Optimal Collective Action Clause Thresholds

Andrew G Haldane Adrian Penalver Victoria Saporta
Hyun Song Shin[1]

May 2004

[1]Andrew Haldane, Adrian Penalver and Victoria Saporta are at the Bank of England, Threadneedle Street, London EC2R 8AH, UK. Hyun Song Shin is at the London School of Economics, Houghton Street, London WC2A 2AE, UK. The views expressed in this article are those of the authors and not necessarily those of the Bank of England. We would like to thank Ken Kletzer, Charles Goodhart, Chris Salmon, Misa Tanaka, David Wall, seminar participants at the Bank of England and an anonymous referee for helpful comments.

Abstract

Since February 2003 a number of debtor countries have issued bonds with collective action clauses (CACs) under New York Law – a development welcomed by the official sector as tangible progress towards more orderly crisis resolution. Not all of these countries, however, have opted for the same CAC voting threshold, raising concerns that lack of standardisation might undermine the wider adoption of CACs. In this paper, we analyse debtors' optimal choice of CAC threshold using a theoretical model of 'grey-zone' financial crisis, which allows for the interaction of liquidity problems with solvency problems. We find that individual countries may wish to set different thresholds because of differing risk preferences and credit worthiness. Strongly risk-averse debtors put much greater weight on payoffs during crisis periods than non-crisis periods and are therefore more likely to choose lower CAC thresholds than less risk-averse debtors. The worse the creditworthiness of risk-averse debtors, however, the more likely they will want to issue bonds with high collective action clauses.

Keywords: Sovereign Debt; Liquidity Crises; Restructuring Mechanisms; Collective Action Clauses.

JEL Classification: F33; F34.

1 Introduction

Over the past year, tangible progress has been made towards improving the resolution of sovereign financial crises. In February 2003, Mexico made a policy decision issue to include collective action clauses (CACs) in its sovereign bonds issued under New York Law, contrary to market convention. With the first-mover problem solved, most other emerging markets issuing in New York have followed suit. A new market standard for emerging market sovereign bonds appears to have been set, with CACs as its centrepiece.

The potential advantages of CACs have of course long been recognised. They have been standard in English law bonds since the 19th century (Buchheit and Gulati (2002)). But under New York law, unanimity clauses have until recently remained the market convention.[1] This is generally felt to be sub-optimal. Unanimity bonds mean that debt restructurings are potentially held hostage to the actions of recalcitrant or rogue creditors. More specifically, they may engender rent-seeking among some creditors, with attendant welfare externalities for the system (see Kletzer (2003), Haldane, Penalver, Saporta and Shin (2003)).

In response to these concerns, a push to introduce CACs in New York law bonds was first made by the official sector after the Mexican crisis, with the publication of the Rey Report (1996) by the Group of Ten countries (see also Eichengreen and Portes (1995)). Little action followed. A second push was made by the official sector in 2002, following crises in Turkey, Brazil and most prominently Argentina. Again under the auspices of Group of Ten, a working group was set up to draft model CACs. These draft clauses were

[1] It was not nearly as strict a convention as generally thought. Richards and Gugiatti (2003) document that Bulgaria, Egypt, Kazakhstan, Lebanon and Qatar had issued bonds with CACs in New York prior to 2003.

published in March 2003.

The aims of the Group of Ten working group were twofold. First, to examine a range of potential contractual clauses that could be included in sovereign bonds and recommend which ones to include. For example, they specified a majority voting threshold of 75% for changes in a bond's financial terms. Second, to set a new market standard. Contractual clauses set the rules of a debt restructuring and if the rules vary too much, they become a different game. The precise details of the clauses would depend on the jurisdiction of issuance but the intention was to make the substance as similar as possible.

The bonds issued by Mexico in February 2003 followed closely the G10 model clauses, including a 75% threshold. But some subsequent issues by other countries – Brazil, Belize, Guatemala and Venezuela – opted for higher 85% thresholds. These are closer to the levels proposed by private sector trade associations (EMCA (2002)).

Some within the official sector have taken a dim view of these developments. First, because these higher thresholds take us closer to a 100% unanimity bond, thereby increasing the risk of holdouts. And second, because different voting thresholds risk a splintering of the market standard (see also Portes (2003)). A combination of standard and non-standard thresholds could create unnecessary uncertainty during a debt restructuring (see also Gray 2004). One contribution of this paper is to critically evaluate these propositions using a theoretical model of financial crisis. In particular, we ask: what factors might determine the choice of optimal CAC threshold for a debtor? Is a lower threshold always better? And are there valid reasons why different issuers may want to set different, but country-specific, thresholds? To our knowledge, the literature has not yet addressed these questions within an analytical framework.

Our findings suggest that there are costs to a policy of the "lower the better". A lowering of CAC thresholds provides assurance to the debtor that in the event of debt restructuring holdout creditors can be held in check with a lower offer. But this insurance benefit of CACs has to be weighed against the prospect of a lower offer increasing the likelihood of creditors running for the door and, consequently, higher *ex ante* interest rates.[2] The choice of threshold that strikes the optimal balance between these costs and benefits depends on debtor risk preferences and creditworthiness. Risk neutral debtors prefer high thresholds because the *ex post* costs of getting away with a lower offer are more than outweighed by the *ex ante* benefits of lower interest rates and a lower probability for a liquidity run. Risk averse debtors may however prefer lower CACs. Moreover, for a given level of risk aversion, the lower the debtor's creditworthiness the more likely they will want to issue bonds with higher CAC-thresholds. In other words, different choices of threshold between countries emerge as an optimal debtor response to different risk preferences and creditworthiness.[3]

A second contribution of this paper is to develop a model which nests both liquidity runs and debt restructuring following a solvency crisis. Typically, the two are treated separately.[4] In practice, however, it is rarely straightforward to partition crises in this way. Liquidity crises affect prospects for solvency; and expected recovery rates for creditors following a debt restructuring will in turn affect short-term decisions on liquidity. These interactions

[2] The analysis by Eichengreen et al includes the potential for the insurance element of CACs to induce moral hazard on the part of the debtor.

[3] The paper does not assess whether a country should maintain a uniform threshold in all issues if creditworthiness and rating circumstances change.

[4] See, for example, Chang and Velasco (1999) for a model of liquidity crises and Bolton and Jeanne (2003) for a model of sovereign solvency crises.

mean that most crises lie in the 'grey-zone' between pure liquidity and pure insolvency.

