Analytics of Sovereign Debt Restructuring

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Contents

Abstract

Over the past few years there has been an active debate on appropriate mechanisms for restructuring sovereign debt, particularly international bonds. This paper develops a simple theoretical model to analyse the merits of these proposals. The analysis suggests that CACs can resolve the inefficiencies caused by *intra-creditor coordination* problems providing that all parties have complete information about each other's preferences. In such a world, statutory mechanisms are unnecessary. This is no longer the case, however, when the benefits from reaching a restructuring agreement are private information to the debtor and its creditors. In this case, the inefficiencies induced by strategic behaviour - the *debtor-creditor bargaining* problem - cannot be resolved by the parties themselves: removing these inefficiencies would require the intervention of a third party.

Summary

Recent years have seen an increasing incidence of sovereign debt crises, including Russia in 1998, Turkey in 2000 and 2001 and Argentina in 2001 and 2002. The costs imposed on debtors, creditors and the official sector of these crises have activated a heated debate on appropriate mechanisms for the restructuring of sovereign debt, particularly international bonds. Some commentators have argued in favour of market-based solutions, whereas others – most prominently the International Monetary Fund's First Deputy Managing Director Anne Krueger – have advocated statutory approaches akin to an international bankruptcy court.

This paper develops a simple theoretical model of sovereign debt restructuring to analyse the merits of some of these proposals. In the model, a debtor country with an unsustainable debt stock makes a write-down offer to its creditors. Creditors vote whether to accept of reject the offer. Two market-based arrangements are analysed: under the first, contractual provisions require unanimous consent for the offer to go through; under the second, collective action clauses (CACs) bind the minority to the will of the majority. These arrangements are compared against a first-best welfare benchmark.

The results suggest that when *intra-creditor coordination problems* are sufficiently severe, voluntary market-based approaches with unanimity clauses are inefficient. By providing incentives for a number of creditors to holdout, resources are unnecessarily expended on legal proceedings and costly renegotiations which in turn induce the debtor to exert suboptimal effort. CACs can resolve these inefficiencies, providing that all parties have complete information about each other's preferences. In such a world, statutory mechanisms are unnecessary.

This conclusion, however, does not survive the relaxation of the assumption that the debtor and its creditors have complete information about each other's preferences. In this case, the inefficiencies induced by strategic behaviour - the *debtor-creditor bargaining* problem - cannot be resolved by the parties themselves. The only way to remove these inefficiencies would require the intervention of a third party, with powers similar to an international bankruptcy court.

1 Introduction

Recent years have seen an increasing incidence of large-scale sovereign debt crises – for example, Mexico in 1995, Russia in 1998, Brazil in 1999, Turkey in 2000 and 2001 and most recently and seriously, Argentina in 2001 and 2002. These crises have proven costly for the debtor country and private creditors. The financial commitments of the official sector have often also been very large. As a result, resolving sovereign debt crises in a less painful way than in the past has become a key preoccupation of the international financial community. In particular, in the past year there has been an active debate on appropriate mechanisms for the restructuring of sovereign debt, especially in the context of international sovereign bonds.

Broadly-speaking, two approaches to the restructuring of sovereign debt have been proposed – the so-called "contractual" and "statutory" approaches. The contractual approach relies on inserting clauses into bond contracts which set out procedures for initiating and negotiating a restructuring and which allow a qualified majority of creditors to modify the financial conditions of the bond (so-called collective action clauses (CACs)). One purported merit of the contractual approach is that creditors agree to be bound by these clauses when they purchase the bond and therefore are not subject to retrospective adjustment by outside parties.

There has been an active debate on the benefits of CACs in international bonds, beginning with Eichengreen and Portes (1995) and the Rey Report (1996). CACs are currently included in international bonds issued under English law, but unanimity has been the market practice to change the financial conditions of a bond issued under New York law. Most recently, the official community has made a strong push for CACs to be a standard element of international bond contracts (see, eg, G7 (2002)). Having rejected previous calls for action, private creditors have recently shown a greater acceptance of CACs (IIF (2002)). But these private sector views are by no means universal. And even among those in favour, there is still disagreement about the appropriate qualified majority threshold for amending financial terms, with some favouring a very high threshold close to unanimity (EMCA (2002)). Other remain opposed to the introduction of such clauses. They favour voluntary, market-based approaches such as debt exchanges. Nevertheless, Mexico, South Africa and, most prominently, Brazil, which is not investment grade, have recently issued a series of bonds in New York which contain CACs with no discernible premium.

The statutory approach would involve the creation of an international body or mechanism, underpinned by international law, which would oversee the restructuring of sovereign debt. This idea is not a new one (see Rogoff and Zettelmeyer (2002)), but it has recently been given impetus by the IMF's Deputy Managing Director Anne Krueger (Krueger (2001,2002)), who proposed a Sovereign Debt Restructuring Mechanism (SDRM). Several versions of the SDRM have been considered. A "Fund-heavy" SDRM would involve the IMF or some other supranational agency playing a central role in the initiation and approval of debt restructuring (see Krueger (2001)). A "Fund-lite" SDRM would be initiated by the debtor with the restructuring deal approved by a qualified majority of creditors, with the IMF only acting in a signalling capacity through its decisions to provide programmes (Krueger (2002)). The latter version has considerable similarities with the contractual approach.

The debate on the SDRM has been heated. Prior to the Spring Meetings of the IMF earlier in the year, the official sector pursued a "twin-track" approach, with work on the SDRM and CACs proceeding in parallel (G7 (2002)). At the Spring Meetings, however, the requisite consensus to proceed further with the SDRM was not available.

Some of this debate about the two approaches concerns technical or legal questions – for example, the scope of debt to be included in the SDRM and its legal status (see IMF (2002)). But sovereign debt restructuring also raises some fundamental behavioural issues. This paper seeks to develop an analytical framework within which these behavioural issues can be explored.

