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The contractual approach to sovereign debt restructuring

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Abstract

The contractual approach proposes the introduction of clauses in sovereign debt contracts to address a number of inefficiencies in sovereign debt markets. Two of its central innovations are collective action clauses and seniority clauses. This paper analyses these two clauses when: (1) repayment is endogenous and depends on creditor lobbying effort; (2) litigation for full repayment does not increase the payment to be extracted from the creditor. There is a positive externality of effort that strongly interacts with asset distribution and contractual clauses. Individual litigation is not desirable from the creditors' point of view since it weakens the incentives to exert effort. Collective action clauses block litigation and maximise repayment, especially when creditors are heterogeneous in the amount of debt they hold. The adoption of seniority clauses modifies the incentives to exert effort and thus repayment. This effect can be positive or negative. If average portfolio sizes are similar but the marginal loan being repaid is unevenly distributed among creditors, repayment falls. Since effort decisions are influenced by asset distribution, the paper also identifies and analyses a novel role for secondary markets.

Key words: Sovereign debt, collective action clauses, seniority clauses, secondary markets.

JEL classification: F33, F34.

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Summary

The resolution of sovereign debt defaults is a complex process. For instance the last Argentine default took four years to settle and over 140 lawsuits were filed against the sovereign. In order to lessen these problems, the international community has been discussing the so-called ‘contractual approach’ to sovereign debt crises. In short, this approach suggests that debt contracts should include additional provisions to facilitate the resolution of defaults. Two of its main innovations are collective action clauses (CACs) and seniority clauses (SCs). A CAC is a supermajority voting rule to change the payment terms of a contract. For example, 75% of creditors could impose a decision on a dissenting minority; in the absence of CACs unanimity would be required. Their policy purpose is to improve creditor co-ordination. SCs establish a priority rule to repay debts in the event of a default: junior debt is not repaid until senior debt has been repaid in full. Without SCs, all debts have the same footing. This opens the door to debt dilution and could yield under or overborrowing.

Previous work has studied CACs and SCs assuming that the amount creditors recover after a default does not depend on their actions. Instead, the focus has been on the decisions taken by the debtor (for instance regarding fiscal policy). This paper shows that creditor incentives also respond to changes in the debt contract.

In this paper, the two main elements the creditors have control over are lobbying efforts and litigation for full repayment. As regards the first element, each creditor can put individual lobbying effort to extract more repayment from the sovereign. At a later stage, creditors can also litigate for full repayment. In the model, these lawsuits do not extract more money from the sovereign, they just affect the distribution of repayment that results from lobbying efforts. Both lobbying and litigation suppose a private cost for an individual creditor engaging in either activity.

The first result that follows from this framework is that individual lobbying effort has a positive effect on other creditors (an externality): repayment increases with effort and since it is shared among all creditors according to the contract, all creditors benefit from individual lobbying. The size of creditors is one key determinant of the decision to exert effort: small creditors do not

lobby but large creditors do. If a creditor is small, the small fraction of repayment they will receive would not compensate them for the cost of lobbying. The opposite is true of a large creditor.

CACs are also important for effort decisions. If some creditors litigate for full repayment, the rest of the creditors will receive a lower payment and will thus have a weak incentive to incur the lobbying cost. Without CACs, nothing can block the litigators, but in the presence of CACs a coalition of creditors can stop a minority from going to court. Then, CACs have the property of maximising repayment after a sovereign default.

SCs change the incentives to lobby for repayment. Without SCs, all debts have the same priority to recoup repayment and, as explained above, the size of the creditor determines effort. With seniority, a creditor that is holding junior debt may have little incentive to lobby (independently of their size) because repayment will in any case go to senior debts. If these senior loans are big, there would be nothing left for the junior creditor. Then, to avoid low repayment under SCs, creditors not only have to be relatively large but also hold the right mix of junior and senior debt.

The properties of CACs are reinforced when sovereign debt can be traded in the secondary market. Without CACs, creditors are likely to use secondary markets to buy cheap debt and litigate for full repayment. With CACs, litigation is avoided and creditors use secondary markets to buy up enough debt to make lobbying profitable from an individual perspective.

It is worth stressing that this paper does not derive any welfare implications of CACs and SCs. Welfare cases can be made for and against high repayment. If a sovereign has limited access to capital markets, higher repayment in the event of a default could relax the borrowing constraint *ex ante*. In contrast, low repayment could be desirable if a country has been hit by an exogenous shock such as a natural disaster.

To sum up, this paper argues that not only debtor incentives change with innovations in sovereign debt contracts, creditors also respond to new contracts and affect debt repayment. Therefore, it is important to assess the likely response of both debtors and creditors to policy measures aimed at reducing the complexity of sovereign debt renegotiations.

1 Introduction

Debt restructuring following default is a costly and complex process very often undermined by a host of inefficiencies in bargaining (see Rogoff and Zettelmeyer (2002)). The Argentinian episode is a striking example: renegotiation involved a very diffuse base of creditors with a wide range of interests. The result was an expensive and slow restructuring process that went on for four years. As of today, approximately US$20 billion in bond capital remains in default.[1]

This evidence has led many to argue that there is a strong case for reforming the sovereign debt market. This desire for reform has yielded a proposal generically called the contractual approach which is the object of study of this paper.[2] The contractual approach addresses the inefficiencies by introducing new clauses in debt contracts. Two of its central innovations are collective action clauses (CACs) and seniority clauses (SCs). In order to improve creditor co-ordination and avoid the holdout problem, CACs allow a contractually defined supermajority of creditors to impose decisions on a dissenting minority instead of waiting for unanimity. It is a choice of the debtor whether to include CACs in debt contracts. In recent years, almost every new issue featured CACs: 57% of outstanding sovereign debt includes CACs and in 2005, 95% of issues, in value, included CACs.[3] In order to prevent debt dilution,[4] SCs establish a schedule of repayment priorities in the event of default. In contrast with CACs, SCs have never been formally implemented in sovereign debt markets. Nevertheless, we do observe debtors granting *de facto* seniority to creditors such as the IMF.

The goal of this paper is to provide an analytical debt renegotiation framework capable of evaluating the two proposals above to give guidance on the shape of an optimal restructuring regime. This is not the first paper to address this issue but the existing literature has researched the topic under the assumption that penalties such as market exclusion or trade sanctions are independent of creditor actions.[5] Instead, I propose a new theory of endogenous repayment in

[1] American Task Force Argentina, September 2007.

[2] The alternative is the so-called statutory approach that, in short, involves the creation of international laws and institutions akin to those regulating domestic bankruptcy (Hagan (2005) and (Krueger (2001)). For a comprehensive discussion of both approaches see Roubini and Setser (2003), Bolton (2003), Taylor (2001) or Eichengreen (1999).

[3] Data as of 23 January 2006 from *IMF Global Financial Stability Report*, April 2006.

[4] Debt dilution occurs when new loans reduce the value of the outstanding stock of debt. The *IMF World Economic Outlook*, September 2003, reports evidence of such a failure in emerging economies. The use of principal reinstatement clauses, providing an automatic upward revision of principal in the event of default, reflects the concern about debt dilution.

[5] Papers such as Haldane *et al* (2005a) and Eaton and Fernandez (1995) make penalties endogenous to the sovereign's fiscal effort but

which incentives to increase penalties are shaped by asset distribution among creditors and contractual clauses. Penalties are the fruit of creditors' private lobbying and bargaining efforts but their provision carries a positive externality to all creditors, which parallels the well-known problem of public goods provision. Understanding how CACs and SCs affect this externality is important to assess their desirability in real world situations.

Consider first the use of CACs. The existing literature makes a case for CACs based on the need to force small creditors, who are not internalising the effects of their actions on the debtor's incentives, to participate in debt forgiveness agreements.[6] This paper emphasises the role of CACs in shaping intracreditor incentives. I argue that CACs also address another type of free-rider behaviour that could be welfare decreasing in some cases. More precisely, I allow creditors to follow a holdout strategy by seeking full repayment through courts at the expense of a large fixed cost.[7] In the model, litigation does not increase repayment. It is modelled as a purely redistributive activity. If not all creditors are large enough to afford legal costs, litigation will interfere with the incentives of small creditors who have lobbying skills. In this setting, the redistribution of resources through litigation magnifies the externality of lobbying effort, undermines the incentives to lobby, and results in an endogenously low level of repayment. CACs are very powerful in this environment. Not only are they able to avoid the waste of legal costs, but they also ensure maximum repayment. CACs have these properties as long as legal costs are large relative to lobbying costs. The purely redistributive litigation assumption is strong but the appendix shows that this result survives in a model where litigation moderately increases repayment but is still partially redistributive.

SCs have been typically studied under the implicit assumption that *ex-post* repayment is not sensitive to the shift from pro-rata clauses to SCs.[8] The literature supports the idea that SCs are unambiguously desirable since they are shown to prevent *ex-ante* overborrowing and assumed to be completely neutral *ex post* (Eaton and Fernandez (1995)). However, under endogenous repayment, this conclusion need not necessarily hold since pro-rata and SC contracts provide different incentives to exert lobbying effort. Following the adoption of SCs, *ex-post* repayment

never to creditor actions.

[6]Bolton and Jeanne (2005) and Weinschelbaum and Wynne (2005) are examples of papers modelling CACs as a device to achieve co-ordinated debt forgiveness.

[7]This strategy was relatively common in the recent case of Argentina: 140 lawsuits were filed against the sovereign.

[8]With pro-rata clauses, all loans have the same footing in the event of default.

might fall under certain portfolio configurations (specifically, when all creditors are relatively large but the marginal loan being repaid is not evenly distributed among them). In turn, this would exacerbate the temptation to default. As a result, the *ex-ante* borrowing constraint would be tighter and interest rates would be higher. These two effects have a negative impact on welfare that could offset the gains derived from the prevention of overborrowing.

The introduction of secondary markets in this framework yields interesting results. Consistent with the empirical evidence, I find that, if CACs cannot be used to block legal actions, vulture funds buy debt in the secondary market to litigate for full repayment. As discussed above, this reduces the incentives of small creditors to lobby. However, if CACs are preventing such behaviour, secondary markets unambiguously increase repayment. By trading debt, creditors can adjust the size of the effort externality so as to elicit full effort and maximise repayment both under pro-rata and SC contracts. Thus, secondary markets validate the simplifying assumption of no *ex-post* effects of SCs used in previous literature.

All the results in this paper rest on the assumption that penalties are endogenous to creditors' lobbying actions. It is therefore important to justify the plausibility of lobbying for higher repayment. Although it is difficult to provide hard evidence of such lobbying activities taking place, facts pointing to debt concentration devices and debt value increasing with creditor concentration lend support to the theory. First, Fernandez and Ozler (1999) and Ozler and Huizinga (1991) document that in the period 1986-88, the secondary market value of developing country loans rose with the share of debt held by large international banks relative to small banks. This is consistent with the predictions of the model: large banks enjoy a large amount of lobbying power and, as their share in the debt issue increases, their incentive to exert lobbying effort strengthens. Since this increases the recovery rate in the event of default, the secondary market price of the loan will rise. Second, I would argue that organisations such as the Emerging Markets Creditors Association, the London Club, or the historical Corporation of Foreign Bondholders[9] are important organisations that play key roles in debt restructuring. At the same time, they can be characterised in terms of being creditor lobbying organisations to increase the leverage of creditors on a sovereign debtor. Also, a creditor committee can be interpreted as a device to share the lobbying costs among a number of creditors to make bargaining more

[9]In the recent case of Argentina, several organisations of that sort arose (Task Force Argentina, Global Committee of Argentina Bondholders, and Argentine Bond Restructuring Agency to cite a few).

affordable. For the pre-1914 period, Esteves (2007) finds that the presence of such bondholder committees is positively correlated with *ex-post* rates of return. This is consistent with the proposition that creditor committees have a certain degree of lobbying power.

