# Contractual Resolutions of Financial Distress

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**Abstract**

In a financial contracting model we study the optimal debt structure to resolve financial distress. We show that a debt structure where two distinct debt classes co-exist − one class fully concentrated and with control rights upon default, the other dispersed and without control rights − removes the controlling creditor's liquidation bias when investor protection is strong. These results rationalize the use and the performance of floating charge financing, debt financing where the controlling creditor takes the entire business as collateral, in countries with strong investor protection. More broadly, our theory predicts that the efficiency of contractual resolutions of financial distress should increase with investor protection.

**JEL classification:** G33, K22.

**Keywords:** Financial Distress, Investor Protection, Financial Contracting.

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# 1 Introduction

The institution of bankruptcy is of central importance for the economy-wide reallocation of resources, especially in downturns when financial distress is pervasive. The traditional economic approach to bankruptcy posits that a state provided bankruptcy procedure is needed to attain an efficient resolution of financial distress (e.g. Hart 2000). In its absence, ex post conflicts among creditors and between the debtor and the creditors would lead to inefficient reorganization and liquidation, as well as under- and over-investment (Gertner and Scharfstein 1991). This view sheds some light on the use of bankruptcy procedures in many countries, but it does not explain why in many other countries firms instead choose to resolve financial distress by way of ex ante contracts when they are given the contractual freedom to do so (Djankov et al. 2008a).[1]

For instance, Franks and Sussman (2005a) document that in the U.K. one common way to resolve financial distress is to use floating charge financing. In its basic version a large creditor, typically a bank, lends under both a "fixed charge" (i.e. physical collateral), and a "floating charge", which is a collateral to the whole reorganized firm, including working capital, intangibles and future cash flows. Upon default, the creditor holding the floating charge has the *exclusive* right to reorganize or liquidate the firm. The rest of the lending is dispersed among secured and unsecured claims. Well beyond the U.K., Djankov et al. (2008a) confirm that, when legally allowed, floating charge financing is widely used and works well.

This evidence on the use and performance of these contractual resolutions of financial distress raises two key questions. What are the features of an optimal ex ante debt structure (and of the associated control rights allocation) when financial distress is taken into account? Under what conditions can a form of creditor control such as the one implemented by floating charge financing attain an efficient resolution of financial distress? The theoretical literature on bankruptcy does not address these questions, as it has focused on ex post procedures, taking the ex ante debt structure as given. Surprisingly, not even the financial contracting literature addresses these questions satisfactorily. First, such literature typically associates creditor control with pervasive over-liquidation. Second, such literature does not explain the co-existence in the same debt structure of two classes of debt with different control rights and different concentration, which is another key feature of floating charge financing and more generally of creditor control in the real world.[2]

[1] For further evidence on contracting restrictions in mandatory bankruptcy codes see Smith and Strömberg (2005).

[2] For instance, Dewatripont and Tirole (1994) rationalize the mix of equity and debt, and Berglöf and von Thadden (1994) the mix of short and long term debt. Neither of them, however, rationalizes the differential concentration of

This paper addresses the above questions by studying a financial contracting model where the firm's debt structure is set by taking the possibility of financial distress into account. In line with Aghion and Bolton (1992) and Hart and Moore (1998), we assume that debt contracts can only allocate control rights over the reorganization v. liquidation decision, and cash flows are less pledgeable than liquidation proceeds. The distinctive features of our approach are to use multiple creditors to counter the controlling creditor(s)' liquidation bias, and to allow the extent of cash flows pledgeability to vary. Crucially, we interpret this latter parameter as a proxy for investor protection, inspired by the evidence documenting the strong impact of investor protection on international financing patterns (e.g. La Porta et al. 1998).[3] In such a setup we ask: How do optimal debt structures resolve financial distress?

We find that the optimal debt structure consists of two classes of secured creditors. One class is fully concentrated on a single, large creditor. Upon default, this creditor has exclusive control over the liquidation v. reorganization and refinancing decisions and lends under a security pledging him both physical collateral and an equity stake in the reorganized firm. The other debt class is fully dispersed among small creditors who have no control rights but are entitled to cash in some liquidation proceeds. This debt structure captures two key features of floating charge financing: it concentrates control on a single creditor who has claims on the continuation value of the firm and it disperses the rest of the lending.

Crucially, the performance of this specific form of creditor control is shaped by investor protection. When investor protection is strong, creditor control implements the first best reorganization and reinvestment policies. As investor protection becomes weaker only a second best outcome can be attained where the firm is efficiently reorganized but – to ensure ex ante break even – some profitable investment opportunities must be foregone to prevent the debtor from tunneling most of the resulting cash flows away. Finally, when investor protection is low, committing to liquidation ex post is the only way for the debtor to ensure break even ex ante. In this case, the constrained efficient resolution of financial distress can be attained with a much simpler debt structure consisting of one single class of standard "straight debt" contracts whereby each creditor can unilaterally foreclose on (a fraction of) the firm's assets.

these classes of investors. The same is true with respect to Berglöf, Roland and Von Thadden (2007) who show how the multiplicity of *homogenous* debt claims can shape the resolution of financial distress. As we shall see, another innovation of our approach is to derive the optimality of multiple securities as a function of investor protection.