The model presented here is one such 'grey-zone' model, which allows behavioural interactions between short-term liquidity and debt restructuring following a solvency crisis. The framework allows us to explore the interaction between liquidity and solvency crisis tools. For clarity of analysis, insolvency is determined by inability to pay and therefore would be also applicable to corporate financial crises. But this does sidestep the additional sovereign constraint of willingness to pay (Eaton and Gersovitz (1981)). But this additional layer of uncertainty only reinforces the complexity of 'grey-zone crises'. Taking account of these interactions is important when assessing the design and potential benefits of CACs as a crisis resolution measure.

The paper is planned as follows. Section 2 presents the stylised grey-zone model. Section 3 discusses the determination of interest rates in the model and Section 4 the debtor's choice of optimal CAC threshold. Section 5 concludes with some policy implications.

2 The Model

A debtor who wishes to finance a risky project issues a bond with collective action clauses. These clauses stipulate that if a proportion κ or more of creditors vote to change the financial terms of the contract they bind the rest. The debtor chooses a collective action clause threshold κ from a set of thresholds $[\underline{\kappa}, \overline{\kappa}]$, where $\underline{\kappa}$, for example, could be 65% and $\overline{\kappa}$ 85%.

A continuum of small risk neutral creditors buy the bond. Each creditor has a legal cost $l_i > 0$, which is the cost that this creditor would face if creditors collectively chose to reject a restructuring offer from the debtor. It captures the disutility arising from the costs of taking the debtor to court and prolonging the bargaining process.[5] The probability distribution function of legal costs across the creditors is common knowledge. The bond is short-term. Creditors face the choice of whether to roll over their funding at an interim stage and can decide not to roll over their funding to the last period of the game.

The project's return depends on the realisation of a fundamental θ. We assume that the *ex ante* distribution of θ is uniform on $[0, b]$. Before creditors make their decision to foreclose or roll over they receive a private signal about the fundamentals $x_i = \theta + s_i$ where s_i is i.i.d. with a uniform distribution over the interval $[-\varepsilon, \varepsilon]$. The noise term s_i is independent of i's legal costs. Creditors who foreclose receive a fixed payoff of 1. Creditors who roll over get a gross return $(1 + r)$ if the project succeeds. If the project fails, they participate in a bond restructuring.[6]

The exchange offer proceeds as follows. The debtor makes an offer to write-down the debt according to the contractual conditions of the bond.

[5] There are many reasons why such costs may differ across creditors. For example, some creditors (eg, bond mutual funds) may have investors with shorter investment horizons than others (eg, 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. 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).

[6] We have not allowed for secondary market trading because there are no pure strategy equilibria to such a subgame (full proof available from the authors). Vulture funds have weak incentives to bid for bond issues when: (i) ownership of the issue is widely dispersed; (ii) each creditor owns small proportion of the total issue; and (iii) contractual provisions ensure that during the subsequent restructuring stage holdouts are kept in check, so that all creditors that hold on to their bonds get the same return. In essense, the argument is identical to the one made by Grossman and Hart (1980) but in the context of corporate raids. Creditors (shareholders) have very little incentive to tender their bonds (shares) to a vulture fund (raider) whose participation in the restructuring stage (in the management of the company) is expected to increase the value of the debtor's offer (the value of the stock) for all, when each creditor (shareholder) is small enough not to affect the outcome of the vulture's (raider's) bid.

The creditors vote to accept or reject the offer. If κ or more creditors vote to accept the offer, it goes ahead. Otherwise, creditors get a pro-rata share of the residual project return less their private legal costs.[7]

More precisely, the extensive form of the game is as follows:

1. The debtor chooses a CAC threshold $\kappa \in [\underline{\kappa}, \overline{\kappa}]$ to insert into the bond contract used to finance a risky project.

2. The bond contract is offered to multiple risk neutral creditors who buy an equal share of the total debt stock (normalised to one here) at a market-determined interest rate r.

3. Creditor i observes signal $x_i = \theta + s_i$, as described above.

4. Creditors decide whether to flee or roll over their bond contracts. We denote by f the proportion of creditors who flee.

5. Fundamental θ is realised. This in turn determines the return on the project which is given by

$$\theta - f,$$

   where f is the deadweight damage to the project from early liquidation.[8] The project succeeds if there is enough project return to pay

[7] For the purpose of our analysis, this assumption can be interpreted to mean that foreign creditors are able to attach assets with value equal to the residual project return in the jurisdiction where the bonds were issued. In practice, there are few tangible assets that creditors can attach in foreign jurisdictions. The important aspect of this assumption is that the higher the available project return, the greater the payout to creditors who decide to pursue their claim in courts. Other aspects of the analysis can be generalised as long as this assumption is maintained. See also Haldane *et al.* (2003).

[8] Implicitly, we have assumed that the marginal damage to the project of one fleeing creditor is equal to 1. The model can be easily generalised by assuming that the damage is equal to kf with $k \neq 1$. All the results that follow are still valid as long as we allow for the possibility of a liquidity crisis, ie, as long as $k > r$.

the creditors who stay after the fleeing creditors have been paid out. That is, if

$$\theta - f - f \geq (1 - f)(1 + r)$$

then the debtor repays the creditors who rollover in full and keeps the residual project return for itself. The game ends. Otherwise, the project fails, the debtor defaults and we enter the restructuring phase of the game described below.

6. The debtor makes an offer to write down $(1 - f)(1 + r)$.

7. Creditors vote to accept or reject.

8. If the offer is accepted all creditors receive a payment equal to the offer. In the event that the offer is rejected, each creditor i gets a pro-rata share of the return to the project less their private legal costs l_i.[9]

9. Final payoffs are determined.

We proceed to solve the game.

2.1 Restructuring subgame

Stages 6-8 of the game are a voting subgame. The debtor makes a request to its creditors to write down the repayment on its bond. Creditors decide whether to accept or reject the offer. Since all bonds have collective action clauses, the debtor's offer will bind any dissenting creditors as long as the incidence of accepting creditors is κ or higher. If fewer than κ creditors accept

[9] The model does not nest the case of unanimity provisions according to which all creditors are required to agree before an offer can go through. The reason is because it is assumed that creditors lie on a continuum. For a welfare analysis of CACs versus unanimity provisions from an *ex post* perspective, see Kletzer (2003) and Haldane *et al.* (2003).

the offer, claims are pursued through the courts and the debtor remains in default. In this event, each creditor will eventually receive a pro-rata share of gross project return, θ, net of payouts to fleeing creditors, f, and net of the damage done by early liquidation, f, and less the legal costs spent pursuing their claim.[10] The debtor receives whatever is left from the project after it has paid its creditors.

