are incomplete in two ways:

• the repayment cannot be made contingent on the realized level of output (that is, we exclude repayment functions $D_t(y)$);

• the repayment to the first lender cannot be made contingent on the contract with the second lender (that is, we exclude repayment functions $D_0(\theta_1, D_1)$).

Although both assumptions are realistic and standard in the sovereign debt literature, they require an explanation. The first assumption, that the sovereign cannot issue GDP-indexed debt, is in line with the fact that the overwhelming majority of sovereign debts are not GDP-indexed. This is somewhat of a puzzle, however, as these debts appear to be feasible, desirable, and most importantly,

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relatively immune to manipulation, as GDP for a whole country can be measured and observed (Borensztein and Mauro, 2004). Indeed, in our simple model the sovereign would be able to achieve the first best by issuing GDP-indexed n-debt.

One reason why we observe so little GDP-indexed debt may be that sovereigns' willingness to repay has many other determinants besides domestic GDP.[14] This extra uncertainty could be captured, in our simple model, by assuming that γ is uncertain viewed from periods 0 and 1. What would be required, then, is debt indexed to the cost of default. Obviously, the informational requirements to be able to enforce such a debt instrument are likely to be prohibitive. In sum, in a richer model, where both y and γ are uncertain, our analysis would apply even if the sovereign was able to issue GDP-indexed debt. To keep the analysis as simple as possible, however, we have assumed that γ is certain and than D is independent of y.

The second form of incompleteness—that the contract with the first lender cannot be made contingent on the contract with the second lender—is also key to our analysis. It generates the non-exclusivity problem and the risk of dilution that make sovereign debt excessively difficult to restructure in the laissez-faire equilibrium. It is a priori a realistic assumption, as it would seem very difficult to write a debt contract contingent on all the possible borrowing decisions that the sovereign could take during the life of the contract. However, the non-exclusivity problem could be mitigated to some extent by shortening the maturity of debt. In reality we do observe sovereign debt of various maturities, and one role of short-term debt may indeed be to mitigate the risk of dilution. For the sake of simplicity, we postpone the analysis of short-term debt contracts to section 9.

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[14]For example, the domestic political support for sovereign debt repayment, as it is determined by the redistributive implications of a default. See Guembel and Sussman (2005) for a model. Evidence that negative output shocks are not a strong predictor of sovereign defaults suggests that these other determinants play an important role (Tomz and Wright, 2007).

3   Strategic default

In this section we determine when the sovereign repays its debts in period 2 and when it defaults, taking D_r and D_n as given. The debtor country may repay all its debts, default partially, or fully. Default without restructuring results in an output loss of γy.

Let us assume that the sovereign defaults. Is the default full or partial? This depends on whether the r-creditors can make an acceptable offer $\eta \geq 0$ to the sovereign. In the event of a partial default on r-debt, the sovereign's payoff is

$$y - \eta - D_n$$

if it accepts the offer η from r-creditors, which is the case if and only if $y - \eta - D_n \geq (1 - \gamma)y$. The r-creditors can make an acceptable offer, therefore, if and only if,

$$D_n \leq \gamma y. \tag{1}$$

The holders of r-debt always prefer a positive repayment $\eta \geq 0$ to a full default with no repayment. Since they have all the bargaining power, they therefore set η at the level that makes the sovereign indifferent between a partial and a full default, or

$$\eta = \gamma y - D_n.$$

By contrast, if $D_n > \gamma y$ the r-creditors cannot make an acceptable offer and the default must be full. The sovereign is better off defaulting on all its debts than selectively defaulting on r-debt. Conditional on a default, therefore, the default is partial if y is larger than D_n/γ, and full otherwise.

When is the sovereign better off defaulting? To answer this question we only need to compare the sovereign's payoff under no default,

$$y - D_r - D_n,$$

and its payoff under partial or full default, which in either case is

$$(1 - \gamma)y,$$

since all renegotiation rents are extracted by r-creditors. Thus, the sovereign defaults if and only if period 2 output falls below a threshold:

$$y < \frac{D_r + D_n}{\gamma}. \tag{2}$$

A partial default, therefore, occurs if and only if conditions (1) and (2) are met. Ordering these cases in terms of y then gives the following result:

Proposition 1 *The sovereign's debt repayment strategy is as follows:*

(i) <u>full repayment:</u> if $y \geq \frac{D_n + D_r}{\gamma}$, the sovereign fully repays its renegotiable and non-renegotiable debt.

(ii) <u>partial default:</u> if $\frac{D_n}{\gamma} \leq y < \frac{D_n + D_r}{\gamma}$, the sovereign fully repays its non-renegotiable debt and repays $\gamma y - D_n$ to the holders of renegotiable debt.

(ii) <u>full default:</u> if $y < \frac{D_n}{\gamma}$, the sovereign defaults on all outstanding debts and repays nothing.

Proof. See discussion above. ∎

This proposition clarifies the notion that non-renegotiable debt is effectively senior to renegotiable debt. In the case of partial default, the allocation of the repayment between r-creditors and n-creditors is the same as if the latter enjoyed strict seniority over the former. Because of this effective seniority, n-creditors have a larger expected recovery ratio than r-creditors, so that the interest rate should be lower on n-debt than on r-debt.

4 Optimal debt structure under commitment

What is the ex-ante optimal combination of n-debt and r-debt? The answer to this question depends on whether the government can commit not to dilute

debt issued in period 0 with new debt issued in period 1. In this section we assume that the government can credibly commit not to dilute its initial debt. We thereby isolate the only remaining moral hazard problem in our model: the classic *willingness-to-pay problem*. This assumption, although not realistic, provides a convenient benchmark for the case with no commitment, where dilution is possible.