Let us note that the results described above are entirely positive. A fully-fledged normative analyisis of the contractual approach would require endogenous debt issuance and a well-defined welfare function. This paper describes which debt contracts deliver maximum repayment but welfare cases can be made for and high repayment. For instance, in a set-up like Eaton and Fernandez (1995) where penalties are random and there is no other source of uncertainty, it is optimal to maximise repayment since then the contractual interest rate is lower and the debtor can raise more funds. In contrast, the opposite recommendation can arise from risk-sharing considerations since low output realisations call for low repayment in order to smooth consumption.

The rest of the paper is organised as follows. The next subsection reviews the related literature. Section 2 lays out the basic set-up. Section 3 considers the effects of CACs and SCs. The role of secondary markets is explored in Section 4. Section 5 concludes. The appendix contains extensions of the model and proofs.

1.1 Related literature

The few papers pursuing an analytical approach to debt restructuring with CACs focus on debtor incentives in a debt overhang framework.[10] Weinschelbaum and Wynne (2005) analyse the interaction between CACs and government's fiscal incentives. They point to a trade-off between positive *ex-post* effects of debt reduction and negative *ex-ante* incentives to trigger a default that is cheaper when CACs allow *ex-post* forgiveness. Haldane *et al* (2005a) is the closest paper to my work. They develop a model where litigation interferes with the debtor's incentives to generate repayment resources. CACs solve the inefficiencies by inducing the optimal effort on behalf of the debtor and discouraging litigation. In the present framework a parallel mechanism is at work on the creditors' side: litigation distorts the incentives of creditors to extract repayment

[10]See also Cohen and Portes (2004) that, despite not modelling an explicit voting rule, highlight the importance of CACs to prevent self-fulfilling crises. Yue (2005) and Ghosal and Miller (2003) also provide insightful discussions on debt restructuring.

from the debtor but CACs are able to optimise creditors' effort. Finally, Kletzer (2004) addresses the collective action problem in a framework based on risk-sharing arguments. In his model CACs guarantee efficiency by ruling out war of attrition games.

Regarding SCs, contributors to the ongoing debate such as Bolton and Jeanne (2005), Bolton and Skeel (2004), Borensztein *et al* (2004) and Roubini and Setser (2004), recommend the implementation of explicit seniority in sovereign debt contracts based on its desirable *ex-ante* effects. I show that SCs also have *ex-post* effects in a setting with endogenous penalties.[11] Taking into account *ex-post* considerations, the welfare effects of SCs are unclear. Preventing *ex-ante* debt dilution is clearly welfare improving. However, I show that *ex-post* repayment can either increase or decrease with the adoption of SCs. If repayment actually falls, there is also a negative welfare effect in the form of higher interest rates and tighter borrowing constraints.

The only paper linking secondary markets with debt enforcement is Broner *et al* (2009) who show that, even in the absence of penalties, secondary markets ensure enforcement by transferring claims to domestic agents to whom the debtor does not want to default. Alternatively, in the endogenous penalties framework secondary markets transfer claims to the agents most able to sanction the debtor. It is worth emphasising that this result only holds conditional on the presence of CACs. If holdouts are not deterred, secondary markets need not increase repayment.

2 A model of endogenous penalties

This section sets the core elements of the debt restructuring game. The sovereign has $J = 2$ outstanding loans of face values D_1 and D_2 held by I risk-neutral creditors.[12] Let $D \equiv D_1 + D_2$ denote the total outstanding debt. Without loss of generality, I normalise $D = 1$. α_i^j, $i \leq I$, $j \leq J$, denotes the share of loan j held by creditor i. $\alpha_i \equiv \frac{\alpha_i^1 D_1 + \alpha_i^2 D_2}{D}$ denotes the share of total face value held by creditor i. Every period the sovereign can default on its debt and trigger the sequence of events described in the model. I assume that intercreditor equity is strictly respected and default must be on both loans.[13]

[11] The corporate finance literature has dealt with the parallel question of the interaction between seniority and monitoring incentives. See for instance Park (2000) and Rajan (1992). Also in the corporate context, Bris and Welch (2005) derive the optimal number of creditors with an endogenous recovery rate but do not tackle the issue of voting rules, SCs or secondary markets. Moreover, there are a number of differences between corporate and sovereign defaults that limit the applicability of corporate finance results to sovereign default causes.

[12] All results generalise to $J > 2$ loans.

[13] Alternatively, the use of cross-default clauses by creditors also justifies the assumption.

Following one of the main strands in the literature, I assume that there will be partial repayment P induced by the threat of suffering default penalties such as limited access to capital markets, trade sanctions or asset seizure. The debtor always repays exactly up to P and penalties are never actually imposed.[14]

The main novelty of the model is to make penalties endogenous to creditors' lobbying effort. More specifically, all creditors simultaneously decide whether to exert a lobbying effort or not ($e_i = 0$ or $e_i = 1$). The individual cost of positive effort is $c > 0$. Contracts on effort cannot be written and enforced.[15] Contributions to penalties are aggregated according to the following function

$$P = \sum_{i=1}^{I} p_i e_i \tag{1}$$

where p_i is a non-negative parameter that is meant to capture the fact that bargaining power might differ across creditors. The existing literature has implicitly set $c = 0$ by assuming that penalties are exogenous to creditors. However, this paper shows that this is not a neutral assumption. Let $\overline{P} \equiv \sum_{i=1}^{I} p_i$ denote the highest feasible penalties. Consistent with real-world recovery rates, I assume that full settlement is not possible, ie, $\overline{P} < D$. Lobbying productivity and cost satisfy the following two properties.

Assumption 1 Lobbying productivity and cost are such that $p_i > c$ for all $i \leq I$.

Assumption 2 Lobbying productivity and cost are such that there exist portfolios $\{\alpha_i^1, \alpha_i^2\}_{i=1}^{I}$ satisfying $\alpha_i p_i \geq c$ for all $i \leq I$.

Assumption 1 assures that the net productivity of lobbying is positive and makes lobbying desirable from the creditors' standpoint. However, since contracts on effort cannot be written, assumption 1 is not enough to guarantee the feasibility of full effort. Note that lenders bear the full cost c but they might capture only a fraction of their contribution since P is shared according to contractual clauses and asset holdings. In other words, there is a positive externality of effort. Assumption 2 warrants that, for some portfolio configurations, all creditors will successfully internalise the effort externality and penalties will be maximised.

[14] P can be thought of as an upfront cash payment or, more realistically, as a new bond with present value P.

[15] It is straightforward to show that if effort is contractible, repayment is invariant to any of the contracts considered in this paper.

This model of endogenous penalties is the cornerstone of the paper and thus deserves some discussion. Traditionally, the sovereign debt literature has not put much emphasis on post-default events and exogenous penalties are the usual shortcut to summarise in a stylised way the bargaining process between the debtor, creditors and international financial institutions leading to a certain level of partial repayment. Nevertheless, on-the-ground experience shows that sovereign debt restructuring is a complex and protracted process. Undoubtedly, an exogenous cost of default is an ill-suited modelling instrument to explore the consequences of imperfect *ex-post* bargaining. Effort in equation **(1)** should be interpreted in a broad sense. It can represent direct negotiations with the debtor but can also be interpreted as the cost of lobbying third parties such as governments or banks providing trade credit to have them threaten the sovereign with further punishment if treatment to creditors is too harsh.

3 The contractual approach and creditor incentives

This section presents the main ideas of the paper by embedding the lobbying mechanism previously described into a game in which creditors can sue the sovereign for full repayment. Important interactions between litigation and the externality of effort arise and CACs are shown to play a central role in maximising repayment. Moreover, the choice of pro-rata or SC contracts also interacts with the externality of effort. From the creditors' perspective, two types of inefficiencies arise in this setting. First, even though the marginal productivity of effort p_i is larger than its marginal cost c, effort can be underprovided. Second, litigation costs are inefficiently spent on purely redistributive activities. To establish these results, let us first define every contractual clause and the timing of actions.

Debt contract

I shall consider two types of debt contracts specifying alternative rules to allocate repayment after default.

(i) *Pro-rata debt contracts*: both loans have the same priority in the event of default. Repayment is shared in proportion to the face value of loans. This means that loan D_1 recovers $\frac{D_1}{D}P$ and loan D_2 captures $\frac{D_2}{D}P$ where $D = D_1 + D_2$.

(ii) *Seniority clauses*: debt contracts with SCs specify a repayment priority scheme in the event of default. Repayment is first allocated to the most senior loan and, once it has been fully serviced, the remaining resources (if any) accrue to the junior loan. In the model D_1 is the senior loan and D_2 the junior loan. Therefore, D_1 recoups $\min\{D_1, P\}$ and D_2 the remaining amount $\max\{0, P - D_1\}$. Within a loan, payments are shared on a pro-rata basis.

For the time being, these contracts are not traded in the secondary market. In Section 4 I relax this assumption.

Timing

The sequence of actions is the following.[16] At every stage all choices are made simultaneously.

1. *Lobbying stage*

Creditors decide whether to exert the lobbying effort already described in Section 2 and P is determined. The game moves to the following stage.

2. *Restructuring stage*

Every creditor votes whether to change the payment terms of the debt contract or not. A favourable vote from creditor i is codified by $v_i = 1$ and a negative vote by $v_i = 0$. The result of the voting is summarised by the variable $V = \sum \alpha_i v_i$. If the contract is unchanged, a creditor with share α_i is still entitled to recoup α_i. In the case of pro-rata contracts, restructuring involves setting a new face value of P so that repayment to creditor i is lowered from α_i to $\alpha_i P$. For SC contracts, restructuring translates into a binding agreement to distribute repayment according to contractual priorities. I allow for a voting rule of the type: the contract is rewritten if at least a fraction $\overline{v} \in (0, 1]$ of bondholders vote in favour. $\overline{v} = 1$ corresponds to the standard debt contract in which unanimity is needed. When CACs are in place a supermajority $\overline{v} < 1$ of voters can impose any decision on a dissenting minority.[17] If the contract is restructured, the game ends and P is distributed among creditors according to the original contractual clauses. Otherwise, the game moves to the next stage.

3. *Litigation stage*

At this point the original debt contract is still unaltered and every creditor has the right to enforce

[16] Swapping stages one and two is qualitatively irrelevant since the key element of the model is the interaction between litigation and the externality of effort and not the specific timing.

[17] In real world cases, $\overline{v}$ is usually set in the range 0.75–0.85. See Haldane *et al* (2005b) for a discussion on optimal thresholds.

it by going to court. This action is represented by $l_i = 1$. The associated legal costs are $\phi > 0$. The contract explicitly specifies that repayment is $\alpha_i^j D_j$ and the court will recognise that. I assume that the resources available to the court are P, which means that the judicial system has no enforcement power on a sovereign. All that can be done by the judge is to redistribute the voluntary repayment P to litigators.[18] This is a reasonable assumption since sovereigns hardly ever hold attachable assets in the court's jurisdiction. Likewise, courts find it difficult to impose other penalties to the debtor (for instance, preventing the debtor from accessing capital markets in all jurisdictions is not feasible). The assumption also simplifies the exposition of the results. In Appendix A3, I show that essentially the same results follow from a model where courts can seize assets of moderate value.[19] Creditors not litigating have lower priority and collect their corresponding part of the remaining resources after litigators are paid out and in some cases might receive nothing. To put it in different words, creditors can buy seniority at price ϕ.