So the debtor's payoffs are:

$$\begin{cases} U(\theta - 2f - \text{offer}) & \text{if } \kappa \text{ or more creditors accept} \\ U(0) & \text{otherwise} \end{cases} \tag{1}$$

where $U(.)$ is the utility function of the debtor. The payoff to the creditor in the $(1-\kappa)$-th quantile of the distribution of legal costs from a given offer is:

$$\begin{cases} \text{offer} & \text{if } \kappa \text{ or more creditors accept} \\ \theta - 2f - l_{1-\kappa} & \text{otherwise} \end{cases} \tag{2}$$

So from the point of view of the creditor and assuming full information, it is a weakly dominant action to vote to accept the offer provided that the debtor's offer is greater or equal to $\theta - 2f - l_{1-\kappa}$. From the point of view of the debtor, again under full information, and since legal costs are positive it is optimal to make an offer which is just large enough to persuade the $(1-\kappa)$-th creditor to accept, that is to offer:

$$\theta - 2f - l_{1-\kappa}. \tag{3}$$

This offer would be exactly equal to the net project return (after payouts to fleeing creditors have been met) less the legal costs of the $(1-\kappa)$-th most stringent creditor from the pool of $(1-f)$ creditors who participate in the

[10] This restructuring subgame is very similar to the one set out in Haldane *et al.* (2003). The main difference is that here we do not assume that the debtor exerts adjustment effort after learning the outcome of the vote. For our purposes, including adjustment effort would complicate the notation without changing the analysis.

restructuring.[11] From (2), this offer is just large enough for the marginal $(1-\kappa)$-th creditor who votes on a restructuring to accept the offer and for the deal to go through. In this set-up, CACs ensure that restructuring is not delayed and resources are not expended on litigation; they neuter rent-seeking among bondholders.[12]

In the event of a restructuring, therefore, the payoff to the debtor is

$$U(l_{1-\kappa}) \tag{4}$$

whereas the payoff to each creditor who rolled-over is equal to the offer made by the debtor, given by (3). Comparing (3) and (4) we can see that after default has occurred, a lowering of the CAC threshold would shift the allocation of residual project return from the creditors to the debtor and *vice versa*. Hence looking at solvency crises in isolation, debtors would always prefer a lower voting threshold. We will see below, however, that this result is modified when crises are neither pure insolvency nor pure liquidity, ie, when we have 'grey-zone' crises.

2.2 Rollover subgame

Working backwards, we now determine the proportion of creditors who flee. This involves solving stages 3-6 of the extensive form of the game, which form a rollover global game in the manner of Morris and Shin (1998).

The aggregate strategy of creditors is a rule of action which depends on whether the signal creditors receive is above a critical threshold x^*. A creditor

[11] Say the threshold κ is 75%, then for the offer to go through the debtor needs only to persuade the creditor with the *highest* legal cost in the first quartile of the distribution of legal costs.

[12] Haldane *et al.* (2003) show that this outcome in no longer guaranteed when there is two-sided information asymmetry between the debtor and its creditors about how much they stand to gain or lose if the restructuring does not take place.

will flee if his private signal is lower than x^* and will roll over otherwise. More formally, the strategy $v(x^*)$ is an indicator function which takes the value one if $x < x^*$ and takes the value of zero, otherwise. This implies that the proportion of investors who flee given the aggregate strategy and the uniform distribution of private signals is

$$f[v(x^*)] = \Pr(x_i < x^*) = \frac{x^* - (\theta - \varepsilon)}{2\varepsilon}. \tag{5}$$

The equilibrium in switching strategies, in turn, implies that there is a critical state of fundamentals, θ^*, above which the project succeeds and below which the project fails. At the equilibrium switching point, two conditions need to be met.

First, the proportion of creditors who flee must be such that the solvency constraint just binds. We refer to this condition as the 'solvency condition'. The solvency condition is given by $\theta^* - 2f(v(x^*)) = (1 - f(v(x^*)))(1 + r)$, which simplifies to

$$f(v(x^*)) = \frac{\theta^* - (1 + r)}{1 - r} \tag{6}$$

From (5) and (6), we obtain

$$\theta^* = \frac{(x^* + \varepsilon)(1 - r) + 2\varepsilon(1 + r)}{1 - r + 2\varepsilon}. \tag{7}$$

In the limit as $\varepsilon \to 0$, we have $\theta^* \to x^*$.

The second condition is that, at the switching point, the marginal creditor must be indifferent between fleeing and staying. We refer to this as the 'indifference condition'. This says that the expected payoff from rolling over if the debtor defaults plus the expected payoff from rolling over if the debtor repays must equal the deterministic payoff from fleeing. That is:

$$\int_{-\infty}^{\theta^*} (\theta - 2f - l_{1-\kappa})p(\theta|x^*)d\theta + \int_{\theta^*}^{\infty} (1 + r)p(\theta|x^*)d\theta = 1, \tag{8}$$

where we have used the fact that the payoff from rolling over if the debtor defaults is equal to (3) and where $p(\theta|x)$ is the density of θ conditional on x. Since the prior over θ is uniform and the noise is also uniform with support $[-\varepsilon, \varepsilon]$, the conditional density $p(\theta|x^*)$ is uniform with support $[x^* - \varepsilon, x^* + \varepsilon]$. So, (8) can be written as:

$$\frac{1}{2\varepsilon}\int_{x^*-\varepsilon}^{\theta^*}(\theta^* - 2f)d\theta - l_{1-\kappa}(\theta^* - x^* + \varepsilon) + (1+r)\left[1 - \frac{\theta^* - x^* + \varepsilon}{2\varepsilon}\right] = 1. \quad (9)$$

Using (7) to eliminate x^*, we can express (9) as a quadratic equation in θ^*. In Appendix 1, we show that (9) can be written as

$$\theta^{*2} - \{F_1 + F_2 l_{1-\kappa}\}\theta^* + \{F_3 + F_4 l_{1-\kappa}\} = 0, \quad (10)$$

where the coefficients $\{F_j\}$ are simple functions of ε and the interest rate r. Appendix 1 also shows that, in the economically meaningful case where (10) has a positive root for θ^*, there is precisely one such positive root. Hence, the switching equilibrium is unique. This root gives the trigger point of fundamentals at which a liquidity crisis will commence. This trigger point lies between two points: a 'fundamental insolvency' point and a 'fundamental solvency' point, denoted $\underline{\theta}$ and $\overline{\theta}$ respectively. Fundamental insolvency occurs when the project return is insufficient to pay out creditors even if they all rollover ($f = 0$), that is when $\theta < \underline{\theta} = (1 + r)$. Fundamental solvency occurs when the project return is so high that there is enough to pay out all creditors even if they all foreclose ($f = 1$), that is $\theta \geq \overline{\theta} = 2$. In the region in between ($(1 + r) \leq \theta^* < 2$), we have liquidity crises – that is defaults which would not have occurred were it not for the decision of a sufficient proportion of creditors to flee.

