"BAIL-OUTS THAT ARE TRULY "INVOLUNTARY""

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Abstract

The paper considers the issue of bail-out lending to sovereign debtors when some lenders have more information than others. It is shown that in a pooling equilibrium, uninformed but strategically-thinking lenders with no prior exposure can be induced to take participations in syndicates whose role will be to refinance troubled debtors. This will be possible when the uninformed lenders are optimistic enough about the overall state of the market. When their priors on the market deteriorate, a sudden shift can be triggered to a separating equilibrium; such a shift is called a "debt crisis". The new equilibrium is characterized by a higher concentration of lending among large banks, at a lower overall level.

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1. Introduction

While the "debt crisis" no longer makes it to the headlines, except in its Eastern European avatar, it can hardly be said that all of its features have been fully explored. As "debt crises" are a regular part of the economic development process since the XIVth century[1] and are bound to recur, some of their features are still worth exploring ten years after the Mexican default triggered the latest drama.

Asymmetric information is one such feature. A borrowing country must usually submit lending banks an *information memorandum* summarizing basic data on the use of the loan requested, the country's economic condition, including its overall indebtedness, and other information pertinent to the determination of the credit risk. In practice, a country's external debt is made of a complex mix of claims on public, para-public and private entities whose individual borrowing policies are hardly coordinated. As a result, creditors typically lend without knowing exactly how much the country has already borrowed, merely imposing seniority or *pari passu* clauses to protect their own claims[2]. At least since Kletzer (1984) the literature has recognized this as a central feature of

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[1] The *Bardi* bank of Florence failed in 1346 following default by the Kings of England and Sicily on their enormous external debt (Lopez, 1976).

[2] This type of situation is typical of the pre-1982 period, after which compulsory disclosure by lending banks of data on their exposure improved the market's general information. However, the uncertainty surrounding estimates of the ex-Soviet Union's external debt shows that the problem has not disappeared.

the sovereign lending business. A second type of information asymmetry, *between lenders themselves*, while being recognized as a fact (see Baron, 1979; Hayes, Spence and Marks, 1983; Berlin and Loeys, 1986; and Melnik and Plaut, 1991), has not been modelled formally. Bank syndicates are typically not coalitions of symmetric players. They are organized and managed by a couple of large banks who negotiate loan contracts and sell participations to smaller banks worldwide (Fernandez and Kaaret, 1988). The same small group of large banks - usually, though not exclusively, based in the U.S. - can be found organizing most of the large syndicates in the late 1970's and early 80's (UNCTC, 1991), and can be considered as the real insiders in the country-risk business. These large banks, being in close contact with officials of borrowing-country governments, had private - although imperfect - information on the true level of credit risks in any particular country[3], and might even get advanced warning of coming repayment difficulties. Whether syndicate lead managers had any incentive to pass that information around to all participants in the market is another story. When a country is in a temporary liquidity crisis, banks with high exposure to that country may want to raise money for a rescue (more on this below). Raising that money will be easier if the market is not scared by bad news.

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[3] Regulatory problems arising from the risk-taking behaviour of banks having private information on the quality of their claims have been examined in the context of domestic lending by Lucas and McDonald (1987a, 1987b).

Who wants to rescue a debtor in difficulty? According to Guttentag and Herring (1985), "bail-out loans are made only by lenders with outstanding claims on the borrower". This is because bail-out loans are defined as loans that have an expected return lower than the opportunity cost of funds, thus being unattractive to new lenders. Lenders with exposure, by contrast, may be willing to refinance troubled debtors if new money increases the probability of repayment of outstanding claims by a sufficient amount (if new money allows a creditor to avoid making irreversible moves, such as declaring the debtor officially in default, it also has an option value; this was pointed out in the present context by Krugman, 1985). The Guttentag-Herring definition is operational in a world of symmetric information. The question addressed by this paper, by contrast, is the following: Can creditors with private information and high exposure convince uninformed but strategically-thinking followers to participate in a refinancing that is in fact a quasi-bailout[4]? The creditors' problem here is to avoid the contagion of fear; the analysis is thus related to the literature on bank panicks under asymmetric information (Smith, 1984; Gorton, 1985; Waldo, 1985; see also Smith, 1991 for a survey

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[4] The question is targeted at lending behaviour during the "pre-Mexican" phase, in particular the year 1981, when a substantial number of newcomers were drawn into large syndicated euroloans (see UNCTC, 1991). Those relatively unsophisticated newcomers - *e.g.* banking institutions from OPEC countries - were largely ignorant of the actual financial situation of most Latin American debtors, which was rapidly deteriorating in 1981. After August 1982, the bad news having broken, all lending - however little there was - was clearly involuntary, and any information asymmetry had all but disappeared.

and different approach).

The paper also draws, obviously, from the voluminous literature on sovereign lending[5], in particular on the vexed issue of default and enforcement. Since Eaton and Gersovitz (1981) and Eaton, Gersovitz and Stiglitz (1986), one strand of this literature has stressed the threat of being cut off from future access to capital markets as the basic deterrent against repudiation. The argument has been refined by Chowdhry (1991) who shows that syndication may be a device to overcome coordination problems in applying sanctions. Another strand (see for instance Bulow and Rogoff, 1989; Fernandez and Rosenthal, 1988, 1989) has stressed partial default and renegotiation, suggesting that loan contracts to sovereign entities are really contingent claims. In order to focus on hidden information problems, I have chosen to assume away moral hazard by postulating the existence of credible sanctions on the part of creditors (see Cohen, 1992, for more details on the enforcement question).