These issues would include: Under what circumstances are CACs helpful in a debt restructuring? Can the same benefits be delivered by bonds issued under the prevailing market convention in New York? What factors determine the choice of optimal majority voting threshold in CACs? Under what circumstances might an SDRM add value over contractual approaches? Is it better to have an SDRM-heavy or SDRM-lite approach? And should we think of the contractual and statutory approaches as complements or substitutes?

The analytical framework, although simple, aims to capture many of the key features of sovereign debt restructuring. Much of the existing debate has focussed on potential co-ordination problems within the creditor community - for example, free-rider problems, "rogue" creditors and litigation risks. These risks may have been over-emphasised. Sovereigns, for example, cannot be liquidated

and it is difficult to attach their assets. Nonetheless, we show that when these co-ordination inefficiencies are important, CACs can deal with them.

A potentially significant problem comes from the interaction between creditors and the debtor. In a sovereign context, the debtor's payment capacity is usually dependent on their own actions. And these actions, in turn, are subject to domestic political constraints. So the debtor may have an incentive not to reveal its "true" payment capacity. Creditors, in turn, may have little incentives to reveal the minimum deal they are prepared to accept. The resulting bargaining game between the debtor and creditors under incomplete information may give rise to strategic failures. These have been little discussed in the debate to date, but are likely to be fundamental to the design of sovereign debt restructuring mechanisms.

In short, the restructuring of sovereign debt gives rise to potential co-ordination failures at two levels - among creditors and between creditors and the debtor. The second of these failures in particular is likely to be more acute than in a corporate context. Both have efficiency costs. The paper explores analytically the mechanisms that might best mitigate these inefficiencies.

By using an analytical framework, we hope to identify some of the key characteristics that are likely to determine the optimal restructuring regime. The model suggests that no one mechanism is always and everywhere optimal – contrary to what much of the existing debate would have us believe. But it provides clues on the shape of an optimal sovereign debt restructuring regime.

We are not aware of many previous papers to have tackled these types of question from a theoretical perspective. In a repeated game setting, Kletzer (2002) shows that CACs with renegotiation can resolve the debtor commitment and intra-creditor coordination problems. Using a standard model of sovereign debt with a "willingness to pay problem" and costly default, Bolton and Jeanne (2002) show that contractual incompleteness – in the form of countries not being able to write state-contingent contracts – can result in serious inefficiencies. Unlike in our framework, neither paper analyses the robustness of their results to a relaxation of the complete information assumption. This problem could be an important impediment to sovereign debt restructurings, even in the absence of "willingness to pay" or debtor commitment problems.

The paper is planned as follows. Section 2 sets out the model and derives a welfare benchmark

against which different contractual arrangements can be compared. Sections 3 and 4 characterise the equilibrium for an exchange offer with conventional New York law bond provisions and CACs respectively. Section 5 illustrates the potential importance of debtor-creditor bargaining problems given informational incompleteness. Section 6 discusses policy implications and concludes.

2   The Model

There is a single debtor and D external creditors of identical size each holding one unit of a bond, where D is assumed to be large[1]. The debtor's resources at the start of the game are determined by initial output, $y(0)D$, and the face value of the bond is $(1+r)D$. We assume that pre-game output is a stochastic variable with positive expected net returns. The debtor has an opportunity to exert effort to augment output (as will be discussed below) but we start the game in circumstance in which the debtor does not have sufficient initial output to pay this debt and must make an offer to all creditors to write-down the value of outstanding obligations. Each creditor then votes to decide whether to accept or reject the offer. The equilibrium outcome depends on the voting rule that applies to the debt.

As mentioned, the debtor is given the option to exert effort, a, once it receives initial output. The cost of exerting effort $c(a)$ is assumed to be increasing and concave in a. We rule out, for convenience, instances of strategic default[2] when the debtor would still gain a surplus by exerting effort and paying off debt but chooses not to[3]. Debtors default in this model because they are unable to repay debt rather than unwilling. Therefore we are considering situations in which

$$y(a)D - c(a)D \; < \; (1+r)D. \tag{1}$$

Since the debtor cannot repay, the debtor makes an offer $\omega(1+r)$ to each creditor, where $0 < \omega < 1$. Creditors who participate in the exchange receive this payment. If the offer fails or creditors choose to hold out, we call their fallback option, "going to court", although this can include any options to disrupt the debtor's output. Each creditor, i, has a claim $(1+r)$ and can be uniquely identified by the expected private cost of holding out by rejecting the offer, l_i. In what

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(1) A model with differenet sizes of creditor, each with different degress of power, is explored in Corsetti, Dasgupta, Morris and Shin (2001).
(2) The distinction between willingness and ability to pay was first emphasised by Eaton and Gersovitz (1981).
(3) We also rule out an equilibrium in which the debtor price discriminates, paying each creditor the amount owed less their individual legal costs and keeping the rest. We do not think this equilibrium is practical (how could the debtor tell what each creditor's legal costs actually are?) or legal (it violates *pari passu* clauses).

follows, we refer to these holdout costs as "legal costs" for convenience, but the term should be interpreted more broadly as a metaphor for the expected costs associated with rejecting an offer and prolonging the restructuring process. There are several reasons why such costs might be different across investors. For example, some creditors (eg, mutual funds) may target different investment horizons than others (eg, pension funds and life insurance companies) because of differences in balance sheet structures, in principal-agent problems related to compensation structure, and in accounting and regulatory rules. Equivalently, l_i can be thought of as measuring the relative degree of risk aversion of different sets of creditors, in deciding between choosing a certain option (accepting the offer) and an uncertain one (holding out). These costs are given by:

$$l_i = \bar{l} + \varepsilon_i,$$

where $\bar{l} \geq 0$ is the average cost across creditors and ε_i is a mean zero random variable with commonly known cumulative distribution function $F(\cdot)$ defined on $[\underline{\epsilon}, \bar{\epsilon}]$. All creditors have non-negative costs, $-\underline{\epsilon} \leq \bar{l}$.