[3] A few papers study bankruptcy from an ex ante perspective, but they either do not consider creditor multiplicity (Ayotte and Yun 2009), investor protection (Bisin and Rampini 2006), or both (Berkovitch and Israel 1999).

The logic of the optimal debt structure at high levels of investor protection is particularly insightful. Giving the creditor in control both physical collateral and equity in the reorganized firm induces him to internalize the upside of efficient reorganization and reinvestment. Interestingly, this incentive mechanism works best in the presence of a second debt class. Because liquidation proceeds are easier to pledge than reorganization cash flows, some liquidation proceeds must be redistributed away from the controlling creditor to remove his liquidation and under-investment biases. Distributing such liquidation proceeds to the second debt class without control rights, as opposed to "leaving them on the table", allows to maximize total repayment to *all* creditors. Of course, since creditors collectively lose from reorganization and reinvestment, collusion among the two classes of debt could undo the working of the controlling creditor's incentive scheme. To prevent such collusion, it is then optimal to concentrate control on a single large lender and disperse the other debt class among many small creditors.

These results differ from the traditional idea that debt dispersion makes lenders tough by preventing renegotiation following a strategic default (e.g. Bolton and Scharfstein 1996, Diamond 2004). In our model, dispersion reduces collusion among creditors, preventing over-liquidation ex post. These two views have different empirical implications: in the traditional view, dispersion should be observed at low levels of investor protection, where strategic default risk is severe; in our model, dispersion should be observed at relatively high levels of investor protection, where rescuing valuable firms does not clash with ex ante break even. Also the different concentration of our two debt classes is novel to the financial contracting literature. To the extent that the large investor in control is interpreted as a "bank", for example because banks have a comparative advantage in monitoring (e.g. Diamond 1984), our model can rationalize the coexistence of "bank" and "arm's length" debt in a firm's debt structure and predicts that such coexistence should be observed at relatively high levels of investor protection.[4]

More broadly, our model shows that stronger investor protection improves the performance of creditor control in resolving financial distress by enabling the issuance of flexible debt structures. This prediction is consistent with the evidence in Lerner and Schoar (2005), Bergman and Nikolaievski (2007) and Qian and Strahan (2007). In Section 4.3 we provide some preliminary but more

[4]Arm's length investors can be interpreted both as bondholders and as dispersed trade creditors. We are not aware of papers that derive the optimality of two differently concentrated debt classes from first principles in a model with ex ante homogenous investors. Existing analyses of bank and arm's lenght debt [e.g. Diamond (1991, 1993) and Rajan (1992)] either study the choice between the two as opposed to their optimal mix in an optimal debt structure, or assume that investors are ex ante different, or both.

direct evidence on this prediction of our model by using the data collected by Djankov et al. (2008a and 2008b) on debt enforcement and investor protection around the world. The evidence appears consistent with the notion that creditor control in financial distress works particularly well in countries with strong investor protection, and particularly so when matched with the use of floating charges, namely of contractual instruments that pledge creditors the entire business as collateral, not just some specific physical assets.

It is important to stress that our theory does not imply that ex ante debt structures are necessarily the only efficient way to resolve financial distress. Indeed, it might be very hard if not outright impossible for contracts to properly internalize several relevant interests in financial distress that we have not modeled explicitly, for instance those of workers or tort creditors. In these cases ex post bankruptcy procedures might prove to be beneficial (see Biais and Mariotti 2008). Our analysis simply suggests that a purely contractual mechanism such as the one embodied in our optimal debt structure and in floating charge financing in the real world has the potential to mitigate many of the inefficiencies typically associated with creditor control in financial distress when investor protection is strong. In the Conclusions we illustrate the implications of this idea for the design of bankruptcy codes in developed and emerging economies.

# 2 The Model

We describe the basic setup in Section 2.1 and the contracting frictions in Section 2.2.

## 2.1 The Basic Setup

We study a model of credit in the spirit of Aghion and Bolton (1992) and Hart and Moore (1998). An entrepreneur ($E$ henceforth) has the human capital to run a two-period firm but not the money to set up its physical asset, which requires an initial outlay of $K > 0$. In period 1, with probability $\pi$ the firm is liquid and produces a cash flow $y_1 > 0$; with probability $1 - \pi$ the firm is in financial distress and its cash flow is 0. If the firm was liquid in period 1, its period 2 cash flow is $\overline{y}_2$; if instead the firm was in financial distress, with probability $\mu$ the firm is viable as a going concern and its period 2 cash flow is $\overline{y}_2$, while with probability $1 - \mu$ the firm is also in economic distress and its period 2 cash flow is $\underline{y}_2$. To simplify the algebra, we set $\mu = 1/2$. Thus, the firm can be in one of three states of nature, $G$ ("good"), $U$ ("unlucky") and $B$ ("bad"), (Figure 1).

At the end of period 1 and before period 2, the physical asset can be liquidated, yielding $L$.

One can think of $L$ as representing the value of the firm's physical asset in a piecemeal liquidation or under the management of the investor $I$, as opposed to the value $y_2(\omega)$ generated by a reorganization. The reorganization value $y_2(\omega)$ can be interpreted both as the value under $E$, and as the value under an alternative management team with the same managerial skills/human capital as $E$. This simple setup helps us illustrate our findings in the most intuitive manner. Importantly, in Appendix A2.1 we show formally that our basic results generalize in a straightforward way to a general setting where reorganization as well as liquidation values are stochastic and take on a continuum of values.