The model formalizes the following situation: a large bank with exposure to a debtor country is trying to organize a syndicate to lend to that country. The country may be of a good type, in which case new lending is justified by the country's growth; or of a bad type, in which case new money refinances it to overcome a liquidity crisis. The country's type is the large bank's private information. I show that in a pooling equilibrium, uninformed participants in the syndicated euroloan market may take syndicate

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[5] See Cohen (1991) for an up-to-date treatment.

participations knowing that, with positive probability, they are bailing out troubled debtors. A deterioration of their beliefs may trigger a transition to a separating equilibrium where the information spreads out and large creditors are left alone to do the rescuing job, *i.e.* a "debt crisis". The analysis may help to explain an increased aggressiveness of large creditors in pushing loans in the final pre-crisis phase, and is thus complementary to other analyses of "loan pushing" (see Basu, 1991).

The paper is organized as follows. Section 2 sets out the model, section 3 solves it, and section 4 concludes.

2. **The model**

2.1 *Assumptions on the parameters*

The bank organizing the syndicate, which I call the "leader", has initial exposure e (evaluated at book value) to the debtor country. The claims constituting this exposure can be of high quality (type H) or low quality (type L), depending on the quality of the country against which they are written. The type of the country (and therefore of the claims) is the leader's private information. It is not observed by the large number of small banks (called "followers") who are offered ϵ-size participations in the

syndicate[6]. The new syndicate must be arranged *before* the uncertainty about existing debt is lifted. This gives rise to a signaling problem, where the leader is the informed player moving first and the (symmetric) followers know only the game structure, which is common knowledge.

A debtor country government, whether of type H or L, trades off the cost of raising transferable resources against the cost of default[7]. The government's cost of raising resources to service a debt d, $c^i(\omega,d)$ $(i = H,L)$ is a state variable, the state ω being a summary statistic for the performance of the country's export sector, terms-of-trade shocks, and so on. In each state ω, the cost of servicing a given debt is higher for an L-type government than for an H-type government: $c^L(\omega,d) > c^H(\omega,d)$. If the debtor country government chooses to default, it will do so on its entire debt, as cross-default clauses prevent it from defaulting selectively. The cost of defaulting is the cost of being subjected to sanctions from all current creditor banks, and is thus positively related both to the number of initial creditors and to the number of participants

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[6] I assume that each syndicate is constituted by only one leader together with a large number of followers. The analysis goes through with several leaders as long as they act collusively.

[7] I assume here an extreme case where default wipes out entirely the value of the debt. Following Fernandez and Rosenthal (1988), among others, one may alternatively assume that bargaining takes place between creditors and borrowers. One may then assume that the bad state of nature is one where the market value of the debt is depressed, because a renegotiation is "bad news" for financial markets in the sense of Milgrom (1981). Such an assumption would be consistent with the results of Kyle and Sachs (1984), and the model goes through with either formulation.

in the new syndicate. This provides a rationale for syndication[8]. The probability that a debtor government of type i ($i = H,L$) will choose *not* to default is given by a function $p^i(\ell,s,d)$ mapping $R_+^2 \times \mathbb{N}_n$ into [0,1], where $\mathbb{N}_n$ is the set of integers up to n, and whose properties are described in assumptions A1 to A5 below[9]. The argument $\ell \in R_+$ is the new loan offered to the country. The integer $s \leq n$ is the number of followers who decide to take the ϵ-participation in the syndicate offered by the leader (the pool of n potential participants in the syndicate is exogenously given). ℓ is itself a function of s, the number of participants in the syndicate, as $\ell = \alpha + s\epsilon$, where α is the amount of "new money" contributed by the leader bank. Finally, $d \geq e$ is the country's initial debt. Using superscripts to designate types and subscripts to designate partial derivatives, the properties of the functions p^i are the following:

A1. $p^H(\ell,s,d) > p^L(\ell,s,d)$ for all triplets (ℓ,s,d)

A1 justifies the terms "good type" and "bad type". It means that everything else being constant, a high-type government will repay its debt with a higher probability than a low-type one.

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[8] With an infinite horizon, each creditor must, by a classic reputational argument, sanction a defaulting borrower. The argument, however, applies only to a creditor's *own* borrowers. When loans are syndicated and contain cross-default clauses, this means that all banks in a syndicate will sanction a defaulting borrower. See Chowdhry (1991) for a more detailed explanation.

[9] Modeling a debtor government's decision, as perceived by creditor banks, as a random variable does not mean that the government is using a mixed action rule. The government's action rule is pure, but contingent on the realization of a random variable, namely $c^i(\omega,d)$.

A2. $p_\ell^H < 0$

A2 implies that for the good type, any new lending exerts a negative externality on the quality of existing claims.

A3. $p_\ell^L > 0$ iff $\ell < \bar{\ell}(s,d) > 0$; $p_{\ell\ell}^L < 0$

A3 implies that, by contrast, the bad debtor is in a liquidity crisis and that, up $\bar{\ell}(s,d)$, to new money will help. By a "liquidity crisis" is meant that the debtor country's government faces a temporarily high cost of raising transferable resources.