In practice, there are very few assets that creditors can attach in foreign jurisdictions but the existence of outstanding claims can disrupt future market access[4]. In what follows, we assume that the court either upholds the original claim at face value if there is enough output available or residual output if there isn't. The only important aspect of this assumption is that the more output is available, the greater the payout to hold-out creditors[5].The sequence of moves in the game is as follows:

1. The debtor offers payment $\omega(1 + r)$ to each creditor.
2. Creditors vote simultaneously either to accept this offer or to hold out.
3. The debtor learns the outcome of the vote and chooses policy effort, a.
4. Output $y(a)D$ is realised.
5. Payoffs are distributed. Creditor payoffs depend on whether they accepted or rejected the offer

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(4) In June 2000, Peru paid $56 million to Elliott Associates after the latter succeeded in getting a Brussels court to make a judgement that Euroclear could not distribute payment on Peru's Brady bonds unless it paid pre-Brady commercial loans which Elliott had bought for $20 million in 1997. It's not clear that Elliott's case would have survived an appeal but the decision would only have been overturned after Peru was declared in default on its Brady bonds. This threat was enough for Peru to pay. For more details, see Box 2.6 in IMF (2001).

(5) A debtor who exerts effort may, for example, have developed a number of positive net present value investment opportunities but before it can reacess international markets may have to pay-off outstanding claims. The more such investment opportunities the debtor has, the more leverage outstanding claimants have and the greater the payoff they can expect to receive. A similar rationale underlies the debt-overhang models of Krugman (1989) and Sachs (1989).

and the voting rules associated with the bond. The debtor gets any surplus output, net of payments to creditors and any costs associated with adjustment effort, $c(a)D$.

So the overall payoff to the debtor is given by

$$y(a)D - c(a)D - \text{total payout to creditors.}$$

The payoff to a hold-out creditor is the repayment received from the debtor less their private legal costs. The social welfare function is equal to the sum of the debtor's and creditors' payoffs, less the sum of legals costs paid by the holdouts. Formally, it is given by

$$W = D[y(a) - c(a) - h \int_{\bar{l}+\underline{\epsilon}}^{l_h} lf(l)dl], \qquad (2)$$

where h is the proportion of creditors who hold out and l_h is the legal cost for the marginal holdout creditor. Since the last term of **(2)** is decreasing in h (all legal costs are non-negative), the socially optimal outcome is attained when $h = 0$, and adjustment effort a solves:

$$y'(a) = c'(a). \qquad (3)$$

Denote by a^* this socially optimal level of policy effort[6]. So if we denote welfare $W(a, h)$ first-best welfare is $W(a^*, 0)$. We use this as the welfare benchmark when comparing different contractual arrangements.

3   Equilibrium under New York Law

We first consider contractual arrangements that require the unanimous consent of all creditors to adjust financial terms. Several countries, most prominently recently Brazil, have issued bonds in New York containing CACs but unanimity remains the market convention in international sovereign bonds issued under New York law (Dixon and Wall 2000, Buchheit and Gulati 2002). The usual means of restructuring bonds under New York law is an exchange offer. The debtor offers creditors $\omega(1+r)$ in return for the existing bonds of face value $(1+r)$. Creditors who decline the offer can seek full repayment through the courts. If there are sufficient resources to pay each hold-out creditor in full, then we assume that the creditor receives the face value of the original bond less the costs associated with taking the legal route. But if there are too many

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(6) Trivially, we require $y(a^*) - c(a^*) > y(0)$ to get $a^* > 0$.

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hold-outs and the debtor's resources are insufficient to repay in full, hold-out creditors receive instead a pro-rated share of residual output after creditors who accept the offer have been paid[7].

On practical grounds, we rule out cases in which the debtor deliberately makes an offer that no creditor will accept, adjustment effort is zero and all creditors foreclose, as this is worst case scenario for all parties. So we consider cases in which

$$\omega(1+r) > y(0) - \bar{l} - \bar{\epsilon}. \tag{4}$$

The payoff to a holdout creditor j is given by

$$\min\left\{(1+r) - l_j, \frac{y(a) - \omega(1+r)(1-h)}{h} - l_j\right\} \tag{5}$$

and the payoff to a creditor who accepts the offer is $\omega(1+r)$.

The debtor's strategy in making the offer $\omega(1+r)$ is to maximise $[y(a)D - c(a)D - \text{total payout to creditors}]$ based on **(5)**. Ideally, the debtor would like to cap the total payout to creditors and then exert optimal effort a^*. One option would be to make an offer that every creditor would accept. If the debtor sets the lowest feasible offer consistent with $h = 0$, total repayments are

$$D[(1+r) - \bar{l} - \underline{\epsilon}]. \tag{6}$$

This strategy, which is feasible when average legal costs are high, involves paying all creditors the fall back option of the creditor with the lowest legal costs. The debtor, however, may be better off by lowering the total payout to creditors by paying out some creditors in full in return for lower repayments to all accepting creditors. If the marginal creditor who accepts the deal has legal costs $\bar{l} + \tilde{\epsilon}$, then total repayments are:

$$hD(1+r) + (1-h)D[(1+r) - \bar{l} - \tilde{\epsilon}]. \tag{7}$$

Total repayments when some creditors holdout and are paid in full are lower than repayments when no creditor holds out if **(7)**<**(6)**, which in turn implies

$$\tilde{\epsilon} - \underline{\epsilon} > \frac{h}{1-h}(\bar{l} + \underline{\epsilon}). \tag{8}$$

If we assume legal costs are uniformly distributed, then we can write down a closed form solution for the proportion of holdout creditors. In particular we find that:

$$h = \frac{\tilde{\epsilon} - \underline{\epsilon}}{\bar{\epsilon} - \underline{\epsilon}}.$$

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(7) As those accepting the offer are paid out in full from the debtor's resources.