**Figure 1. States of Nature**

| $\omega$ | $\Pr(\omega)$ | $y_1(\omega)$ | $y_2(\omega)$ |
|---|---|---|---|
| $G$ | $\pi$ | $y_1$ | $\overline{y}_2$ |
| $U$ | $(1-\pi)/2$ | 0 | $\overline{y}_2$ |
| $B$ | $(1-\pi)/2$ | 0 | $\underline{y}_2$ |

Both investment and liquidation are zero-one decisions (Section 4 allows for partial liquidation).

We assume:

**A.1:** $y_1 > \overline{y}_2 > L > \underline{y}_2 > 0$.

Besides imposing $y_1 > \overline{y}_2$ (which only simplifies the exposition and does not entail a loss in generality), A.1 implies that in the first best the project should be liquidated if and only if reorganization profits are low; in $G$ the project is both liquid and profitable, in $U$ the project is illiquid but eventually profitable. Only in $B$ is the project both illiquid and unprofitable so that it should be liquidated. We also assume:

**A.2:** $\pi(y_1 + \overline{y}_2) + (1-\pi)L > K$.

A.2 implies that the net present value of the firm is positive even if its assets are liquidated in $U$, when continuation is efficient. This assumption only simplifies the exposition of our findings on contract choice; its implications will become clear after Proposition 1. To finance the firm, $E$ tries to borrow from a wealthy investor $I$ under a contract ensuring that $I$ breaks even. To describe the set of feasible contracts, we must specify the contracting frictions in our model.

## 2.2 Investor Protection

The key contracting friction in our model captures the extent of legal protection of investors against managerial tunneling and is measured by the share $\alpha \in [0, 1]$ of the firm's (first and second period) cash flows that can be pledged to $I$. The remaining share $(1 - \alpha)$ goes to $E$. Legal protection against tunneling increases in $\alpha$. Our model nests the Hart and Moore (1998) case of unverifiable cash flows as a special case when $\alpha = 0$. When $\alpha > 0$ the cash flows are partially verifiable, in the sense that courts cannot force $E$ to repay more than $\alpha y_t(\omega)$ (although they can infer the actual level of the firm's cash flows). One interpretation of this formulation is to view the share of cash flows $(1 - \alpha)$ as non-dissipative private benefits (Aghion and Bolton 1992), with the size of such private benefits that depends on the extent of investor protection $\alpha$, using a formulation introduced in a different context by Shleifer and Wolfenzon (2002).[5]

In line with much of the financial contracting literature [e.g. Hart and Moore (1998), Bolton and Scharfstein (1996)], we assume that it is easier to pledge to investors physical collateral rather than cash flows. For simplicity, we assume that the full liquidation value $L$ of physical collateral can be pledged to $I$, even though allowing investor protection to increase the pledgeability of physical collateral would not change our results, as long as physical collateral remains easier to pledge than cash flows. As a result of these assumptions, the first period liquidation proceeds pledgeable to $I$ are equal to $L + \alpha y_1(\omega)$, that is to the value of the firm's physical assets $L$ plus the amount $\alpha y_1(\omega)$ of first period cash flows that $E$ was unable to divert. More important, there is a potential incentive for $I$ to reorganize: by doing so, $I$ obtains $\alpha y_2(\omega)$ in period 2, as opposed to 0 in models of unverifiable cash flows. Thus, not only can $E$ fully pledge physical collateral $L$ as in Hart and Moore (1998), but also other less tangible assets up to the extent of investor protection $\alpha$.

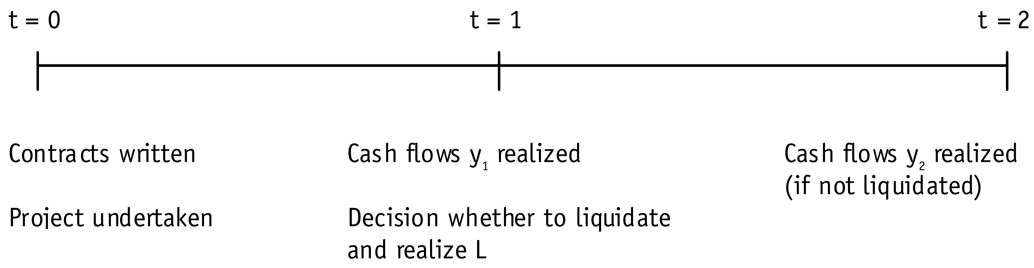
As an additional contracting friction, we assume that the firm's reorganization value is unverifiable by courts. If courts could perfectly verify the firm's reorganization value, then the parties would resolve financial distress by writing a forcing contract where reorganization is implemented if and only if the firm's reorganization value is high. To highlight the role of incentive mechanisms, we assume this possibility away.[6]

[5] Our focus on $\alpha$ as a proxy for investor protection is due to our interest in cross country comparison in the resolution of financial distress, as stressed in the empirical discussion of Section 4.3. More generally, though, parameter $\alpha$ can be interpreted as the contractibility of cash flows, which might allow our model to yield cross-industry predictions on debt (and perhaps even capital) structure.