Let us assume that the sovereign finances the expenditure in both periods $t = 0$ and $t = 1$. There are three types of debt structures to consider:

- pure r-debt, with r-debt in both periods: in each period the sovereign issues a promise to repay $\widehat{D}_r$ satisfying[15]

$$g = \int_0^{2\widehat{D}_r/\gamma} \frac{\gamma y}{2} f(y) dy + \widehat{D}_r \int_{2\widehat{D}_r/\gamma}^{+\infty} f(y) dy. \tag{3}$$

- pure n-debt, with n-debt in both periods: in each period the sovereign issues a promise to repay $\widehat{D}_n$ satisfying

$$g = \widehat{D}_n \int_{2\widehat{D}_n/\gamma}^{+\infty} f(y) dy. \tag{4}$$

- mixed debt, with n-debt in one period and r-debt in the other: the promised repayments $\widetilde{D}_r$ and $\widetilde{D}_n$ satisfy

$$g = \int_{\widetilde{D}_n/\gamma}^{(\widetilde{D}_r+\widetilde{D}_n)/\gamma} (\gamma y - \widetilde{D}_n) f(y) dy + \widetilde{D}_r \int_{(\widetilde{D}_r+\widetilde{D}_n)/\gamma}^{+\infty} f(y) dy, \tag{5}$$

$$g = \widetilde{D}_n \int_{\widetilde{D}_n/\gamma}^{+\infty} f(y) dy. \tag{6}$$

The mnemonic is that a debt structure with only one form of debt is denoted with a hat, whereas a structure that mixes two forms of debt is denoted with a tilde. It does not matter, viewed from period 2, if the debt has been issued in period 0 or in period 1 given that there is no seniority or first-in-time rule in place.

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[15] If this equation admits several solutions we pick the smallest one. This also applies to equations (4), (5) and (6).

Given that in any equilibrium investors obtain a zero net expected return, the equilibrium welfare of the representative agent is equal to the net welfare benefit from the expenditures in the two periods plus the total expected output net of the cost of default, or[16]

$$U_0 = (V_0 - g)^+ + (V_1 - g)^+ + E(y) - \int_0^{D_n/\gamma} \gamma y f(y) dy,$$

where $D_n = 0$, $2\widehat{D}_n$, or $\widetilde{D}_n$ in respectively a pure r-debt, pure n-debt and mixed debt structure. As this expression immediately reveals the representative agent's welfare is highest under the structure with the lowest D_n, namely the pure r-debt structure. Thus we have the following result.

Proposition 2 *Under a pure willingness-to-repay problem it is optimal for the sovereign to issue r-debt in both periods.*

Proof. See discussion above. ■

Renegotiable debt is unambiguously preferable to non-renegotiable debt in our model. If the government could commit not to dilute, it would never issue n-debt. This result is in part driven by our assumption that r-creditors are able to appropriate the entire amount γy in debt renegotiations following default. Thus, n-debt does not have an advantage over r-debt in extracting repayment from the sovereign. If the bargaining power of the r-creditors were lower than 1 the sovereign might have to issue n-debt in order to increase its pledgeable output.[17] We focus on the extreme case where the creditors have all the bargaining power in renegotiation for expositional reasons—because it yields a clear prediction on the optimal form of debt.

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[16] Recall that with r-debt the deadweight default costs can be avoided through ex-post debt restructuring.

[17] In the opposite polar case where the creditors have no bargaining power, the sovereign would be unable to issue r-debt since it would always default on it. The case with intermediate bargaining power is analyzed in our companion paper Bolton and Jeanne (2007).

5 Dilution with non-renegotiable debt

We now relax the assumption on commitment made in the previous section and assume that the sovereign can reoptimize in period 1 in a discretionary way. We will show that under a weak and plausible assumption on the probability distribution of output there cannot be an equilibrium with only r-debt in this case, as the sovereign then always dilutes outstanding r-debt with n-debt in period 1.

The equilibrium debt type in period 1 is determined by a simple rule: the sovereign issues the type of debt with the lowest interest rate. This is because expected consumption is given by,

$$E(c) = \int_0^{D/\gamma} (1-\gamma) y f(y) dy + \int_{D/\gamma}^{+\infty} (y - D) f(y) dy,$$

where D is total debt repayment, irrespective of debt types. The sovereign's problem is thus to minimize D, which is achieved in period 1 by issuing the debt with the lowest interest rate.

It is easy to see that the interest rate is lower on r-debt than on n-debt if the only type of debt outstanding is n-debt (because of the higher recovery value of r-debt in defaults). It follows that if the sovereign has issued n-debt in period 0, then it does not re-issue the same type of debt in period 1. Thus we have the following result.

Proposition 3 *There is no equilibrium in which the sovereign issues n-debt in both periods 0 and 1.*

Proof. See discussion above. ∎

But, is there an equilibrium in which the sovereign issues r-debt in both periods? The answer is negative if the interest rate is lower on n-debt than on r-debt in period 1, after the sovereign has issued $\widehat{D}_r$ of r-debt in period 0. We show in the Appendix that this is the case if the following assumption holds:

Assumption 1. *The output density function $f(\cdot)$ is increasing in the interval of output levels for which there is default under pure r-debt.*

This assumption is both weak and intuitive. An increasing density $f(\cdot)$ ensures that selective defaults, in which n-debt dominates r-debt, are more likely than full defaults, in which r-debt dominates n-debt. It is satisfied for most usual specifications of $f(\cdot)$ if default is a tail probability event. Under Assumption 1 we have the following result.

Proposition 4 *Consider an equilibrium in which the sovereign spends g in both periods $t = 0, 1$ and cannot commit to a particular debt structure. Then, under Assumption 1, the sovereign issues a mixture of n-debt and r-debt.*

Proof. See the appendix. ∎

Welfare is lower than under commitment by an amount $\int_0^{\widetilde{D}_n/\gamma} \gamma y f(y) dy$. This represents the welfare cost of full defaults induced by the n-debt issued in period 1. Under laissez-faire there is, thus, an excessive level of n-debt issued relative to the first-best (in which there is no n-debt).

