Collective Action Clauses: An Analytical Model

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Abstract

A major sovereign restructuring exercise is underway in Argentina and another is ready to get started in Lebanon, both very significant borrowers in the international capital markets. Surely, the two situations are vastly different. First, while Argentina is striving to avoid a hard default, Lebanon procrastinated to the point that one became inevitable. Secondly, a very substantial portion of Argentina's public debt (including multilateral debt) is foreign-owned, the overwhelming majority of Lebanon's is owned by residents (including its central bank). Lastly, among the major differences, Argentina's problem is one of unsustainability of the central government's debt, while in Lebanon, due to the central bank's insolvency, the consolidated public debt is the relevant metric of indebtedness. But, as much as the two situations differ in terms of the buildup dynamics and resolution structure, they share one thing in common: both countries have elected to deal first with their New York law debt which, in both cases, contains collective action clauses (CACs). While Argentina's New York law private debt contains double-limb and single-limb (with aggregation) issues, the entire stock of Lebanon's New York law debt is governed by classic CACs (bond-by-bond voting, no aggregation). We hope that, as negotiations start, this article can contribute to both debtors and creditors in each hot spot make rational decisions tending to preserve as much value as possible for all stakeholders.

1 Introduction

The contractual approach currently in use to facilitate sovereign debt restructurings relies on inserting clauses in sovereign bond contracts which set out procedures for initiating and negotiating a restructuring and which allow a qualified majority of creditors to modify the financial terms of the bonds (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.

The analytical framework, although simple, aims to capture many of the key features of sovereign debt restructuring. Much of the historical debate over the last two decades has focused on potential coordination problems within the creditor community – e.g., free-rider problems, "rogue" creditors, and litigation risks. These risks may have been over-emphasized: sovereigns cannot be liquidated and it is difficult to attach their assets. Nonetheless, we show that when these coordination inefficiencies are important, CACs can deal with them.

A second potentially significant coordination problem comes from the interaction between creditors and the debtor. In a sovereign context, the debtors' payment capacity is usually dependent on its own actions. And these actions are, in turn, subject to domestic political constraints. Consequently, the debtor may have disincentives to revealing its true payment capacity while creditors may have little incentive to reveal the lowest NPV deal they are prepared to accept. The resulting bargaining game between the debtor and its creditors under incomplete information may thus give rise to inefficiencies.

In short, the sovereign debt restructuring process gives rise to intra-creditor and debtor-creditor coordination problems, with the latter likely being more acute than in the corporate context for lack of a liquidation remedy. Both have efficiency costs. This article analytically explores the mechanisms that might best mitigate these inefficiencies.

By using an analytical framework, I hope to identify some of the key characteristics that are likely to determine the optimal restructuring mechanism. The model suggest that no one mechanism is always and everywhere optimal – contrary to what much of the existing debate would have us believe.

A limited number of papers have addressed this problem 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 my framework, neither paper tests the robustness of their results to a relaxation of the complete information assumption. This problem may be an important impediment to sovereign debt restructurings, even in the absence of willingness to pay or debtor commitment problems.

This article is organized 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 characterize 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 concludes.

2 The Model

There is a single debtor and a continuum of external creditors of unit mass, each holding one unit of a bond.[1] For the purposes of my analysis, I take as a given that the debtor finds itself without sufficient resources to repay this debt, and must make an offer to all creditors to be relieved of part of its outstanding obligations. In this sense, my analysis has an *ex post* focus. A more complete analysis of sovereign debt would also need to address the *ex ante* issue of the borrower's access to the international capital markets. Haldane *et al.* (2002) address some of these issues.

Let's denote y_0 the amount of debtor's resources at the start of the game. This amount is less than the total amount owed, $1 + r$. However, the debtor has the ability to exert fiscal effort to augment the total resources available for repayment. If the debtor exerts effort a, then the total resources available to repay creditors become $y(a)$.

If no fiscal effort is expended, then total resources remain at y_0. That is, $y(0) = y_0$. For the purposes of this analysis, we can interpret $y(a)$ as the total value of claims that are attachable by the creditors in the jurisdiction in which the bond was issued. Such claims include not only the assets owned by the debtor in the jurisdiction of issue, but also the net present value of future receivables. In practice, there are very few assets that creditors can attach in foreign jurisdictions. The existence of outstanding claims can, however, disrupt future market access. In what follows, I assume that the court finds for the creditors and allocates $y(a)$ among them. The important aspect of this assumption is that the more the available output, the greater the payout to holdouts.[2] Other aspects of my model can be generalized, as long as this key assumption remains.