A4. *For any particular* ℓ *and* d, $p^i(\ell,n,d) > p^i(\ell,0,d)$; *furthermore,* $p^i(\ell,.,d)$ *is strictly concave on its domain.*

A4 means that the probability of repayment of a given loan ℓ is higher if the loan is shared with n participants than if it is entirely underwritten by a single bank, because more participants make default sanctions more dissuasive. This is just a restatement of Chowdhry's (1991) argument. Note that sanctions taken by small banks themselves may not matter so much as their insistance, in rescheduling committee meetings, that a consistently tough line be followed with bad debtors. Their presence and the publicity of discussions in large syndicates may then act as a commitment mechanism for renegotiation-prone large creditors.

A5. $p_d^i < 0 \ \forall i$

Finally, A5 means that a higher level of initial exposure reduces the probability of repayment for both types. Properties A1 to A4 hold locally in d at a level of d which is kept constant throughout the analysis; therefore, d will be dropped as an argument of the relevant functions.

2.2 *Timing and information structure*

The leader initially picks a level of lending α to the debtor, then offers individual participations of size ϵ to the n atomistic, uninformed followers who simultaneously accept or reject the offer[10]. The leader's lending level α acts as a signal and is used by the followers to update their beliefs about the type of the country (and claims). A representative follower's prior probability that the debtor is of type H is denoted by q, while his or her posterior probability for the same event, given α, is denoted by $\mu(\alpha)$. Nature then picks the terminal node.

2.3 *Strategy space and payoffs*

A strategy for the leader is a probability distribution of density $\pi(\alpha)$, thus satisfying $\pi(\alpha) \geq 0 \ \forall \alpha$ and $\int_0^\infty \pi(\alpha) d\alpha = 1$. A *pure* strategy, being a degenerate probability distribution, is simply described by α, the amount of new money. The total participation offered by the leader to the set of n followers is fixed, so that α simultaneously determines the amount of the "new money" package and its split between the leader and followers in

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[10] Because the leader makes a take-it-or-leave-it offer to the followers, the surplus of the latter should be squeezed down to zero. Here, it is not, because the terms of the participation are identical to the terms of the leader's own share. In practice, syndicate organizers obtain fee income, and such fees could easily be added to the model.

the syndicate[11]. A (pure) strategy for a follower is a function β: $R_+ \rightarrow \{0,\epsilon\}$, denoted by $\beta(\alpha)$.

Finally, let $f(\alpha,\beta)$ be the follower's payoff and $g^i(\alpha,s)$ the leader's payoff $(i = H,L)$; these functions will be defined explicitely in terms of the basic functions and parameters of the model in the next section.

Let $\alpha^L(n) = arg\ max_\alpha\ g^L(\alpha,n)$ and $\alpha^H(n) = arg\ max_\alpha\ g^H(\alpha,n)$. Existence and uniqueness of $\alpha^H(n)$ and $\alpha^L(n)$ will be established in section 3. I suppose that

A6. $g^L(0,0) < g^L[\alpha^L(n),n] < 0 < g^H[\alpha^H(n),n]$

Assumption A6 means that lending is involuntary for the bad type (first two inequalities) but voluntary for the good type (last inequality)[12]. Finally, let r be the interest rate on the new loan and c the cost of funds to a lending bank. Both r and c are exogenous, constant and common knowledge, and are the same for all banks (this can easily be relaxed); as a last piece of notation, let $\delta = (1+c)/(1+r)$.

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[11] This ensures that signaling remains one-dimensional.

[12] The first inequality in A6 reflects the usual rationale for "involuntary lending": because of its initial exposure, the bank would be losing even more by not lending at all. By throwing in fresh money, it raises the probability of repayment over its entire exposure (see assumption A3). It requires that e and $p_\ell^L|_{\alpha = 0}$ be sufficiently large.

3. Solution

3.1 *Preliminary results*

a) leader

I first derive $\alpha^H(n)$ and $\alpha^L(n)$ in terms of the model's basic parameters. The expected payoff to a leader conditional on type i and given that participations will be sold is given by:

$$\begin{aligned} g^i(\alpha,n) &= p^i(\ell,n)\,[(1+r)-(1+c)]\,(\alpha+e) - [1-p^i(\ell,n)]\,(1+c)\,(\alpha+e) \\ &= (1+r)\,[p^i(\ell,n)-\delta]\,(\alpha+e) \end{aligned} \tag{1}$$

and the first-order condition for a maximum is:

$$p^i(\ell,n) + (\alpha+e)\,p_\ell^i(\ell,n) = \delta \tag{2}$$

which simply says that the marginal revenue from additional lending has to equal its marginal cost. The second-order condition is:

$$(\alpha+e)\,p_{\ell\ell}^i + 2p_\ell^i < 0 \tag{3}$$

which holds under assumptions A1 to A3. The solutions uniquely determined by (2) and (3) for types H and L are respectively $\alpha^H(n)$ and $\alpha^L(n)$. Similar solutions can be calculated for $s = n-1, \ldots, 0$, which are denoted respectively by $\alpha^L(s)$ and $\alpha^H(s)$.

