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Does strengthening Collective Action Clauses (CACs) help?

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Abstract

In a model with both issues of sovereign debtor moral hazard and creditor coordination under incomplete information, we show that the resulting conflict between *ex ante* and *interim* efficiency limits the welfare impact of strengthening CACs. Conditional on default, we show that an *interim* efficient CAC threshold exists and improving creditor coordination results in welfare gains. However, when *ex ante* efficiency requires the sovereign debtor to choose actions that reduce the probability of default, improved creditor coordination reduces *ex ante* efficiency and the *interim* efficient CAC threshold is higher than the *ex ante* efficient CAC threshold.

Keywords: *Sovereign Debt, Coordination, Moral Hazard, Collective Action Clauses, Ex Ante, Ex Post, Efficiency.*

JEL classification: *C72, C78, D82, F34*

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1 Introduction

In this paper we study the efficiency gains of strengthening Collective Action Clauses (CACs) whereby a qualified majority of bondholders can bind all bondholders (within the same issuance) to the financial terms of a sovereign debt restructuring [1] . By removing the threat of an individual creditor holdout, strengthening CACs away from unanimity, should reduce the cost associated with protracted sovereign debt restructuring driven by creditor coordination failure (Liu, 2002).

Initially, CACs came to prominence in the aftermath of the Mexican crisis in 1995, but it was only after the successful issuance of $1 million global bonds by Mexico in New York in March 2003 containing CACs that triggered a major change in the market practice. Subsequently, the inclusion of CACs, especially the qualified majority restructuring clauses, in the sovereign bonds issued in New York has become more common (Kletzer, 2004a).

In this paper we study the efficiency gains of strengthening Collective Action Clauses (CACs) in a model with both creditor coordination under incomplete information and sovereign debtor moral hazard. The starting point of our analysis is a situation where, due to a negative shock, the sovereign debtor is unable to fulfill the terms of the debt contract thus triggering default. Conditional on default, the sovereign debtor issues a new one-period bond rolling over the outstanding coupon payment and the future obligations. As this constitutes a change in the financial terms of the existing debt contract, existing creditors have to decide whether or not to accept the debt rollover under the conditions of incomplete information about the future value of the new one-period debt. We show that there are multiple Bayesian equilibria of the resulting creditor coordination game. We also show that an *interim* efficient CAC exists in threshold strategies and strengthening CACs away from unanimity could result in welfare gains by improving creditor coordination (although bondholder committees may be required to complement the role of CACs).

Next, we introduce debtor moral hazard by making the probability of default conditional on the adverse shock a function of the actions (policy measures) chosen by the sovereign debtor. When *ex ante* efficiency requires the sovereign debtor to choose actions that lower the probability of default, a positive crisis

[1] CACs consist of two main provisions: majority restructuring provisions (hereafter, qualified majority restructuring clauses) and majority enforcement provisions. While the former allow the qualified majority of bondholders to bind all bondholders within the same issuance to the financial terms of a debt restructuring, the latter enable the qualified majority of bondholders to limit the ability of minority of bondholders to accelerate their claims after a default (IMF, 2002, p.14) In this paper, we focus on the former aspect of CACs.

risk conditional on default is a necessary condition for resolving debtor's *ex ante* incentives. We argue that different solutions to the creditor coordination problem at the *interim* stage could alter the *ex ante* incentives of the sovereign debtor. Since improved creditor coordination lowers crisis risk conditional on default, such a measure increases the probability of default by relaxing the incentives of the sovereign debtor to undertake the *ex ante* efficient action. In such cases, the *interim* efficient CAC threshold is higher than the *ex ante* efficient CAC threshold. Therefore, in general, there is a conflict between *ex ante* and *interim* efficiency.

Our analysis captures, in a simple model, two main concerns which have been frequently raised in the policy debate over the reform of the international financial architecture: whether strengthening CACs actually helps reduce the cost of protracted debt restructuring and whether strengthening CACs would induce the problem of debtor moral hazard (Kletzer, 2004a). Our key contribution to this literature is to show that when both issues of sovereign debtor moral hazard and creditor coordination under incomplete information matter, the resulting conflict between *ex ante* and *interim* efficiency limits the welfare impact of strengthening CACs.

The remainder of this paper is structured as follows. The next section discusses related literature. In Section 3, we then present the basic model, which is used to study creditor coordination and *interim* efficiency in Section 4. In Section 5, we extend the model in Section 3 to allow for sovereign debtor moral hazard and contrast the issue of *interim* efficiency with the issue of *ex ante* efficiency. Section 6 concludes and contains a discussion of some policy issues.

2 Related literature

A number of existing papers model how strengthening CACs might reduce the costs of debt restructuring and affect sovereign debtor incentives. In general, they find that incorporating CACs into debt renegotiation raises welfare; however, these papers do not attempt to study the conflict between *ex ante* and *interim* welfare. In a bargaining model, Kletzer (2003) has shown that CACs lead to welfare gains in post-default scenarios. Kletzer (2004b), building on the analysis of Kletzer and Wright (2000) (see also Bulow and Rogoff, 1989) studies a model of debtor-creditor bargaining where strengthening CACs eliminates the inefficiency of creditor holdout. In Kletzer and Wright (2000), a higher probability of disagreement has a higher impact on the debtor's willingness to pay. In a very different setting from the one studied by us, Weinschelbaum and Wynne (2005) show that CACs are useful in coordinating creditors within the same jurisdiction thus this mechanism could lower the cost of debt restructuring although they find that CACs could have an adverse impact on

the sovereign debtor's incentive to run reckless fiscal policies that increase the possibility of crisis. However, they do not carry out an explicit welfare analysis (and certainly do not distinguish between *ex ante* and *interim* welfare) as we do here. Pitchford and Wright (2007) argue that CACs enhance welfare in the post-default scenarios. They argue that the net impact on welfare is still positive even after taking into account debtor moral hazard; in contrast, here, we show that strengthening CACs can unambiguously lower *ex ante* efficiency.