[6] In a previous version of the paper we formally proved that our main results (especially those under multiple creditors) are unchanged if we allowed the parties to contract on a noisy signal of $y_2(\omega)$. We interpreted the precision of the signal as an index of courts' ability to verify the firm's reorganization value. These results are available upon

What about the parties' information structure? To simplify the exposition here we assume that $E$ and $I$ are perfectly informed about the firm's reorganization value, but Appendix A2.2 shows that our results easily extend to the case where $E$ is privately informed about the firm's reorganization value. Figure 2 shows the timing of the model.

**Figure 2. Timeline**




We consider contracts where $I$ lends $D \geq K$ to $E$ in exchange for a repayment schedule. In line with Aghion and Bolton (1992), we allow contracts to allocate to $E$ or $I$ the decision of whether to liquidate or reorganize the firm after first period profits and repayment. Crucially, we allow repayments to depend on whether the party in control reorganized or liquidated the firm in financial distress. This assumption allows contracts to provide the party in control with incentives to take an efficient decision. As we shall see, the parties' ability to provide such incentives (and the resulting efficiency of contracts) depends on investor protection $\alpha$.[7]

## 3 The Case with One Creditor

With only one creditor, the entrepreneur chooses a contract maximizing his own expected profits subject to such creditor's break even. Since this one-creditor problem is reminiscent of classical papers such as Aghion and Bolton (1992) and Hart and Moore (1998), we leave its formal description in the Appendix. Here we provide an intuitive version of the proof to highlight the main novelty of our approach, namely the role of investor protection $\alpha$ in shaping the parties' ability to resolve financial distress by contract. This analysis allows to build up intuition for the more interesting

request. See Gennaioli (2008) for a formal model of court state verification and contracting.

[7] Aghion and Bolton (1992) also consider the case where actions are verifiable and note that in this case the allocation of cash flows can serve incentive purposes. However, rather than explicitly solving for optimal contracts, they establish that even in this case similar agency problems to the case of unverifiable actions arise.

case where the firm borrows from multiple creditors. We discuss only the case without ex post renegotiation but renegotiation is explicitly studied in the proof of Proposition 1.

The optimal contract terms for state $G$ are set in isolation because in our model courts perfectly determine if the state is $G$ or not (i.e. if the first period cash flow is 0 or $y_1$). Put differently, $G$ only affects the optimal resolution of financial distress in states $U$ and $B$ by affecting the ex ante break even constraint.[8] As in Hart and Moore (1998), the optimal contract specifies that a default occuring when current cash flows are high (i.e. equal to $y_1$) is punished with the firm's liquidation. Intuitively, this liquidation threat alone makes $E$ willing to pay up to his continuation value $(1-\alpha)\,\overline{y}_2$. At the same time, $I$ can always seize $\alpha y_1$ at $t=1$ and $\alpha\overline{y}_2$ at $t=2$. As a result, over the two periods $I$ obtains $\alpha y_1+\overline{y}_2$. Note that it is feasible for $E$ to additionally pay $(1-\alpha)\,\overline{y}_2$ at $t=1$ due to our assumption $y_1>\overline{y}_2$. These contract terms are optimal in $G$ because not only do they avoid ex post inefficient liquidation in equilibrium, they also maximize ex ante repayment. Under automatic liquidation, $I$ would only obtain the smaller repayment $\alpha y_1+L$.

Matters are different in states $U$ or $B$, in which the $t=1$ cash flow is zero, so that the firm is in financial distress. Crucially, reorganization can now be socially costly not only ex post – as when the state is $B$ – but also ex ante, as $E$ does not have sufficient cash to pay for his reorganization rent $(1-\alpha)\,y_2(\omega)$ at $t=1$. In light of these observations, it is typically pointed out that a conflict arises among the parties, with the debtor always preferring reorganization as it allows him to extract private benefits of control, and with the creditor preferring liquidation as he does not see the upside of reorganization. In our setup, however, this conflict may be solved by collateralizing to $I$ the reorganization proceeds $\alpha y_2(\omega)$, and not just certain physical assets as in standard debt contracts. If $I$ is given a claim on the firm's reorganization proceeds and in financial distress he is handed control over the liquidation v. reorganization decision then, provided $\alpha\overline{y}_2\geq L$, he finds it optimal to liquidate if and only if the state is $B$, consistent with ex post efficiency. But even if $\alpha\overline{y}_2<L$ and thus $I$ has a bias for liquidation, an ex ante contract can induce $I$ to make a socially

[8] The alternative assumption that courts cannot perfectly tell apart strategic and liquidity default would complicate the analysis but not affect our results. This is literally the case if $y_2(\omega)$ can be generated under an alternative management team. In such case $I$ can avoid strategic default by threatening $E$ to fire him if he repays less than $\alpha y_1+(1-\alpha)\,y_2$. Then, not only has $E$ never the incentive to strategically default, but also $I$ (weakly) prefers to keep $E$ in place because the threat of dismissal allows $I$ to maximize the resouces extracted from $E$ for any given liquidation policy. We formalize this idea in Appendix A2.1 in a general setup with stochastic reorganization and liquidation values. But we believe that little would change also in the case where $y_2(\omega)$ can only be produced by $E$ (although the analysis would be more complicated). Indeed, while in such a case the firm would sometimes be inefficiently liquidated to deter strategic default, it would still be true that higher investor protection $\alpha$ reduces the extent of such inefficient liquidation both directly, by reducing strategic default (i.e. $E$'s ability to $t=1$ cash flows) and indirectly, by reducing the ability of $E$ to steal the reorganization cash flows.