Let $L^j \equiv D_j \sum_{i=1}^{I} \alpha_i^j l_i$, $j = 1, 2$, and $L \equiv L^1 + L^2$. Then, the pay-off functions of creditor i with pro-rata contracts are

$$\pi_i(l_i = 0) = \begin{cases} \frac{\alpha_i}{1-L}(P - L) - ce_i & \text{if } P \geq L \\ -ce_i & \text{if } P < L \end{cases} \tag{2}$$

$$\pi_i(l_i = 1) = \begin{cases} \alpha_i - \phi - ce_i & \text{if } P \geq L \\ \frac{\alpha_i}{L} P - \phi - ce_i & \text{if } P < L \end{cases} \tag{3}$$

In the SC case I assume that the judge enforces the original seniority structure within the class of litigators. Pay-offs are

$$\pi_i(l_i = 0) = \begin{cases} \frac{\alpha_i^1}{1-L^1} \min\{D_1, P - L\} + & \\ + \frac{\alpha_i^2}{1-L^2} \max\{0, P - D_1 - L\} - ce_i & \text{if } P \geq L \\ -ce_i & \text{if } P < L \end{cases} \tag{4}$$

$$\pi_i(l_i = 1) = \begin{cases} \alpha_i - \phi - ce_i & \text{if } P \geq L \\ \alpha_i^1 D_1 + \frac{\alpha_i^2}{L^2}(P - L^1) - ce_i & \text{if } P \in (L^1, L) \\ \frac{\alpha_i^1}{L^1} P - ce_i & \text{if } P \leq L^1 \end{cases} \tag{5}$$

[18] Put differently, the judge only has access to the amount P once it enters the settlement system.

[19] As the appendix details, very valuable attachable assets could reverse the result. This is an unlikely scenario in real world situations. For insightful discussions on sovereign debt litigation see chapter 3 in Sturzenegger and Zettelmeyer (2006) and Miller and Thomas (2007).

Note that litigation as described here is a redistributive activity that the creditors as a group would like to avoid since it carries a cost ϕ that is a pure loss. However, below I show that at the individual level it is sometimes optimal to seek full repayment through courts. The second stage of the game provides a co-ordination device that can get rid of the inefficiencies in the litigation stage.

I focus on subgame perfect equilibria. The formal definition of the equilibrium is

Definition 1 A subgame perfect equilibrium of the game is a set of strategies $\left\{\left(e_i^*, v_i^*, l_i^*\right)\right\}_{i=1}^{I}$ such that

(i) If the litigation subgame is reached, no creditor wants to deviate from l_i^*.

(ii) Given $\left\{l_i^*\right\}_{i=1}^{I}$, no creditor wants to deviate from v_i^*.

(iii) Given $\left\{(l_i^*, v_i^*)\right\}_{i=1}^{I}$, no creditor wants to deviate from e_i^* in the lobbying game.

Having described all the elements in the model, I first study the interaction between CACs and litigation to then highlight the differences between pro-rata and SC contracts in terms of lobbying incentives.

Since pro-rata contracts are the norm in sovereign debt markets and CACs have been progressively introduced under this type of contract, I study in detail litigation and CACs in a pro-rata environment and relegate to Appendix A5 the analysis of litigation under SC contracts.

3.1 Collective action clauses

The mainstream argument to implement CACs in sovereign debt contracts is based on the observation that a small creditor (in terms of their portfolio) does not voluntarily participate in an exchange offer since their individual debt forgiveness has a negligible impact on the debt overhang problem suffered by the sovereign. Put differently, debt forgiveness carries a positive externality that small creditors do not internalise. CACs are necessary to bind the mass of small creditors to agree to a haircut that optimally alleviates the debtor's repayment burden. The set-up here presents a complementary mechanism relating CACs and creditor incentives. The analysis broadens the scope of CACs beyond debt overhang considerations: CACs also prevent negative externalities among creditors. The model shows that, under endogenous penalties, litigation offers holdout option to large creditors that disrupts the incentives of small creditors to extract repayment. This is a new reason for large creditors to reject participation in exchange offers that CACs successfully prevent.

Let us first specify the main assumptions on the number and size of creditors and debt issues. First, I assume that both loans have the same collective action threshold $\overline{\upsilon}$. Appendix A1 discusses partial implementation of CACs. In this case, the relative sizes of D_1 and D_2 are irrelevant since the contracts governing both loans are identical. Second, to make the analysis tractable and clear I deal with a specific but interesting portfolio configuration: the case of one large creditor and many small creditors. Appendix A2 discusses the case of symmetric creditors. Creditor heterogeneity is a very plausible assumption in today's markets: bonded debt is easily traded and, as a result, it is held in different amounts by thousands of investors.[20] More specifically, let us assume that creditor one is large enough to litigate,[21]

$$\alpha_1(1 - \alpha_1) > \phi \tag{6}$$

but the rest of creditors are small in the sense that they cannot afford the cost of seeking full repayment through court

$$\alpha_i < \phi \quad \text{for } i = 2, \ldots, I \tag{7}$$

Although this might seem a very arbitrary debt distribution, the main properties of the model also hold for more complicated configurations as long as there is an asymmetry in the opportunity of going to court. It is a robust result that litigators disincentivise effort by non-litigators. The assumption that only one creditor can litigate matches real world cases in a stylised way: in most default cases, only a small number of creditors litigate.

I also place the following assumption on the lobbying abilities of creditors.

$$\alpha_i p_i \geq c \quad \forall i \tag{8}$$

[20] Alternatively, the large creditor can be interpreted as a coalition of small creditors initiating a class action suit against the debtor.

[21] It follows from equations **(2)** and **(3)** that, for a given value of P, the large creditor only litigates if $P \in (P_1, P_2)$, where $P_1 = \frac{\phi}{1-\alpha_1}$ and $P_2 = \frac{\alpha_1 - \phi}{\alpha_1}$. In order to make litigation feasible we need $P_2 > P_1$ which holds if and only if **(6)** is satisfied.

In short, equations **(6)**, **(7)** and **(8)** state that all creditors are relatively large with respect to the lobbying cost c, but that only creditor one is large with respect to the legal cost ϕ. In words, the assumption is that litigation skills are a lot more unusual than lobbying skills. This is reasonable because lobbying is a skill routinely used by many types of agents. In contrast, sovereign debt litigation requires very specialised and expensive legal advice. Reversing assumption **(8)**, ie making the lobbying cost very large for all creditors, has important implications that I discuss below. When assumption **(8)** holds for only a few creditors, the results below still hold. With these three assumptions at hand, we obtain the following result.[22]

Result 1 CACs with $\overline{v} < 1 - \alpha_1$ maximise repayment and minimise litigation costs. Contracts with $\overline{v} \geq 1 - \alpha_1$ are never restructured and there is litigation in equilibrium. The precise shape of the equilibrium is

1. If $\overline{v} < 1 - \alpha_1$, $P^* = \overline{P}$
   If $\overline{v} \geq 1 - \alpha_1$, $P^* < \overline{P}$ is always an equilibrium

2. $v_1^* = 0$; $v_i^* = 1$ for $i \geq 2$ so that $V^* = 1 - \alpha_1$

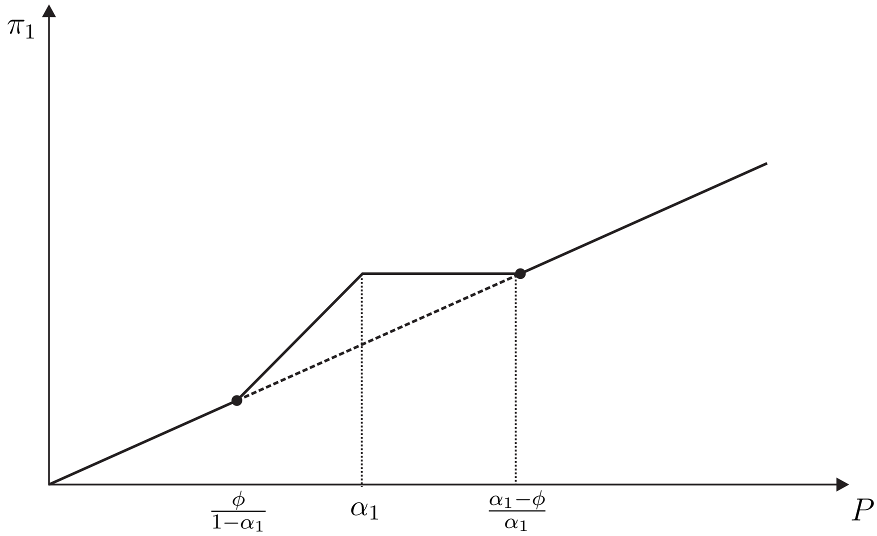
3. $l_1^* = 1$ if $P \in \left(\frac{\phi}{1-\alpha_1}, \frac{\alpha_1 - \phi}{\alpha_1}\right)$ and $l_1^* = 0$ otherwise. For $i \geq 2$, $l_i^* = 0 \quad \forall P$

I next develop intuition of the equilibrium features. First of all, let us look at the incentives to sue the debtor if the contract has not been restructured. Small creditors cannot litigate since $\alpha_i < \phi$ for $i \geq 2$ but in contrast, creditor one is able to capture more resources than the rest of creditors by going to court. Only certain values of repayment make litigation attractive. Low levels of repayment relative to the cost ϕ render litigation unattractive and high values of P bring $\alpha_1 P$ close enough to face value α_1 to also disincentivise litigation. However, in the middle region litigation takes place and resources are transferred from the small creditors to the litigator. More formally, notice that the pay-off described by equation **(2)**, which always applies to the small creditors since they never litigate, is decreasing in L. The behaviour of creditor one brings about the first intercreditor inefficiency: ϕ is being spent on unproductive redistribution of repayment. Yet another inefficiency related to litigation will arise in the lobbying stage.

[22] I also assume $\overline{P} \geq \frac{\phi}{1-\alpha_1}$. Otherwise, the game is uninteresting since penalties cannot reach the minimum level required to trigger litigation.

Charts 1 and 2 make clear that litigation has opposite effects on both types of creditors. The large creditor increases profits through courts at the expense of small creditors' repayment. As a result, at the time of voting the interests of the small and large creditor diverge. Creditor one benefits from litigation but small creditors are never interested in making it feasible. Therefore, $V^* = 1 - \alpha_1$ and CACs play a central role. If unanimity is required, the contract is not restructured and ϕ is spent on legal costs. When CACs with threshold $\overline{v} < 1 - \alpha_1$ are written into the contract small creditors can impose their decision to the rogue creditor and block litigation.

Chart 1: CACs, large creditor



So far, we have seen that in the absence of CACs resources are inefficiently allocated to redistributive litigation. I next show that if litigation is allowed, additional negative effects on net repayment emerge in the lobbying stage.