There is also a literature which focuses on studying the impact of CACs on the interest rate premiums after taking into account the ease of debt restructuring and the problem of debtor moral hazard that result from CACs. Kletzer (2004a) notes a potential drawback with strengthening CACs: interest rate premiums may actually rise with the inclusion of CACs in sovereign bond contract if creditors expect debtor moral hazard to dominate the benefits of easier, less costly restructuring. The empirical studies in this area provide a mixed results for the impact of CACs on interest rate premium. Eichengreen et al. (2003) include both primary and secondary market premiums in their study and also find that the credit rating of the issuer plays a crucial role. They predict that CACs will be able to price *ex ante* debtor moral hazard by lowering the borrowing cost for a creditworthy issuer but increasing the borrowing cost for less creditworthy issuer. Eichengreen and Mody (2000, 2004) study the launch spreads on emerging market bonds – both bonds subject to UK governing law and those subject to New York law – and find that CACs reduce the borrowing cost for more creditworthy issuers, while the less creditworthy issuers need to pay higher spreads for issuing bonds that contain CACs.

On the contrary, Becker et al. (2003) and Richards and Gugiatti (2003) find that, by considering the yields in the secondary markets, the inclusion of CACs in a bond issue did not increase the interest rate premium (and not change the bond prices) for that particular bond. Their results seem to support the ambiguous impact of CACs on cost of borrowing and bond prices. Our model predicts that strengthening CACs will reduce borrowing costs for issuer with high credit rating only when it lowers *interim* crisis risk. Weinschelbaum and Wynne (2005) challenge the conclusions from previous empirical results and argue that the results obtained by the previous empirical studies do not account for (endogenous) IMF intervention and compositional effects in the markets for sovereign debt. They argue that CACs could be irrelevant in the sovereign debt markets and therefore yield spreads with and without CACs are uninformative about moral hazard problems.

While in Gai et al. (2004), Roubini and Setser (2004) and Tanaka (2006) the crisis is exogenous to the mechanism of debt restructuring, in our model, the crisis cost is endogenous through the threat of having an endogenously generated crisis risk. Our analysis complements Tirole (2003) who provides a

rationale for debt finance, short maturities and foreign currency denomination of liabilities by adopting a 'dual- and common agency' perspective. His formal analysis takes as exogenous both the probability of default conditional on the adverse shock and the probability of debt crisis. In contrast, here while the maturity structure of debt is taken as given, both the probability of default and the probability of a debt crisis, conditional on default, are endogenous. We also want to make a note that our analysis of the efficacy of various policy interventions is related to Rodrik (1998) who suggests that, when financing development by issuing bonds exposes the country to excessive crises, the unrestricted use of such debt instruments should be limited.

Finally, in contrast to the unique equilibrium obtained in the literature on global games which study coordination games with asymmetric information (Carlsson and van Damme, 1993; Morris and Shin, 1998), here, conditional on default, we obtain multiple Bayesian equilibria. In our paper, the way payoffs to creditors are indexed by the underlying fundamentals ensures that an extreme form of coordination failure between creditors always exists for all values of the fundamentals. In the global games literature, the way payoffs to creditors are indexed by the underlying fundamentals ensures that there are always two extreme regions in the space of fundamentals with a strongly dominant action [2].

3 The Basic Model

There are three time periods, $t = 0, 1, 2$. We consider a sovereign debtor who is embarking on a bond-financed project $t = 0$ by issuing two-period bonds, each with a face value of b, denominated in US dollars. These bonds are sold to n identical private creditors. The promised return for each private creditor is r at $t = 1$ and $(1 + r)$ at $t = 2$. For future reference, note that all payoffs are denoted in $t = 1$ units.

We assume that the sovereign debtor's capacity to service existing debt in period t is determined by the amount of available international reserves denoted by Q_t for $t = 1, 2$. We also assume that, if there is no adverse, exogenous shock or if there is a successful debt rollover at $t = 1$ conditional on default, the debtor would obtain a non-contractible payoff $Z > 0$ [3] at $t = 2$. The fact

[2] There are, of course, other technical differences. We look at a model with a finite number of creditors. In our model, the (privately observed) signalling has a finite support.

[3] Following Eaton and Gersovitz (1981), we interpret this non-contractible payoff as the benefit at $t = 1$ of gain in national output at $t = 2$ when a debt crisis is prevented at $t = 1$. Another example of such non-contractible payoff can be

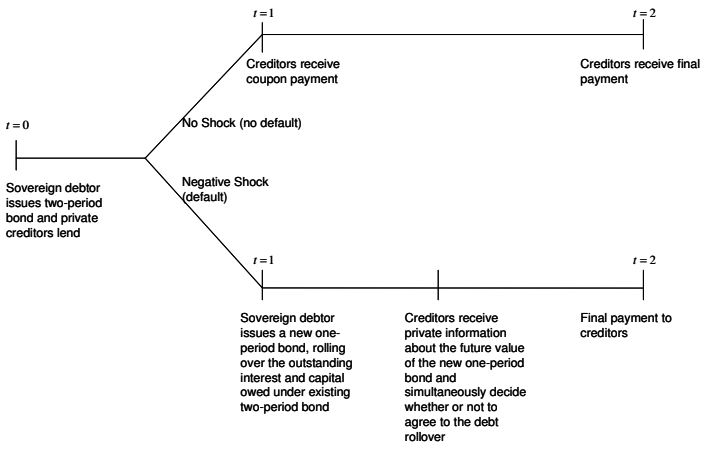

Fig. 1. Time line of events

that Z is non-contractible means that Z cannot be attached by the private creditors in the settlement of their claims – nor can the sovereign debtor make a credible commitment to transfer such payoff to the private creditors.

So long as Q_1 is greater than nrb at $t = 1$ and Q_2 is greater than $(1 + r) nb$ at $t = 2$, all is well and the project will run to completion.

Consider what happens if an unanticipated, negative exogenous shock ("bad luck") occurs at $t = 1$. The adverse shock referred to here is a sudden devaluation of domestic currency, which triggers a substantial decline in the international reserves Q_1 and Q_2 at both $t = 1$ and $t = 2$: the effect of the negative shock is persistent. Conditional on the negative shock, $Q_1 < nrb$. The sovereign debtor's failure to comply with the terms of the debt contract constitutes a 'technical default' at $t = 1$. The precise way in which Q_2 is affected is specified below.