The debtor's cost of effort is given by $c(a)$, an increasing function of a. The debtor's objective is to maximize resources, net of the cost of effort and net of the repayment to creditors. The debtor's objective can thus be written as:

$$y(a) - c(a) - \text{repayment to creditors}$$

[1] A model with different sizes of creditors, each with different degrees of power, is explored in Corsetti, Dasgupta, Morris, and Chin (2001).

[2] A debtor who exerts effort may, for example, have developed a number of positive-NPV investment opportunities but would have to settle with holdouts before re-accessing the international capital markets. The more such investment opportunities the debtor has, the more leverage holdouts 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).

I assume that the difference $y(a) - c(a)$ is single-peaked, concave, and differentiable in a. I rule out instances of strategic default[3], where the debtor would still gain a surplus by exerting effort and paying off debt but chooses not to do so.[4] In my model debtors default because they are unable, not unwilling, to repay their debt.

Since the debtor cannot repay in full, 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 action aimed at disrupting the debtor's output and/or prolonging the restructuring process.

All creditors have a claim, $1+r$, on the debtor, but they differ according to the costs of rejecting the offer and holding out. Each creditor, i, has a private cost of l_i to holding out. There are many reasons why such costs may differ across creditors. For example, some creditors (e.g., bond mutual funds) may have investors with shorter investment horizons than others (e.g., pension funds and life insurance companies). There may also be differences in balance sheet structures, in agency problems related to compensation structure, and in accounting and regulatory rules. Alternatively, i_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) versus an uncertain one (holding out). These costs are given by:

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

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 $F(.)$ with support on $[\underline{\epsilon}, \bar{\epsilon}]$. All creditors have non-negative costs, so that the lowest possible realization of l_i is non-negative.

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 reject it.

3. The debtor learns the outcome of the vote and chooses policy effort a.

4. Total resources $y(a)$ are realized.

5. Payoffs are distributed. Creditors who accepted the offer receive $\omega(1 + r)$. Creditors who rejected the offer receive the face value of the claim, $1 + r$, net of legal costs, if $y(a)$ is large enough. Otherwise, they receive an equal share of the remaining resources, net of legal costs. The debtor's payoff is given by:

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

[3]The distinction between willingness and ability to pay was first emphasized by Easton and Gersowitz (1981).

[4]I 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. This hypothetical equilibrium would violate *pari passu*

The social welfare function is given by the sum of the debtor's and creditors' payoffs, less the sum of legal costs paid by the holdouts. Formally, it is given by:

$$W = y(a) - c(a) - \int_{\bar{l}+\underline{\epsilon}}^{l_h} z f(z) dz, \tag{1}$$

where l_h is the marginal holdout creditor. Since Eq. (1) is decreasing in l_h, the socially optimal outcome is attained when there are no holdout creditors (i.e., $l_h = \bar{l} + \underline{\epsilon}$), and adjustment effort a solves:

$$y^{'}(a) = c^{'}(a) \tag{2}$$

I denote this socially optimal level of policy effort[5] as a^*. So, by denoting welfare a $W(a, h)$, the first-best welfare is $W(a^*, 0)$. I use this as the welfare benchmark when comparing different contractual arrangements.

3 Equilibrium Under New York Law

I first consider contractual arrangements that require the unanimous consent of all creditors to amend financial terms. The usual means of restructuring bonds under New York law are exchange offers. The debtor offers creditors $\omega(1 + r)$ in return for the old bonds with value $1 + r$. Creditors who decline the offer can seek full repayment through the courts. If there are enough resources to pay each holdout creditor in full, then I assume that the creditor receives the full value of their claim less their litigation costs. But if there are too many holdouts and the debtor's resources are insufficient to satisfy them all in full, each holdout receives a pro-rated share of residual output after the creditors who accepted the offer have been paid.[6]

On practical grounds, I rule out cases in which the debtor deliberately makes an offer that no creditor will accept, adjustment effort is zero and all creditors litigate, since this is a worst-case scenario for all parties. Consequently, I only consider cases where:

$$\omega(1 + r) > y(0) - \bar{l} - \bar{\epsilon}. \tag{3}$$

Where the payoff to a holdout then becomes:

$$min\Big\{(1 + r) - l_j \, , \, \frac{y(a) - \omega(1 + r)(1 - h)}{h} - l_j\Big\} \tag{4}$$

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

In making the offer $\omega(1+r)$ the debtor's strategy is to maximize $y(a) - c(a)$ net of total payout to creditors, based on Eq. (4). Ideally, the debtor would like to cap the total payout

[5] Trivilally, we require $y(a^*) - c(a^*) > y(0)$ to get $a^* > 0$.