Substituting this expression into **(8)**, it follows that **(7)** is lower than **(6)** when

$$\bar{\epsilon} - \underline{\epsilon} - \tilde{\epsilon} > \bar{l}.$$

To see whether there is any incentive to follow this strategy, this last inequality needs to be evaluated at $\tilde{\epsilon} = \underline{\epsilon}$, the demeaned legal cost for the toughest creditor. So, if $\bar{\epsilon} - 2\underline{\epsilon} > \bar{l}$ the debtor will always prefer to payout some creditors in full and will do so until $\tilde{\epsilon} = \bar{\epsilon} - \underline{\epsilon} - \bar{l}$. The proportion of holdouts will then be given by $h = 1 - \frac{\bar{l}+\underline{\epsilon}}{\bar{\epsilon}-\underline{\epsilon}}$. Condition $\bar{\epsilon} - 2\underline{\epsilon} > \bar{l}$ is more likely to be met when the distribution of legal costs is widely dispersed relative to its mean. If the debtor does prefer to pay out some creditors in full, this can be very profitable for these hold-out creditors. This is the strategy of the so-called "vulture funds".

Both these options cap total payments to creditors and motivate the debtor to exert the socially optimal level of effort. But, these strategies are only feasible if average legal costs are very high. As legal costs fall, the number of hold-outs increases and the second argument of **(5)** binds. In equilibrium the payoff to holding out and accepting must be equalised for the marginal creditor denoted l_h, that is:

$$\omega^*(1+r) = \frac{y(a) - \omega^*(1+r)(1-h)}{h} - l_h, \qquad (9)$$

implying

$$\omega^*(1+r) = y(a) - hl_h. \qquad (10)$$

The debtor's payoff will be given by

$$\begin{aligned}
D\left\{y(a) - c(a) - (1-h)\,\omega^*(1+r) - h\left(\tfrac{y-\omega^*(1+r)(1-h)}{h}\right)\right\} \\
= D\left\{y(a) - c(a) - (1-h)[y(a) - hl_h] - y(a) - (1-h)[y(a) - hl_h]\right\} \qquad (11) \\
= -c(a)D,
\end{aligned}$$

which is maximised at $a = 0^{(8)}$.

In conclusion, there are three potential equilibria under the New York law case:

1. If legals costs are very high, the debtor can set an offer so that no creditor will have an incentive to holdout, $h = 0$, the debtor exerts optimal effort and social welfare is maximised.

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(8) The conclusion that the debtor will exert zero effort is not meant to be taken literally. For convenience we have set to zero, the minimum additional amount of effort exerted by the debtor, but this could be scaled up to a positive number.

2. If legal costs are high on average but sufficiently dispersed around the mean that a small set of creditors has low legal costs, $h > 0$ but sufficiently low that some creditors are paid out in full and the debtor still has the incentive to exert optimal effort. Social welfare, however, is no longer first-best because of the dead-weight loss of the legal costs paid by the holdout creditors.

3. In all other cases, $h > 0$ and too high to enable holdout creditors to be paid out in full, output is exhausted by payments to creditors and the debtor has no incentive to exert effort. Social welfare is reduced by suboptimal effort and the legal costs incurred by hold-out creditors.

We discuss the policy implications of these different outcomes in Section 6.

4   Equilibrium under CACs - common information

Now consider a device, such as CACs, for binding-in creditors when a sufficient proportion of them have accepted an offer. CACs are common in sovereign bonds issued under English and Japanese law and can be used to change a number of provisions in bond contracts - see Liu (2002) for more details. The focus of the international debate is on the use of CACs under a which a suitable majority of bondholders can agree to change financial provisions of bonds. Under English law, this threshold is typically 75% of outstanding principal at a meeting of bondholders. In this paper we will assume that all bondholders are represented. In this section we assume that information on the distribution of legal costs across creditors is common knowledge; incomplete information will be considered in the next.

Let κ be the critical voting threshold written into the bond. If the incidence of voters who accept the offer is greater than or equal to κ then the offer by the debtor is applied to all creditors, including those that have voted against it. If the offers fails because fewer than κ creditors accept it, then creditors pursue their claims through the courts and the debtor remains in default. In this event, we assume each creditor will eventually receive a share of total output less the resources spent pursuing his claim. As in the New York law case, we assume the legal costs per unit of debt l_i characterise uniquely the "type" of each creditor. In the event that the deal fails, the debtor will not obtain any surplus, so it will not exert any effort. So in going to court a creditor i would expect to receive $y(0) - l_i$. If the offer is accepted, the debtor secures all the surplus and therefore has an

incentive to exert effort. So the debtor's payoffs are:

$$
\begin{cases}
y(a) - \omega^*(1+r) - c(a) & \text{if } \kappa \text{ or more creditors accept} \\
0 & \text{otherwise.}
\end{cases}
\tag{12}
$$

The payoff to the creditor in the $(1-\kappa)$-th quantile of the distribution of legal costs from an offer $\omega(1+r)$ is:

$$
\begin{cases}
\omega(1+r) & \text{if } \kappa \text{ or more creditors accept} \\
y(0) - l_{1-\kappa} & \text{otherwise.}
\end{cases}
$$

So it is a weakly-dominant action to vote to accept the offer provided that $\omega(1+r) \geq y(0) - l_{1-\kappa}$.