3 Interest rate determination

Having solved for the roll over stage of the game, we now solve for the market-determined, actuarially fair interest rate. In equilibrium, the expected return to the risky project must equal creditors' outside option if they invest elsewhere, which for convenience we normalise to one. That is

$$\int_0^{\theta^*} (\theta - l_{1-\kappa} - 2f)p(\theta)d\theta + \int_{\theta^*}^{b} (1+r)p(\theta)d\theta = 1, \tag{11}$$

where $p(\theta)$ is the unconditional density of θ which is equal to $\frac{1}{b}$. Appendix 2 shows that in the limit as the signals about fundamentals received by all creditors become very precise, ie, as $\varepsilon \to 0$, (11) can be rewritten as:

$$\theta^{*2} - 2\left(2 + l_{1-\kappa} + 1 + r\right)\theta^* + 2br = 0, \tag{12}$$

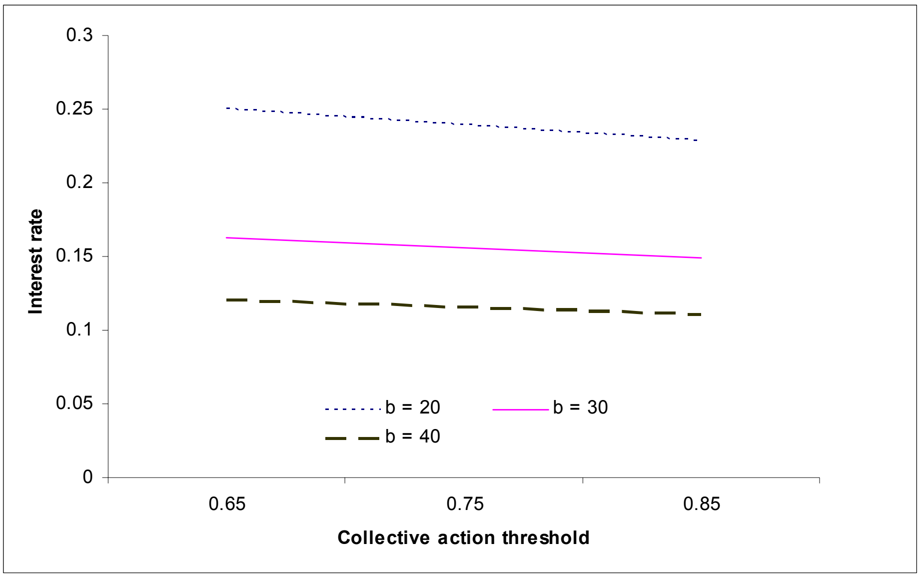
where

$$\theta^* = \frac{F_1 + F_2 l_{1-\kappa} + \sqrt{\left(-F_1 - F_2 l_{1-\kappa}\right)^2 - 4\left(F_3 + F_4 l_{1-\kappa}\right)}}{2} \tag{13}$$

is the positive root of (10) and where the coefficients $\{F_j\}$ have been evaluated in the limit as $\varepsilon \to 0$.

Expression (12) is an equation in three variables: r, $l_{1-\kappa}$ and b. So, for a given value of the CAC threshold, κ, or equivalently, for a given legal cost of the $(1-\kappa)$-th creditor, $l_{1-\kappa}$, and a value for the upper support of the unconditional distribution of the project, b, we can determine the market interest rate r. Because the market interest rate is actuarially fair it is equal to creditors' expected loss in the event of crisis. This expected loss, in turn, is equal to the product of the loss in the event of crisis and the *ex ante* probability of a liquidity crisis. From (3), we know that creditors' loss in the

Figure 1: Variation of interest rates with CAC threshold



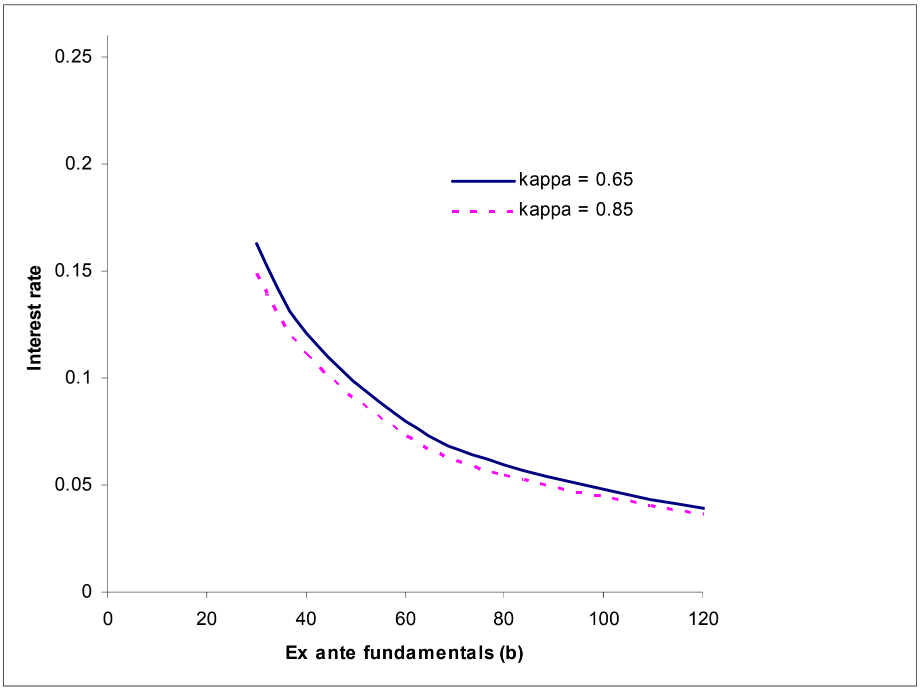
event of crisis (recovery rate) is decreasing (increasing) in the voting threshold κ. We would therefore expect the interest rate to decrease as the CAC threshold, κ, increases. Figure 1 illustrates for a simple parameterisation that this is indeed the case.[13] The *ex ante* probability of a liquidity crisis, on the other hand, depends on both fundamentals and on the voting threshold. First, we would expect the probability of crisis to increase as the debtor's fundamentals, b, deteriorate.[14] Figure 1 confirms this. Second, the *ex ante* probability of crisis depends on the voting threshold chosen by the debtor. Intuitively, other factors being equal, lower voting thresholds make creditors more trigger-happy during the roll over game because in the event of crisis

[13]For the purposes of generating this figure and all the ones that follow we assume that the distribution of legal costs is uniform on $[0, 1]$. Under this assumption collective action clauses of 0.65, 0.75 and 0.85 imply marginal creditor legal costs, $l_{1-\kappa}$, of 0.35, 0.25 and 0.15 respectively.