Expression (1) implies that the market value of the debt is less than the full discounted value of the stream of contractual repayments. Furthermore, condition (2) implies that, depending on the functional form of $p^i(\ell,n)$, a creditor bank may be willing to depress the market value of its outstanding claims on a country by lending more. The reason for this apparent paradox is that the

function $p^i(\ell,n)$ is period-specific. Increased borrowing ability coming from the country's growth pushes up the optimal level of exposure over time. Each new round of lending brings in more expected future payments, but depresses the value of outstanding claims. Time-consistency requires that this phenomenon is anticipated in the initial stage where the level e of current exposure is determined.

In order to lift an indeterminacy coming from the generality of the functions used, I will assume that

A7. $\alpha^H(n) < \alpha^L(n)$

This means that the optimal loan to the good country is smaller than the bail-out loan to the bad one (see figure 2).

b) follower

Follower banks being atomistic, they ignore the effect of their participation on the value of existing claims[13]. Furthermore, I assume that even once they have joined a syndicate, mere participation does not give them access to the information the leader has[14]. Therefore, follower banks face the same decision problem whether or not they have initial exposure to the debtor country at the start of the game. If they do have exposure, they just free-ride on the leader. Whether the initial loans were syndicated or not has thus no relevance for the working of the

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[13] In other words, $p^i(\ell,s,d) \approx p^i(\ell,s+1,d)$.

[14] This information asymmetry is widely documented. See *e.g.* Baron (1979), Hayes, Spence and Marks (1983), Berlin and Loeys (1986), Melnik and Plaut (1991).

model. Without loss of generality, I will assume that they have no initial exposure. Let us note a first result.

Lemma 1

Given beliefs $\mu(\alpha)$, the follower's best response to α is given by a step function

$$\beta = \begin{cases} \epsilon & \alpha \in A \\ 0 & otherwise \end{cases} \tag{4}$$

where $A = \{\alpha : E^{\mu(\alpha)} p^{i}(\ell, n) \geq \delta\}$

Proof

It suffices to note that

$$\begin{aligned} f(\alpha,\epsilon) &= \{\mu(\alpha)[p^{H}(\ell,n)-\delta] + [1-\mu(\alpha)][p^{L}(\ell,n)-\delta]\}(1+r)\epsilon \\ &= \epsilon(1+r)E^{\mu(\alpha)}[p^{i}(\ell,n)-\delta] \end{aligned} \tag{5}$$

while $f(\alpha,0) = 0$, and the result follows. *Q.E.D.*

Lemma 1 establishes that, given beliefs $\mu(\alpha)$, for all α in A, setting $\beta = \epsilon$ is "sequentially rational" for the follower.

3.2 *Separating and pooling equilibria*

In this subsection, I characterize two types of sequential equilibria: separating (proposition 1) and pooling (proposition 2); for the class of two-period sequential games to which the present one belongs, sequential equilibria are equivalent to perfect

Bayesian equilibria[15]. Restrictions on out-of-equilibrium beliefs are formally discussed in an appendix.

Let $\tilde{\alpha}$ satisfy the incentive-compatibility constraint that $g^L(\tilde{\alpha},n) = g^L[\alpha^L(0),0]$. In words, $\tilde{\alpha}$ is that level of lending by the bad-type leader at which the bad-type leader's payoff, given that followers get in, is just equal to its maximum payoff when followers stay out. In other words, given that $g^L(\alpha,n)$ is increasing in α at $\tilde{\alpha}$[16], $[\alpha^H(n) - \tilde{\alpha}]$ is the largest reduction in lending that a bad-type leader is willing to take for the sake of mimicking a good-type. Note that, for a signaling problem to exist, we must have that $\tilde{\alpha} < \alpha^H(n)$.

Proposition 1

If $g^H(\tilde{\alpha},n) \geq \max_\alpha g^H(\alpha,0)$ and $(p_\ell{}^L - p_\ell{}^H) > (\tilde{\alpha}+e)(p_{\ell\ell}{}^H - p_{\ell\ell}{}^L)$, *the following assessment is a sequential equilibrium of the game:*

$$\mu(\alpha) = \begin{cases} 1 & \alpha \leq \tilde{\alpha} \\ 0 & \textit{otherwise} \end{cases}$$

$$\beta(\alpha) = \begin{cases} \epsilon & \alpha \leq \tilde{\alpha} \\ 0 & \textit{otherwise} \end{cases} \qquad \textbf{(6)}$$

$$\alpha^H = \tilde{\alpha}$$

$$\alpha^L = \alpha^L(0)$$

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[15] See Fudenberg and Tirole, 1991, ch. 8.

[16] This holds if $\tilde{\alpha} < \alpha^L(n)$ and $g^L(\alpha,n)$ is strictly concave in α in the relevant interval. The latter is implied by A3, and the former is a condition for a signaling problem to exist.

Proof

I first establish that $\beta(\alpha)$ is sequentially rational given the particular form of $\mu(\alpha)$.

(i) For $\alpha \leq \tilde{\alpha}$, $E^{\mu(\alpha)}f(\alpha,\epsilon) = [p^H(\ell,n)-\delta](1+r)\epsilon$. By A6, $g^H[\alpha^H(n),n] > 0$. Therefore, using (1), $p^H(\ell,n)|_{\alpha^H(n)} > \delta$. By A2, $\tilde{\alpha} < \alpha^H(n) \rightarrow p^H(\ell,n)|_{\tilde{\alpha}} > p^H(\ell,n)|_{\alpha^H(n)}$. Therefore $\alpha \leq \tilde{\alpha} \rightarrow f(\alpha,\epsilon) > 0$. Using lemma 1, this establishes that the strategy $\beta(\alpha)$ is rational for $\alpha \leq \tilde{\alpha}$.