Since $y(a^*) - y(0) - c(a^*) > 0$ and legal costs are non-negative, it will always be feasible for the debtor to make an offer that is large enough to persuade a proportion of κ creditors (or more) to accept the offer but small enough to ensure that the first equation in **(12)** is non-negative. The weakly-dominant action for the debtor would be to make an offer which is just large enough to persuade the $(1-\kappa)$-th creditor to accept the offer [9]:

$$
\omega^*(1+r) = y(0) - l_{1-\kappa}.
\tag{13}
$$

So collective action clauses can always elicit the socially efficient level of holdouts: zero. Moreover, this offer will also induce the debtor to exert optimal adjustment effort. To see this, note that debtor surplus is given by

$$
D[y(a) - y(0) + l_{1-\kappa} - c(a)].
\tag{14}
$$

This is maximized when $y'(a) = c'(a)$, which yields the socially efficient level of adjustment effort a^* [10].

How does changing the threshold κ change the outcome? From above we know that

$$
y(a^*) - c(a^*) - y(0) + l_{1-\kappa} > 0,
\tag{15}
$$

and socially optimal effort will always be achieved. There are, therefore, a range of threshold values, κ, which satisfy *ex post* efficiency. Lowering the value of κ gradually transfers any surplus from creditors to the debtor through a lowering of the equilibrium offer. Debtors will clearly

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(9) As the voting threshold, κ, is increased the debtor needs to convince creditors with increasingly lower legal costs. So for example, if $\kappa = 0.9$, the debtor's offer would need to persuade the marginal creditor in the first decile of the legal cost distribution.

(10) The move ordering here is important. If creditors could co-ordinate *ex ante*, they could offer $\omega^*(1+r)$ such that $y(a^*) - c(a^*) - \omega^*(1+r) = 0$, ie extract all the surplus. This is a better offer than they will receive from the debtor and also secures first best effort. But this would remove by assumption any potential intra-creditor coordination problems. The remaining issue would then be any bilateral debtor-creditor bargaing problems that may exist in the presence of incomplete information. These are discussed in the next section.

prefer a low value of κ *ex ante* because it increases their share of the surplus but creditors, on the other hand, prefer a high value of κ because it raises the debtor's offer. This result, though, is highly dependent on the assumption of complete information. Under incomplete information, as discussed in the next section, satisfying **(15)** is no longer guaranteed.

It is also worth noting that, in this set-up, since **(15)** is satisfied, a SDRM-type of mechanism or a bankruptcy court would be redundant. Given a choice of κ satisfying **(15)**, the debtor will always be able to make an offer that will be accepted by the requisite majority of creditors and which will elicit socially optimal adjustment effort. The first-best obtains without the need for a centralised body or mechanism to oversee the restructuring.

5   Equilibrium under CACs - incomplete information

So far, the analysis of CACs has assumed complete information. We consider now the more plausible situation in which there are information asymmetries between the debtor and private creditors at the time the debtor makes the offer. In most real-world situations, the value of creditors' outside options and debtor disutility from adjustment effort are private information to both parties. This, in turn, might induce gaming or bargaining behaviour. Creditors may have an incentive to understate the costs of holding out, to induce the debtor to make a larger offer. And debtors may have an incentive to overstate the true disutility of adjustment effort, to try to get away with making lower offers. We set out an example of this strategic debtor-creditor bargaining behaviour, based on Chatterjee and Samuelson (1983) and assess the efficiency of different mechanisms for debt restructuring.

We assume, as before, that the κ threshold has been specified in the bond contract and is determined in advance. Majority voting with a continuum of creditors is essentially equivalent to a bilateral bargaining game between the debtor and the marginal creditor at the voting threshold. In what follows, we utilise this equivalence by characterising the restructuring as a simultaneous offer from the debtor to a representative creditor[11].

The debtor makes an offer, $\Pi = \omega(1 + r)$ and the representative creditor chooses a minimum offer

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(11) The example can be easily reworked on the assumption that the debtor or creditor moves first, with the main conclusions remaining unaltered. An exact analogy between CACs and a bilateral bargain would require that the marginal creditor could be identified and would know they were the representative negotiator. Nothing of substance is lost by making this assumption.

they are prepared to accept (M). If the debtor's offer exceeds the creditor's minimum, $\Pi \geq M$, then the vote is passed. Π is paid by the debtor to all the creditors and the debtor has an incentive to exert effort because it keeps all the surplus, $\pi = y(a^*) - c(a^*) - \Pi$. On the other hand, if the deal is rejected, the debtor receives no surplus and exerts no effort, as before, and each creditor gets $\widehat{x}_\kappa = y(0) - l_{1-\kappa}$. In summary, the debtor receives

$$\begin{cases} \pi = y(a^*) - c(a^*) - \Pi & \text{if the offer is accepted} \\ 0 & \text{otherwise.} \end{cases} \tag{16}$$

and the κ-th creditor receives

$$\begin{cases} \Pi & \text{if the offer is accepted} \\ \widehat{x}_\kappa = y(0) - l_{1-\kappa} & \text{otherwise.} \end{cases}$$

But the debtor's surplus when exerting optimal effort, and the creditor's return after going to court, are private information and provide the incentive for each party to act strategically. For simplicity, we normalise the debtor's surplus and the representative creditor's reservation value to be defined uniformly on $[0, 1]$[12].

Nature draws π and $\widehat{x}_\kappa$ from their respective distributions[13]. The ranges of these distributions are common knowledge, but the precise outcomes are not known to the creditor and the debtor respectively.