The nature of the problem faced by the sovereign here is essentially one of time consistency. The sovereign would like to commit not to issue n-debt but it is not able to do so. We discuss in sections 8 and 9 how this problem can be solved contractually or through the creation of new institutions.

6   Non-renegotiable debt to forestall dilution

The analysis in the previous section might suggest that n-debt should be eradicated. We now show that such a conclusion would be hasty because it misses an important benefit of n-debt, which is that it cannot be diluted. The holders of long-term n-debt are protected against dilution by their effective seniority. The sovereign, therefore, may issue its long-term debt in the form of non-renegotiable debt to forestall dilution.

One of the costs of dilution of r-debt by n-debt is the deadweight cost of a full default. But another, more subtle, cost is that dilution creates incentives for overinvestment in period 1. A sovereign with no outstanding debt always makes an efficient investment decision: spend if and only if the expenditure is socially efficient $(V_1 > g)$ and finance the expenditure with r-debt. But the sovereign's decision may be distorted by the presence of outstanding r-debt.

To see this, suppose that the sovereign has issued $\widetilde{D}_r$ of r-debt in period 0, under the expectation that there will be another investment expenditure in period 1 financed with n-debt. This expectation is rational if the sovereign is indeed better off financing the expenditure in period 1, or if:

$$V_1 + \int_0^{(\widetilde{D}_r+\widetilde{D}_n)/\gamma} (1-\gamma)y f(y)dy + \int_{(\widetilde{D}_r+\widetilde{D}_n)/\gamma}^{+\infty} (y - \widetilde{D}_r - \widetilde{D}_n)f(y)dy >$$

$$\int_0^{\widetilde{D}_r/\gamma} (1-\gamma)y f(y)dy + \int_{\widetilde{D}_r/\gamma}^{+\infty} (y - \widetilde{D}_r)f(y)dy.$$

Substituting for

$$g = \widetilde{D}_n \int_{\widetilde{D}_n/\gamma}^{+\infty} f(y)dy,$$

and rearranging this condition can be rewritten as:

$$V_1 > \underline{V} \equiv g - \widetilde{D}_n \int_{\widetilde{D}_n/\gamma}^{\widetilde{D}_r/\gamma} f(y)dy - \int_{\widetilde{D}_r/\gamma}^{(\widetilde{D}_r+\widetilde{D}_n)/\gamma} (\widetilde{D}_n + \widetilde{D}_r - \gamma y)f(y)dy. \quad (7)$$

Note that the right-hand term $\underline{V}$ is lower than g, implying that the investment expenditure might be undertaken in period 1 even if it is inefficient. The sovereign's decision is biased towards excessive spending through dilution.

In contrast, if the sovereign had issued n-debt in period 0, there is no dilution bias since n-debt cannot be diluted. So n-debt is a double-edged sword: *n-debt is an instrument of dilution, but it is also a weapon against dilution.* The dual nature of n-debt is very important for the normative analysis that follows.

Expropriation of outstanding debt through dilution requires both a default and a debt restructuring. Intuitively, thus, a debt issue that is more difficult

to restructure should also be more difficult to dilute. This intuition is captured in a stark way in our model, as n-debt cannot be diluted *at all,* because when period 0 n-creditors are not fully repaid, no other creditors are.[18] In contrast, renegotiable debt can be diluted by subsequent issues of either renegotiable or non-renegotiable debt.

7 Equilibrium

Suppose now that V_1 is stochastic and that it could take values that are strictly lower than g but no lower than $\underline{V}$:

Assumption 2. V_1 *is uncertain viewed from period* 0*. It is lower than* g *with a nonzero probability but higher than* $\underline{V}$ *with probability* 1*.*

This assumption is meant to make the problem interesting without adding unnecessary complications. The assumption that V_1 can be lower than g implies that dilution has a positive distortionary welfare cost equal to $\int_{\underline{V}}^{g}(g - V_1)h(V_1)dV_1$, where $h(\cdot)$ is the pdf of V_1. The role of the assumption that V_1 remains above $\underline{V}$ is only to simplify the analysis by ensuring that the sovereign always dilutes outstanding r-debt in period 1.[19]

Under Assumption 2 the equilibrium is relatively simple to characterize. First, we know that the sovereign issues both n-debt and r-debt (by Proposition 4). But which type of debt is issued first? If V_1 is known ex ante to be larger than g, then the sovereign is indifferent between issuing n-debt in period 0 or in period 1. But if V_1 is smaller than g with positive probability the sovereign is strictly better off issuing n-debt in period 0: the deadweight loss from full defaults is the

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[18]This extreme outcome is driven by our assumption that the recovery value of debt is zero in a full default. If the recovery value of n-debt were positive, the n-debt issued in period 0 could be diluted in period 1 (by issuing more n-debt if n-creditors were effectively senior to r-creditors in the restructuring process). Even in this case, however, it would remain true that n-debt is diluted less often than r-debt.

[19]Without this assumption one would have to compute the probability of dilution as the solution of a fixed-point problem, and this added analytical complication bring no additional economic insight. The details are available upon request to the authors.

same as when n-debt is issued in period 1, but the spending decision in period 1 is efficient. It follows that issuing n-debt in period 0 dominates issuing it in period 1.

Proposition 5 *The sovereign issues n-debt in period* 0*, and when* $V_1 > g$ *issues r-debt in period* 1*.*

   Proof. See discussion above. ∎

In sum, it is optimal to use n-debt as a protection against dilution rather than as a tool of dilution, and therefore to issue n-debt early.

8   Public policy

If sovereign debt is inefficiently structured, is there a case for policy intervention, and if so what form of intervention would be desirable? In particular, is there a case for intervening to facilitate debt renegotiations ex post, or should there be other forms of intervention? We take up these questions in this section.