(ii) For $\alpha > \tilde{\alpha}$, $E^{\mu(\alpha)}f(\alpha,\epsilon) = [p^L(\ell,n)-\delta](1+r)\epsilon$. By A6 again, $g^L[\alpha^L(n),n] > 0$. By construction of $\alpha^L(n)$, this implies $g^L(\alpha,n) < 0$ for all α. But then $p^L(\ell,n) < \delta$ for all ℓ. Therefore $\alpha > \tilde{\alpha} \rightarrow f(\alpha,\epsilon) < 0$. Given $\alpha^H = \tilde{\alpha}$ and $\alpha^L = \alpha^L(0)$, it is clear that $\mu(\alpha)$ is consistent with Bayes rule.

Next, for the good type, note that $g^H(\alpha,n)$ is increasing in α at $\tilde{\alpha}$. Therefore deviations cannot be by reducing α. But then $g^H(\alpha,n) \geq max_\alpha\, g^H(\alpha,0)$ is sufficient to establish that no deviation is profitable given $\beta(\alpha)$.

Finally, we need to show that signaling (by way of reduced α) is more costly for the bad type than for the good type. This requires that $g_\alpha{}^L|_{\tilde{\alpha}} > g_\alpha{}^H|_{\tilde{\alpha}}$. Using (2), this is equivalent to the condition stated in the proposition. Note that in the latter, all derivatives are evaluated at $\tilde{\alpha}$. Q.E.D.

The equilibrium described in proposition 1 has the separating property. We characterize now a pooling equilibrium:

Proposition 2

If $g^L[\alpha^H(n),n] \geq max_\alpha\ g^L(\alpha,0)$, there exists a $q^* \in (0,1)$ such that whenever $q \geq q^*$, the following assessment is a sequential equilibrium of the game: $\alpha^i = \alpha^H(n)$, $i = H,L$, and

$$\mu(\alpha) = \begin{matrix} 1 & & \alpha \leq \tilde{\alpha} \\ q & \tilde{\alpha} < & \alpha \leq \alpha^H(n) \\ 0 & \alpha^H(n) < & \alpha \end{matrix} \qquad (7)$$

$$\beta(\alpha) = \begin{cases} \epsilon & \alpha \leq \alpha^H(n) \\ 0 & \alpha > \alpha^H(n) \end{cases}$$

Proof

For the follower, $\tilde{\alpha} \leq \alpha < \alpha^H(n) \Rightarrow E^{\mu(\alpha)}f(\alpha,\epsilon) = \epsilon(1+r)E^q[p^i(\ell,n)-\delta]$. Therefore, sequential rationality requires $E^q p^i(\ell,n) > \delta$. Given that $p^H(\ell,n) > \delta$ for $\alpha < \alpha^H(n)$, by continuity of $E^q p^i(\ell,n)$ in q, there must exist a q^* having the required property. For $\alpha \leq \tilde{\alpha}$, $E^{\mu(\alpha)}f(\alpha,\epsilon) = \epsilon(1+r)[p^H(\ell,n)-\delta]$, which is positive by A6. Finally, for $\alpha > \alpha^H(n)$, $E^{\mu(\alpha)}f(\alpha,\epsilon) = \epsilon(1+r)[p^L(\ell,n)-\delta]$ which is negative by A6 again. Therefore $\beta(\alpha)$ is optimal given $\mu(\alpha)$. Furthermore, given that for both good and bad type, $\alpha = \alpha^H(n)$, $\mu(\alpha)$ is clearly consistent with Bayes' rule.

For the good type, $g^H[\alpha^H(n),n] = max_{\alpha,s}\ g^H(\alpha,s)$. Therefore there is no incentive whatsover to deviate. Finally for the bad type, provided that $max_\alpha\ g^L(\alpha,0) \leq g^L[\alpha^H(n),n]$, there is no incentive to deviate by increasing α. Since $\alpha^H(n) < \alpha^L(n) = argmax\ g^L(.,n)$, and by concavity of $g^L(.,n)$, we have $g_\alpha{}^L|_{\alpha^H(n)} < 0$, so that deviations by way of reduced α are not optimal.

Q.E.D.

The pooling equilibrium described by proposition 2 is one where signaling has no value to a good-type leader bank; what matters is to get some participants. Existence of the pooling equilibrium thus hinges on whether mimicking is a profitable strategy for a bad-type leader, and, more importantly, on whether potential participants are optimistic enough *ex ante*, as measured by their prior.

Note that both equilibria pass the intuitive criterion of Cho and Kreps (1987). The demonstration (for the pooling equilibrium) is relegated to an appendix.