Following a technical default, each creditor is entitled to accelerate her claim, demanding the capital sum as well as the current coupon owed in the first period. In other words, a technical default makes the sovereign debt callable at $t = 1$. Figure 1 shows the time line of events.

Conditional on default, the sovereign debtor issues a new one-period bond rolling over the outstanding interest and capital owed in the existing two-period bond. The new one-period bond has a face value of rb and promises a return of $(1 + r)$. Therefore, a successful debt rollover implies that, at $t = 2$, the amount falling due becomes $rb(1 + r) + (1 + r) b = (1 + r)^2 b$ which at $t =$

described as follows. Suppose the funds borrowed by the sovereign debtor are used to finance a publicly operated infrastructure project. If the infrastructure project succeeds, the government enjoys the prospect of higher tax revenue as more domestic and foreign firms invest and employment is generated. No private creditor can attach the future tax revenues generated by the infrastructure project.

1 (using $\frac{1}{(1+r)}$ as the discount factor) is worth $(1+r)\,b$. We find it convenient to work with normalized per capita creditor payoffs, which are obtained by dividing the gross creditor payoffs by $(1+r)nb$. Thus, in a normalized per capita payoff term, the amount owed by the debtor to each creditor at $t=2$ is 1.

Conditional on default at $t=1$, γ determines the value of the new one-period bond issued by the debtor if the project continues to completion at period $t=2$ (in other words, if a sufficiently large number of private creditors roll over), where $\gamma \in [0,1]$. It is important to note that $\gamma\,(1+r)^2\,b$ is the amount actually paid out by the debtor at $t=2$, which, at $t=1$, this amount is worth $\gamma\,(1+r)\,b$ (again using $\frac{1}{(1+r)}$ as the discount factor). The (prior) probability over γ is given by some continuous probability density function $p(.)$ (with $P(.)$ being the associated cumulative probability distribution).

Conditional on default at $t=1$, there is an incomplete information: each private creditor i receives a privately observed signal $\sigma^i \in \{\gamma-\varepsilon, \gamma+\varepsilon\}$ of the true value of γ, where $\varepsilon > 0$ but small. Specifically, $\varepsilon < \bar{\varepsilon}$, $\bar{\varepsilon} > 0$ and $\bar{\varepsilon} < \frac{1}{H}$ for large but finite $H > 2$. Conditional on γ, for each i, σ^i is i.i.d. over $\{\gamma-\varepsilon, \gamma+\varepsilon\}$ according to the distribution $\left\{\frac{1}{2}, \frac{1}{2}\right\}$ [4].

We label an individual private creditor by i, where $i = 1, ..., n$. Each private creditor privately observes a signal σ. Conditional on σ, each private creditor simultaneously chooses an action $a^i(\sigma) \in \{\text{Accept } (A), \text{Reject } (R)\}$, where A denotes accepting the debt rollover (the new one-period bond issued by the sovereign debtor, conditional on default at $t=1$) and R denotes rejecting the debt rollover. A strategy of the creditor i is a map that specifies an action for each σ. Conditional on $\boldsymbol{\sigma} = (\sigma^1, ..., \sigma^n)$, let $a(\boldsymbol{\sigma}) = (a^1(\sigma^1), ..., a^n(\sigma^n))$. For each σ, let $\tilde{n}_a(\sigma) = \#\{i : a^i(\sigma) = R\}$ denote the number of private creditors who choose to reject the debt rollover when the value of the signal is σ. Given γ, let $n_a(\gamma) = \tilde{n}_a(\gamma-\varepsilon) + \tilde{n}_a(\gamma+\varepsilon)$ denote the number of creditors who reject the debt rollover.

How are the decisions of individual creditors aggregated? Built into the existing two-period bond contract is a critical threshold $m \in [0,1]$, though in practice, we look at the case in which $m \in \left[\frac{1}{n}, 1\right]$, where m denotes the proportion of private creditors that are needed to block a successful debt rollover at $t=1$, i.e. m represents the critical CAC threshold. When $m = \frac{1}{n}$, a decision of only one private creditor not to roll over the short-term debts is sufficient to prevent a successful debt rollover, which is equivalent to requiring unanimity in the debt rollover decision. If the proportion of private creditors who

[4] When $\gamma = 0$, $\sigma^i = \varepsilon$ for all i and when $\gamma = 1$, $\sigma^i = 1-\varepsilon$ for all i. Appropriate adjustments to all expressions involving signals need to be made at the boundary: these are not explicitly stated in the text.

reject the debt rollover exceeds the critical CAC threshold, m, a 'sovereign debt crisis' occurs[5]. In general, increasing m is equivalent to strengthening CACs, which should make debt restructuring easier. Moreover, since all private creditors are *ex ante* symmetric, by invoking the doctrine of 'pari passu', we assume that any offer made by the sovereign debtor, conditional on default, treats each creditor symmetrically.

Conditional on γ, in order to determine each creditor i's payoffs, there are two scenarios to be considered.

In the first scenario, $n_a(\gamma) \geq mn$. This scenario captures a situation where there is no debt rollover. In this contingency, we assume that creditors enter into the asset grab race as follows. Each private creditor who chooses to reject the debt rollover is a first mover in the asset grab race, while the private creditor who chooses to accept the debt rollover is a second mover. The payoff of each creditor i depends on whether she is the first- or the second mover in the asset grab race. The first mover recovers either her initial investment, b, plus interest, rb, or the liquidation value of foreign-owned assets by the sovereign at $t = 1$, denoted by q, minus the privately borne legal costs, L, leaving the second mover with the residual resources. In other words, litigation allows the first mover to exit without much loss of value but it is potentially costly for the second mover. Formally, the payoff to the first mover is determined by the function g such that $g(n_a) = \min\left\{1, \frac{q}{n_a(1+r)b}\right\} - \frac{L}{(1+r)b}$, where $n_a < n$, $g(n) = \frac{q}{n(1+r)b} - \frac{L}{(1+r)b}$. Note that the normalization is done by dividing the creditor's payoffs by $(1+r)b$. For internal consistency, we assume that $\frac{q}{n} - L > 0$ and that $\frac{q}{n} - L < (1+r)b$ (otherwise, the sovereign debtor could liquidate its own foreign-owned assets and service its debt) so that $0 < g(n) < 1$. The payoff to the second mover is determined by the function $l(n - n_a)$ such that $l(n - n_a) = \max\left\{\frac{[q-(1+r)bn_a]}{(n-n_a)(1+r)b}, 0\right\}$, where $n_a < n$ and again the normalized payoff is obtained by dividing the creditor's payoff by $(1+r)b$. Note that the function $l(n-n_a)$ is well-defined for all n_a as long as we have that $(1+r)bn > q$. Thus, the payoffs to private creditor i when $n_a(\gamma) \geq mn$ can be specified as follows. If $a^i(\sigma) = R$, the per capita normalized payoff for creditor i is $g(n_a)$, while if $a^i(\sigma) = A$, the per capita normalized payoff to creditor i is $l(n - n_a)$.