What strategies would both sides pursue? To simplify matters, we focus on pure linear strategies which are strictly increasing and continuously differentiable. The strategy of the debtor, $s_d(\pi)$, maps any surplus from $[0, 1]$ into an offer to creditors. Since π is bound by $[0, 1]$, so is the offer, Π. Similarly, the strategy of the representative creditor, $s_c(\widehat{x}_\kappa)$, maps the creditor's reservation value from $[0, 1]$ into a minimum acceptable offer. The generic linear strategy of the debtor is given by $s_d(\pi) = d_1 + d_2\pi = \Pi(\pi)$ and the generic strategy of the creditors is given by $s_c(\widehat{x}_\kappa) = c_1 + c_2\widehat{x}_\kappa = M$.

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(12) We assume that the distributions of the debtor's surplus and the creditor's reservation values are identical for simplicity. Chatterjee and Samuelson (1983) show that results carry accross when the upper and lower supports of the two distributions are not the same, provided there is some overlap in the distributions which generates mutual benefit from agreeing a deal.

(13) To make matters interesting, we only consider situations in which a restructuring deal is actually feasible which implies $\pi \geq \widehat{x}_\kappa$. If this condition fails, the debtor gets nothing and the creditors get $\widehat{x}_\kappa = y(0) - l_{1-\kappa}$.

In the Appendix it is shown that under these assumptions the equilibrium strategies are given by

$$\Pi = s_d(\pi) = \frac{1}{2}\pi \qquad (17)$$

$$M = s_c(\widehat{x}_\kappa) = \widehat{x}_k,$$

implying that a deal is agreed if

$$\pi \geq 2\widehat{x}_k.$$

This equilibrium is inefficient because gains from a restructuring agreement are possible for all $\pi \geq \widehat{x}_k$. Fewer voluntary agreements will be struck between creditors and the debtor than would be optimal. Given our assumptions about the distribution of creditor legal costs and debtor surplus, the probability of reaching a deal in the absence of strategic behaviour is equal to $\frac{1}{2}$. Strategic behaviour, however, reduces the *ex ante* probability of reaching an agreement from $\frac{1}{2}$ to $\frac{1}{4}$. Intuitively, the debtor exploits the mutual uncertainty about outside options to rise their expected surplus. It is optimal for the debtor to risk failing to secure a deal to lower the amount it has to pay if a deal is reached.

Consider now what occurs if a higher collective action threshold is chosen so the representative creditor is more stringent and the distribution of the debtor's and creditor's reservation values no longer perfectly overlap. Specifically assume the creditor's reservation value is uniform over $[\frac{1}{4}, 1]$ instead of $[0, 1]$. Clearly, one implication is that offers over the interval $[0, \frac{1}{4}]$ are no longer feasible even under full information. If deals are possible, we show in the Appendix that the strategy rule for the debtor is to offer:

$$\Pi = s_d(\pi) = \frac{1}{8} + \frac{1}{2}\pi. \qquad (18)$$

Comparing **(18)** with **(17)** one can see that for a value of π in the feasible region of the deal, the debtor must offer $\frac{1}{8}$ more. This increases the return to all creditors in the event that a deal is struck. Equally, the debtor now receives less in the event that a deal is struck. By comparing **(18)** with the debtor's strategy under **(17)**, we can see that in the relevant region deals can be struck whenever $\pi \geq 2\widehat{x}_k - \frac{1}{4}$. But, overall, the ex ante probability of a deal being struck falls from $\frac{1}{4}$ to $\frac{3}{16}$. Returning to the question of the optimal threshold we can see that debtors will prefer a lower threshold because it simultaneously lowers the amount they have to pay in a successful deal and increases the range of outcomes in which a deal is feasible. Creditors will prefer a higher threshold as long as the benefit of a higher return in the event of a deal is not offset by the fact that the deal are less likely. The official sector will prefer that deals are struck but be uncomfortable if low offers encourage debtor moral hazard. This might explain why there are differences between

debtors, creditors and the official sector, indeed among the private creditor community itself, about the appropriate choice of the threshold[14].

This problem could also arise when there is more than one class of creditor (eg, banks, various bondholders classes and the official sector). These classes of creditor may differ in may ways including in the value of their outside options and in their majority voting thresholds. These differences lower the chances of simultaneously reaching agreement across all classes of creditor. More generally, the probability of simultaneously successful deals falls rapidly as the number of separate deals increases.

One might argue that general conclusions should not be drawn from the above example on three grounds: first, the linear equilibrium outlined above is not unique; second, it refers to a particular game (a double price auction and a particular bargaining procedure); and third, the game does not allow for sequential bargaining. In fact, these generalisations do not alter the basic result. A strong and very general conclusion from the literature on games with private information is that when individual rationality constraints bind and when participation in a deal is voluntary, private information leads to *ex post* bargaining inefficiencies. In particular, the Myerson and Satterthwaite theorem (1983) establishes that two players are unable to exhaust the mutual gains from reaching an agreement if they have incomplete information about each other[15]. Voluntary, market-based solutions to the bargaining problem will generate suboptimal outcomes under imperfect information. This is the case regardless of how the strategies of the players are formulated, how trading mechanisms for the debt are specified and how the bargaining process is sequenced[16].

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(14) Haldane, Hayes, Penalver, Saporta and Shin (2002) develop a model which nests both liquidity and solvency crises. They find that expected creditor returns in the event of insolvency are key in determining the probability of a liquidity run by short-term creditors. The higher the expected recovery rate, the lower the probability of liquidity runs. In such an extended framework, debtors may be better off sacrificing surplus ex-post by issuing bonds with high voting thresholds because it lowers the probability of a liquidity run.

(15) Laffont and Maskin (1979) also arrive at an inefficiency result in a more general model with more than two agents (but with an additional regularity assumption on acceptable equilibria that Myerson and Satterthwaite do not need to make). A number of extensions to the Myerson and Satterthwaite result exist. For references, see Fudenberg and Tirole (1991).