3.3 *Extensions*

Using standard techniques, a semi-separating equilibrium can also be constructed. Informally, it is characterized by the following configuration: The follower participates with probability ρ; the H-type plays $\alpha^H(\rho)$ which maximizes her payoff given the follower's randomization rule, summarized by ρ; and the L-type randomizes between $\alpha^H(\rho)$ and $\alpha^L(0)$, assigning probability π to the former. The follower's posterior beliefs are given by

$$\mu(\alpha) = \begin{cases} \dfrac{q}{q + \pi(1-q)} & \text{if} \quad \alpha = \alpha^H(\rho) \\ 0 & \text{otherwise} \end{cases} \tag{8}$$

π can be calculated to be $q(p^H - \delta)/(1-q)(\delta - p^L)$, and ρ is determined by a fixed point of the expression:

$$\rho = \frac{g^L[\alpha^L(0),0] - g^L[\alpha^H(\rho),0]}{g^L[\alpha^H(\rho),\rho] - g^L[\alpha^H(\rho),0]} \tag{9}$$

We turn now to some positive implications of the model, which can be checked against known facts. Let ℓ_s be the total amount of bank lending in the separating equilibrium and ℓ_p the total amount of lending in the pooling equilibrium.

Proposition 3

For $\tilde{\alpha} + n\epsilon < \alpha^L(0) < \alpha^H(n) + n\epsilon$, $\ell_s < \ell_p$ (less lending takes place in the separating equilibrium) and $\tilde{\alpha}/\ell_s > \alpha^H(n)/\ell_p$ (leader banks take up a higher proportion of lending in the separating equilibrium).

Proof

We show that the second inequality in the chain implies $\ell_s < \ell_p$.

$$\begin{aligned}
& \alpha^L(0) < \alpha^H(n) + n\epsilon \\
\Rightarrow\ & \alpha^L(0) - \alpha^H(n) < n\epsilon \\
\Rightarrow\ & (1-q)\,\alpha^L(0) + (q-1)\,\alpha^H(n) < (1-q)\,n\epsilon \\
\Rightarrow\ & (1-q)\,\alpha^L(0) + q\tilde{\alpha} - \alpha^H(n) < (1-q)\,n\epsilon \\
\Rightarrow\ & q(\tilde{\alpha}+n\epsilon) + (1-q)\,\alpha^L(0) < \alpha^H(n) + n\epsilon \\
\Rightarrow\ & \ell_s < \ell_p
\end{aligned} \tag{10}$$

where the third implication follows from the fact that $\tilde{\alpha} < \alpha^H(n)$.

We now show that the first inequality in the chain implies $\tilde{\alpha}/\ell_s > \alpha^H(n)/\ell_p$.

$$
\begin{aligned}
& \alpha^L(0) > \tilde{\alpha} + n\epsilon \\
\Rightarrow\ & (1-q)\alpha^L(0)\alpha^H(n) > (1-q)\tilde{\alpha}\alpha^H(n) + (1-q)\alpha^H(n)n\epsilon \\
\Rightarrow\ & L.H.S. > (1-q)\tilde{\alpha}\alpha^H(n) + [\tilde{\alpha} - q\alpha^H(n)]n\epsilon \\
\Rightarrow\ & q\tilde{\alpha}\alpha^H(n) + qn\epsilon\alpha^H(n) + (1-q)\alpha^L(0)\alpha^H(n) > \tilde{\alpha}\alpha^H(n) + \tilde{\alpha}n\epsilon \\
\Rightarrow\ & [q(\tilde{\alpha} + n\epsilon) + (1-q)\alpha^L(0)]\alpha^H(n) > \tilde{\alpha}[\alpha^H(n) + n\epsilon] \\
\Rightarrow\ & \frac{\tilde{\alpha}}{q(\tilde{\alpha}+n\epsilon) + (1-q)\alpha^L(0)} > \frac{\alpha^H(n)}{\alpha^H(n) + n\epsilon} \\
\Rightarrow\ & \frac{\tilde{\alpha}}{\ell_s} > \frac{\alpha^H(n)}{\ell_p}
\end{aligned}
\tag{11}
$$

Q.E.D.

The condition stated in proposition 3 is sufficient, but not necessary (the necessary condition is weaker). What it does is to ensure that the amount by which large banks are willing to refinance bad debtors is "not too large", and that the amount of participation by small banks in a pooling equilibrium is nontrivial. Under these weak requirements, the model predicts that total lending after a transition from a pooling equilibrium to a separating equilibrium goes down. This is consistent with the well-documented collapse of syndicated lending after the Mexican debt crisis. For instance, the UNCTC reports that the average value of capital mobilized by way of syndicated lending went down from 112 billion of 1980 dollars per year over 1978-82 to 55.3 billion per year over 83-84 (UNCTC, 1991). The model also predicts that the share of leader banks in what remains of syndicated lending goes up after the transition. This is consistent with evidence that a large

proportion of the involuntary lending of the period 83-84 was picked up by large banks. Smaller banks were frequently "bought out" with exit bonds (Fernandez and Kaaret, 1988) when they had previous exposure, and did not participate at all when they had no exposure. As a result, the share of the top nine US banks in total bank exposure to Latin American borrowers went up from 1982 to 1984 (UNCTC, 1991).