In the second scenario, $n_a(\gamma) < mn$. In this scenario, the debt rollover is successful. If $a^i(\sigma) = R$, the per capita payoff for creditor i is $\gamma(1+r)b - L'$,

[5] It is important to note the distinction between a technical default and a sovereign debt crisis. A *technical default* occurs when the sovereign debtor is unable to pay the promised returns to the private creditors in the first period due to the occurrence of an adverse, unanticipated shock. Conditional on default, debt rollover game takes place and each creditor decides whether to accept the debt rollover (the new one-period bond issued by the sovereign debtor at $t = 1$). A *sovereign debt crisis* only occurs when a sufficiently large number of creditors decide not to roll over the debts.

while if $a^i(\sigma) = A$, the per capita payoff to creditor i is $\gamma(1+r)b$, where $L' > 0$ reflects the fact that an individual creditor, who unsuccessfully tries to accelerate the project, pays a small legal fee, L', for doing so but as the debt rollover is successful, obtains her continuation payoff $\gamma(1+r)b$. After normalizing the payoffs by dividing the creditor i's payoffs by $(1+r)b$, we obtain the following: if $a^i(\sigma) = R$, the per capita normalized payoff for creditor i is $\gamma - \varphi$, while if $a^i(\sigma) = A$, the per capita normalized payoff to creditor i is γ, where $\varphi \equiv \frac{L'}{(1+r)b}$.

We study the Bayesian equilibria of this game.

In most policy discussions, and in our model, the private creditors have to decide whether or not to accept the debt rollover conditional on default but before all payoff-relevant uncertainty has been fully revealed. Accordingly, we ask whether relative to a first-best benchmark, which corresponds to the case with complete information about the value of the new one-period bond issued by the debtor, the equilibrium crisis risk is *interim* efficient [6]. As all creditors are identical, it follows that whenever the per capita payoff from debt rollover exceeds the per capita payoff when all the creditors are the first movers, it requires that there should be a successful debt rollover, i.e. whenever $\gamma \geq g(n)$, where n is the total number of private creditors, the project should be continued to completion at $t = 2$, while if $\gamma < g(n)$, the project should terminate at $t = 1$. As throughout the paper we base our analysis on a fixed n, it follows that $g(n)$ is just a constant.

4 Creditor Coordination and CACs: Interim Welfare

In this section, we examine the conditions under which the Bayesian equilibria of the creditor coordination game is *interim* efficient. We study two strategic scenarios: a situation in which the actions of creditors do not depend on their privately observed signals and a scenario in which the creditors' actions depend on their signals and each creditor uses a threshold strategy.

[6] From an *ex ante* viewpoint, the relevant welfare comparison would have to take into account both states of the world where the debt is rolled over and states of the world where the debt is not rolled over. In this section and the following, unless explicitly stated otherwise, we assume that, in the first-best *ex ante* scenario, the project will be funded.

4.1 Creditor Coordination and Interim Efficiency when Creditors' Actions do not Depend on Signals

In this subsection, we examine the *interim* efficiency of the Bayesian equilibria when the actions of creditors do not depend on their signals. We begin by noting the extreme forms of coordination failure: conditional on default, it is always an equilibrium for all creditors to choose not to roll over irrespective of their signals. As long as $m \leq \frac{n-1}{n}$, if $n-1$ creditors reject the debt rollover, then the remaining creditor will also reject the debt rollover. Evidently, in such a scenario, strengthening CACs (equivalently, increasing m) will have no effect on the debt rollover. Note that such scenario is an equilibrium even when γ is close to 1.

At the other extreme, when $m > \frac{1}{n}$, there is also always an equilibrium where the debt is rolled over with a probability one. Indeed, if all other creditors agree to a debt rollover (i.e. accept the new one-period bond issued by the sovereign debtor after a technical default occurs at $t = 1$), a deviation by an individual creditor cannot block the debt rollover. Note that such an equilibrium persists even when γ is close to 0.

It follows that for each $\gamma \in [0, 1]$ and privately observed signal σ, as long as $\frac{1}{n} < m < \frac{n-1}{n}$, both action profiles, one where each creditor agrees to a debt rollover and the other where each creditor rejects the debt rollover, are both Bayesian equilibria. Clearly, such Bayesian equilibria cannot be *interim* efficient.

What is the impact of strengthening CACs? Consider a situation in which the debt rollover is *interim* efficient. Suppose that the existing two-period debt contract has $m = \frac{1}{n}$. Within this class of Bayesian equilibrium, there is no possibility of a debt rollover. What happen if m increases so that we strengthen CACs away from unanimity. By doing so, the preceding analysis suggests that there will be a new equilibrium where the debt rollover occurs with a probability one. However, note that even when it is efficient to do so, there is no guarantee that strengthening CACs alone will ensure that creditors coordinate on the new equilibrium.

4.2 Creditor Coordination and Interim Efficiency with Threshold Strategies

In what follows, we show that there are other equilibria where all private creditors use symmetric threshold strategies so that for some $\bar{\gamma} \in [0, 1]$, whenever $\sigma^i \geq \bar{\gamma}$, creditor i rolls over but whenever $\sigma^i < \bar{\gamma}$, creditor i does not rollover. Let us denote such strategy configuration by $a_{\bar{\gamma}}$. For such equilibria, creditor coordination depends on the payoff relevant uncertainty.