One can distinguish two approaches to facilitating sovereign debt restructuring. The contractual approach focuses on making debt contracts easier to renegotiate by including collective actions clauses (CACs) in sovereign bond issues.[20] The more ambitious statutory approach proposes the creation of new institutions that supersede contracts. The latter approach reached a culmination point when the IMF's Anne Krueger put forward the idea of a sovereign debt restructuring mechanism (SDRM) that would fulfill some of the functions of a bankruptcy regime (Krueger, 2002).[21]

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[20] These clauses allow for the reduction in the payment terms of a bond issue if a super-majority of bondholders (often a 2/3 majority) approves the proposed reduction or "haircut". If a debtor wants to renegotiate the payment terms of a bond issue with collective action clauses, it can approach the trustee representing the bondholders with a renegotiation offer, who in turn can put the proposal to a vote of all bondholders (see Gelpern and Gulati, 2007, or Eichengreen, 2003).

[21] The notion of a "bankruptcy court for sovereigns" has a long history that goes back to Adam Smith. See Rogoff and Zettelmeyer (2002) for historical background and a review of the recent developments on this proposal. The SDRM failed to gain enough support in the international community and the main outgrowth of this debate has been the spread of CACs.

8.1 Making debt easier to restructure

Suppose, for simplicity, that the sovereign's debt is the form of bonds held by a large number of creditors. In terms of our model, r-debt would be interpreted as a bond issued with a collective action clause, while n-debt would be a bond issued without such a clause. Then Proposition 4 says that one half of the sovereign's debt will not have a collective action clause in equilibrium, even though it would be optimal to include such a clause in all the debts (by Proposition 2). The purely voluntary approach to the adoption of collective action clauses, thus, is unlikely to work.

One way of making sovereign debt easier to renegotiate would be to make collective action clauses mandatory—or to strongly encourage their adoption with subsidies, public pressure or moral suasion—so that all the debts are of type r. Equivalently, one can establish a bankruptcy regime that forces n-creditors to renegotiate in the same way as r-creditors.

For concreteness, consider a bankruptcy regime where all creditors are required to delegate renegotiation authority to a creditor committee. Individual creditors see their litigation rights suspended, and must all accept the outcome of the negotiation between their representative and the sovereign. Thus, the free-riding equilibrium in which individual creditors were seeking to seize a small amount of assets ε is eliminated.

We assume that the n-debt is restructured in the same way as the r-debt. The creditor committee has the exclusive right to make a restructuring proposal $\hat{\eta}$. The sovereign can only accept or reject the offer (as before, creditors have all the bargaining power). If the sovereign rejects the offer the restructuring game ends, with the sovereign getting $y(1-\gamma)$ and creditors getting no debt repayment.[22] If the sovereign accepts the offer his payoff is $y - \hat{\eta}$ and creditors

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[22] An alternative end-game could be to let the sovereign revert back to uncoordinated renegotiations with creditors. The sovereign's payoff in that case would be unchanged but creditors'

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get $\hat{\eta}$. Creditors would then collectively concede a "haircut" of $\frac{D-\hat{\eta}}{D}$. The game is effectively the same as when all the debt is of type r: there is no meaningful difference, therefore, between mandatory collective action clauses and a bankruptcy regime (at this stage of our analysis).

Making debt easier to restructure does not always improve ex ante efficiency in our model. To see this, suppose that all debts are made renegotiable in one way or another (through mandatory collective action clauses or a bankruptcy regime). The benefit is that the deadweight cost of full defaults disappears. But the cost is that the period-1 investment decision is now distorted because of dilution. Under Assumption 2 dilution will be systematic in period 1. Thus, making debts easier to renegotiate increases welfare if and only if the deadweight loss from full defaults is larger than the welfare loss from dilution. That is if and only if:

$$\int_0^{\widetilde{D}_n/\gamma} \gamma y f(y) dy > \int_{\underline{V}}^g (g - V_1) h(V_1) dV_1.$$

One can construct examples in which this condition may be satisfied or not, so that the welfare benefits from facilitating renegotiation are ambiguous.

Making debt easier to renegotiate could also give rise to credit rationing in period 0. To see this, suppose that the country's pledgeable income is sufficient to finance the expenditure in one period only ($g < \gamma E(y) < 2g$). Then the sovereign cannot finance expenditure in period 0 because of the expectation of dilution in period 1. This is so even though investment might be more efficient in period 0 than in period 1 ($V_0 > V_1$). Our results are summarized in the following proposition.

Proposition 6 *Assume that a bankruptcy regime coordinates all the creditors in a sovereign debt restructuring renegotiation. Then welfare could be higher or lower than under laissez-faire, and in general remains strictly below the (com-*

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payoffs could be higher, with n-creditors again benefiting from their higher de facto seniority.

mitment) first-best level.

Proof. See discussion above. ∎

8.2 Establishing seniority

Facilitating debt renegotiations produces ambiguous effects because renegotiation does not address the underlying source of inefficiency: the non-exclusivity problem and the "race to seniority". Sovereigns have an incentive to bias their debt structure towards hard debt that is difficult to renegotiate as a way of achieving *de facto* seniority and thus limit the extent of debt dilution. A sovereign engages in this form of inefficient debt structuring because there is no easy way of implementing seniority *de jure*. Replacing *de facto* seniority prevailing under laissez-faire with *de jure* seniority could increase welfare. In our model a time-based priority rule where early lenders (who have lent in period 0) are senior to later lenders (who are lending in period 1) would lead to a Pareto improvement.

For concreteness, consider the restructuring procedure described in the previous section with the following modification: the repayment $\hat{\eta}$ the sovereign agrees to is distributed among creditors according to absolute priority, with priority based on a first-in-time issuance rule. That is, for a given debt $D = (D_{02} + D_{12})$, the holders of the debt claim D_{12} would not recover anything out of the agreed repayment $\hat{\eta}$ until the holders of the debt D_{02} are paid in full. The enforcement of this rule would entirely eliminate the sovereign's incentives to dilute the outstanding debt at time $t = 1$ so that the first-best outcome is implementable.