[14]As θ is uniform on $[0, b]$, the *ex ante* expected value of the fundamental is $b/2$.

they would allow the debtor to get away with a lower offer and still keep holdout creditors in check.[15]

Figure 2: Variation of interest rates with fundamentals



It is also interesting to note that although interest rates increase linearly as the CAC threshold decreases, they increase at an increasing rate as fundamentals deteriorate. Therefore, given a certain CAC threshold, κ, one would expect to observe a greater premium above risk-free rates for bonds issued by poor credit quality borrowers than for bonds issued by better quality borrowers. Figure 2 illustrates this more clearly by plotting interest rates against fundamentals for two different values of the CAC threshold. Lower voting thresholds raise the probability of a liquidity run, the more so the less

[15] In the next section we show this more formally.

creditworthy the borrower because the higher interest rate itself affects the solvency constraint. So lower-rated sovereigns need to offer creditors greater compensation *ex ante*, for a given threshold. This finding is consistent with the empirical findings of Eichengreen and Mody (2003) who find that lower-rated borrowers are charged a premium to issue bonds with collective action clauses, whereas higher-rated borrowers can issue at a discount.[16] The suggested reason by Eichengreen and Mody, a modelled in Eichengreen, Kletzer and Mody (2003), is borrowers' greater propensity to default strategically when they lack creditworthiness. In our set up, a premium could arise even without an additional incentive to default. Rather, investors require extra compensation as a result of the increased fragility of short-term creditors when creditworthiness is low.

4 Debtor's choice of CAC threshold

Arbitrage among creditors establishes a relationship between interest rates, the collective action voting threshold and the range of fundamentals (equation (12)). The debtor can use this relationship when it chooses the voting threshold in bonds it issues. We now turn to the first stage of the extensive form of the game, to determine the debtor's choice of optimal collective action threshold.

Intuitively, the debtor cares about three things: the probability of crisis (which depends on fundamentals b and on the expected rollover behaviour of creditors); its payoff in the event of non-crisis (which depends on the market interest rate); and its payoff in the event of a crisis. As we have seen from (4), the CAC threshold directly affects the debtor's payoff in the event of crisis.

[16] Richards and Gugiatti (2003), on the other hand, find no discernible difference from the inclusion of CACs, whatever the credit rating of the issuer.

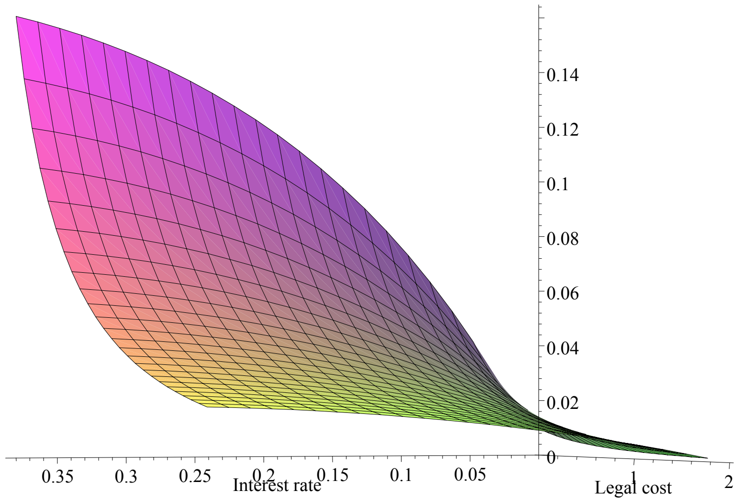
The lower the CAC threshold, the higher the legal costs of the marginal creditor and the higher the debtor's payoff in the event of crisis. But Figure 1 shows that a lower collective action clause threshold results in a higher interest rate. What the debtor gains from a higher payoff in the bad state, it loses in the good state. So a crucial question for the debtor in determining the optimal voting threshold is its impact on the probability of crisis.

This can be determined by differentiating θ^* with respect to $l_{1-\kappa}$. The analytical expression – a function of r and $l_{1-\kappa}$ – is complicated so results are better illustrated pictorially. In Figure 3 we plot $\frac{\partial\theta^*}{\partial l_{1-\kappa}}$ for all valid combinations or r and $l_{1-\kappa}$. Given that the surface always lies in the positive region, $\frac{\partial\theta^*}{\partial l_{1-\kappa}} > 0$ or, equivalently, $\frac{\partial\theta^*}{\partial\kappa} < 0$. Therefore, the debtor can lower the probability of crisis by raising the CAC threshold, κ. A higher voting threshold provides short-term creditors with additional assurance, and so lowers their incentive to run and hence the probability of crisis. This is the essence of the 'grey-zone' dimension to the model. Decisions regarding outcomes in the event of solvency crisis affect the probability of liquidity crisis, and hence shape *ex ante* choices about optimal debt contracts. Previous papers have looked at the effects of solvency crisis measures on contract design (eg, Haldane *et al.* (2003), Kletzer (2003)), or the effects of liquidity crisis measures on contract design (eg, Dooley (2000), Gai and Shin (2003)) but none, to our knowledge, have considered the interaction among these measures.

More formally, the debtor would choose the CAC threshold, κ, to maximise its expected return on the project. In doing so the debtor takes into account the payoff they expect to receive in the event of a crisis, $U(l_{1-\kappa})$, and the payoff they expect to receive if no crisis occurs, $U[\theta - (1 + r)]$.[17] So the debtor solves the following maximisation problem:

[17] Recall that we are conducting our analysis as $\varepsilon \to 0$. A consequence of this is that the proportion of creditors who flee becomes polar $0, 1$.