efficient decision by stipulating a debt write-down $S$ such that:

$$\alpha \overline{y}_2 \geq L - S. \tag{1}$$

Thus, by contracting ex ante on the firm's reorganization value, $I$ can be made to internalize the social benefit of liquidation, triggering an ex post efficient outcome. Clearly, this contract can only be used if it is ex ante feasible, which is indeed the case provided:

$$\pi \left(\alpha y_1 + \overline{y}_2\right) + \frac{1-\pi}{2} \left[\alpha \overline{y}_2 + (L - S)\right] \geq K. \tag{2}$$

When investor protection is strong, contracts can give $I$ the incentive to resolve financial distress efficiently and condition (2) is met (if $\alpha = 1$, then $S = 0$ and $E$ can pledge all cash flows to $I$). When instead $\alpha$ is low break even is hard to attain because low $\alpha$ reduces repayment in $G$, $U$ and increases the debt write-down $S$. This last effect is key: at low investor protection providing $I$ with incentives may undermine ex ante break even. Indeed, if $\alpha = 0$, $I$ efficiently reorganizes if and only if $S = L$, which yields break even only under the restrictive condition $\pi \overline{y}_2 \geq K$. Thus, better investor protection improves the performance of creditor control in financial distress by reducing the ex ante cost of making the creditor internalize the social benefit of reorganization.

If inducing $I$ to efficiently reorganize is infeasible, the parties may let $E$ control the reorganization decision upon default. $I$ is still pledged both reorganization cash flows $\alpha y_2(\omega)$ and physical collateral $L - S$, but now the debt write-down $S$ must induce $E$ to efficiently liquidate the firm in $B$ and reorganize it in $U$. The smallest $S$ attaining this goal is:

$$S = (1 - \alpha) \underline{y}_2. \tag{3}$$

$E$ efficiently liquidates the firm when the contract compensates him for the control rents he loses in liquidation. To simplify the analysis, we call $E$-control this arrangement and $I$-control the previous one to stress the key difference between them, namely the identity of the party controlling the reorganization decision. Also $E$-control is ex ante feasible when condition (2) is met (and thus when $\alpha$ is large), although now $S$ equals $(1 - \alpha) \underline{y}_2$ and not the level implied by expression (1).

If neither $E$- nor $I$-control are feasible, ex ante break even requires $E$ to sacrifice ex post efficiency. A simple way to go is for $I$ to commit to terminating the firm upon default by writing a contract whereby foreclosure automatically follows non-repayment. We call this arrangement, akin to the Hart and Moore (1998) debt contract, *straight debt* to stress its similarities with the standard notion of debt. Because in financial distress *straight debt* yields $L$ to $I$, it facilitates break even relative to both $I$- and $E$-control when $\alpha\overline{y}_2 < L$. Unfortunately, this ex ante benefit comes at the cost $(\overline{y}_2 - L)/2$ of over liquidating the firm in $U$. The proposition below illustrates the impact of $\alpha$ on contracts and welfare:[9]

**Proposition 1** *There exist $\alpha_I, \alpha_E$ and $\alpha_S$ with $\min(\alpha_I, \alpha_E) \geq \alpha_S$ such that: i) for $\alpha > \max(\alpha_I, \alpha_E)$ parties attain the first best with either $I$- or $E$-control; ii) for $\alpha \in [\min(\alpha_I, \alpha_E), \ \max(\alpha_I, \alpha_E)]$ parties attain the first best with $I$-control when $\alpha_I \leq \alpha_E$ and with $E$-control otherwise; iii) for $\alpha \in [\alpha_S, \ \min(\alpha_I, \alpha_E))$, the parties attain the second best under straight debt. For $\alpha < \alpha_S$ the firm is not financed.*

The proof is in the Appendix. *Straight debt*, *E-control* and *I-control* are the most efficient contracts for the parties to resolve financial distress. As in Aghion and Bolton (1992) the choice between entrepreneur and investor control is a key dimension in financial contract design. The novel idea here is that investor protection $\alpha$ shapes the optimality of different contracts by shaping the trade-off between ex ante and ex post efficiency. If $\alpha$ is high [$\alpha > \max(\alpha_I, \alpha_E)$], the parties reach the first best with either $I$- or $E$-control. If $\alpha$ is intermediate, parties may attain the first best with $I$- or $E$-control but not with both. In this range, $I$-control is used if and only if the optimal debt write down $S$ under $I$-control is lower than the one under $E$-control. Intuitively, at intermediate investor protection the first best is attained by giving control to the party that is cheaper to incentivize. Depending on parameter values, such party is some times the investor (when $\alpha_I \leq \alpha_E$), and some other times the entrepreneur (when $\alpha_I > \alpha_E$). To fix ideas, though, note that at relatively high levels of investor protection, when $\alpha\overline{y}_2 \geq L$, the debt write down under $I$-control is zero. As a result, when $\alpha\overline{y}_2 \geq L$, $I$-control is preferable to $E$-control, as in $E$-control the debt write down is always positive, except at $\alpha = 1$.