Proposition 7 *A bankruptcy regime that enforces a time-based de jure priority rule allows the sovereign to achieve an optimal debt structure, which puts its welfare at the (commitment) first-best level.*

Proof. See the discussion above. ∎

Two important further points can be made in our model. First, the optimality of the bankruptcy regime does not rely on any violation of sovereign immunity. Indeed, such a bankruptcy mechanism would not need to be endowed with more enforcement powers on the sovereign debtor than we have assumed so far. Conditional on a total repayment γy, the sovereign would have no reason to object to the enforcement of this seniority rule, which does not affect domestic welfare. The bankruptcy mechanism's statutory powers are only applied to the the n-creditors who have lent in period 1 and who lose their de facto seniority.

The second observation is that the optimal seniority rule would be difficult to implement contractually. To see this, suppose that the period-0 r-lenders add a clause specifying that their debts are senior to all future debts. Such a clause would provide protection against dilution by future r-lenders but would be ineffective against dilution by n-debt, since the n-creditors are not included in a future restructuring agreement. Thus, *de jure* seniority is trumped by *de facto* seniority if it is not supported by a statutory regime that forces all creditors to participate in a restructuring.[23]

The highly simplified procedure outlined above is an idealization that works in the context of our simple model. Real world sovereign debt restructurings are, of course, much more complex. A difficult policy issue is how to actually structure a sovereign debt restructuring procedure in practice. This problem is taken up in depth in Bolton and Skeel (2004), who discuss a detailed proposal specifying how a restructuring procedure might be initiated, how different

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[23] In addition, a statutory mechanism may dominate the contractual approach even if there is no n-debt. Contracting on the form of restructuring (in other words, on the division of the pie among creditors in a restructuring) is tantamount to letting the creditors set up a bankruptcy scheme contractually, a form of "sovereign pre-pack". It is a well-known result in corporate bankruptcy theory that a legal bankruptcy institution may do no better than an optimal pre-pack, if complete contracts are possible. But there are several reasons why it would not be easy to set up and enforce a sovereign debt pre-pack. In particular, decentralized contractual pre-packs are likely to involve larger transaction costs than a single statutory bankruptcy regime. In section 9.1 we actually develop a formal argument along these lines, namely that making the first debt contract contingent on the second contract—a form of pre-pack—is dominated by a bankruptcy institution with a seniority rule, due to the higher cost of monitoring.

creditor classes should be formed, how a restructuring plan is determined and approved, under what conditions additional lending can be granted, and how the agreement can be ultimately enforced (see also Schwarcz, 2000 and 2004; and Krueger and Hagan, 2005).

9 Extensions

Another way in which the sovereign could forestall dilution is by issuing short-term debt. Short-term creditors cannot be diluted as they get to roll over their debts at terms that reflect the dilution of their claims. Can short-term debt financing then be a substitute for de jure seniority? This section shows that this is not the case if it is costly to monitor the sovereign (subsection 9.1) or if short-term debt raises the risk of default (subsection 9.2). This section also presents an extension of the model in which it may be optimal to suspend the time-based seniority rule in a default, which further strengthens the case for a statutory approach to sovereign debt restructuring (subsection 9.3).

9.1 Short-term debt with monitoring

In this section we introduce short-term debt into the model, and show that it is not an effective tool to forestall dilution if monitoring the sovereign's debt issues is costly for the lenders. Without any loss of generality we restrict attention to renegotiable debt (and drop the subscript r to alleviate the notations).

Thus, suppose that the sovereign issues short-term debt in period 0, D_{01}, to be rolled over in period 1. The debt is repaid in period 1 with the proceeds of a new debt issue in period 1, D_{12}. We assume that the sovereign does not default in period 1, so that the interest rate on the debt issued in period 0 is equal to 0 ($D_{01} = g$). To keep the analysis as simple as possible, we consider an equilibrium in which expenditures g are efficient and the sovereign finances them in both periods $t = 0, 1$. The sovereign, thus, issues D_{01} and D_{02} in period

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0, and D_{12} in period 1.

In period 1 the sovereign must raise $2g$ in the debt market (g to refinance the short-term debt coming to maturity, plus g for the new expenditure). The key difference with our previous analysis is that the sovereign borrows from the two lenders at the same time, which removes the dynamic consistency problem that underpinned our previous results.[24]

To be able to forestall dilution, however, short-term lenders must have complete information on the sovereign's overall debt obligations. This may require continuous costly monitoring on their part. We capture this observation in our model by assuming that period-1 lenders can make two types of bids: with monitoring, and without monitoring.

A lender who does not monitor makes non-contingent bids, as before. In contrast, a lender who monitors can make her offer contingent on the sovereign's overall debt. More formally, a bid with monitoring consists of a repayment function $D(\theta', D')$ where θ' and D' are respectively the type and repayment on the debt contract with the other lender. Allowing for such bids removes the second kind of contractual incompleteness that we have assumed so far (non-exclusivity).