Figure 3: Variation of probability of liquidity crisis with legal costs of marginal creditor ($\frac{\partial\theta^*}{\partial l_{1-\kappa}}$)



$$\max_{\kappa}\left\{\int_0^{\theta^*} U(l_{1-\kappa})p(\theta)d\theta + \int_{\theta^*}^{b} U\left[\theta-(1+r)\right]p(\theta)d\theta\right\}, \tag{14}$$

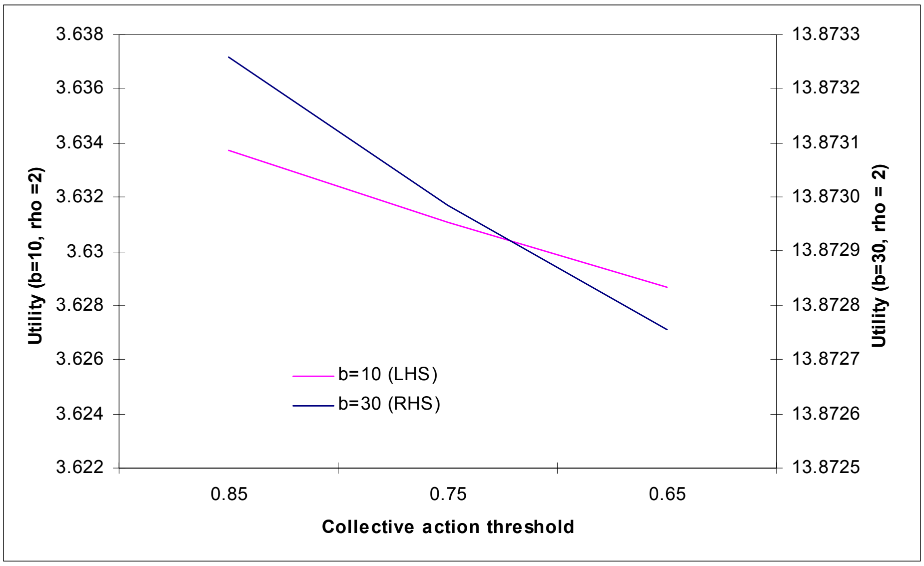
where θ^* is the trigger point at which short-run creditors flee (13) and $p(\theta)$, as before, is $\frac{1}{b}$.

In what follows, we assume that the debtor has utility $U(x)=\frac{x^{\rho-1}}{\rho-1}$, where $2-\rho\geq 1$ is the coefficient of risk aversion. As a result, (14) becomes:

$$\max_{\kappa}\left\{\frac{l_{1-\kappa}^{\rho-1}\theta^*}{b\,(\rho-1)}+\frac{1}{\rho b\,(\rho-1)}\left[[\theta-(1+r)]^{\rho}\right]_{\theta^*}^{b}\right\}. \tag{15}$$

Taking into account the endogeneity of the crisis threshold and interest rates,

Figure 4: Variation of debtor utility with CAC threshold - risk neutral debtor



this can be rewritten as

$$\max_{\kappa}\left\{\frac{l_{1-\kappa}^{\rho-1}}{b\,(\rho-1)}\theta^{*}(\kappa)+\right.$$
$$\left.\frac{1}{\rho b\,(\rho-1)}\left[\left[b-(1+r(b,\kappa))\right]^{\rho}-\left[\theta^{*}(\kappa)-(1+r(b,\kappa))\right]^{\rho}\right]\right\}. \quad (16)$$

The maximisation problem in equation (16) does not have a closed-form solution, but simulated results provide interesting insights.

- First, for all values of creditworthiness b, a *risk-neutral* debtor ($\rho = 2$) will prefer a higher collective action threshold to a lower one. This is illustrated in Figure 4. Intuitively, a risk-neutral debtor does not care about the distribution of possible payoffs, only their expected value. And the expected repayment by the debtor to its creditors is equal to 1 from equation (11). What the debtor gains by increasing its *ex* *post* payout in a crisis by lowering the collective action threshold is offset exactly by higher *ex ante* interest charges when there is no crisis. Since the debtor makes a surplus when the prokect succeeds, a risk-neutral debtor gains by simply minimising the *ex ante* probability of crisis, which is achieved by issuing bonds with high collective action thresholds.

- Second, this conclusion is modified if the debtor is risk-averse ($\rho < 2$). This is illustrated in Figure 5. The more risk-averse the debtor, the more it weighs the payoffs it receives in a crisis period over those in a non-crisis period. With strong risk-aversion, the debtor may prefer to issue bonds with a low voting threshold, so that it reduces what it has to pay out *ex post* in a debt restructuring, even though this increases the *ex ante* risk of crisis and raises the *ex ante* interest rate.

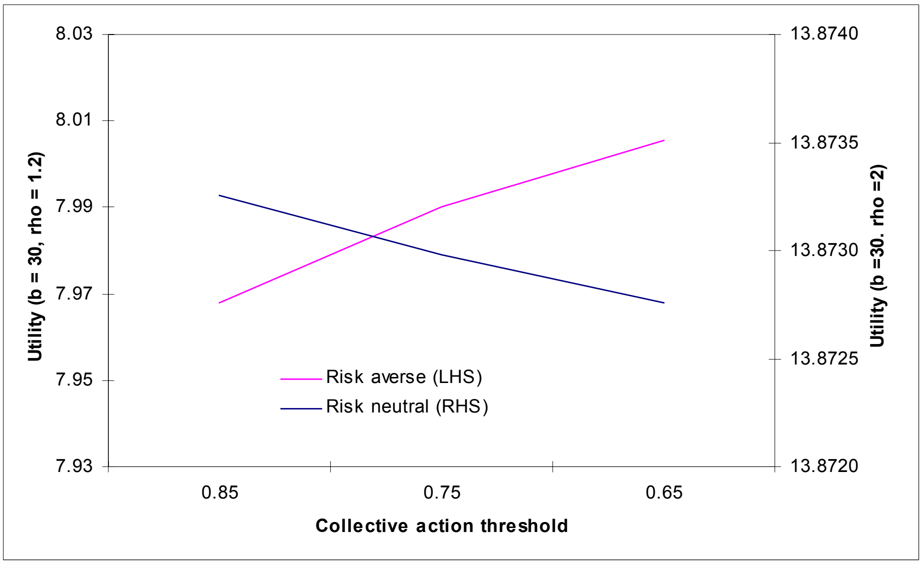
- Third, the lower the creditworthiness, the more likely it is that a moderately risk-averse debtor will want to issue bonds with a high collective action threshold (Figure 6). This occurs because creditors consiering their roll over decision require increasingly more compensation for the risk of default as creditworthiness declines (Figure 2): when fundamentals are weak, short-term creditors are more trigger-happy. This will tend to lead lower-rated debtors to choose a higher threshold to minimise this risk.