If $\alpha$ is low, tunneling of the firm by $E$ is a major problem for $I$, creating pressure for a quick piecemeal sale. To attain break even, $I$ commits to always liquidate ex post by using *straight debt.* Over-liquidation is thus the price to pay to ensure break even at low $\alpha$. Thus, in our model the contractual inclusion of automatic foreclosure on the debtor's physical assets depends endogenously

[9] To preserve our focus on contracts, Proposition 1 only reports which of the above defined contractual typologies is used as a function of $\alpha$. The detailed Proof of Proposition 1, including the expression for total debt capacity at different levels of $\alpha$, is in Appendix 1.

on $\alpha$.[10] Finally, when $\alpha$ is lowest (i.e. $\alpha < \alpha_S$) the firm is not financed.

In principle, since parties are symmetrically informed about the firm's reorganization value, the contract could include a revelation game (Maskin 1999) of the following sort. The parties separately report the state of nature. The contract specifies that if both reports are $U$ the firm is reorganized, if both reports are $B$ the firm is liquidated. If reports disagree, the firms is liquidated and the proceeds are paid to charity. This contract induces a truth telling Nash equilibrium implementing the first best with the appropriate assignment of payouts. Unfortunately, however, the players may also coordinate on two other Nash equilibria (always say $B$ or always say $U$, where the latter equilibrium could be eliminated by fining the investor ex post for having lied). As a result, whenever feasible, $E$-control and $I$-control dominate this revelation game. When instead both $E$ and $I$-control are infeasible, the revelation game may improve upon straight debt, although the revelation game itself is infeasible for low $\alpha$ because in financial distress it repays at most $(1/2)(\alpha\overline{y}_2 + L)$ to $I$. Crucially, in Section 4 we shall see that when $E$ borrows from multiple creditors $I$-control always (at least weakly) dominates the revelation game.

The key lesson of this one creditor model is that higher investor protection increases the efficiency of contractual resolutions of financial distress by allowing contracts to collateralize the firm's reorganization value, not just specific physical assets. Crucially, at high $\alpha$ the first best can be attained by giving the creditor control upon default over the liquidation vs. reorganization and by giving him two separate claims, one on physical collateral (for the amount $L - S$), and another one on reorganization proceeds (for the amount $\alpha\overline{y}_2$). Crucially, because liquidation proceeds are easier to pledge to $I$ than reorganization proceeds, the claim of the investor is under-collateralized (i.e. $S > 0$) when $\alpha$ is low. The combination of the reorganization stake and of physical collateral give $I$ the incentive to efficiently resolve financial distress. This efficiency of creditor control at high levels of investor protection is a fundamental result of our analysis, and the intuition is that at high $\alpha$ the optimal contract can pledge the entire business as collateral to the creditor, not just certain physical assets, inducing him to internalize the social benefit of efficient reorganization. Appendix A2.1 proves that this result is robust to the general case where both reorganization and liquidation values are stochastic and can take arbitrary values.

[10] Two clarifications are worthwhile at this point. First, Assumption A.2 implies that if *straight debt* guarantees financing, $E$ prefers to sign it rather than doing nothing, but the main features of contract choice remain valid even if A.2 is relaxed. Second, the Proof of Proposition 1 shows that allowing for ex post renegotiation does not affect our main results. Introducing renegotiation only reduces investor repayment in $G$, thereby uniformly increasing $\alpha_I$, $\alpha_E$, $\alpha_S$, but it neither affects the comparison of different contracts nor the role of investor protection.

The incentive mechanism built into our $I$- control (but also $E$-control) contract is related to proposals suggesting automatic conversion of debt into equity upon default (Aghion, Hart and Moore, 1992)[11], as such conversion is another way of pledging the creditor not only physical collateral but also reorganization proceeds. There is however an important difference between the two mechanisms. By giving both an equity stake in the reorganized firm and – at the same time – undersecuring the investor in terms of physical collateral, our optimal contract allows the investor to internalize the benefit of efficient reorganization also when $\alpha \overline{y}_2 < L$. By contrast, under conversion of debt into equity the investor would obtain the same share of liquidation and reorganization proceeds, thereby inefficiently liquidating the firm whenever $\alpha \overline{y}_2 < L$. From an ex post perspective, the optimality of implementing a debt write-down $S$ to controlling creditors upon default can be viewed as providing an efficiency justification to violations of priority.

By suggesting that at high levels of investor protection creditor control can trigger an efficient resolution of financial distress our preliminary analysis so far can already help rationalize the workings of creditor control mechanisms used in the real world, which will be discussed in Section 4.3. Of course, one fundamental question remains open: how does creditor control perform in the presence of multiple creditors? Answering this question is important because in the real world debt structures typically feature multiple creditors and multiple debt classes and it is conventional wisdom that inter-creditor conflicts may magnify any creditors' bias toward liquidation. It is thus important to study whether in a world with multiple creditors there may still be conditions under which a case for $I$-control can be made, or whether $E$-control would instead always dominate. To address this issue, we study the multiple creditors case in Section 4 below.