We make the trade-off between monitoring and non-monitoring debt contracts non-trivial by assuming that monitoring involves a cost, denoted by μ. Thus a lender offering a monitoring contract will request a higher expected payoff, $g + \mu$, than a lender offering a contract with no monitoring. We think that monitoring costs are a realistic assumption to introduce in this context. Whereas in our simple model monitoring occurs only once, real world short-term creditors would have to continuously monitor the sovereign's debt issues

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[24] The same outcome could be achieved, in our model, by assuming that the sovereign raises $2g$ in period 0 and puts aside one g to spend in the following period. However, having the sovereign borrow upfront for all its future needs would not be a viable solution in a model with a more general dynamic structure.

in order to forestall dilution.[25]

The costly monitoring by short-term creditors could be avoided by the institution of a cheaper form of monitoring through a bankruptcy regime with de jure seniority. Although a bankruptcy court would still have to incur the costs of establishing the sovereign's overall debt obligations in the event of default, the bankruptcy regime would nevertheless be more cost efficient. To see this, we make the extreme assumption that the bankruptcy regime's debt certification cost (in period 2) is the same as to the sum of the monitoring costs for the two short-term lenders: $\mu_{CB} = 2\mu$. This assumption is extreme as it does not account for the court's special powers in gathering information, nor does it account for the duplication of costs by short-term lenders, which a bankruptcy court could avoid. Despite this assumption, however, we are able to establish the following result.

Proposition 8 *Assume that short-term creditors must pay a monitoring cost to observe the debt issuances of the sovereign. If the monitoring cost is non-zero, a bankruptcy regime with de jure seniority dominates laissez-faire with short-term debt.*

Proof. See the appendix. ∎

The laissez-faire equilibrium can be of two types, depending on the level of the monitoring cost. If μ is lower than a threshold $\overline{\mu}$, the sovereign issues short-term r-debt in periods 0 and 1. The lenders monitor the debt structure in period 1, so that the sovereign's welfare is reduced below the first-best level by the total cost of monitoring, 2μ. Even though we assumed that it had no comparative advantage in terms of monitoring, a bankruptcy regime offers a more efficient way of mitigating dilution, because its monitoring cost is paid only if there is a default. If μ is larger than $\overline{\mu}$, the laissez-faire equilibrium is

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[25] This insight can be formally established in an extension of our model with infinite time. The details are available upon request to the authors.

the same as in Proposition 5 (the sovereign issues long-term n-debt in period 0).[26]

9.2   Short-term debt with default risk

The analysis in the previous section was premised on the assumption that the sovereign does not default in period 1 on its short-term debt. We now consider the case where the sovereign can default in period 1, and show that the thrust of our results is preserved even if there are no monitoring costs.

The debt is repaid in period 1 out of first-period output y_1 and/or the proceeds of any new debt issued in period 1, D_{12}. As before, we assume that the sovereign chooses not to default in period 1 as a way of avoiding a default cost γy_1, and also that short-term creditors have all the bargaining power in any debt restructuring. Hence short-term creditors receive γy_1 in a default (on r-debt). In addition as seems realistic, we assume that the sovereign cannot finance the expenditure g in period 1 following a default on its debt issued in period 0.

To keep the analysis as simple as possible, we consider an equilibrium in which y_1 and $V_1 > g$ are known in period 0, and the sovereign finances the expenditure g in both periods $t = 0, 1$. The sovereign, thus, issues $D_{01} = g$ in period 0, D_{12} in period 1, and does not default in period 1. The equilibrium condition for D_{12} then is,

$$2g = y_1 + \int_0^{D_{12}/\gamma} \gamma y f(y) dy + D_{12} \int_{D_{12}/\gamma}^{+\infty} f(y) dy, \tag{8}$$

(recall that y refers to second period output). This equation says that the

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[26] Short-term debt is not the only form of repeated interaction between the sovereign and period-0 creditors, and the basic insight of our analysis above carries over to other settings. For example, a sovereign having issued long-term r-debt in period 0 could try and renegotiate the repayment of this debt under the threat of dilution in period 1. An efficient and costless negotiation would avoid the issuance of n-debt in equilibrium and thus implement the first-best. However, if renegotiation involves monitoring costs (to verify that the sovereign is not issuing n-debt in period 1) the basic trade-off is essentially the same as in the case of short-term debt financing with monitoring.

new expenditure g and the rollover of the short-term debt D_{01} are financed by output y_1 and by issuing new short-term debt D_{12}. The value of D_{12} is, of course, rationally anticipated in period 0.

It is easy to see that if the sovereign can finance the expenditures with short-term r-debt in both periods, the (commitment) first-best is achieved. The short-term debt coming to maturity in period 1 cannot be diluted by r-debt or n-debt. This implies that the expenditure is financed in period 1 only if it is efficient $(V_1 > g)$.

The question is whether it is possible for the sovereign to finance the expenditures with short-term r-debt in both periods. This is the case if the sovereign does not default in period 1, that is if

$$V_1 + \int_0^{D_{12}/\gamma} (1-\gamma)y f(y) dy + \int_{D_{12}/\gamma}^{+\infty} (y - D_{12}) f(y) dy \geq (1-\gamma)y_1 + \int_0^{+\infty} y f(y) dy.$$

This incentive condition may not hold if the default cost γy_1 is too small. Using (8), one can see that the incentive condition is satisfied if and only if $\gamma y_1 \geq 2g - V_1$. We summarize the above discussion in the following proposition.

Proposition 9 *Assume that the sovereign can default on its short-term debt in period 1, at an output cost of γy_1. The first best is achieved if the sovereign can finance the expenditure g in $t = 0$ with short-term r-debt that is rolled over in period 1. This is possible only if and only if the cost of default in period 1 is large enough: $\gamma y_1 \geq 2g - V_1$.*

Proof. See discussion above. ∎

When y_1 is risky it is even harder to efficiently forestall dilution by issuing short-term debt, as the sovereign would default on its outstanding debt in period 1 whenever there is a sufficiently negative output shock in that period. Thus, the main insight from this analysis is that a strategy of forestalling dilution by relying on short maturity debt has some limits, and may come with a cost in

terms of financial fragility. As a result, the sovereign may issue long-term debt even if this creates incentives for debt dilution and overborrowing in the future.