Given $a_{\bar{\gamma}}$, conditional on σ, let E_R^m denote creditor i's expected payoff from not agreeing to the debt rollover and E_A^m denote creditor i's expected payoff from agreeing to the debt rollover. To compute E_R^m and E_A^m, it is necessary for us to compute the probability that other creditors not agreeing to the debt rollover. Given the strategies of other creditors, conditional on observing a signal σ, from the perspective of any one creditor, in general, the number of other creditors not agreeing to the debt rollover is a random variable. For any private creditor i, given m, if all other private creditor $k \neq i$ are following a symmetric threshold strategies, $a_{\bar{\gamma}}$, and creditor i observes a signal $\sigma = \bar{\gamma}$, let $p_j(\bar{\gamma})$ denote the probability that exactly j other creditors (from a population of $n-1$ other private creditors) do not agree to the debt rollover [7]. Given a threshold strategy $\bar{\gamma}$, notice that $\{p_j(\bar{\gamma})\}_{j=0}^{n-1}$ is a symmetric binomial distribution. For the two different threshold strategies $\bar{\gamma}$ and $\bar{\gamma}'$, it is checked that the two distributions, $\{p_j(\bar{\gamma})\}_{j=0}^{n-1}$ and $\left\{p_j\left(\bar{\gamma}^\dagger\right)\right\}_{j=0}^{n-1}$, are identical, where

$$p_j(\bar{\gamma}) = p_j\left(\bar{\gamma}^\dagger\right) = \binom{n-1}{j}\left(\frac{1}{2}\right)^n = p_j.$$

The expected payoff of creditor i from not rolling over the debts, E_R^m, is given by

$$E_R^m = \sum_{j=mn-1}^{n-1} g(j)p_j + (\bar{\gamma} - \varphi)\sum_{j=0}^{n(m)} p_j, \tag{1}$$

where $n(m) = \max\{0, mn-2\}$. [8]

The first term in equation (1) can be interpreted as follows. Given that $(mn-1)$ private creditors have chosen to reject the debt rollover (which occurs with a probability $\sum_{j=mn-1}^{n-1} p_j$), if creditor i chooses to reject the debt rollover, this is sufficient to render the debt rollover at $t=1$ to be unsuccessful thus the asset grab race ensues. When this is the case, since the creditor i's action is rejecting the debt rollover, the creditor i and each of the other $(mn-1)$ creditors are entitled to receive $g(j)$, which is the payoff to the first mover in the asset grab race. The second term in equation (1) shows the expected payoff of creditor i under the case in which $n(m)$ other private creditors already decided to reject the debt rollover. Despite the fact that creditor i chooses to reject the debt rollover, this is not sufficient to block a debt rollover. Therefore, each of the $n(m)$ creditors as well as the creditor i receives the continuation value, $\bar{\gamma}$, net of a small legal fee, φ, for unsuccessfully trying to accelerate the project.

The expected payoff of creditor i from agreeing to the debt rollover, E_A^m, is

[7] Recall from Section 3 that $p(.)$ is the continuous probability density function, which gives the (prior) probability over γ.

[8] In what follows, we assume, for ease of exposition, that mn is an integer.

given by

$$E_A^m = \sum_{j=mn}^{n-1} l(n-j)p_j + \bar{\gamma} \sum_{j=0}^{mn-1} p_j. \tag{2}$$

The first term in equation (2) shows creditor i's expected payoff when there are already mn private creditors chosen to reject the debt rollover; thus, even though creditor i chooses to accept the debt rollover, the debt rollover is unsuccessful and the asset grab race occurs. Since creditor i chooses to accept the debt rollover and did not join the queue in the asset grab race, she is classified as the second mover and is entitled to receive $l(n-j)$. The second term in equation (2) captures the expected payoff to creditor i under the scenario in which the debt rollover is successful. Each of the $(mn-1)$ private creditors and creditor i receives the continuation payoff, $\bar{\gamma}$.

The following proposition establishes that a Bayesian equilibrium in symmetric threshold strategies exist and is decreasing in the CAC threshold, m.

Proposition 1 *The Bayesian equilibrium threshold, $\bar{\gamma}_m^*$, exists. Whenever $0 < \bar{\gamma}_m^* < 1$, $\bar{\gamma}_m^*$ is an interior Bayesian equilibrium threshold. Moreover, $\bar{\gamma}_m^*$ is decreasing in the critical CAC threshold, m; thus, strengthening CACs should make debt restructuring easier.*

PROOF. We begin by proving the existence of an interior Bayesian equilibrium threshold. When creditor i is choosing a best response, (a) whenever $E_R^m - E_A^m > 0$, creditor i does not agree to the debt rollover, and (b) whenever $E_R^m - E_A^m \leq 0$, creditor i agrees to the debt rollover. Conditional on observing the signal $\sigma = \bar{\gamma}$, creditor i's expected payoffs from not agreeing to the debt rollover, E_R^m, and her expected payoffs from agreeing to the debt rollover, E_A^m, are given by the expressions in (1) and (2), respectively. Notice that both E_R^m and E_A^m are increasing linear functions of $\bar{\gamma}$, the intercept of E_A^m is lower than the intercept of E_R^m, and the slope of E_A^m is higher than the slope of E_R^m. As $l(n-j)$ is strictly less than $g(j)$ for all j; $l(n-j)$ is decreasing in j, and $g(j)$ is increasing in j, by computation, we have

$$\begin{aligned} E_R^m - E_A^m &= \sum_{j=mn-1}^{n-1} g(j)p_j + (\bar{\gamma} - \varphi) \sum_{j=0}^{n(m)} p_j - \sum_{j=mn}^{n-1} l(n-j)p_j - \bar{\gamma} \sum_{j=0}^{mn-1} p_j \\ &= \sum_{j=mn}^{n-1} \left[g(j) - l(n-j) \right] p_j + \left[g(mn-1) - \bar{\gamma} \right] p_{(mn-1)} - \varphi \sum_{j=0}^{n(m)} p_j. \end{aligned}$$