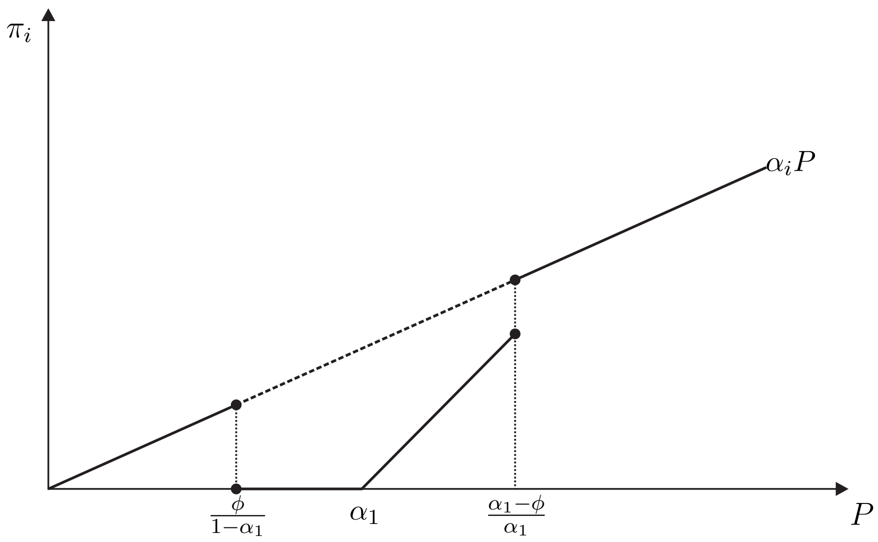
If CACs can be used to restructure the contract, courts cannot break the pro-rata clause and creditor i captures a fraction α_i of resources with certainty so that in the lobbying stage they just solve

$$\max_{e_i \in \{0,1\}} \quad \alpha_i \sum_{n=1}^{I} p_n e_n - c e_i \tag{9}$$

Optimal effort is

$$e_i^* = \begin{cases} 1 & \text{if } \alpha_i p_i \geq c \\ 0 & \text{if } \alpha_i p_i < c \end{cases} \tag{10}$$

Chart 2: CACs, small creditor



which yields $e_i^* = 1$ for all creditors by the assumption in equation **(8)**. Condition **(10)** states that a creditor contributes to penalties only if the combination of their lobbying power p_i and the share of repayment they capture is high enough relative to the cost of lobbying. Put differently, as the externality of effort grows, the incentive to bear the private cost of lobbying weakens. Note that under CACs, litigation cannot cause any effort distortion since all creditors anticipate that the contract will be restructured in the voting stage. Thus, under CACs repayment is maximised.

In contrast, if CACs are absent, a new adverse effect of litigation stemming from the fact that courts exacerbate the externality of effort arises. $\alpha_i p_i \geq c$ is no longer a sufficient condition to maximise penalties. Equation **(9)** does not apply since the small creditor is not receiving a pro-rata share of repayment when creditor one is litigating. Since at $P = \frac{\phi}{1-\alpha_1}$ creditor one is exhausting resources through litigation, a marginal small creditor putting effort would face a zero marginal increase in their portfolio value but a positive marginal cost c (graphically, this corresponds to the flat region in Chart 2). In other words, 100% of the small creditor productivity would be an externality and, obviously, this rules out positive effort. Therefore, underprovision of lobbying effort is always an equilibrium outcome in the absence of CACs. I relegate to Appendix A7 the description of equilibrium penalty values since they depend intensively on parameter values but always satisfy the qualitative property $P^* < \overline{P}$. In short, litigation endogenously lowers penalties and CACs accomplish two goals: minimisation of legal costs and maximisation of repayment.

The relative values of the lobbying and legal cost play a central role in result 1. By assuming that all creditors are large relative to the lobbying cost c, we guarantee that penalties are maximised if CACs are ready to block litigation. By assuming that only one creditor is large enough to have access to courts, we magnify the externality of small creditors' effort so that being large with respect to the lobbying cost is no longer a sufficient condition to maximise penalties if CACs are absent. If we instead let the lobbying cost be large to the point that $\alpha_i p_i < c$ for all creditors but still assume $\alpha_1(1-\alpha_1) > \phi$ and $\alpha_i < \phi$ for $i \geq 2$, litigation cannot weaken the incentives to exert effort. In fact, the properties of CACs can be reversed. If $p_1 \geq c + \phi$, litigation would allow the large creditor to fully internalise the benefit of their effort. However, if creditor one exerts effort under a CAC contract, small creditors would block litigation in the voting stage in order to capture their pro-rata share of p_1. Then, the large creditor would incur a net loss since $\alpha_1 p_1 < c$. Thus, $e_1 = 1$ is not a subgame perfect decision when $\overline{v} < 1 - \alpha_1$ and the equilibrium involves $P^* = 0$. Conversely, if $\overline{v} \geq 1 - \alpha_1$, the large creditor is free to litigate, successfully internalises the effects of their effort, and $P^* = p_1$. In sum, CACs do not maximise repayment when lobbying is very costly but litigation is still affordable to one creditor. As discussed above, this is an unlikely scenario.

Summarising, legal actions result not only in the waste of litigation costs but also in endogenously low repayment because they discourage lobbying. CACs are able to prevent both phenomena. It is worth stressing that the results differ from the typical view on debt renegotiation inefficiencies: it is usually argued that large agents are able to internalise bargaining inefficiencies while small agents have the incentive to be opportunistic and hold out for full repayment. Absent any co-ordination device, the debt overhang problem is not corrected and the debtor's fiscal incentives are misaligned. Instead, I claim that filing suit against a sovereign is an expensive option that only creditors holding a significant share of a bond issue can afford and that such actions distort the incentives of other creditors. Regarding policy recommendations, this paper indicates that CACs are not only a useful tool in debt forgiveness environments but also in cases where *ex-post* repayment is too low from a welfare perspective. In Appendix A3 I show that the result holds in the case where litigation extracts some additional resources from the debtor. Of course, the result breaks in the (unrealistic) case where very valuable assets can be seized by courts.

The next subsection assumes that CACs are always written into debt contracts to show that, despite the absence of litigation, the choice between pro-rata and SC contracts has effects on effort decisions too.

3.2 Seniority clauses

As of today, pro-rata debt contracts are the standard in sovereign debt markets. However, contracts including SCs are a potential innovation in the sovereign debt arena that has recently attracted attention from both academic and policy circles.[23] Under the current regime, new loans impose a negative externality on existing creditors by shrinking the share of repayment that those creditors can claim in the event of default. Since the new lender does not suffer this loss, the externality is not priced into the new bond and overborrowing follows. The rationale to introduce an absolute priority rule is to subordinate the marginal lender in order to prevent a reduction in the value of the outstanding stock of debt. Missing in this argument is any potential *ex-post* effect of SCs. The present paper is silent on the *ex-ante* mechanisms just described to bring a number of *ex-post* considerations to the SCs debate. I uncover previously hidden consequences of the adoption of SCs that might make them undesirable under certain conditions.

To simplify the exposition, I assume that CACs are effectively preventing litigation and focus on the lobbying incentives under both types of repayment rules.[24] I assume that $I = 2$ creditors are the holders of the debt. Appendix A4 shows that all results are robust to the general case with $I > 2$ creditors. Without loss of generality, I also assume that both creditors have the same lobbying abilities, ie, $p_1 = p_2 = p$. No particular assumptions are placed on asset holdings or loan face values.

The goal of the section is to pin down the portfolios that maximise repayment for the cases of pro-rata and SC contracts and compare them. Let us first examine the case of pro-rata contracts. Since litigation is ruled out by CACs, creditor i solves

$$\max_{e_i \in \{0,1\}} \quad \pi_i = \alpha_i p(e_i + e_{-i}) - ce_i \qquad \textbf{(11)}$$

[23] SCs would implement *de jure* seniority. Appendix A6 tailors the model to the case of *de facto* seniority in which the debtor treats a certain creditor (not loan) as implicitly senior.

[24] More precisely, the threshold $\overline{v}$ must satisfy $\overline{v} < 1 - \max\{\alpha_i : \alpha_i > \phi, i = 1, \ldots, I\}$ in order to successfully forestall litigation.

The equation governing effort is

$$e_i^* = 1 \text{ iff } \alpha_i \geq \frac{c}{p} \qquad i = 1, 2 \tag{12}$$

This condition is essentially identical to **(10)**. A creditor only finds it profitable to exert effort if their stake in final repayment is high enough to cover the cost of lobbying. Put differently, if the lobbying externality $(1 - \alpha_i)p$ is too large, the creditor fails to internalise the positive effect of individual effort and refuses to lobby. The following result summarises the conditions leading to maximal penalties under pro-rata contracts.

Result 2 With pro-rata debt contracts penalties are maximised ($P^* = 2p$) if portfolios satisfy

$$\alpha_i \geq \frac{c}{p} \quad i = 1, 2 \tag{13}$$

Note that the weight of an individual loan in the portfolio is irrelevant since both loans have the same priority to recoup repayment; only total portfolio size conditions effort. This property breaks down under SCs with important implications on effort levels. I next show that this makes the choice of contractual clauses relevant to the level of repayment. With an absolute priority rule and no litigation the problem of creditor i is

$$\max_{e_i \in \{0,1\}} \quad \pi_i = \alpha_i^1 \min\{D_1, p(e_i + e_{-i})\} + \alpha_i^2 \max\{0, p(e_i + e_{-i}) - D_1\} - ce_i \tag{14}$$

Unlike the pro-rata case, effort choices exhibit interdependence and forces at work are better understood by summarising the pay-offs in the following table. The first line in every cell is the pay-off to creditor one and the second is the pay-off to creditor two.[25]

Table A: Pay-offs with SCs

	$e_2 = 0$	$e_2 = 1$
$e_1 = 0$	0 0	$\alpha_1^1 \min\{D_1, p\} + \alpha_1^2 \max\{0, p - D_1\}$ $\alpha_2^1 \min\{D_1, p\} + \alpha_2^2 \max\{0, p - D_1\} - c$
$e_1 = 1$	$\alpha_1^1 \min\{D_1, p\} + \alpha_1^2 \max\{0, p - D_1\} - c$ $\alpha_2^1 \min\{D_1, p\} + \alpha_2^2 \max\{0, p - D_1\}$	$\alpha_1^1 \min\{D_1, 2p\} + \alpha_1^2 \max\{0, 2p - D_1\} - c$ $\alpha_2^1 \min\{D_1, 2p\} + \alpha_2^2 \max\{0, 2p - D_1\} - c$

The description of the equilibria of the game for every possible parameter configuration is tedious but the properties of portfolios achieving maximal effort are intuitive. The next result characterises such portfolios.

[25] D_2 does not enter the pay-off functions since I am assuming $2p < D_1 + D_2$.

Result 3 With SCs penalties are maximised ($P^* = 2p$) if portfolios satisfy the following conditions

1. In the case $D_1 < p$,

$$\alpha_i^2 \geq \frac{c}{p} \quad i = 1, 2 \tag{15}$$

2. In the case $D_1 \in [p, 2p]$,

$$\alpha_i^1 (D_1 - p) + \alpha_i^2 (2p - D_1) \geq c \quad i = 1, 2 \tag{16}$$

3. In the case $D_1 > 2p$,

$$\alpha_i^1 \geq \frac{c}{p} \quad i = 1, 2 \tag{17}$$

The portfolios achieving maximal penalties differ from the pro-rata case and merit a detailed explanation. Intuitively, effort decisions are not based on total portfolio size but on the allocation of the marginal loan being repaid when effort increases. Depending on the relative size of D_1 and p, individual effort deviations can affect only the market value of the junior loan, only the senior's value or both. Thus, we must distinguish three cases. When the senior loan is very small, $D_1 < p$, deviations from full effort cannot affect its market value since the effort of only one creditor already covers D_1 in full. Then, in a penalty maximising equilibrium both creditors must hold a high enough share of the junior loan to prevent deviations. A parallel argument applies if $D_1 > 2p$. In this case ownership of the junior loan is irrelevant since it will never recoup any repayment and decisions boil down to an evaluation of the senior loan's weight in the portfolio. Finally, in the middle region $D_1 \in [p, 2p]$, both loans are affected by deviations from full effort. The deviation spares the creditor the lobbying cost c but reduces the value of the junior loan by $(2p - D_1)$ and the value of the senior loan by $(D_1 - p)$. In turn, their portfolio loses $\alpha_i^1 (D_1 - p) + \alpha_i^2 (2p - D_1)$. This loss must be large with respect to the lobbying cost to prevent deviation from full equilibrium.