9.3 Optimal dilution

One concern one might have with the strict enforcement of a time-based priority rule is that it may give rise to a debt overhang problem and put the sovereign in a position ex post where it cannot borrow to finance valuable investments because it has already accumulated too much debt. As a way of reducing this risk it may, thus, be desirable to allow for some debt dilution.[27] Alternatively, it may be desirable to allow for deviations from an absolute priority rule under the sovereign bankruptcy regime, as is the case in corporate bankruptcy. We explore this idea in this section by assuming that dilution can help the sovereign to finance a solvency-enhancing policy action in times of financial distress. For simplicity, suppose that y is observed one period ahead, so that creditors know whether the sovereign is going to default in period 1. Instead of an expenditure g we shall allow the sovereign to take an action in period 1 that can reduce the negative impact of a default on the domestic economy. This action increases domestic output by $(\alpha + \beta)y$ in period 2, but requires an expenditure of αy in period 1. To keep the analysis as simple as possible, we assume that this increase in domestic output cannot be pledged in repayment to foreign creditors. We further assume that the country is not able to finance the new expenditure with period 1 output, so that it has to borrow αy in period 1.

If the bankruptcy court gives absolute priority to the period 0 lenders, then the sovereign cannot raise any new funds in period 1. For the country to be able to finance the welfare-enhancing expenditure in period 1, the bankruptcy regime would have to violate the seniority of early lenders. Thus, suppose that

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[27]Diamond (1993) presents a model in which dilution plays a useful role as a buffer against negative shocks.

the bankruptcy court grants a higher level of seniority to new lenders in order to borrow αy. Under this assumption the country's budget constraint and ex ante welfare are given by respectively

$$g = (1 - \alpha) \int_0^{\frac{D_{02}}{\gamma}} y f(y) dy + D_{02} \int_{\frac{D_{02}}{\gamma}}^{+\infty} f(y) dy,$$

and

$$U_0 = V_0 - g + E_0(y) + \beta \int_0^{\frac{D_{02}}{\gamma}} y f(y) dy.$$

The expected cost of dilution arising from the new priority lending in period 1 is captured in the term in α in the first equation. Because of this cost the sovereign must promise a larger D_{02} to finance the same g, and therefore faces a higher probability of default (for the same level of borrowing g). The second equation captures the welfare benefit of dilution (the term in β). As the second equation makes clear, as long as β is positive it is preferable to allow for dilution or to grant higher priority to new lenders in period 1.

Proposition 10 *It may be optimal for the bankruptcy court to grant seniority to post-default lenders over pre-default lenders.*

Proof. See discussion above. ■

The right to grant higher priority to new lenders given to a bankruptcy court is essentially the same as the right to grant debtor-in-possession lending in corporate bankruptcy regimes. Note that the original creditors suffer from the dilution so they would never vote for it if given the opportunity. The optimal conditional dilution policy cannot, therefore, be implemented simply by coordinating creditors ex post. The court must be granted the discretionary power of deviating from the absolute priority rule.[28]

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[28] However, this could introduce a distortion if the court puts more weight on the welfare of the debtor country than on the welfare of the creditors. Discretionary dilution, then, would be too lenient for the debtor.

10 Concluding comments

We have shown that under *laissez faire* equilibrium sovereign debt structures
are likely to be inefficient. In the absence of any seniority rule sovereigns have
an incentive to dilute outstanding debt that is relatively easy to restructure by
issuing debt that is hard to restructure. At the same time, if debt markets
anticipate such dilution, sovereigns may also have an incentive to issue hard-
to-restructure debt as a way of forestalling future dilution. Our analysis, thus,
does not support the Panglossian view that sovereign debt contracts are efficient
ex ante and that there is no scope for welfare-improving reforms. Our model
mainly points in the direction of policy interventions that aim to enforce an
absolute priority rule for sovereign debt, and highlights potential weaknesses of
recent policies towards facilitating restructuring directly by inserting collective
action clauses into bond contracts.

We think that this line of analysis could be pushed in several directions of
future research. First, it would be interesting to see how the analysis would be
affected if we allowed debt to be traded in the secondary market. It would then
be conceivable that n-debt can be turned into r-debt (if it is purchased by large
investors), or conversely that r-debt is turned into n-debt (if it is purchased
by small "vulture funds"). If this transformation can be achieved costlessly
through transactions in the secondary markets, the two types of debt should
have the same price in equilibrium, which—we conjecture—would still lead to
an excessive level of n-debt, since all the debt is likely to end up in the hands
of n-creditors who can better protect themselves against dilution.

Second, our analysis has ignored the role of official lending to sovereigns in
default. The perceived difficulty of restructuring sovereign debt was one reason
why the international community has sometimes resorted to large "bailouts" to
resolve sovereign debt crises. On the one hand, this lending may be a way of

avoiding the deadweight loss of full defaults associated with n-debt, but it may also lead to debtor moral hazard. On the other hand, if the official sector is senior to the private creditors, official lending could also be viewed as a form of dilution—which could be used, in the context of a debt restructuring agreement, as a form of debtor-in-possession lending.

Finally, although a 3-period time structure is useful to keep the analysis tractable, it would be interesting to quantitatively estimate the impact of the reforms considered in this paper in a calibrated dynamic general equilibrium model of sovereign debt. We leave these issues for future research.