# 4 Multiple Creditors and Creditor Control

We introduce multiple creditors by assuming that the firm's physical assets feature constant returns to scale and can be partially liquidated. That is, after liquidating a share $f < 1$ of the firm's assets, total output is $fL$ plus the continuation value $(1 - f)\, y_2(\omega)$. This assumption of constant returns greatly simplifies the analysis and the exposition, but our results turn out to be even stronger if the firm's assets are complementary.

[11] In contrast to our approach, Aghion, Hart and Moore (1992) do not derive their proposal in an optimal contracting model, nor do they stress the role of investor protection. Most important, as we discuss in the Conclusions, the AHM proposal is similar to our $E$-control contract in the single creditor case and it is significantly different from our optimal debt structure in a multiple creditors setting.

Before studying the properties of the optimal debt structure, note that in our model the three leading inter-creditor conflicts stressed by bankruptcy scholars can arise: the conflict among multiple secured creditors leading to inefficient runs on the firm's assets (e.g. Jackson 1986), the conflict between secured and unsecured creditors (e.g. Manove, Padilla and Pagano 2001), and the conflict between old and new creditors leading to over- or under-investment in financial distress (e.g. Gertner and Scharfstein 1991). Section 4.2 allows for the arrival of new creditors and studies the optimal debt structure in such case. For now, we focus on the first two conflicts, which occur among existing creditors. The following numerical examples show that under certain debt structures both the conflict among secured creditors and the conflict between secured and unsecured creditors can arise in our model and lead to over-liquidation.

*Example.* Suppose that $L = 10$, $y_1 = 100$, $\overline{y}_2 = 32$, $\underline{y}_2 = 6$, $\alpha = 1/2$. The ex post efficient resolution of distress is also ex ante optimal because it maximizes repayment to the creditors. The maximum (first and second period) payout to creditors in state $G$ is $(1/2) * 100 + 32 = 82$. Suppose that creditors as a group are owed 88 and the debt structure does not take financial distress into account. As in the traditional bankruptcy literature, suppose that ex post bargaining among creditors is ruled out. The following two outcomes may then arise in financial distress.

$A$ (*inefficient run*). There are two senior secured creditors. Each of them is entitled to a first period repayment of 10. Each creditor can liquidate the firm's physical assets and obtain 10 in case of default. If both creditors exercise their liquidation rights, each of them gets 5. All other creditors are unsecured. Clearly, this debt structure leads to efficient liquidation in state $B$. Consider now state $U$. If both secured creditors wait until the second period, they share $(1/2) * 32$, each getting 8. If they both liquidate, each obtains 5. As a result, efficient continuation is socially profitable for them. Unfortunately, it is not in the creditors' individual interest: if one creditor liquidates and the other does not, the former obtains 10 and the second obtains nothing. This is an example of a *prisoner's dilemma.* As a result, in state $U$ there will be a run on the firm's assets, leading to inefficient liquidation. This inefficiency arises because of two reasons: i) both creditors have control rights on the same pool of assets, and ii) the creditors are over-collateralized, i.e. they obtain more under unilateral inefficient liquidation than under efficient reorganization.

$B$ (*lazy secured creditor*). There is only one secured creditor, who has all the liquidation rights and is entitled to a first period repayment of 10. All other creditors are unsecured. This debt structure leads to efficient liquidation in $B$. Consider now state $U$. Irrespective of the outcome, the secured creditor obtains 10. As a result, he has no particular incentive to reorganize the firm, in spite of the fact that reorganization would benefit creditors as a whole. The intuition is best seen by assuming that the creditor is uninformed about the firm's reorganization value but can acquire information at a positive cost. Clearly, the secured creditor sees no benefit to acquiring information, although creditors as a whole would be willing to spend up to 3 to gather information about the reorganization value. This inefficiency arises because the secured creditor's payoff is the same under liquidation and efficient reorganization.

These examples illustrate two problems that may arise with many creditors. In both cases the debt structure plays an important role. In the first case, too many creditors have the right to liquidate the company and their claims are over-collateralized. In the second case, the repayment schedule of secured debt was too flat across states.

### 4.1 The Optimal Debt Structure

We now study how the optimal debt structure can deal with those inter-creditor conflicts and the role of investor protection. To simplify the exposition, we initially focus only on the case where control is handed over to creditors upon default. We first illustrate in Lemma 1 how, when all creditors exert some control over the liquidation v. reorganization decision (as in example $A$ above), the sharing of liquidation and reorganization proceeds studied in Section 3 can already solve both inefficient runs and the lazy creditor problem. Lemma 2 then shows how the debtor can improve upon $I$-control by issuing two different classes of debt. To facilitate comparison with the traditional bankruptcy literature, we begin by ruling out renegotiation among creditors. Proposition 2 then derives the optimal debt structure in our model when renegotiation is allowed.