An important policy question arises from the last two results. Since effort incentives vary with contractual clauses, would the introduction of SCs raise or lower repayment? No assertive answer can be given as I next show through simple examples.

Example 1 (SCs lower repayment) Consider the following parameter values

(i) Portfolios are $\alpha_1^1 = \alpha_2^2 = 1$ and $\alpha_1^2 = \alpha_2^1 = 0$

(ii) Loans satisfy $D_1 = D_2 < p$

In words, assumption (i) says that creditor one holds the whole debt issue D_1 and creditor two is the sole owner of loan D_2.[26] Therefore, it is clear that, under this debt distribution, the marginal loan being repaid with SCs is not present in one of the portfolios. As a result, repayment is not maximised under SCs (specifically, condition **(15)** fails to hold for creditor one). In contrast, if contracts are pro-rata, only total portfolio mass matters. Since both loans have the same face value it immediately follows that every creditor holds half of the total face value and condition **(13)** for penalty maximisation under pro-rata contracts is satisfied.

Example 2 (SCs do not alter repayment) Consider the following parameter values

(i) Portfolios are $\alpha_i^j = \frac{1}{2}$ for $i = 1, 2,\ j = 1, 2$

(ii) Loans satisfy $D_1 = D_2$

In this particular example, substitution of assumption (i) into **(11)** and **(14)** proves that the pay-offs are identical under both types of clauses and that only total portfolio mass affects effort even under SCs. Since every creditor holds half of the debt their stake in final repayment is high enough to support maximum effort both under pro-rata and SC contracts.

Example 3 (SCs raise repayment) Consider the following parameter values

(i) Initial portfolios are $\alpha_i^1 = \frac{1}{2}$ for $i = 1, 2$. $\alpha_1^2 = 0$ and $\alpha_2^2 = 1$

(ii) Loans satisfy $D_1 = 2p$ and $D_2 > \frac{p/2-c}{c} D_1$

[26]This can be justified on the grounds that creditor two did not have income when loan D_1 was floated and that creditor one did not have wealth at the time D_2 was issued.

In this case, the marginal loan being repaid under SCs is D_1 and it turns out to be properly allocated to maximise repayment by assumption (i). However, D_2, which is entirely owned by creditor two, is large enough to yield a divergence in total portfolio sizes that results in low repayment in the case of pro-rata contracts (the stake of creditor one is too small for them to exert effort).

In short, these examples warn that, under endogenous penalties, it is not granted that repayment stays constant after the adoption of SCs. However, the existing literature assumes an invariant repayment to derive the welfare implications of SCs. Taking into account *ex-post* effects, the welfare effects of SCs are unclear. Preventing *ex-ante* debt dilution is clearly welfare improving. However, *ex-post* repayment can either increase or decrease with the adoption of SCs. If repayment actually fell, there would be a negative welfare effect in the form of higher interest rates and tighter borrowing constraints.

4 The role of secondary markets

The previous section studied the contractual approach under the assumption of no secondary markets for sovereign debt. CACs were shown to maximise penalties and the introduction of SCs could have effects on repayment going in either direction. Importantly, these effects were shaped by the asset distribution among creditors. Then, it is natural to think that the possibility of trading claims in the secondary market has implications on the results presented so far. While the lack of explicitly modelled secondary markets is a common feature in the literature,[27] I next show that they play a meaningful role in a model of endogenous penalties.

Regarding the timing of secondary market transactions, I assume that in stage one creditors simultaneously trade in a frictionless secondary market and choose their lobbying effort. After that, the voting and litigation stage follow. Note that if trade took place after lobbying decisions but before litigation decisions, secondary markets could not influence repayment. If a creditor were too small relative to the lobbying cost, they would have no option to increase their portfolio's size before the lobbying cost is sunk. This implies that result 4 below would not hold: initial portfolios would condition effort as described in the previous section. The opportunistic behaviour I describe in example 4 below would still be possible.

[27] Broner *et al* (2009) is the exception.

The first important result is that secondary markets can be used by vulture funds to achieve the critical mass necessary to litigate if CACs are not in place.[28] Since a full characterisation of the litigation game with secondary markets is beyond the scope of this paper, I make the point clear through a simple example.

Example 4 (Secondary markets foster litigation without CACs) Consider the case of pro-rata contracts with no CACs. I creditors hold the debt and lobbying power is such that $p_1 = p > 0$ and $p_i = 0$ for $i \geq 2$. The initial asset distribution satisfies

(i) $\alpha_i < \phi \quad i = 1, \ldots, I$

(ii) $\alpha_1 = \frac{c}{p}$

Condition (i) assures that no litigation takes place in the absence of secondary markets since the portfolio's face value is lower than the legal cost of claiming it for all creditors. Condition (ii) guarantees that there is a creditor who exerts lobbying effort if courts do not interfere. Therefore, the equilibrium with no secondary markets is $P^* = p$, $L^* = 0$ with $\pi_1^* = c$ and $\pi_i^* = \alpha_i p$ for $i \geq 2$. Is this equilibrium always robust to opening a secondary market? In general, no. I next describe a deviation by purchasing claims in the secondary market to litigate which is profitable for a range of litigation costs. Variables with hats denote the deviation. Suppose that creditor one buys $\hat{\gamma}$ claims (face value) in the secondary market. Assuming that available resources are high enough to pay the holdout in full,[29] the deviation is profitable if

$$\hat{\pi}_1 = \alpha_1 + \hat{\gamma} - \phi - c - \hat{\gamma} p > \pi_1^* = c \qquad \textbf{(18)}$$

The term $\hat{\gamma} p$ on the left-hand side is the price paid by creditor one in the secondary market (assuming that sellers break even). Given that the cost of litigation is fixed, creditor one maximises their profit by purchasing a portfolio that results in them appropriating repayment in full through litigation. This is achieved by setting $\hat{\gamma} = p - \frac{c}{p}$. This profit maximising strategy is feasible if legal costs are such that

$$\phi < p(1 - p) \qquad \textbf{(19)}$$

[28] A real world example of such behaviour is the case of Elliot Associates versus Peru. In 1995, Elliot purchased US$20.7 million (face value) of Peruvian debt at a distressed price of US$11.4 million with the sole intention of litigating. The final judgment was favourable and Elliot recovered the sum of US$55.6 million.

[29] This is the case if and only if $p \geq \frac{c}{p} + \hat{\gamma}$.

Then, in the range $\phi \in \left(\frac{c}{p}, p(1-p)\right)$ litigation is not feasible without secondary markets but becomes profitable if trading is allowed. The same result would follow if the lobbying and trading stages were swapped.

We have seen that the introduction of secondary markets in environments where litigation is allowed is bound to have negative effects since trading can be used to achieve the share of debt consistent with profitable litigation. An entirely different conclusion arises if contracts feature CACs to block litigation. In this case secondary markets play the unambiguously positive role of maximising repayment. I next state the result formally and derive its policy implications. For the sake of simplicity, I present the case of $I = 2$ creditors. Appendix A4 shows that the result also holds in the general case.

Result 4 Under perfect secondary markets and CACs, repayment is always maximised ($P^* = 2p$) both under pro-rata and SC contracts. The equilibrium portfolios are those already described in results 2 and 3.[30]
Proof: see Appendix A8

Intuitively, starting from a situation in which portfolios do not induce full effort, trades that increase total repayment are always executed since such exchanges generate a positive net surplus in the form of higher penalties. Denoting by e_i^0 the effort levels before trading, the expression for this surplus is $(p-c)(2-e_1^0-e_1^0) > 0$. Then, there always exists a way of sharing these additional resources such that both creditors earn a strictly higher profit.

In terms of the externality, the power of secondary markets stems from the fact that the size of the externality becomes endogenous to creditors' trading decisions. Therefore, creditors choose to minimise the negative impact of the externality by choosing portfolios that successfully internalise the effects of effort.

To conclude, this section has shown that the combination of CACs with secondary markets has a strong impact on repayment. No litigation takes place, repayment is maximised, and the introduction of SCs is neutral. The existing literature has established welfare implications of SCs

[30] I do not report equilibrium secondary market prices since the expressions are cumbersome and irrelevant to the central results regarding the level of default penalties.

assuming no haircut variation following their introduction. I claim that the assumption is still valid under endogenous repayment if debt is traded in frictionless secondary markets. In this particular case, SCs will prevent overborrowing with no *ex-post* impact.

5 Conclusion

This paper evaluates the contractual approach to sovereign debt crisis resolution under the novel assumption that default penalties and repayment are a function of creditors' lobbying effort. There is a positive externality of lobbying effort that reacts to changes in contractual clauses and portfolio configuration.

The option to litigate endogenously reduces repayment. This happens because holdouts exacerbate the externality of lobbying effort by non-litigators. CACs play a twofold role when blocking litigation: they prevent the waste of legal costs and assure that repayment is maximised. The result holds under the plausible assumptions that at least a few creditors have strong lobbying skills relative to the cost of litigation and that courts have a relatively limited capacity to attach assets.

Having CACs in place, it is shown that pro-rata and SC contracts do not necessarily yield the same level of repayment. Depending on asset distribution, the adoption of SCs can depress or raise repayment. Secondary markets have an adverse effect on repayment in the absence of CACs since they promote holdout behaviour. Conversely, if CACs are ready to deter litigation, secondary markets maximise repayment and make repayment invariant to the introduction of SCs.

The reader should bear in mind that the present analysis is entirely positive. A precise welfare assessment of the impact of CACs, SCs and secondary markets requires an examination of *ex-ante* events. Cases can be made for and against high repayment. For instance, in a set-up like Eaton and Fernandez (1995) where penalties are random and there is no other source of uncertainty, it is optimal to maximise repayment since then the contractual interest rate is lower and the debtor can raise more funds. In contrast, the opposite recommendation can arise from risk-sharing considerations since low output realisations call for low repayment in order to smooth consumption.

Of special interest is the trade-off between the *ex-ante* and *ex-post* effects of SCs when no secondary markets are available. On the one hand, SCs have the well-known property of preventing overborrowing *ex ante*. But on the other hand, this paper warns that SCs might lower *ex-post* repayment which, in turn, would result in a tight *ex-ante* borrowing constraint. If this effect is strong enough, the sovereign would go into an underborrowing situation by introducing SCs. Whether the actual outcome will be underborrowing or full efficiency is unclear and promises to be a fruitful avenue of research.

Appendix A: Model extensions and proofs

A.1 Partial implementation of collective action clauses

The analysis of CACs presented so far assumed that both loans had the same collective action threshold. The main result was that CACs maximised the value of debt. Both the threshold assumption and the result on penalty maximisation are at odds with empirical observations. First, virtually every country has an outstanding debt stock of debt mixing bonds with and without CACs. Second, Becker *et al* (2003) and Gugiatti and Richards (2003) find that the inclusion of CACs has no significant impact on bond yields. It is clear that, if CACs actually maximise the value of a bond in the event of default, its primary and secondary market yield should be lower. A straightforward modification of the model to incorporate bond-specific thresholds reconciles the theoretical predictions with the empirical regularities.