[6] As those accepting the offer are paid out from the debtor's resources.

to creditors and then exert optimal effort a^*. Another option available to the debtor is to make an offer that every creditor would accept. If the debtor sets the lowest feasible offer consistent with $h = 0$, total repayments are:

$$(1 + r) - \bar{l} - \underline{\epsilon}. \tag{5}$$

This strategy, which is feasible when average legal costs are high, involves paying all creditors the fallback 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:

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

Total repayments when some creditors hold out and are paid in full are lower than repayments when no creditor holds out if Eq. (6) ¡ Eq. (5) which, in turn, implies:

$$\tilde{\epsilon} - \underline{\epsilon} > \frac{h}{1 - h}(\bar{l} + \underline{\epsilon}). \tag{7}$$

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

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

Substituting this expression into Eq. (7), it follows that Eq. (6) is less than Eq. (5) 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 pay some creditors out in full until $\tilde{\epsilon} = \bar{\epsilon} - \underline{\epsilon} - \bar{l}$. The proportion of holdouts will then be $h = 1 - (\bar{l} + \underline{\epsilon})/(\bar{\epsilon} - \underline{\epsilon})$. The condition $\bar{\epsilon} - 2\underline{\epsilon} > \bar{l}$, which creates an incentive for the debtor to prefer to pay some holdouts in full is most likely to be met when the distribution of legal costs is widely dispersed relative to its mean. Therefore, this is the ideal scenario for vulture investors.

Both options above cap total payments and motivate the debtor to exert the socially optimal level of effort. But these strategies are only feasible when legal costs are very high. As legal costs fall, the number of holdouts increases and the second argument of Eq. (4) binds. In equilibrium, the payoff from holding out must equal that from accepting for the marginal creditor, l_h, that is:

$$\omega^*(1 + r) = \frac{y(a) - \omega^*(1 + r)(1 - h)}{h} - l_h, \tag{8}$$

implying:

$$\omega^*(1+r) = y(a) - hl_h. \tag{9}$$

The debtor's payoff will be given by:

$$\begin{aligned} & y(a) - c(a) - (1-h)\omega^*(1+r) - h\Big(\frac{y - \omega^*(1+r)(1-h)}{h}\Big) \\ & = y(a) - c(a) - (1-h)[y(a) - hl_h] - y(a) - (1-h)[y(a) - hl_h] \\ & = -c(a) \end{aligned} \tag{10}$$

which is maximized at $a = 0$[7]

Thus, depending on the legal costs of the lenders, we can identify three possible outcomes of the game under New York law.

1. If legal costs are high on average but differ widely among the creditors so that:

$$\bar{\epsilon} - 2\underline{\epsilon} > \bar{l} \tag{11}$$

then it is optimal for the debtor to offer creditors of the type $\tilde{\epsilon} \equiv \bar{\epsilon} - \underline{\epsilon} - \bar{l}$ indifferent between accepting and rejecting the offer. All creditors with legal costs lower than this marginal type will hold out. Nevertheless, in this scenario the debtor exerts optimal effort and gains a surplus.

2. If Eq. (11) is not satisfied but legal costs are high enough that:

$$y(a^*) - c(a^*) > (1+r) - \bar{l} - \underline{\epsilon} \tag{12}$$

then the debtor's optimal offer is $(1+r) - \bar{l} - \underline{\epsilon}$ to all creditors , and no creditor holds out. In this scenario the debtor also exerts optimal effort.

3. In all other cases, $h > 0$ and the incidence of holdouts is too high to enable holdouts to be paid in full. Total resources are 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 the holdouts.

4 Equilibrium With CACs – Common Information

Now consider that the sovereign bonds are still governed by New York law but contain CACs. We assume that all bondholders vote and (for now) that the distribution of legal costs across creditors is common knowledge; incomplete information will be considered in the next section.