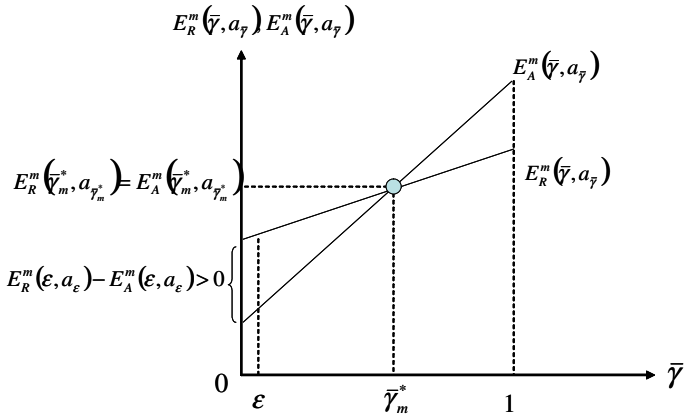

Fig. 2. An interior Bayesian equilibrium threshold

It follows that there exists a $\bar{\gamma}_m^{'}$ such that $E_R^m - E_A^m = 0$, where

$$\bar{\gamma}_m^{'} = g\left(mn-1\right) + \frac{\sum_{j=mn}^{n-1}\left[g(j) - l(n-j)\right]p_j - \varphi\sum_{j=0}^{n(m)} p_j}{p_{(mn-1)}},$$

where $p_{(mn-1)} = \binom{n-1}{mn-1}\left(\frac{1}{2}\right)^n$. Therefore, a Bayesian equilibrium threshold, $\bar{\gamma}_m^*$, exists, where $\bar{\gamma}_m^* = \min\left\{\bar{\gamma}_m^{'}, 1\right\}$ and it is interior whenever $\bar{\gamma}_m^* < 1$.

When an interior Bayesian equilibrium threshold, $\bar{\gamma}_m^*$, exists, what is the impact of an increase in m on $\bar{\gamma}_m^*$? As m increases, the events where there is a successful debt rollover have a higher probability. By first-order stochastic dominance, for m, m' where $m < m'$, by computation note that $E_R^{m'}(\bar{\gamma}_m^*) - E_A^{m'}(\bar{\gamma}_m^*) < 0$, this implies that $\bar{\gamma}_{m'}^* < \bar{\gamma}_m^*$. Therefore, $\bar{\gamma}_m^*$ is decreasing in m. *Q.E.D.*

It is useful to depict the interior Bayesian equilibrium threshold in Figure 2.

Proposition 1 implies that, in general, when an interior Bayesian equilibrium threshold, $\bar{\gamma}_m^*$, exists, strengthening CACs away from unanimity lowers $\bar{\gamma}_m^*$, thus improving coordination among private creditors and reducing the *interim* crisis risk, conditional on default.

From the perspective which we adopt here, we ask whether strengthening CACs allows us to achieve an *interim* efficiency. In what follows, we characterize the *interim* efficient CAC threshold. It follows that when the creditors use threshold strategies, at the Bayesian equilibrium threshold, $\bar{\gamma}_m^*$, the expected payoff to the creditor is $\bar{\gamma}_m^*$. By computation, observe that when $m = 1$, $\bar{\gamma}_m^* = 0 < g(n)$; however, when $m = 0$, $\bar{\gamma}_m^* = 1 > g(n)$. As $\bar{\gamma}_m^*$ is decreasing in m, by correcting for the integer effects, it follows that there exists a CAC

threshold, $\hat{m}$, such that $\bar{\gamma}^*_{\hat{m}} = g(n)$. We refer to this CAC threshold, $\hat{m}$, as an *interim efficient CAC threshold* [9] .

In general, our analysis says that strengthening CACs away from unanimity is a move towards an *interim* efficiency when the creditors use the threshold strategies. However, even if $m = \hat{m}$ nothing in our analysis so far suggests that creditors will coordinate on the Bayesian equilibrium with *interim* efficient threshold strategies.

4.3 CACs and the role of the bondholder committee

Our analysis in both the preceding subsections indicates that the choice of m, for example by strengthening CACs away from unanimity, will have an impact on the set of Bayesian equilibria of the creditor coordination game. However, because in this setting there are multiple Bayesian equilibria, merely manipulating m will not guarantee that creditors coordinate on the *interim* efficient equilibrium. This creates a role for the third parties like the creditor coordination committees or bondholder committee to ensure that the creditors coordinate on the *interim* efficient Bayesian equilibrium.

How would the bondholder committee help? Eichengreen and Portes (2000) and Portes (2000) highlight the potential relevance of the bondholder committee. Mauro and Yafeh (2003) analyze the role played by the Corporation of Foreign Bondholders (CFB), which is an association of British investors holding bonds issued by foreign governments. The CFB provides information, which includes the economic commentary, data as well as the analysis of political developments in the debtor's country, to bondholders, especially in the case of default. The provision of information by the CFB helps facilitate the coordination among the creditors as the creditors tend to agree on a common strategy if they base their decisions on similar data and analysis (Mauro and Yafeh, 2003, p.13). Besides providing information, the CFB also helps coordinate bondholders' actions: whenever possible, attempts were made to foster unanimity among bondholders. Even though an individual bondholder is not formally barred from taking independent action, the benefits from cooperation are usually so great that there can seldom be sufficient ground for a separate action.

[9] By using a theoretical model of grey-zone financial crisis, which allows for the interaction of liquidity problems with solvency problems, Haldane et al. (2004) find that the sovereign debtors' optimal choice of CAC threshold could vary because of their different risk preferences and creditworthiness. In our analysis, the optimal CAC threshold, $\hat{m}$, ensures that probability of crisis risk, conditional on default, is *interim* efficient.

5 Debtor Moral Hazard: Interim Vs Ex Ante Efficiency

In this section, we study *ex ante* debtor moral hazard. There are two main reasons for doing so. First, it enables us to endogenize the probability of default conditional on the adverse shock. Second, we want to rule out the possibility of long-term debt contracts, which mature at $t = 2$. In principle, the presence of long-term debt contracts maturing at $t = 2$ could be welfare improving since this type of contract would rule out the *interim* inefficient creditor coordination. With *ex ante* debtor moral hazard, a positive crisis risk, conditional on default, is a necessary condition for resolving debtor's *ex ante* incentives. Therefore, long-term debt contracts should not be used with *ex ante* debtor moral hazard [10] .