5 Policy Implications

The model of grey-zone crisis developed here suggests the following policy implications:

- In choosing the optimal CAC threshold, there are costs to a policy

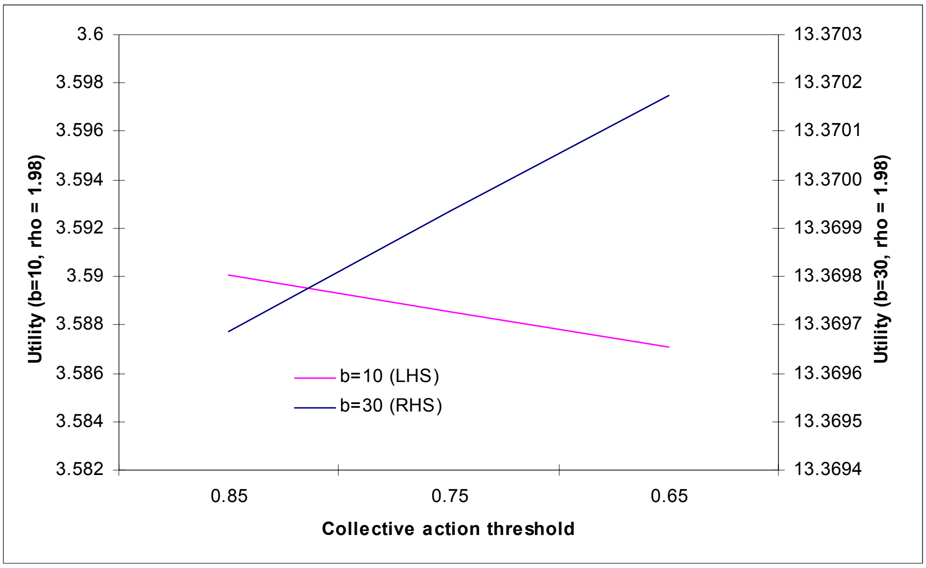
Figure 5: Variation of debtor utility with CAC threshold - effect of risk aversion



of “the lower the better”. A lowering of CAC thresholds may provide some assurance to the debtor in the event of a default, because it allows holdout creditors to be held in check with a lower offer. But there is a dark side to this CAC benefit. The prospect of a lower offer increases the likelihood of creditors running for the door in the first place. So a lower CAC threshold risks increasing the chances of liquidity crisis, thereby raising initial borrowing costs for the debtor. For example, in the simple model presented here, if a debtor is risk-neutral they would prefer a higher collective action threshold to a lower one because the *ex post* benefit of having CACs is more than outweighed by its *ex ante* cost.

- In more general settings, higher thresholds may no longer be optimal.

Figure 6: Variation of debtor utility with CAC threshold - effect of fundamentals



For example, a risk-averse debtor – one which places greater weight on the adverse consequences of default – is more likely to choose a lower CAC threshold.[18] This suggests there may be a role for the international official community in promoting lower thresholds. It is tantamount to asking the sovereign to behave in a more risk-averse way. Put differently, if CACs are insurance, then asking sovereigns to self-insure by choosing a lower threshold lowers the burden on the official sector as a centralised provider of sovereign insurance.

- Even when there is a demand (voluntary or induced) for CAC insurance, the optimal degree of insurance will vary across borrowers. The more creditworthy the debtor, the lower the tolerable CAC threshold, for a given level of risk aversion. Therefore, although there may be benefits in having a market standard for CAC thresholds to reduce uncertainty in debt restructurings, such a standard may be suboptimal for some debtors.

- The most general policy lesson which emerges from the model is that solvency crisis tools and liquidity crisis tools cannot and should not be viewed in isolation. The interaction and spillovers between them need to be weighed carefully when crafting both sets of policy. This has been demonstrated here in the context of CAC-design and its important implications for liquidity crisis. But it equally applies in reverse when considering the efficacy of liquidity crisis measures. The model presented here provides a framework for assessing these welfare ques-

[18] There may be other (than risk aversion) reasons why a lower CAC threshold may have a benefit – for example, in situations where there is two-sided information asymmetry between debtors and creditors (Haldane *et al.* (2003)). On the other hand, others argue that mitigating the costs of crisis of the debtor by lowering the CAC threshold may weaken the disincentives to default (Dooley (2000)).

tions in an integrated fashion. It also provides a vehicle for exploring complementarities between different (liquidity and solvency) tools.

Appendix 1

Recall from the main text that there are two equations, (7) and (9), in two unknowns, θ^*, the trigger value of fundamentals for a crisis and x^*, the signal of the marginal creditor who flees. The relationship between $\theta^*$and x^* also determines the proportion of people who flee $f(v(x^*))$ and final project return at the trigger value of crisis $\theta^* - f(v(x^*))$.

The first step in the solution is to rewrite (7) for x^*. For convenience, this can be written in two forms:

$$x^* = A_1 + (\theta^* - \varepsilon) \tag{17}$$

where $A_1 = 2\varepsilon\left(\frac{\theta^*-(1+r)}{1-r}\right)$ and

$$x^* = B_1\theta^* - B_2\varepsilon \tag{18}$$

where $B_1 = \frac{1-r+2\varepsilon}{1-r}$ and $B_2 = \frac{3+r}{1-r}$. The indifference condition (9) can be written as

$$[C_1\theta^* + C_2x^* - C_3]\left[\frac{\theta^* + \varepsilon - x^*}{2\varepsilon}\right] = -r, \tag{19}$$

where $C_1 = \frac{\varepsilon+1}{2\varepsilon}$, $C_2 = \frac{\varepsilon-1}{2\varepsilon}$ and $C_3 = \left(\frac{\varepsilon+3}{2}\right) + l_{1-\kappa} + (1+r)$. Expressions (17) and (19) are two equations in two unknowns x^* and θ^*. Substituting (17) or (18) into (19) we obtain:

$$[C_1\theta^* + C_2\left(B_1\theta^* - B_2\varepsilon\right) - C_3]\left[\frac{\theta^* + \varepsilon - A_1 - (\theta^* - \varepsilon)}{2\varepsilon}\right] = -r$$