[7] The conclusion that the debtor will exert zero effort must not be taken literally. For convenience, I have set the minimum amount of additional effort to be exerted by the debtor at zero, but this could be scaled up to a positive number.

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 all creditors, including those who have rejected the offer, are bound by it. If the offer 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, I assume that each creditor will eventually receive a share of total output less the resources spent pursuing their claim. As in the no-CACs case, I assume that the legal costs per unit of debt, l_i, characterize uniquely the "type" of each creditor. In the event that the deal fails, the debtor will not obtain any surplus and, therefore, 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:

$$\begin{cases} y(a) - \omega^*(1+r) - c(a) & \text{if } \kappa \text{ or more creditors accept} \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

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

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

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

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 (or more) creditors to accept the offer but small enough to ensure that the first term in Eq. (13) 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[8]:

$$\omega^*(1+r) = y(0) - l_{l-\kappa} \tag{14}$$

So CACs 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 the debtor's surplus is give by:

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

This expression is maximized when $y^{'}(a) = c^*(a)$, which yields the socially efficient level of adjustment a^*.[9]

[8] 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.

[9] The sequencing is important here. If creditors could coordinate *ex ante*, they could offer $\omega^*(1+r)$ such that $y(a^*) - c(a^*) - \omega^*(1+r) = 0$, i.e., 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.

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

$$y(a^* - c(a^*) - y(0) + l_{1-\kappa} > 0, \tag{16}$$

and socially optimal effort will always be achieved. There are, therefore, a range of threshold values, κ, which satisfy *ex post* efficiency. Altering κ within this range does, however, have distributional consequences. Lowering the value of κ gradually transfers any surplus from creditors to the debtor through a lowering of the equilibrium offer. Debtors will clearly prefer a low value of κ *ex ante* because it increases their share of the surplus. By contrast, creditors 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 Eq. (16) is no longer guaranteed.

5 Equilibrium With CACs – Incomplete Information

So far, the analysis of CACs has assumed complete information. I 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, induces gaming or bargaining behavior. Creditors have an incentive to understate the costs of holding out and debtors to overstate the true disutility of the adjustment effort. To illustrate, I set an example of this strategic debtor-creditor bargaining behavior based on Chatterjee and Samuelson (1983), and assess the efficiency of different mechanisms for debt restructuring.

I assume, as before, that the κ threshold has been specified in advance in the bond contract. 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. From here on, I utilize this equivalence by characterizing the restructuring as a simultaneous offer from the debtor to a representative creditor.[10]

The debtor makes an offer, $\Omega = \omega(1 + r)$ and the representative creditor chooses a minimum offer they are prepared to accept, M. If the debtor's offer exceeds the creditor's minimum, $\Omega \geq M$, then the vote exceeds the required threshold, κ. Ω is paid by the debtor to all the creditors and the debtor has an incentive to exert effort because it keeps all the surplus, $y(a^*) - c(a^*) - \Omega$. On the other hand, if the deal is rejected, the debtor receives no surplus and the debtor exerts no effort; in this case each creditor gets $\hat{x_\kappa} = y(0) - l_{1-\kappa}$. For notational simplicity, for here on I denote the output surplus $\pi = y(a^*) - c(a^*)$. In summary, the debtor receives:

[10] The example can be easily reworked on the assumption that the debtor or creditor moves first, with the 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.

$$\begin{cases} \pi - \Omega & \text{if the offer is accepted} \\ 0 & \text{otherwise} \end{cases} \tag{17}$$

and the κ-th creditor receives:

$$\begin{cases} \Omega & \text{if the offer is accepted} \\ \hat{x_\kappa} = y(0) - l_{1-\kappa} & \text{otherwise} \end{cases}$$

But the debtors' surplus when exerting optimal effort and the creditor's return after going to court are both private information and provide incentives for each party to act strategically. For simplicity, I normalize the debtor's surplus and the representative creditor's reservation value to be defined uniformly on $[0, 1]$.[11]

Nature draws π and $\hat{x_\kappa}$ from their respective distributions.[12] The ranges of these distributions are common knowledge, but the precise outcomes are not known to the creditor and the debtor, respectively.

What strategy should each side pursue? For simplicity, I focus on linear strategies. 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, Ω. Similarly, the strategy of the representative creditor, $s_c(\hat{x_\kappa})$, maps the creditor's reservation value from $[0, 1]$ into a minimum acceptable offer. The debtor's strategy is given by $s_d(\pi) = d_1 + d_2\pi = \Omega(\pi)$ and the creditor's strategy can be expressed as $s_c(\hat{x_\kappa}) = c_1 + c_2\hat{x_\kappa} = M$.