We assume as before that the sovereign debtor issues two-period bond at $t = 0$, which promises an interest coupon at $t = 1$ and repayment of the capital sum together with the second interest coupon at $t = 2$. At $t = 0$, the sovereign debtor has to choose an *ex ante* action, a_0, which is a level of effort, where $a_0 \in \{G, B\}$. Note that G and B denote good and bad *ex ante* effort put in by the debtor, respectively. In this context, good effort can be interpreted as the effort which makes the sovereign debtor less vulnerable to the negative external shock, while the bad effort corresponds to the effort which makes the sovereign debtor more vulnerable to adverse external shock [11] . We assume that $c^{a_0} \in \left\{c^G, c^B\right\}$ denote the cost of effort, measured in $t = 1$ payoff units. We also assume that it is more costly for the debtor to exert good effort than to choose bad effort so $c^G > c^B$. Let p^{a_0} denote the *ex ante* probability of default conditional on the adverse shock when the *ex ante* action $a_0 \in \{G, B\}$

[10] In the current policy debate over how to improve the crisis resolution framework, there has been a growing recognition that the proposals to solve creditor coordination problems need to take into account their impact on sovereign debtors' incentives. Ghosal and Miller (2003) argue that a convincing treatment of sovereign debt crises and their resolution needs to combine creditor coordination and debtor incentives in a consistent framework. Their main argument is as follows: "selecting equilibrium without taking account of debtor's behavior is inappropriate if different solutions to the creditor coordination problem alter incentives of the sovereign debtor," (Ghosal and Miller, 2003, p.284). As pointed out by Barro (1998) (as cited in Ghosal and Miller, 2003), if the probability of project termination were reduced to zero, the sovereign debtor could have an incentive to use the borrowed money unwisely. This, thus, implies that a positive probability of project termination may be necessary to solve the debtor moral hazard problem.

[11] In this context, good effort could correspond to a situation where money is borrowed and used to promote R&D in the export sector and bad effort could correspond to transferring borrowed money to local elites who are then free to put it in tax havens overseas. See Ghosal and Miller (2003) for more examples on *ex ante* debtor moral hazard and for other relevant results.

is chosen by the sovereign debtor. We assume that the probability of default conditional on the adverse shock is higher if the debtor chooses bad effort so $p^B > p^G$.

The source of *ex ante* debtor moral hazard in our model is the misalignment between the incentives of private creditors and the incentives of sovereign debtor. As in Section 3, we assume that, if there is no adverse shock at $t = 1$ or if there is a successful debt rollover at $t = 1$ thus the project continues to completion in the second period, the debtor obtains a non-contractible payoff $Z > 0$ at $t = 2$. We also assume that, conditional on default, creditors have to decide whether or not to roll over the debt before observing the *ex ante* choice of action by the debtor [12] .

As a function of the equilibrium threshold prevailing in the post-default debt rollover game, $\bar{\gamma}_m^*$, let $\beta(\bar{\gamma}_m^*)$ denote the debtor's expected payoff conditional on default, measured in $t = 1$ payoff units. The expression for $\beta(\bar{\gamma}_m^*)$ is a product of two terms: the first term is the *ex ante* probability of a successful debt rollover at $t = 1$ and the second term is the non-contractible payoff obtained by the sovereign debtor at $t = 2$ if the project continues to completion at $t = 2$. Let us denote the *ex ante* probability of a successful debt rollover at $t = 1$ by $\Pr(\bar{\gamma}_m^*)$. It follows that the debtor's expected payoff conditional on default, measured in $t = 1$ payoff units, $\beta(\bar{\gamma}_m^*)$, is given by

$$\beta(\bar{\gamma}_m^*) = \Pr(\bar{\gamma}_m^*)\, Z. \tag{3}$$

By the first-order stochastic dominance, a higher Bayesian equilibrium threshold, $\bar{\gamma}_m^*$, implies a lower *ex ante* probability of successful debt rollover at $t = 1$, $\Pr(\bar{\gamma}_m^*)$; thus, $\beta(\bar{\gamma}_m^*)$ is decreasing in $\bar{\gamma}_m^*$. The implication is that the debtor's expected payoff conditional on default, measured in $t = 1$ payoff units, $\beta(\bar{\gamma}_m^*)$, is decreasing in the Bayesian equilibrium threshold prevailing in the post-default debt rollover game, $\bar{\gamma}_m^*$.

The debtor's payoff from choosing a good effort is given by the expression $(1 - p^G)Z + p^G\beta(\bar{\gamma}_m^*) - c^G$, while the debtor's payoff from choosing a bad effort is given by the expression $(1 - p^B)Z + p^B\beta(\bar{\gamma}_m^*) - c^B$. The incentive compatibility constraint, which ensures that the sovereign debtor chooses good effort, is determined by the following expression

$$(1 - p^G)Z + p^G\beta(\bar{\gamma}_m^*) - c^G \geq (1 - p^B)Z + p^B\beta(\bar{\gamma}_m^*) - c^B. \tag{4}$$

By substituting equation (3) into (4) and rearranging, we obtain an upper

[12] For instance, it takes time for the debtor's action to be revealed and creditors have to decide whether or not to agree to the debt rollover before the action of the debtor is revealed.

bound on the *ex ante* probability of successful debt rollover at $t = 1$, $\Pr(\bar{\gamma}_m^*)$, given by

$$\Pr(\bar{\gamma}_m^*) \leq 1 - \frac{(c^G - c^B)}{Z(p^B - p^G)}. \tag{5}$$

Since $0 \leq \Pr(\bar{\gamma}_m^*) \leq 1$, $c^B > c^G$ and $p^B > p^G$, a necessary condition for (5) to be satisfied is that $1 - \frac{(c^G - c^B)}{Z(p^B - p^G)} \geq 0$. This condition can be rewritten as

$$Z(p^B - p^G) \geq c^G - c^B. \tag{6}$$

The LHS of (6) captures the *ex ante* incremental gain, from the sovereign debtor's perspective, from choosing a good effort (since the probability of default conditional on the adverse shock is higher if the debtor chooses bad effort), while the RHS of (6) represents the *ex ante* incremental loss for the debtor from choosing a good effort (since it is more costly for the debtor to exert good effort than to choose bad effort).

It is, however, important to note that this computation is done under an assumption that, in the event of a crisis, the debt rollover occurs with a probability zero.