4. Concluding remarks

Heterogeneity of lenders has several potential consequences on the working of the syndicated eurocredit market. First, it can affect bargaining outcomes in a model of partial default and renegotiation (Fernandez and Rosenthal, 1988). Second, it can induce suboptimal continuation of lending and partial expropriation os some claim-holders, in the tradition of Bulow and Shoven (1975); see Cadot (1991). This paper considers a further effect that follows from the presence of an information asymmetry between lenders. Proposition 1 describes a separating equilibrium where the information spreads out and banks without prior exposure stay out. Proposition 2 describes a pooling equilibrium where the information does not spread out and banks without exposure do participate, knowing that they take a chance of being drawn involuntarily into a bailout. Which equilibrium is reached depends on the priors of the uninformed market participants - or, equivalently, on the

proportion of good types vs bad types. As those priors deteriorate in a continuous way, a sudden jump from a pooling equilibrium to a separating equilibrium is triggered when a critical value is reached from above. Such a jump may be called a "debt crisis". Proposition 3 shows that the post-jump outcome is characterized by lower overall lending and a disproportionate participation of "leader" banks, the most informed and the most exposed.

The model's implications help explain both the willingness of large banks to *increase* the flow of funds to countries such as Chile in the year immediately before the debt crisis, and their ability to mobilize the necessary funds. Cohen (1992) has shown, using a solvency index computable from readily available data, that Chile, although heavily indebted, was in 1982 technically solvent. His analysis, vindicated by the comparatively high price that Chile's debt has always fetched on the secondary market, suggests that Chile could be seen in 1981 as fitting our assumptions for the "bad country": fundamentally solvent but illiquid. Although stable politically and richly endowed with natural resources and human capital, the country was in 1981 on the verge of a severe financial crisis, the peso being significantly overvalued. While careful observers of the country could certainly see clouds accumulating, the peculiar nature of industry-finance links within Chilean conglomerates made it difficult for outsiders to figure out exactly what was going on. The analysis of this paper suggests that a rational response to such a situation was for large and heavily exposed banks to try and enlist "semi-innocent" outside investors

for refinancing operations[17].

[17] As an other illustration of the "pooling" scenario, in June 1982, - that is, two months before the Mexican default - negotiations were broken between Venezuela and a group of twenty international banks over the terms of a jumbo loan of US $ two billion. "The deadlock was a disappointing conclusion for the bankers", writes *Euromoney*, which attributes the failure of the deal to "unreasonable" Venezuelian demands as to the business terms - a lower spread on a smaller loan - and to some misunderstandings between British banks and the Venezuelian government over what the Falklands war was about. It is hard to believe that none of the large U.S. banks pushing for the deal knew at that time that Venezuela's economic performance was, in spite of the 1979 oil price hike, not so promising.

APPENDIX

I will show here that the pooling equilibrium passes the test of Cho and Kreps (1987). Let $I = \{H,L\}$ be the set of types. Fix the equilibrium payoff of type-H and type-L leaders: $g^{i*} = g^i[[\alpha^H(n),n]$. For any out-of-equilibrium message α, define the set of all follower strategies that are best responses to α for some beliefs μ:

$$BR(I,\alpha) = \bigcup_{\mu} BR(\mu,\alpha) \tag{12}$$

Now let $S(I,\alpha)$ be the set of numbers of participants (followers taking shares in the syndicate) that can be obtained when each follower picks a strategy in $BR(I,\alpha)$. In any pure-strategy equilibrium, $S(I,\alpha) = \{0,n\}$: either they all participate, or none does. Now for any out-of-equilibrium message α, define $J(\alpha)$ as the set of types for which α is "equilibrium-dominated":

$$J(\alpha) = \{i \in I : \; g^{i*} > \max_{s \in S(I,\alpha)} g^i(\alpha,s)\} \tag{13}$$

In order to describe the correspondence $J(\alpha)$ for the present model, let us distinguish three cases.

case 1

$\alpha^H(n) < \alpha < \alpha^L(n)$. Then $H \in J(\alpha)$ since, by construction, $g^H(\alpha,n) \leq g^H[\alpha^H(n),n] = g^{H*}$. On the other hand, $L \notin J(\alpha)$ since $g^L(\alpha,n) > g^L[\alpha^H(n),n]$ (there are n participants when $\mu(\alpha) = \text{prob}(i=H|\,\alpha) = 1$).

case 2

$\alpha < \alpha^H(n)$. Then for $i = H,L$, $g^i(\alpha,n) < g^i[\alpha^H(n),n]$, so both H and L belong to $J(\alpha)$.

case 3

$\alpha > \alpha^L(n)$. H and L both belong to $J(\alpha)$ for the same reason as in case 2.

Therefore

$$J(\alpha) = \begin{cases} \{H\} & \text{if } \alpha^H(n) < \alpha \le \alpha^L(n) \\ I & \text{elesewhere} \end{cases} \tag{14}$$

Admissible beliefs $\mu^A(\alpha)$ give probability zero to types in $J(\alpha)$ conditional on observing α, and can be defined only for case 1, where $\mu^A(\alpha) = \text{prob}(i=H|\alpha) = 0$.