The proof in the Appendix shows that, under these assumptions, the equilibrium strategies are given by:

$$\begin{cases} \Omega & = s_d(\pi) = \frac{1}{2}\pi \\ M & = s_c(\hat{x_\kappa}) = \hat{x_\kappa}, \end{cases} \tag{18}$$

implying that a deal is agreed if:

$$\pi \geq 2\hat{x_\kappa}.$$

This equilibrium is inefficient because gains from a restructuring are possible for all $\pi \geq \hat{x_\kappa}$. Fewer voluntary agreements will be struck between creditors and the debtor than would be optimal. Given my assumptions about the distribution of creditor legal costs and debtor surplus, the probability of reaching a deal in the absence of strategic behavior is equal to $\frac{1}{2}$. Strategic behavior, 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

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

[12] I only consider situations in which a restructuring is actually feasible, which implies $\pi geq \hat{x_\kappa}$. If this condition fails, the debtor gets nothing and the creditors get $\hat{x_\kappa} = y(0) - l_{1-\kappa}$.

to increase its expected surplus. If a deal is reached, it is optimal for the debtor to risk failing to secure a deal with a lower payoff.

Consider now what happens if a higher collective action threshold is chosen so that the representative creditor is more demanding and the distribution of the debtor's and creditor's reservation values no longer perfectly overlap. Specifically, assume that 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, I show in the Appendix that the strategy rule for the debtor is to offer:

$$\Omega = s_d(\pi) = \frac{1}{8} + \frac{1}{2}\pi. \tag{19}$$

Comparing Eq. (19) to Eq. (18) we see that, for any value of π within the deal domain, the debtor has to offer $\frac{1}{8}$ more, which increases the recovery to all creditors if a deal is done. By comparing Eq. (19) to de debtor's strategy under Eq. (18), it becomes apparent that deals are possible whenever $\pi \geq 2\hat{x_\kappa} - \frac{1}{4}$. However, *ex ante*, the probability of a deal being struck drops 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 increase the range of outcomes in which a deal is feasible. Creditors will prefer a higher threshold as long as the higher recovery if a deal happens is not offset by the diminished likelihood of a deal. Should be official sector be involved, it will prefer that deals are struck, as long as they don't encourage moral hazard. The above preference trilogy explains why, in most sovereign restructurings, we observe differences between debtors, creditors, and the official sector (and, indeed, among private creditors themselves) above the choice of a threshold.

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 auction); and, third, the game does not allow for sequential bargaining. In fact, the above generalizations do not alter the basic result. A strong and very general conclusion from the literature on bargaining with two-sided incomplete 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-Satterwhaite 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.[13] Voluntary, market-based solutions to the bargaining problem will generate suboptimal outcomes under imperfect information. This is the case regardless of how

[13]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 Satterwhaite do not need to make. A number of extensions to the Myerson-Satterwhaite result exist. For references, see Fundenberg and Triole (1981).

the players' strategies are formulated, how trading mechanisms for the debt are specified, and how the bargaining process is sequenced.[14]

6 Conclusions

Our analysis leads us to the following conclusions:

1. The welfare implications on non-CAC New York law bonds depend on the creditors' bargaining strength . If it is low (e.g., if legal costs are very high), then even a low offer will be capable of satisfying most creditors. In this situation, even non-CAC New York law bonds can achieve a socially optimal restructuring outcome by attracting unanimous creditor support and providing the debtor to put in policy effort. However, this is the exception and not the norm. Non-CAC New York law bonds embed two inefficiencies: (i) a holdout inefficiency, whereby some creditors reject the offer and cause output disruption; and (ii) an adjustment inefficiency, whereby the debtor, knowing that surplus output will be usurped by holdouts, fails to exert sufficient policy effort. Both inefficiencies derive from intra-creditor coordination failures. These are more likely to arise the greater the creditors' bargaining power (the lower their legal costs), and the greater the heterogeneity of creditors.

2. CACs provide a potentially first-best means of overcoming these inefficiencies. First, they alleviate intra-creditor coordination problems by binding in creditors above the contractual threshold, κ. Secondly, they potentially solve the adjustment inefficiency by allowing debtors to enjoy more of the benefits of their policy effort. Whenever the debtor and creditors have complete and common information on each others' preferences, they will agree on a threshold, κ, capable of securing a first-best outcome.