A slight variation in the voting stage is enough to capture the effects of multiple thresholds. Let $\overline{v}_j \in (0, 1]$ denote the collective action threshold of loan j and assume that $\overline{v}_1 < 1$ but $\overline{v}_2 = 1$. In words, loan one includes CACs, but loan two does not. Since the two loans are no longer identical, every creditor votes twice. $v_i^j \in \{0, 1\}$ codifies the vote of creditor i on the amendment of loan j. $V_j \equiv \sum_{i=1}^{I} \alpha_i^j v_i^j$, $j = 1, 2$, summarises the result of each voting. If $V_1 < \overline{v}_1$ or $V_2 < 1$ the game moves to the litigation stage.

As in the main text, I consider the case of one large creditor and many small ones. If the large creditor holds the loan with CACs, it is still the case that CACs maximise repayment and deter litigation. However, if the large creditor has a stake in the loan without CACs, new insights arise. More specifically, assume the following.

$$\alpha_1^1 = 0 \text{ and } \alpha_1^2(1 - \alpha_1^2)D_2 > \phi \tag{A-1}$$

The remaining claims are held by small creditors

$$\alpha_i < \phi \quad i = 2, \ldots, I \tag{A-2}$$

Finally, the lobbying cost is relatively small

$$\alpha_i p_i \geq c \quad \forall i \tag{A-3}$$

In this setting, the power of CACs vanishes.

Result 5 Partial implementation of CACs ($\overline{v}_1 < 1$ but $\overline{v}_2 = 1$) is irrelevant if the large creditor holds the debt issue without CACs. In this case, the equilibrium for all $\overline{v}_1 \in (0, 1)$ is

1. $P^* < \overline{P}$
2. $v_1^2 = 0$. For $i \geq 2$, $v_i^j = 1$, $j = 1, 2$ so that $V_1^* = 1$ and $V_2^* = 1 - \alpha_1^2$
3. $l_1^* = 1$ if $P \in \left(\frac{\phi}{1-\alpha_1^2 D_2}, \frac{\alpha_1^2 D_2 - \phi}{\alpha_1^2 D_2}\right)$ and $l_1^* = 0$ otherwise. For $i \geq 2$, $l_i^* = 0\, \forall P$

This result rationalises the empirical finding that CACs do not affect bond yields. Penalties remain unaltered following a partial adoption of CACs because unanimity is required for the bond the litigator is holding. As a result, the externality of effort is not reduced by the introduction of partial CACs and the market value of the loans cannot vary.

A.2 Collective action clauses with symmetric creditors

Throughout the paper, I have studied CACs under a particular but interesting portfolio configuration that features asymmetric creditor sizes. In this appendix I show that if one assumes the asymmetry away, CACs become an irrelevant dimension of the debt contract.

Let the $I \geq 2$ creditors hold symmetric portfolios

$$\alpha_i = \frac{1}{I} \quad \forall i \leq I \tag{A-4}$$

Lobbying power is not restricted to be homogeneous but is large with respect to the lobbying cost for all creditors[31]

$$\alpha_i p_i \geq c \quad \forall i \tag{A-5}$$

[31] I also assume $\overline{P} \geq \frac{\phi}{1-1/I}$. Otherwise, the game is uninteresting since penalties cannot reach the minimum level required to trigger litigation.

Finally, I restrict the legal cost to be such that $\phi < \frac{1}{I^2}$.[32]

Under these assumptions the following result obtains.

Result 6 With symmetric creditors, penalties are always maximised and legal costs minimised regardless of the inclusion of CACs. The equilibrium is

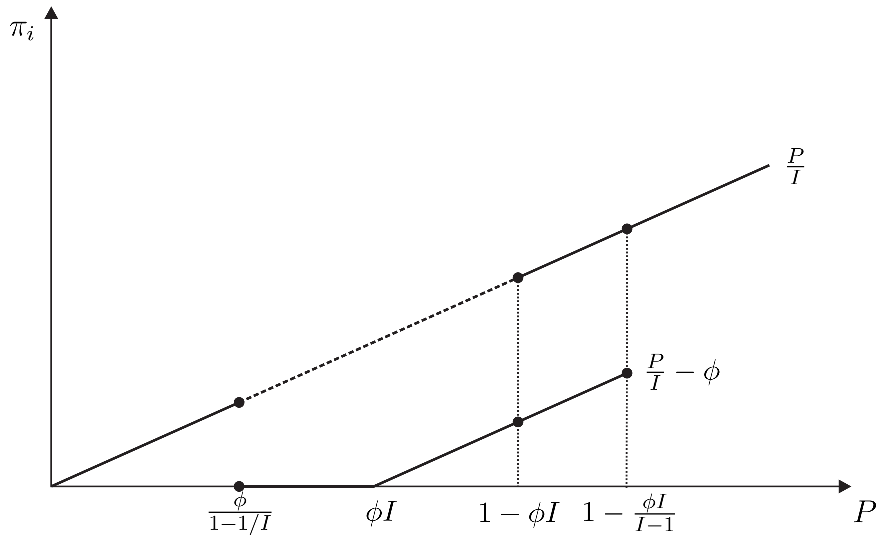
1. $e_i^* = 1 \quad \forall i,\ P^* = \overline{P}$
2. $v_i^* = 1 \quad \forall i,\ V^* = 1$
3. The litigation game depends on P in the following way
   If $P \leq \frac{\phi}{1-1/I}$, $L^* = 0$
   If $P \in \left(\frac{\phi}{1-1/I}, I\right]$, $L^* = \frac{P}{\phi I}$
   If $P \in (\phi I, 1 - \phi I]$, $L^* = 1$
   If $P \in \left(1 - \phi I, 1 - \frac{\phi I}{I-1}\right]$, both $L^* = 0$ and $L^* = 1$ are equilibria
   If $P > 1 - \frac{\phi I}{I-1}$, $L^* = 0$

To understand the qualitative nature of the result, note that the pay-off functions are completely symmetric if one assumes $\alpha_i = 1/I\ \forall i$. Therefore, litigation harms all creditors evenly. Every time ϕ is spent on legal costs everyone's profit falls and it is not possible to do better than average by litigating. At the voting stage, creditors anticipate the negative effects of litigation and perfectly co-ordinate to rewrite the contract. The voting rule is irrelevant since no individual holdout can earn a higher than average return. Chart 3 illustrates the point graphically. A restructured contract assures a pay-off P/I while a nonrestructured contract brought to court always delivers a weakly lower pay-off.

Summing up, asymmetric creditor sizes are critical to generate a meaningful role for CACs. This could partly explain why creditor co-ordination failures were less of a central issue in the syndicated loan era. It is reasonable to argue that, however limited the information on the

[32] There are two more cases, $\phi \in \left(\frac{1}{I^2}, \frac{1}{2I}\right]$ and $\phi \in \left(\frac{1}{2I}, \frac{1}{I} - \frac{1}{I^2}\right]$, that deliver slightly different breaking points between regions. The qualitative results of the model are unaffected by the changes. For costs above $\frac{1}{I} - \frac{1}{I^2}$ litigation never takes place and debt restructuring is a straightforward process.

Chart 3: CACs, symmetric creditors



composition of the investor base might be, the syndicates extending loans in the 1980s were a far more symmetric group than today's bond investors.

A.3 Collective action clauses with attachable assets

So far I have assumed that the court cannot seize any debtor's assets to satisfy demands of full repayment. This is likely to be the case since it is easy to circumvent attachment in the court's jurisdiction by transferring assets to the embassies or similar strategies. However, if assets with total value S are available to the court the game displays some new features. S can be interpreted in a broader sense to encompass other legal penalties such as limited access to financial services in the court's jurisdiction.

As in the main text, I assume pro-rata contracts. The judicial process when the court has further power than the pure redistribution already modelled is as follows. In first place, sovereign's assets are attached to pay the litigators with no redistribution of P. When the total size of litigators surpasses the value of attachable assets, $L > S$, the judge resorts again to the redistribution of P described in Section 3.1. I still assume that there is no way of recouping the face value of the claims: $S + \overline{P} < 1$. The rules for the first two stages and the timing remain the same. Then, the third stage is fully described by

$$\pi_i(l_i = 0) = \begin{cases} \alpha_i P - ce_i & \text{if } L \leq S \\ \frac{\alpha_i}{1-L}(S + P - L) - ce_i & \text{if } S < L \leq S + P \\ -ce_i & \text{if } L > S + P \end{cases} \tag{A-6}$$

$$\pi_i(l_i = 1) = \begin{cases} \alpha_i - \phi - ce_i & \text{if } L \leq S + P \\ \frac{\alpha_i}{L}(P + S) - \phi - ce_i & \text{if } L > S + P \end{cases} \tag{A-7}$$

Litigation as it is described here is a productive activity that increases repayment by S in contrast with the previous set-up where it was just a costly redistribution. A direct implication is that it is not so clear that banning litigation is an efficient choice. On the one hand, legal costs ϕ are saved but on the other hand access to additional resources S is lost. I next explore this trade-off in detail.

As in the main text, I deal with the case of one large creditor and many small ones. I impose $\alpha_1(1 - \alpha_1) > \phi$ and $\alpha_i < \phi$ for $i \geq 2$. The lobbying cost is such that $\alpha_i p_i \geq c$ for all creditors.[33] The upshot of this case is that the guarantee that CACs maximise total net repayment is broken under some conditions. Before showing the result formally, I provide some intuition of it. First of all, note that as long as $S > \phi$ it is optimal for the creditors as a group to attach assets. If S is large enough to pay the large creditor in full, $S > \alpha_1$, the small players are happy to allow litigation since the large creditor demands are fully financed by seizing assets. Nevertheless, opposite interests arise in the region $\phi < S < \alpha_1$. Although it is efficient to attach assets, small creditors do not agree since part of P is used to pay the litigator. Then, if the contract features CACs, the small creditors will block litigation even though total net repayment is lowered.

To make the point clear I focus on the case $\phi < S < \alpha_1$. A short comment is enough for the remaining two cases. When $S < \phi$ (the most probable case in reality) the game is qualitatively identical to the case in section 3.1. Small creditors always choose to block litigation and endogenous penalties are maximised. From an ex-post efficiency standpoint it is optimal to have no litigation since the value of assets is low. The case $S > \alpha_1$ does not generate any disagreement among creditors since P goes in full to small creditors and S is high enough to repay creditor one in full. Litigation is allowed and total net repayment is maximised.

[33] I also assume that individual p_i s are small: $p_1 < \alpha_1 - S$ and $p_i < \alpha_1 - S - p_1 \; \forall i \geq 2$.

The following result describes the properties of the equilibrium in the case $S \in (\phi, \alpha_1)$.

Result 7 Contracts with $\overline{v} < 1 - \alpha_1$ are always restructured. Contracts with $\overline{v} \geq 1 - \alpha_1$ are never restructured and there is litigation in equilibrium. Restructuring the contract reduces total net repayment under the conditions in equation **(A-10)** below. The precise shape of the equilibrium is

1. If $\overline{v} < 1 - \alpha_1$, $P^* = \overline{P}$
   If $\overline{v} \geq 1 - \alpha_1$, $P^* < \overline{P}$

2. $v_1^* = 0$; $v_i^* = 1$ for $i \geq 2$ so that $V^* = 1 - \alpha_1$.