We can now apply the test. Define G^i as the minimum payoff that type i can obtain by playing α given that s followers will participate if all followers adopt a best response to α given some admissible beliefs $\mu^A(\alpha)$. The question is then, is there a type in I which necessarily does better than in equilibrium by playing a deviation (given admissible beliefs)? In case 1, admissible beliefs place zero probability on $i = H$, so that $s = 0$. But then $G^i = g^i(\alpha,0)$. For type H, clearly $G^H < g^H[\alpha^H(n),n]$, so H does not deviate. For type L, $G^L = g^L(\alpha,0) \le \max_\alpha g^L(\alpha,0) = g^L[\alpha^L(0),0] < g^L[\alpha^H(n),n]$, so that L does not deviate either. In case 2, $J(\alpha) = \emptyset$, so that there are no admissible beliefs. In that case the test requires that for every belief μ, one can find a best response such that the resulting number of participants $s(I,\alpha)$ supports the

equilibrium (i.e. does not create an incentive to deviate for either type). For type H, $g^H[\alpha^H(n),n] = \max_{\alpha,s} g^H(\alpha,s)$ so that, whatever the beliefs and resulting best response at any $\alpha \neq \alpha^H(n)$, $\alpha^H(n)$ is the optimal choice. For type L, $g^L(\alpha,s)$ is increasing in α over $[0,\alpha^L(n)]$, so that the same argument applies. Finally in case 3, the same argument applies to type H, while for type L, $G^L = g^L(\alpha,0) \leq g^L[\alpha^L(0),0] < g^L[\alpha^H(n),n]$. Therefore the test is not violated. Similar reasoning applies to the separating equilibrium.

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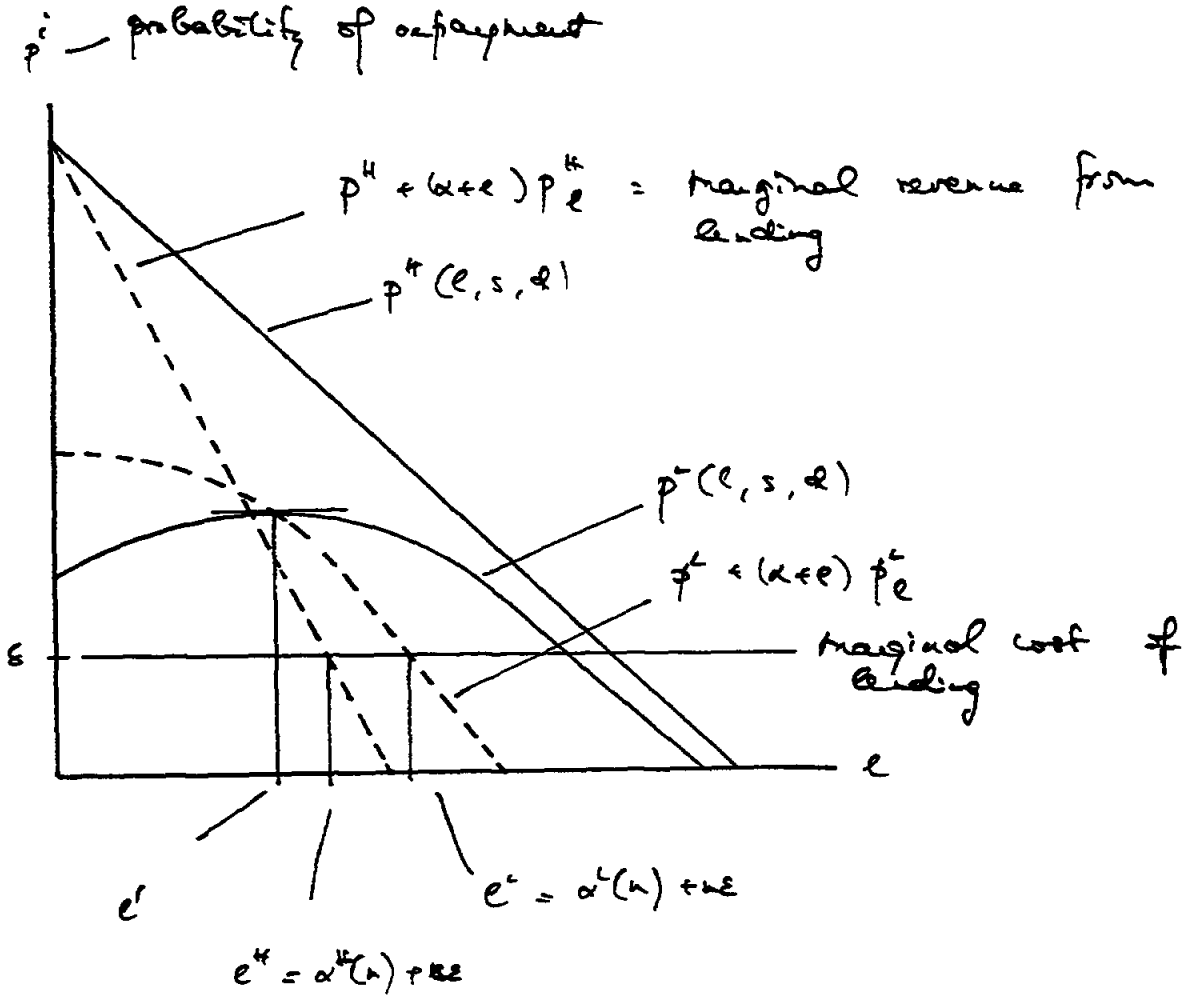
Figure 2


p^i — probability of repayment
$p^H + (\alpha + e) p^H_e$ = marginal revenue from lending
$p^H(\ell, s, \alpha)$
$p^L(\ell, s, \alpha)$
$p^L + (\alpha + e) p^L_e$
s
marginal cost of lending
ℓ
e'
$e^L = \alpha^L(h) + \varepsilon$
$e^H = \alpha^H(h) + \varepsilon$