3. However, the above conclusion does not survive the relaxation of the common information assumption. Incomplete information results in an inefficiency that CACs cannot resolve: strategic behavior. 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 for 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 behavior that market-based coordinating devices cannot solve. Indeed, the information friction introduces a bargaining problem between the debtor and its creditors even in the absence of intra-creditor coordination problems. These inefficiencies are greater the greater the number of contractually heterogeneous debt instruments outstanding – that is, aggregation problems compound this bargaining inefficiency.

[14] The key difference between one-stage and multi-stage models is that, in the latter, the bargaining inefficiency does not result from lack of an agreement but from a delay in the eventual agreement caused by information being revealed over time during the bargaining process (Chatterjee, 1985).

7 Appendix: Solution to the Linear Asymmetric Information Case With CACs

Let $G_d(.)$ and $G_c(.)$ be the equilibrium distributions of the debtor's offer and the creditor's reservation value. The probability that the debtor can extract a surplus that induces them to make an offer less or equal than ϑ is equal to $G_d(\vartheta)$ and the probability that the creditors's reservation value is such that it induces them to accept an offer only if it is greater or equal to ϑ is equal to $G_c(\vartheta)$.

The debtor's maximization problem is to choose an offer that maximizes the expected payoff, i.e.:

$$Max_{\Omega} \int_{0}^{\Omega} [\pi - \Omega] dG_c[s_c(\hat{x_\kappa})] \tag{20}$$

where $\Omega = s_d(\pi)$ The first-order condition is given by:

$$[\pi - s_d(\pi)]g_c(\Omega) = G_c(\Omega)$$

At the margin, the surplus that the debtor can expect to extract by offering less must be equal to the probability that the creditor's reservation value will allow a deal to be reached. The analogous maximization problem for the creditor is given by:

$$Max_M \int_{M}^{1} [\Omega - \hat{x_\kappa}] dG_d[s_d(\pi)], \tag{21}$$

which results in the following first-order condition:

$$-[M - \hat{x_\kappa}]g_d(M) = 0$$

Therefore, the creditor can do no better than follow the strategy $M = \hat{x_\kappa}$ regardless of the debtor's strategy; i.e. guarantee a deal for any offer that guarantees their reservation value.

Given the assumption that the creditor's reservation value is drawn from a uniform distribution over $[0, 1]$, $G_c(\Omega) = \Omega$ and $g_c(x) = 1$.

By substituting this density and the conjectured linear strategy $\Omega = s_d(\pi) = d_1 - d_2\pi$ into Eq. (21), we get:

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

Equating coefficients on both sides, we get $d_2 = \frac{1}{2}$ and $d_1 = 0$. Therefore, the debtor makes the offer:

$$\Omega = s_d(\pi) = \frac{1}{2}\pi \tag{22}$$

and the representative creditor sets a reservation value of:

$$M = s_c(\hat{x_\kappa}) = \hat{x_\kappa}$$

Recall that an offer is only accepted when $\Omega \geq M$, which means that a deal is only struck when $\pi \geq 2\hat{x_\kappa}$. But efficiency requires deals to be struck whenever $\pi \geq \hat{x_\kappa}$, so 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 maximization problems and conditions of Eqs. (20)-(23) are unchanged but $G_c(\Omega) = \frac{4}{3}[\Omega - \frac{1}{4}]$ and $g_c(x) = \frac{4}{3}$. Substituting these values into Eq. (21), we get:

$$\pi - d_1 - d_2\pi = d_1 + d_2\pi - \frac{1}{4} \tag{23}$$

and, equating coefficients on both sides, we obtain a strategy rule for the debtor to offer:

$$\Omega = s_d(\pi) = \frac{1}{8} + \frac{1}{2}\pi \tag{24}$$

Comparing Eq. (26) to Eq. (24) we can see that, for a value of π in the feasible deal region, the debtor must ofter $\frac{1}{8}$ more when the voting threshold is higher. This increases the return to all creditors in the event that a deal is struck. However, the threshold increase causes the probability of striking a deal to drop from $\frac{1}{4}$ to $\frac{3}{16}$. This is the result of the fact that the debtor's probability of 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 $\frac{1}{2}$ for a draw of $\pi = 1$.