which is equal to

$$[\left(C_1 + C_2B_1\right)\theta^* - C_2B_2\varepsilon - C_3]\left(D_1\theta^* - D_2\right) = r,$$

where $D_1 = \frac{1}{1-r}$ and $D_2 = \frac{2}{1-r}$. This can then be rewritten in the form

$$\theta^{*2} - \left\{F_1 + F_2l_{1-\kappa}\right\}\theta^* + \left\{F_3 + F_4l_{1-\kappa}\right\} = 0 \tag{20}$$

where $F_1 = \frac{(\varepsilon-1)(3+r)}{2(\varepsilon-r)}+2+\frac{1-r}{\varepsilon-r}\left[\left(\frac{\varepsilon+3}{2}\right)+(1+r)\right]$, $F_2 = \frac{1-r}{\varepsilon-r}$, $F_3 = \frac{(\varepsilon-1)(3+r)-(1-r)^2 r}{\varepsilon-r}+2\frac{1-r}{\varepsilon-r}\left[\left(\frac{\varepsilon+3}{2}\right)+(1+r)\right]$ and $F_4 = 2\frac{1-r}{\varepsilon-r}$. For $\varepsilon \to 0$, $F_1 = \frac{r^2+4r-1}{r}$, $F_2 = -\frac{1-r}{r}$, $F_3 = \frac{r^3+5r-2}{r}$ and $F_4 = -2\frac{1-r}{r}$. Provided that $F_3+F_4 l_{1-\kappa} < 0$, (20) will have one negative and one positive root. The positive root will be the economically meaningful solution for θ^*. Therefore,

$$\theta^* = \frac{F_1 + F_2 l_{1-\kappa} + \sqrt{\left(-F_1 - F_2 l_{1-\kappa}\right)^2 - 4\left(F_3 + F_4 l_{1-\kappa}\right)}}{2}. \tag{21}$$

Appendix 2

Since θ is distributed uniformly on $[0, b]$, $\Pr(\theta \leq \theta^*) = \frac{\theta^*-0}{b}$ and $p(\theta) = \frac{1}{b}$. Substituting $p(\theta)$ into (11) we obtain:

$$\frac{1}{b}\left[\int_0^{\theta^*} (\theta - l_{1-\kappa} - 2f)d\theta + \int_{\theta^*}^{b} (1+r)d\theta\right] = 1. \tag{22}$$

In the limit, as $\varepsilon \to 0$, signals become fully informative and all creditors would flee if $\theta \leq \theta^*$, i.e., $f = 1$ for $\theta \leq \theta^*$. Therefore as $\varepsilon \to 0$, (22) becomes

$$\begin{aligned} \int_0^{\theta^*} \theta d\theta - (2 + l_{1-\kappa}) \int_0^{\theta^*} d\theta + (1+r) \int_{\theta^*}^{b} d\theta &= b \\ \frac{1}{2}\theta^{*2} - (2 + l_{1-\kappa})\,\theta^* + (1+r)\,(b - \theta^*) &= b \\ \theta^{*2} - 2\,(2 + l_{1-\kappa} + 1 + r)\,\theta^* + 2br &= 0 \end{aligned} \tag{23}$$

where θ^* is given by (13).

References

[1] **Buchheit, L and Gulati, M (2002)**, "Sovereign Bonds and the Collective Will", *Georgetown University Law Center Working Paper No. 34.*

[2] **Bolton, P and Jeanne, O (2002)**, "Sovereign Debt Structuring and Restructuring: An Incomplete Contracts Approach", *mimeo.*

[3] **Chang, R and Velasco, A (1999)**, "Liquidity Crises in Emerging Markets: Theory and Policy", *NBER Working Paper No. 7272.*

[4] **Chui, M K, Gai, P S and Haldane, A G (2002)**, "Sovereign Liquidity Crises: Analytics and Implications for Public Policy", *Journal of Banking and Finance*, 26, 519-46.

[5] **Gai, P S and Shin, H S** (2003), "Debt maturity structure with preemptive creditors", *Bank of England Working Paper No. 201.*

[6] **Dooley, M (2000)**, "Can Output Losses Following International Financial Crises be Avoided?", *NBER Working Paper No.7531.*

[7] **Eaton, J and Gersovitz, M (1981)**, "Debt with Potential Repudiation – Theory and Estimation", *Review of Economic Studies*, 48, 289-309.

[8] **Emerging Market Creditors Association (2002)**, *Model Covenants for New Sovereign Debt Issues.*

[9] **Eichengreen, B, Kletzer, K and Mody, A (2003)**, "Crisis Resolution: Next Steps", *IMF Working Paper* 03/196.

[10] **Eichengreen, B and Mody, A (2003)**, "Would Collective Action Clauses Raise Borrowing Costs? An Update and Additional Results", *mimeo.*

[11] **Eichengreen, B and Portes, R (1995)**, *Crisis What Crisis? Orderly Workouts for Sovereign Debtors*, Centre for Economic Policy Research, London.

[12] **Gray, R (2004)**, "Collective Action Clauses: The Way Forward" paper presented at Georgetown University Law School Conference on Sovereign Debt.

[13] **G10 Working Group on Contractual Clauses (2003)**, *Report of the G10 Working Group on Contractual Clauses.*

[14] **Grossman, S and Hart, O (1980)**, "Takeover bids, the free rider problem and the theory of the corporation", *Bell Journal of Economics and Management Science*, Spring, pages 42-64.

[15] **Haldane, A, Penalver, A, Saporta, V and Shin H S (2003)**, "Analytics of Sovereign Debt Restructuring", *Bank of England working paper No. 203* and forthcoming in the *Journal of International Economics.*

[16] **Kletzer, K (2003)**, "Sovereign Bond Restructuring: Collective Action Clauses and Official Crisis Intervention", forthcoming in Haldane, A (ed.), *Fixing financial crises*, London: Routledge.

[17] **Portes, R (2003)**, "Resolution of Sovereign Debt Crises: The New Old Framework", *mimeo.*

[18] **Rey, J-J (1996)**, "The Resolution of Sovereign Liquidity Crises", Report to the Ministers and Governors of the Group of Ten.

[19] **Richards, A and Gugiatti, M (2003)**, "Do Collective Action Clauses Influence Bond Yields? New Evidence from Emerging Markets", *International Finance*, 6:3, pages 415-447.