(16) The key difference between one-stage and multi-stage models is that in the latter the bargaining inefficiency does not result from lack of agreement but from a delay in the eventual agreement caused by information being revealed over time during the bargaining process (Chatterjee 1985). Using a different framework, Eaton (2002) also discusses how imperfections in information and in enforcement in a sovereign debt context can generate a role for a supranational agency or international bankruptcy court

6 Policy implications

We conclude with some policy implications of our analysis:

(a) The welfare implications of New York law bonds depend on the bargaining strength of creditors. If this is low - for example, if legal costs are very high - then even a low debtor offer will be capable of satisfying most or all of the creditors. In this situation, even New York law bonds can achieve a socially optimal restructuring outcome by attracting unanimous creditor support and providing the debtor with incentives to put in policy effort.

In the majority of cases of interest, however, we might not expect the efficient outcome to obtain under New York law bonds. Two potential interrelated inefficiencies arise: (i) a hold-out inefficiency, whereby some creditors hold out from the offer and cause output disruption; and (ii) an adjustment inefficiency, whereby the debtor knowing that surplus output will be usurped by hold-outs fails to exert sufficient policy effort. Both inefficiencies derive from intra-creditor coordination failures. These are more likely to arise the greater is the bargaining strength of creditors (the lower their legal costs) and the wider the distribution of creditors. The move towards bonds and away from loans during the 1990s is likely to have amplified these effects. So too has some of the evidence that creditors may becoming more adept in attaching sovereign assets, following the Elliott Associates versus Peru case in 2000. Indeed, it is probably these trends in capital markets that explain the renewed focus on other (than New York bond) instruments to help resolve these inefficiencies.

The model does help demonstrate, however, how existing contractual provisions in New York law bonds might be used to improve outcomes. For example "exit consents" were used in the debt exchange by Equador in 2000 and recently in Uruguay. These change the non-financial terms of bonds for hold-out creditors, lowering their value. In our model, this is equivalent to raising the legal costs of rejecting an offer. As the model illustrates, this can be welfare-enhancing as a second-best means of overcoming some of the inefficiencies otherwise associated with New York law bonds.

(b) CACs provide a potentially first-best means of overcoming these inefficiencies. They potentially resolve intra-creditor coordination problems: the holdout inefficiency, by binding-in creditors (above the contractual threshold κ); and the adjustment inefficiency, by allowing debtors to enjoy more of the benefits of their policy effort. Where the voting threshold is set is

a potential source of disagreement between the debtor and creditors, as it determines how the surplus will be divided between them. This helps explain the on-going debate between the two parties on the optimal setting for κ. Wherever this bargain is struck, however, it is capable of securing a first-best outcome - provided importantly, that debtors and creditors have complete and common information on each others' preferences. In this world, the SDRM - whether SDRM-lite or SDRM-heavy - would be redundant. Voluntary, market-based solutions with instruments containing CACs would deliver the social optimum.

(c) This policy conclusion, however, does not survive relaxation of the common information assumption. Incomplete information results in an inefficiency which CACs cannot resolve. In our example, CACs resolve the intra-creditor coordination problem. But the outcome is still *ex post* inefficient. This is because in a world of incomplete information, the optimal offer and the optimal decision rule of each player depends not only on their private valuations, but also on their beliefs about other players' payoffs. Uncertainty over payoffs creates incentives for strategic behaviour that market-based co-ordinating devices cannot solve. Or put another way, the information friction introduces a bargaining problem between the debtor and its creditors, even in the absence of intra-creditor coordination problems. The upshot is that fewer voluntary debt exchange offers are done than would be optimal. And the higher the collective action threshold the more difficult it is to strike a deal. These inefficiencies are potentially greater, the greater the number of debt instruments held by disparate creditor groups - that is, aggregation problems compound this bargaining inefficiency.

(d) How could these inefficiencies be resolved? As Myerson and Satterthwaite (1983) show, no voluntary bilateral exchange is able to resolve this inefficiency, however sophisticated, with or without CACs. One solution is some sort of third-party intervention - in the sovereign context, a bankruptcy court or SDRM[17]. The nature of this intervention will depend on the nature of the friction. If it is a private information friction between debtors and creditors, the role of the third party is to observe private valuations and arbitrate between them in seeking an efficient exchange value. If the friction is due to strategic behaviour, the role of the third party would be to observe true valuations by the debtor and creditors and ensure that a true exchange value is enforced, balancing the interests of debtors and creditors.

In either of these roles, the third-party intervention is much closer to the SDRM-heavy than the SDRM-lite approach. Under SDRM-lite, it would be left in the hands of private creditors to vote and approve voluntarily any exchange offer by the debtor. So with uncertainties and/or

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(17) See White (2002) for a discussion of the merits of various sovereign bankruptcy proposals. Contributions to the SDRM include Roubini (2002), Scott (2002), Truman (2002) and Shleifer (2003).

gaming on both sides, there is little scope for an efficient outcome. Only with the involuntary imposition of an exchange value by some neutral third-party would an efficient allocation obtain - the SDRM-heavy approach.

Indeed, it is possible - although this possibility is not a direct implication of the model - that the mere threat of the SDRM would be sufficient to secure an efficient equilibrium. For example, if differences in creditor and debtor valuations are due to strategic behaviour, then the expectation that the SDRM would be invoked if a voluntary exchange offer failed may induce debtors and creditors to reveal their true valuations at the time of the exchange offer. In this role, the SDRM would backstop CACs. The statutory approach would be a necessary complement to the contractual approach. If the differences in creditors' and the debtor's valuations is due to private information, then the role of the SDRM would be to step in after an exchange offer had failed to arbitrate. Again, the SDRM would backstop CACs. But in this case the statutory approach would substitute for the contractual approach. In either role, the SDRM would be a necessary ingredient of an efficient work-out.