APPENDIX

Proof of Proposition 4

An equilibrium with pure r-debt does not exist if and only if $\widetilde{D}_n < \widehat{D}_r$, that is if the interest rate is lower on n-debt after the sovereign has issued r-debt. $\widetilde{D}_n$ must be smaller than $\widehat{D}_r$ if replacing $\widetilde{D}_n$ by $\widehat{D}_r$ in (6) raises the RHS (otherwise $\widetilde{D}_n$ would not be the smallest solution to (6)). Thus a sufficient condition for $\widetilde{D}_n \leq \widehat{D}_r$ is

$$\widehat{D}_r \int_{\widehat{D}_r/\gamma}^{+\infty} f(y)dy > g = \int_0^{2\widehat{D}_r/\gamma} \frac{\gamma y}{2} f(y)dy + \widehat{D}_r \int_{2\widehat{D}_r/\gamma}^{+\infty} f(y)dy,$$

or

$$\widehat{D}_r \int_{\widehat{D}_r/\gamma}^{2\widehat{D}_r/\gamma} f(y)dy > \int_0^{2\widehat{D}_r/\gamma} \frac{\gamma y}{2} f(y)dy.$$

This can also be written $m(\widehat{D}_r/\gamma) > 0$, where $m(\cdot)$ is the function: $x \mapsto x \int_x^{2x} f(y)dy - \int_0^{2x} \frac{y}{2} f(y)dy$. We have $m'(x) = \int_x^{2x} (f(y) - f(x))dy$, which is positive if $f(\cdot)$ is increasing and negative if $f(\cdot)$ is decreasing. Thus, if $f(\cdot)$ is increasing in the interval where default occurs under pure r-debt, $[0, 2\widehat{D}_r/\gamma]$, then $m(\cdot)$ is increasing in the interval $[0, \widehat{D}_r/\gamma]$ which, together with $m(0) = 0$, implies $m(\widehat{D}_r/\gamma) > 0$. Hence, Assumption 1 implies $\widetilde{D}_n < \widehat{D}_r$.

Proof of Proposition 8

We characterize the equilibrium of the debt market in $t = 1$, assuming that the sovereign must borrow $2g$ from two lenders. There is a large number of lenders of type r and type n who can make bids with or without monitoring. First, consider the equilibria without monitoring. The possible bids are the same as in Section 4: $\widehat{D}_r$, $\widehat{D}_n$, $\widetilde{D}_r$ and $\widetilde{D}_n$. There is no equilibrium without monitoring in which the sovereign borrows from two n-lenders (in such an equilibrium, an r-lender can make a bid D_r that will be preferred by the sovereign, as shown in the proof of Proposition 3). Similarly, there is no equilibrium without monitoring in

which the sovereign borrows from two r-lenders (an n-lender could offer a better bid, as shown in the proof of Proposition 4). So the only possible equilibrium without monitoring is the same as in Proposition 4, with a mixed debt structure $(\widetilde{D}_r, \widetilde{D}_n)$. In such an equilibrium the sovereign's welfare is:

$$U_0 = V_0 + V_1 - 2g + E(y) - \int_0^{\widetilde{D}_n} \gamma y f(y) dy. \tag{9}$$

Next, consider bids with monitoring. Under perfect competition, each lender just breaks even in equilibrium and therefore receives an expected payoff equal to g plus the cost of monitoring μ. We then have four equations that implicitly define equilibrium bid functions $D_\theta(\theta', D')$; one for each pair (θ, θ').

The mixed debt structure without monitoring, $(\widetilde{D}_r, \widetilde{D}_n)$, is an equilibrium if lenders do not gain by deviating and offering bids with monitoring. In an equilibrium with monitoring, the lenders' participation constraint is binding and the sovereign's welfare will be given by,

$$U_0 = V_0 + V_1 - 2g + E(y) - \int_0^{D_n} \gamma y f(y) dy - m\mu, \tag{10}$$

where $m = 1, 2$ is the number of monitoring bids accepted by the sovereign. This payoff can be higher than (9) only if $D_n < \widetilde{D}_n$. This implies that all the debt is renegotiable ($D_n = 0$) since a n-lender cannot break even with less than $\widetilde{D}_n$. Both creditors, therefore, must be of type r. In addition, they must both monitor, since if one did not, an n-lender could make a profitable bid with no monitoring. The sovereign's welfare when it borrows from two r-lenders who each incur monitoring costs μ is therefore given by (10) with $D_n = 0$ and $m = 2$,

$$U_0 = V_0 + V_1 - 2g + E(y) - 2\mu. \tag{11}$$

This payoff is higher than (9) if and only if,

$$\mu \leq \overline{\mu} \equiv \frac{1}{2} \int_0^{\widetilde{D}_n/\gamma} \gamma y f(y) dy. \tag{12}$$

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In sum, the equilibrium must be of one of two kinds: either a mixed debt equilibrium $(\widetilde{D}_r, \widetilde{D}_n)$ with no monitoring, or a pure r-debt equilibrium with monitoring.

Suppose that there are always at least two r-lenders in the market who make bids with monitoring.[29] Then the equilibrium is unique and depends on the monitoring cost as follows: (i) if $\mu \leq \overline{\mu}$, all the other r-lenders make bids with monitoring and the sovereign borrows from two of them; (ii) if $\mu > \overline{\mu}$ all the other r-lenders bid $\widetilde{D}_r$, all the n-lenders bid $\widetilde{D}_n$, with no monitoring in both cases, and the sovereign borrows from one lender of each type.

Finally, suppose that the optimal bankruptcy regime with seniority is established, and costs 2μ to the sovereign conditional on a default. Then the sovereign's ex ante welfare is equal to the first-best level minus the expected cost of the bankruptcy regime,

$$U_0 = V_0 + V_1 - 2g + E(y) - 2\mu \int_0^{2\widehat{D}_r} f(y)dy.$$

This is higher than the RHS of (11). The optimal bankruptcy regime, therefore, yields a higher level of ex ante welfare than short-term debt with monitoring.

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[29] This ensures that borrowing from two monitoring r-lenders is always an option for the sovereign. Without this assumption, there would always be an equilibrium with no monitoring, since an individual r-lender cannot gain from deviating and offering to monitor alone if no other r-lender offers to monitor.

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Figure 1. The repayment game in period 2

Payoffs

	Sovereign	r-creditors	n-creditors
No Default	$y - D_n - D_r$	D_r	D_n
Partial Default	$y - D_n - \eta$	η	D_n
Full default	$(1-\gamma)y$	0	0

Sovereign

repays → No Default

defaults → r-creditors ask η

sovereign accepts → Partial Default

sovereign rejects → Full default