3. $l_1^* = 1$ if $P \in \left[0, \frac{\alpha_1 - \phi}{\alpha_1}\right)$ and $l_1^* = 0$ otherwise. Small creditors never litigate.

Charts 4 and 5 depict pay-off functions for both types of creditors. In the presence of an asset seizure technology, it is still the case that the large creditor earns a higher profit by allowing litigation. More specifically, these two conditions hold

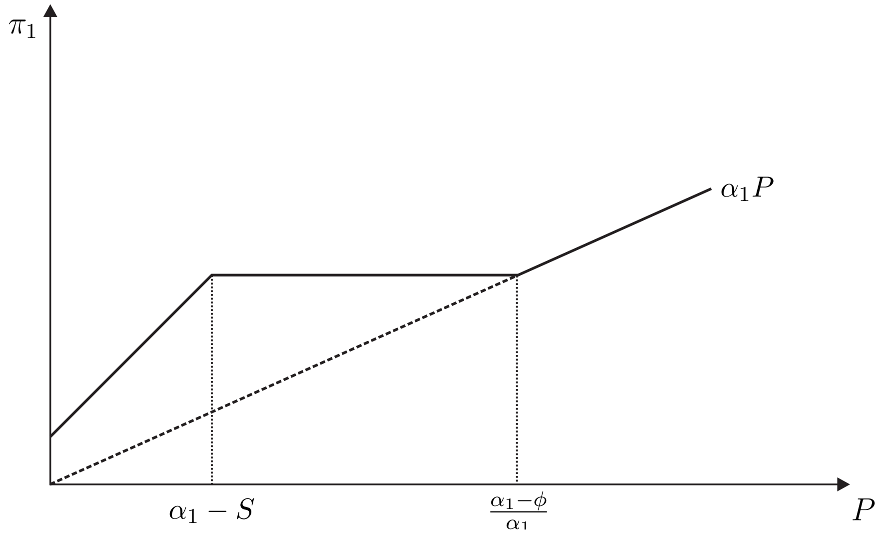
$$\pi_1^r = \alpha_1 \overline{P} - c < \pi_1^{nr} = p_1 + S - \phi - c \qquad \textbf{(A-8)}$$

$$\pi_i^r = \alpha_i \overline{P} - c > \pi_i^{nr} = 0 \qquad i = 2, \dots, I \qquad \textbf{(A-9)}$$

where r denotes a restructured contract and nr a non-restructured one. **(A-8)** and **(A-9)** result in a non-unanimous voting $V^* = 1 - \alpha_1$. In the initial stage, the flat region of small creditors' pay-off precludes contributions for a non-restructured contract. Only the large creditor finds it profitable to increase repayment since they claim it through courts in the third stage. Therefore, penalties are endogenously low when CACs are not available. With CACs the contract is restructured and assets are not attached. The properties of the equilibrium discussed so far are common to the case of no attachable assets. However, there is a new trade-off in terms of total net repayment when using CACs: with CACs endogenous penalties are maximised but S is lost. Conversely, when the large creditor is free to litigate, S is attached but endogenous penalties drop to p_1. The following condition determines parameter values that combined with CACs depress aggregate repayment.

$$\sum_{i=2}^{I} (p_i - c) < S - \phi \qquad \textbf{(A-10)}$$

Chart 4: Attachable assets, large creditor



In words, if the abilities of lobbyists are low relative to the net value of assets, maximising the use of lobbying at the expense of asset seizure does not maximise repayment. However, it is individually optimal to block litigation from the small creditors' standpoint since they suffer a loss in terms of P and do not capture S. As discussed above, the case where attachable assets have a high value is an unlikely one in the real world.

A.4 Seniority clauses with I creditors

This appendix generalises the SC analysis of Sections 3.2 and 4 to the case of $I > 2$ creditors. I still assume that CACs are precluding litigation and $p_i = p$ for all $i \leq I$. I state the results skipping the intuitive discussion since it is identical to that presented in the main text.

When no secondary markets exist, the problem of creditor i with pro-rata contracts is

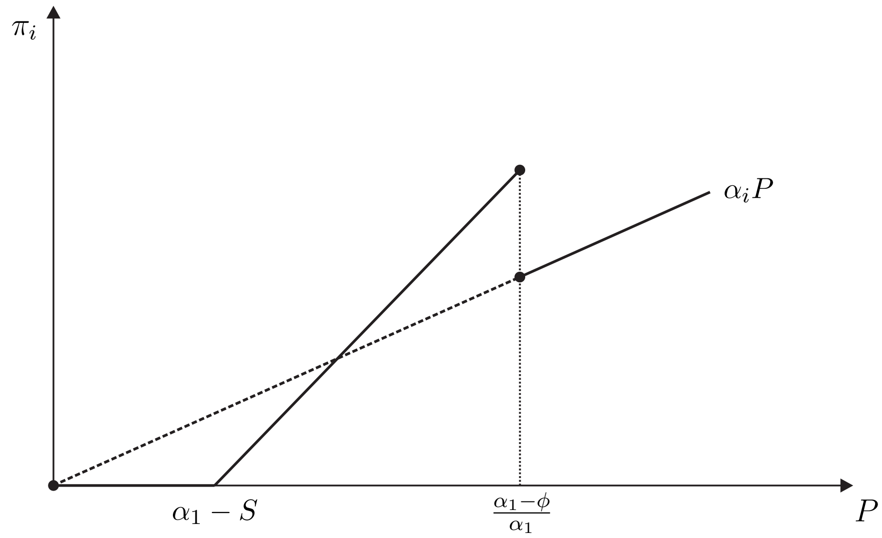
$$\max_{e_i \in \{0,1\}} \quad \pi_i = \alpha_i p \sum_{n=1}^{I} e_n - c e_i \qquad \textbf{(A-11)}$$

The first-order condition of this problem immediately yields the following result.

Result 8 With pro-rata debt contracts penalties are maximised ($P^* = Ip$) if portfolios satisfy

$$\alpha_i \geq \frac{c}{p} \quad i = 1, \ldots, I \qquad \textbf{(A-12)}$$

Chart 5: Attachable assets, small creditor



For the case of SCs, creditor i solves

$$\max_{e_i \in \{0,1\}} \quad \pi_i = \alpha_i^1 \min\{D_1, p \sum_{n=1}^{I} e_n\} + \alpha_i^2 \max\{0, p \sum_{n=1}^{I} e_n - D_1\} - ce_i \qquad \textbf{(A-13)}$$

As before, penalty maximising portfolios are those containing the marginal loan being repaid.

Result 9 With SCs penalties are maximised ($P^* = Ip$) if portfolios satisfy the following conditions

1. In the case $D_1 < (I-1)p$,

$$\alpha_i^{2^*} \geq \frac{c}{p} \quad i = 1, \ldots, I \qquad \textbf{(A-14)}$$

2. In the case $D_1 \in [(I-1)p, Ip]$,

$$\alpha_i^{1^*}(D_1 - (I-1)p) + \alpha_i^{2^*}(Ip - D_1) \geq c \quad i = 1, \ldots, I \qquad \textbf{(A-15)}$$

3. In the case $D_1 > Ip$,

$$\alpha_i^{1^*} \geq \frac{c}{p} \quad i = 1, \ldots, I \qquad \textbf{(A-16)}$$

Qualitatively identical parameter configurations to those in examples 1–3 yield again the result that the introduction of SCs might lower or raise repayment. For the sake of brevity, I omit the equivalent examples with $I > 2$ creditors.

Introducing secondary markets together with CACs yields again the result that penalties are maximised irrespective of the existence of SCs.

Result 10 Under perfect secondary markets and CACs, repayment is always maximised ($P^* = Ip$) both under pro-rata and SC contracts. The equilibrium portfolios are those already described in results 8 and 9.
Proof: Straightforward modification of the proof in Appendix A8

Summing up, the properties of the model do not hinge on the assumption $I = 2$.

A.5 Litigation with seniority clauses

This appendix argues that the interaction between litigation and effort with SC contracts is qualitatively identical to the pro-rata case already discussed in detail. Since closed-form solutions to this case are beyond the scope of the paper, I just show that litigation still disincetivises effort in the setting with one large creditor in front of many small ones. The specific assumptions on creditor sizes are $\phi < 1 - \alpha_1^2 - (\alpha_1^1 - \alpha_1^2)D_1$ and $\phi > \alpha_i$ for $i \geq 2$.[34]

For the sake of simplicity, let us assume $p_i = p\ \forall i$ and take the case $D_1 < (I-1)p$, which implies that the marginal loan being repaid is D_2.[35] According to the pay-off functions in equations **(4)** and **(5)** creditor one will litigate if the third stage is reached as long as penalties satisfy

$$\alpha_1^1 D_1 + \alpha_1^2 D_2 - \phi > \alpha_1^1 D_1 + \alpha_1^2 (P - D_1) \quad \textbf{(A-17)}$$

$$P - \phi > \alpha_1^1 D_1 + \alpha_1^2 (P - D_1) \quad \textbf{(A-18)}$$

which yields $l_1^* = 1$ if and only if $P \in \left(\frac{(\alpha_1^1 - \alpha_1^2)D_1 + \phi}{1 - \alpha_1^2}, 1\right)$. This condition is qualitatively identical to the litigation rule described in result 1.

[34]The steps to derive the restriction on the large creditor's size are qualitatively identical to those described in footnote 21.

[35]Parallel arguments apply to the cases $D_1 \in [(I-1)p, Ip]$ and $D_1 > Ip$.

Having seen that the large creditor litigates for certain values of penalties, let us look at the voting stage. As it was the case with pro-rata contracts, the pay-off of a small creditor is decreasing in L (see equation **(4)**). Therefore, voting decisions diverge. Without CACs the large creditor will deter any attempt to restructure the contract. CACs bind the large creditor and assure that legal costs are not inefficiently incurred.

Finally, it is also possible to show that, in the lobbying stage, incentives to exert effort are weakened if creditors anticipate litigation. To see it, let us compare the conditions leading to maximal repayment in the cases $L = 0$ and $L = \alpha_1$. In the former situation effort decisions are governed by case (i) in result 9:

$$e_i^* = 1 \text{ iff } \alpha_i^2 \geq \frac{c}{p} \quad \forall i \tag{A-19}$$

In contrast, two conditions are required to elicit effort if $L = \alpha_1$

$$\alpha_1 < \overline{P} - D_1 \tag{A-20}$$

and

$$\alpha_i^2 \geq \frac{c}{p} \quad \forall i \tag{A-21}$$

which immediately yields that conditions for maximising penalties are more restrictive when contracts allow litigation. Intuitively, **(A-20)** is required since the litigator is reducing the resources available to repay the marginal loan D_2. Thus, if the mass of the litigator is sufficiently high, nothing is left for the junior loan and small creditors stop exerting effort since 100% of their effort productivity is an externality to the litigator. In a nutshell, in the absence of CACs litigation also distorts effort incentives under SCs. CACs prevent low endogenous repayment and inefficient expenditure on litigation costs just as they did in the pro-rata case.

A.6 Implicit seniority

The core model of the paper has dealt with the case of *de jure* seniority, that is, with an absolute priority rule explicitly stated in the debt contract. Despite the absence of explicit seniority in sovereign debt contracts, Bolton and Jeanne (2005), Roubini and Setser (2004), and Gelpern (2004) note that debtors seem to treat particular creditors as implicitly junior or senior. For instance, Paris Club debt tends to be junior to bonded debt and multilateral agencies senior to the rest of lenders. In these cases, seniority is attached to the creditor and not to the instrument itself.