(e) So what are the necessary conditions for an SDRM type of approach to be welfare-enhancing in a sovereign context? There are broadly two. First, co-ordination problems between debtors and creditors need to be sufficiently acute to rule out an efficient bargaining outcome. This is ultimately an empirical question. Debt work-out experience suggests no hard and fast rules. Some of the sovereign debt work-outs during the 1990s were resolved fairly expeditiously – for example, bond exchanges involving Ukraine and Pakistan in 1999 and Uruguay in 2003. But other experience points towards a lengthier and more acrimonious bargaining game – for example, Russia in 1998, Ecuador in 1999[18] and prominently Argentina during 2002. Indeed, perhaps the best case study was the Latin American debt crisis in the 1980s, when the workout persisted in some cases for almost a decade. Interestingly, the 1980s debt crisis was only resolved following third-party intervention in the form of the Brady plan. Past experience suggests that the creditor-debtor bargaining problem is a very real one in a sovereign context. It has nevertheless been largely overlooked in the recent debate on sovereign debt resolution. Once it is placed centrestage, it suggests quite striking public policy implications: voluntary, creditor-led market mechanisms are no longer adequate. Supra-national intervention can support efficient outcomes.

Second, for this intervention to be welfare-enhancing, however, the third-party needs to have adequate information and enforcement powers, as well as well-aligned incentives. The last of

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[18] Roubini (2002) believes these were sufficiently successful to rule out the need for non-market solutions. He also argues the hold-out problem is overstated.

these has often been a bone of contention with the private sector (eg, IIF (2002)). For example, it is often argued that any third-party - for example, the IMF – would be subject to political pressures (Shleifer (2003)). Whether it is possible to design a supra-national agency whose governance structure is immune to such pressures is a question for political scientists, rather than economists. Economics suggests, however, that this is a question well worth asking.

Appendix: Solution to the linear asymmetric information case under collective action clauses

Let $G_d(.)$ and $G_c(.)$ be the equilibrium distributions of the debtor's offer and the creditor's minimum acceptable offer. The probability that the debtor can extract surplus π that induces him to make an offer less or equal to ξ is equal to $G_d(\xi)$ and the probability that the creditor's reservation value is such that induces him to accept an offer only if it is greater than or equal to ξ is equal to $G_c(\xi)$.

The maximisation problem for the debtor is to choose an offer that maximises the expected payoff, that is

$$\text{Max}_\Pi \int_0^\Pi [\pi - \Pi] dG_c(M) \tag{A-1}$$

where $\Pi = s_d(\pi)$ and $M = s_c(\widehat{x}_\kappa)$. The first-order condition is given by

$$[\pi - s_d(\pi)]g_c(s_d(\pi)) = G_c(s_d(\pi)). \tag{A-2}$$

At the margin, the surplus that the debtor can extract by offering less must be equal to the probability that that the creditor's reservation value is such that the creditor's minimum acceptable offer will still allow a deal to be reached. The analogous maximisation problem for the creditor is given by

$$\text{Max}_M \int_M^1 [\Pi - \widehat{x}_\kappa] dG_d(\Pi), \tag{A-3}$$

which yields the following first order condition

$$0 = 0 - G_d(s_c(\widehat{x}_\kappa)). \tag{A-4}$$

The creditor can do no better than to guarantee a deal for any offer which exceeds the reservation value, therefore creditors should follow the strategy $M = \widehat{x}_\kappa$.

Given our assumption that the creditor's reservation value is drawn from a uniform distribution over $[0, 1]$, $G_c(\Pi) = \Pi$ and $g_c(x) = 1$. Substituting this density and the conjectured linear strategy $\Pi = s_d(\pi) = d_1 + d_2\pi$ into **(A-2)**, we obtain:

$$\pi - d_1 - d_2\pi = d_1 + d_2\pi$$

Equating coefficients we get $d_2 = \frac{1}{2}$ and $d_1 = 0$.

Therefore, the debtor follows a strategy of making an offer

$$\Pi = s_d(\pi) = \frac{1}{2}\pi \tag{A-5}$$

and the representative creditor sets a minimum offer $M = s_c(\widehat{x}_k) = \widehat{x}_\kappa$. Recall that an offer is only accepted when $\Pi \geq M$ which means a deal is only struck when $\pi \geq 2\widehat{x}_\kappa$. But efficiency would require deals to be struck whenever $\pi \geq \widehat{x}_\kappa$, therefore the result under uncertainty is inefficient. Now consider what happens if the creditor's distribution of potential reservation values is uniform over $[\frac{1}{4}, 1]$ instead of $[0, 1]$. The maximisation problems and conditions (A-1) to (A-4) are unchanged but $G_c(\Pi) = \frac{4}{3}[\Pi - \frac{1}{4}]$ and $g_c(x) = \frac{4}{3}$. Substituting these values into (A-2) we get

$$\pi - d_1 - d_2\pi = d_1 + d_2\pi - \frac{1}{4} \tag{A-6}$$

and equating coefficients we obtain a strategy rule for the debtor to offer

$$\Pi = s_d(\pi) = \frac{1}{8} + \frac{1}{2}\pi. \tag{A-7}$$

Comparing (A-7) with (A-5) one can see that for an value of π in the feasible region of the deal, the debtor must offer $\frac{1}{8}$ more when the voting threshold is higher. This increases the return to all creditors in the event that a deal is struck. Equally, the debtor now receives less in the event that a deal is struck. The probability of striking a deal in the first place, however, drops from $\frac{1}{4}$ to $\frac{3}{16}$. This is because the probability of the debtor striking a deal for draws of π in the range $[0, \frac{1}{4}]$ is zero and rises linearly with π to a probability of a $\frac{1}{2}$ for a draw of $\pi = 1$.

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