Before proceeding further we need to clarify the conditions under which it is *ex ante* optimal for the debtor to choose G. Clearly, if $p^B \approx p^G$, it is possible that this is not so. The following result states the sufficient conditions under which it is *ex ante* optimal for the debtor to choose G.

Lemma 2 *There exists $\bar{\varepsilon}$ where ε is small number close to zero such that if $p^B \geq 1 - \bar{\varepsilon}$ and $p^G \leq \bar{\varepsilon}$ and $Z > c^G$, then ex ante efficiency requires that the sovereign debtor chooses a good effort.*

PROOF. Consider a scenario where $p^B \geq 1 - \varepsilon$ and $p^G \leq \varepsilon$. Let K be the maximum *ex ante* expected payoff to a creditor conditional on default over the set of Bayesian equilibria and over m. By definition, whenever $\gamma < 1$, and there is a successful debt rollover, the payoff to a creditor is less than one. When there is no successful debt rollover, even if the creditor has a first mover advantage, she has to pay a positive legal cost. Therefore, $K < (1+r)b$. Next, consider the limit case, when $\varepsilon = 0$. In this case, the *ex ante* per capita creditor payoff when G is chosen is higher than the *ex ante* per capita creditor payoff when B is chosen i.e. $\left(1 - p^G\right)(1 + r)\, b > p^B K$. Irrespective of which Bayesian equilibrium prevails in the creditor coordination game conditional on default, for all values of m, by continuity of the payoffs in p^B, p^G, there is an $\bar{\varepsilon}'$ close enough to zero, if $p^B \geq 1 - \bar{\varepsilon}'$ and $p^G \leq \bar{\varepsilon}'$, the *ex ante* per capita creditor payoff when G is chosen continues to be greater than the *ex ante* per capita creditor payoff when B is chosen. Next, by a symmetric argument, note

that if $Z > c^G$, the *ex ante* payoff of the sovereign debtor with action G also exceeds the *ex ante* payoff of the sovereign debtor with action B if $p^B \geq 1 - \bar{\varepsilon}''$ and $p^G \leq \bar{\varepsilon}''$, for some $\bar{\varepsilon}''$ close enough to zero. Let $\bar{\varepsilon} = \min\{\bar{\varepsilon}', \bar{\varepsilon}''\}$. Then, if $p^B \geq 1 - \bar{\varepsilon}$ and $p^G \leq \bar{\varepsilon}$ and $Z > c^G$, then *ex ante* efficiency requires that the sovereign debtor chooses a good effort. *Q.E.D.*

In the remainder of the section, we assume that it is *ex ante* efficient for the sovereign debtor to choose G.

It follows that in order to achieve an *ex ante* efficiency, the probability of a successful debt rollover conditional on default cannot be too high. However, as *interim* efficiency requires the probability of a successful debt rollover conditional on default to be a fixed number, $\Pr(\bar{\gamma}^*_{\hat{m}})$, improved creditor coordination may lead the sovereign debtor to choose the *ex ante* inefficient action: there is, in general, a conflict between *interim* and *ex ante* efficiency.

Let $\tilde{m}$ denote the *ex ante* optimal CAC threshold, i.e. a level of CAC threshold which ensures that condition (5) is satisfied as an equality. A consequence of the preceding analysis is that $\bar{\gamma}^*_{\hat{m}} \neq \bar{\gamma}^*_{\tilde{m}}$. If $\Pr(\bar{\gamma}^*_{\hat{m}}) > 1 - \frac{(c^G - c^B)}{Z(p^B - p^G)}$, so that the debtor will never choose to put in a good effort if she anticipates that the *interim* efficient threshold will prevail conditional on default, we must have $\Pr(\bar{\gamma}^*_{\hat{m}}) > \Pr(\bar{\gamma}^*_{\tilde{m}})$ and therefore, $\bar{\gamma}^*_{\hat{m}} > \bar{\gamma}^*_{\tilde{m}}$ which implies that $\tilde{m} < \hat{m}$.

Moreover, it is possible that the only *ex ante* efficient CAC threshold is unanimity. Restricting m to be an integer, it follows that there are parameter configurations for which (5) is satisfied if $m = \frac{1}{n}$ but not when $m \geq \frac{2}{n}$.

We summarize the above discussion with the following proposition:

Proposition 3 *When ex ante efficiency requires the sovereign debtor to choose G, the interim efficient CAC threshold will be higher than the ex ante efficient CAC threshold and the resulting conflict between interim and ex ante efficiency limits the welfare impact of strengthening CACs.*

6 Conclusion

This paper is devoted to study the following concern which has been frequently raised in the policy debate over the reform of international financial architecture: how to reduce the cost of protracted sovereign debt restructuring when emerging market countries are in sovereign debt crisis. Given that the use of CACs has been encouraged as the approach for restructuring the unsustainable debts, some very important concerns arise. What is the impact of CACs

on welfare? Would improving coordination among creditors relaxes the incentives of the sovereign debtor to avoid default? In this paper, we address such concerns by studying the conflict between *ex ante* and *interim* efficiency when both issues of sovereign debtor moral hazard and creditor coordination under incomplete information are present. We argue that in such cases the welfare impact of strengthening CACs is limited.

Even at the *interim* stage, as there are multiple Bayesian equilibria, we have argued that there is a role for third parties like the creditor coordination committees or bondholder committee to ensure that the creditors coordinate on the *interim* efficient Bayesian equilibrium.

Since one limitation of CACs is that it cannot address *ex ante* issues, this raises the question of whether there is a role for an appropriately designed formal sovereign bankruptcy procedure that addresses both *ex ante* and *ex post* issues. The key element of such procedure relies on the ability of the court in making the debtor's non-contractible payoff becomes contractible *ex ante* [13]. With this element being embedded to it, such appropriately designed sovereign bankruptcy procedure is useful in solving the problem of *ex ante* debtor moral hazard and leading to more orderly sovereign debt restructuring. In fact, this view has also been shared by several authors, including Sachs (1995), Buchheit and Gulati (2002) and Krueger (2001, 2002). Of course, such a procedure must ensure that payments made in the resolution phase can be made conditional on the policy effort undertaken by the sovereign debtor.

Extending the model to a dynamic setting to study the interaction between sovereign debt crisis and endogenous growth is an important topic for future research.

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