Another remarkable property of bilateral and multilateral loans is that they are not traded in secondary markets.

The model can be easily tailored to explore the implications of these facts on default penalties. Taking the case of Paris Club debt versus bonded debt, let creditor one holding D_1 be a private creditor and creditor two holding D_2 be the Paris Club. To simplify, I assume that no litigation can take place in this setting.[36]

Finding the equilibrium penalties boils down to solving **(14)** for the particular case $\alpha_1^1 = \alpha_2^2 = 1$ and $\alpha_1^2 = \alpha_2^1 = 0$. The equilibrium of this game is relatively simple. The notation used to describe mixed strategy equilibria is $\sigma_1^* = \Pr[e_1^* = 1]$ and $\sigma_2^* = \Pr[e_2^* = 1]$.

Result 11 With implicit seniority effort choices in the parameter regions depicted in Chart 6 are

(a) $e_1^* = 0, e_2^* = 1;\ P^* = p$

(b) $\sigma_1^* = \frac{D_1+c-p}{D_1};\ \sigma_2^* = \frac{D_1-c}{D_1}.\ E\{P^*\} = p\left(2 - \frac{p}{D_1}\right) < 2p$

(c) $\sigma_1^* = \frac{c}{2p-D_1};\ \sigma_2^* = \frac{p-c}{2p-D_1}.\ E\{P^*\} = \frac{p^2}{2p-1} < 2p$

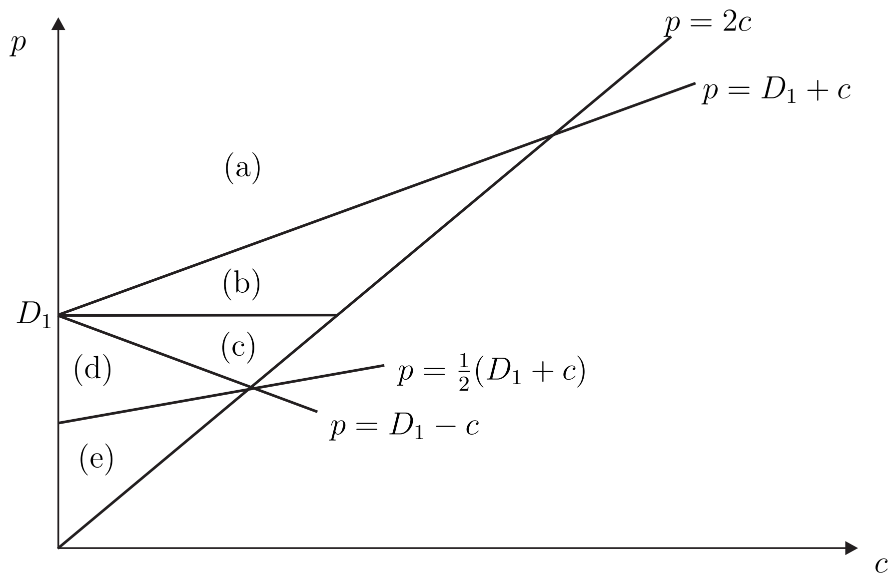
(d) $e_1^* = e_2^* = 1;\ P^* = 2p$

(e) $e_1^* = 1, e_2^* = 0;\ P^* = p$

Summarising, full effort is only an equilibrium under very specific conditions. The reason is that under the initial portfolios creditor one is effectively senior to creditor two and the externalities of effort are large under a variety of parameter values. When lobbying power p is very large relative to D_1 – region (a) in the chart – creditor one would always deviate from $e_1 = 1$ because they know that the junior's effort is very productive (p is high) and $P^* = p$ is high enough to fully repay D_1 and still leave enough repayment to creditor two to make up for the lobbying cost associated with $e_2^* = 1$. Conversely, when p is small compared to D_1 – region (e) – creditor two will never exert effort in equilibrium since they would bear the cost c but the full value of

[36] I impose $p \geq 2c$ to make penalty maximisation feasible if a secondary market opens.

Chart 6: Implicit seniority, penalties as a function of p and c



penalties would be spent to cover the value of the large senior loan D_1 which is held by creditor one. As p takes less extreme values, the effects outlined above weaken and the equilibrium is in mixed strategies in regions (*b*) and (*c*). Finally, in region (*d*) parameter values strike a balance to sustain full effort as an equilibrium: creditor one does not deviate because p is not large enough relative to D_1 to free-ride on the other's effort and creditor two, despite being junior, can cover the cost c since p is high enough.

The disruption caused by implicit seniority could be neutralised if the Paris Club were allowed to trade with private creditors. In that context, purchases by the Paris Club decrease the amount of outstanding senior debt while sales to private creditors increase the amount of senior debt. Let X denote the, possibly negative, face value sold by Paris Club. Q denotes the price of the debt. Then, the optimisation problem of the private creditor is

$$\max_{e_1 \in \{0,1\}} \quad \pi_1 = \min\{D_1 + X, p(e_1 + e_2)\} - ce_1 - QX \qquad \textbf{(A-22)}$$

Paris Club solves

$$\max_{e_2 \in \{0,1\}} \quad \pi_2 = \max\{0, p(e_1 + e_2) - D_1 - X\} - ce_2 + QX \qquad \textbf{(A-23)}$$

With this secondary market in place, there exists a trading strategy $X^* = p + c - D_1$ such that penalties are maximised. Note that when D_1 is large purchases by Paris Club are needed. The reason is that initially the amount of effectively senior debt is too large for the junior Paris Club to exert effort. The opposite argument applies when D_1 is small, ie, when too much junior debt exists. The private creditor has to buy debt from the Paris Club to strengthen their incentive to exert effort. Both creditors are interested in the exchange since it generates a net positive surplus.

To sum up, I collect in the following result the effects and policy implications of implicit seniority patterns.

Result 12 The observed patterns of implicit seniority between bilateral lenders, multilateral agencies and private lenders might distort the incentives of the parties to contribute to penalties. Trading bilateral and multilateral loans in the secondary market would assure that penalties are maximised even in the presence of implicit seniority.

A.7 Details of result 1

This appendix details the equilibrium effort choices in result 1 for all parameter values that are compatible with assumptions **(6)**, **(7)** and **(8)**.[37]

Result 1b 1 If $\overline{v} \geq 1 - \alpha_1$, equilibrium effort levels depend on parameter values in the following way.

1. If $\overline{P} \in \left[\frac{\phi}{1-\alpha_1}, \alpha_1\right)$, $P^* = \frac{\phi}{1-\alpha_1}$
2. If $\overline{P} \in [\alpha_1, \alpha_1 + p_1)$, there is multiple equilibria: $P^* = \frac{\phi}{1-\alpha_1}$ or $P^* = \overline{P}$
3. If $\overline{P} \in \left[\alpha_1 + p_1, \frac{\alpha_1 - \phi}{\alpha_1}\right)$, there is multiple equilibria: $P^* = \frac{\phi}{1-\alpha_1}$ or $P^* = \overline{P} - p_1$
4. If $\overline{P} \geq \frac{\alpha_1 - \phi}{\alpha_1}$, there is multiple equilibria: $P^* = \frac{\phi}{1-\alpha_1}$ or $P^* = \overline{P}$

When $P^* = \frac{\phi}{1-\alpha_1}$, efforts are $e_i^* = 1$ for $i = 1, \ldots, \imath$ and $e_i^* = 0$ for $i = \imath + 1, \ldots, I$ where $\imath$ is implicitly defined by $\sum_{n=1}^{\imath} p_n = \frac{\phi}{1-\alpha_1}$.

[37] I also assume that individual p_i's are small: $p_1 < \frac{\phi}{1-\alpha_1}$ and $p_i < \alpha_1 - \frac{\phi}{1-\alpha_1}$ for $i \geq 2$.

The decisions in the voting and litigation stage do not depend on specific parameter values.

A.8 Proof of result 4

The result in the main text can be restated as follows in order to make the proof clearer.

Result 13 Under perfect secondary markets and CACs, if portfolios such that $e_1^* = e_2^* = 1$ exist, they are the equilibrium portfolios. Any debt allocation with $e_1^* \neq 1$ or $e_2^* \neq 1$ cannot be an equilibrium since mutually profitable trades can be carried out.

Proof. The following identity always holds true

$$\pi_1 + \pi_2 = (p - c)(e_1 + e_2) \qquad \textbf{(A-24)}$$

Note that the sum of profits is maximised when effort is maximal. I first show that no trades take place when portfolios $\{\alpha_i^1, \alpha_i^2\}_{i=1}^2$ are such that $e_1^* = e_2^* = 1$ and $\pi_1^* + \pi_2^* = 2(p - c)$. Suppose that creditors deviate to portfolios $\{\hat{\alpha}_i^1, \hat{\alpha}_i^2\}_{i=1}^2$. Then, for the deviation to be profitable it must be the case that

$$\hat{\pi}_1 \geq \pi_1^* \text{ and } \hat{\pi}_2 \geq \pi_2^* \qquad \textbf{(A-25)}$$

If following the deviation $\hat{e}_1 = \hat{e}_2 = 1$, then $\hat{\pi}_1 + \hat{\pi}_2 = \pi_1^* + \pi_2^*$ and **(A-25)** can only be satisfied with a transaction price such that both inequalities bind. Since creditors are thus indifferent I assume that trading volume is minimised and deviations leading to $\hat{e}_1 = \hat{e}_2 = 1$ are never observed.

If following the deviation $\hat{e}_1 \neq 1$ or $\hat{e}_2 \neq 1$ or both, $\hat{\pi}_1 + \hat{\pi}_2 < \pi_1^* + \pi_2^*$. It is trivial to see that this inequality is incompatible with equation **(A-25)**. If overall profits are strictly lower after trade, one of the creditors must earn a strictly lower profit and that rules out the deviation.

Any debt allocation with $e_1^* \neq 1$ or $e_2^* \neq 1$ is neither an equilibrium if there exist alternative portfolios $\{\hat{\alpha}_i^1, \hat{\alpha}_i^2\}_{i=1}^2$ leading to $\hat{e}_1 = \hat{e}_2 = 1$. Since effort is not the highest, $\pi_1^* + \pi_2^* < 2(p - c)$ whereas $\hat{\pi}_1 + \hat{\pi}_2 = 2(p - c)$. Then, a debt price Q (or range of prices) that satisfies both inequalities in **(A-25)** must exist since the aggregate profit has risen with the deviation.

Finally, I show that the restrictions that parameters p and c must satisfy in order to make penalty maximization feasible are the same under pro-rata and SC contracts. Clearly, the restrictions $\alpha_1^j + \alpha_2^j = 1$, $j = 1, 2$, must hold at all times. Thus, in the case of pro-rata contracts, $2\frac{c}{p} \leq 1 \Leftrightarrow p \geq 2c$ is needed to satisfy **(13)** for both creditors at a time. Under SCs, it is immediate to see that the same condition applies to equations **(15)** and **(17)**. To show that $p \geq 2c$ is also required in the remaining case **(16)**, let us rewrite the inequalities in the following way

$$(1-\alpha_2^1)(D_1 - p) + (1-\alpha_2^2)(2p - D_1) \geq c \qquad \textbf{(A-26)}$$

$$\alpha_2^1(D_1 - p) + \alpha_2^2(2p - D_1) \geq c \qquad \textbf{(A-27)}$$

then suppose **(A-26)** is binding and add it to **(A-27)** to yield

$$(D_1 - p) + (2p - D_1) \geq 2c \qquad \textbf{(A-28)}$$

which simplifies to $p \geq 2c$.

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