**Lemma 1** *In the case of borrowing from $n > 1$ creditors, $E$ can replicate the one-creditor outcome attained under $I$-control by giving each creditor an $I$-control contract that entitles the creditor to liquidate a fraction $1/n$ of the firm's assets, promising to each creditor a share $l^*/n$ of the firm's total liquidation proceeds and a share $1/n$ of the firm's total reorganization proceeds, where $l^* \in \left[\alpha(\underline{y}_2/L), \alpha(\overline{y}_2/L)\right]$.*

By pledging both reorganization proceeds and physical collateral, the entrepreneur can provide *each* creditor with the incentive to efficiently reorganize or liquidate the firm. By using these incentives, the entrepreneur creates unanimity among creditors, replicating the one creditor outcome of

$I$-control under multiple creditors.[12] This unanimity avoids both inefficient runs and lazy creditor problems as we can clearly illustrate in the previous numerical examples $A$ and $B$:

There are two secured creditors, 1 and 2, each of which has the right to liquidate 1/2 of the firm and a claim to 1/2 of liquidation and reorganization proceeds. If a creditor liquidates his share, the resulting liquidation proceeds are equal to 5 out of which he obtains 2.5. If instead he reorganizes his share, he gets $(1/2)*(1/2)*(1/2)*6 = 0.75$ in state $B$ and $(1/2)*(1/2)*(1/2)*32 = 4$ in state $U$. As a result, if creditors know the state, they both implement the efficient reorganization policy. There are neither inefficient runs nor lazy creditors. Moreover, even if creditors are uninformed and on average lose from reorganization (they get less than 2.5), each of them is willing to spend up to 0.75 to obtain information about the firm's reorganization value. Thus, contracts can yield an efficient outcome even if, as stressed by Kahl (2002), something new is learned in financial distress.

In this sense, creditor runs and lazy creditors can be viewed as a by-product of a sub-optimal debt structure rather than as intrinsic problems of financial distress. Of course, when $\alpha < \alpha_I$ the scheme of Lemma 1 does not yield ex ante feasibility. Remarkably, however, with multiple creditors $E$ can relax this constraint: by borrowing from (at least) two classes of secured creditors $E$ can improve upon the one-creditor outcome and also avoid using $E$-control altogether. The optimal debt classes are the following:

**Lemma 2** *The debt structure maximizing investor repayment and attaining an ex post efficient resolution of financial distress consists of two classes of secured debt. One class is given control rights under an $I$-control contract. The second class has no control rights but has cash flow rights over the remaining liquidation and reorganization proceeds. In this arrangement, total expected repayment to creditors equals* $\pi(\alpha y_1 + \overline{y}_2) + (1-\pi)(\alpha \overline{y}_2 + L)/2$.

One class of creditors lends under an $I$-control contract, another class has no control rights but is claimant to a share of liquidation proceeds. This separation between the right to control the firm upon default and the right to cash in some liquidation proceeds allows contracts to divorce the provision of incentives from total repayment, thereby reducing the incentive costs of $I$-control.

[12] We assume that creditors are entitled to obtain a share of the total proceeds from liquidation rather than the proceeds from liquidating a specific fraction of the firm. All of our results go through under the latter, alternative assumption. We proceed with the former assumption because, as we shall see, it is consistent with a key feature of the optimal debt structure with multiple creditors, namely that some creditors are entitled to obtain some of the proceeds from liquidating assets that only other creditors have the right to liquidate.

To see this, suppose that $\alpha\overline{y}_2 < L$. Then, because liquidation proceeds are easier to pledge than reorganization cash flows, some liquidation proceeds must be redistributed away from the holder of control rights so as to give him the incentive to efficiently reorganize. With the single class of debt of Lemma 1, this is attained by redistributing to $E$ an aggregate debt write-down $S = L - \alpha\overline{y}_2$, equally split across the individual creditors each of whom now bears a write-down of $S/n$. As shown by expression (2) this debt write-down reduces creditors' repayment under liquidation, thereby reducing debt capacity. If instead $E$ borrows from two classes of secured creditors where only one of them holds liquidation rights under an $I$-control contract, the redistribution $S$ can be made to the holders of the other class of debt, and not to $E$, maximizing creditors' repayment. Thus, borrowing from two distinct debt classes allows $E$ to reduce the ex ante cost of providing incentives to investors because it allows creditors to obtain $(1/2)(\alpha\overline{y}_2 + L)$ upon default, as opposed to $(1/2)(\alpha\overline{y}_2 + L - S)$ under a single debt class. One consequence of this fact is that now, provided:

$$\pi(\alpha y_1 + \overline{y}_2) + (1-\pi)(\alpha\overline{y}_2 + L)/2 \geq K, \tag{4}$$

$E$ can always attain the first best by giving control rights to a single debt class lending under an $I$-control contract. Note that the left hand side of (4) is the maximum that can be possibly repaid to creditors under a first best optimal reorganization policy because the totality of liquidation proceeds $L$ are pledged to creditors in the aggregate.[13]

This has two key implications. First, introducing a second debt class allows to attain the first best for a (weakly) larger set of investor protection values $\alpha$ relative to the one-creditor outcome of Proposition 1. This is strictly the case if and only if $\min(\alpha_I, \alpha_E) * \overline{y}_2 < L$. In this case, implementing the first best under a single creditor at intermediate values of $\alpha$ requires to transfer part of the liquidation proceeds to $E$ so that introducing a second debt class reduces the ex ante cost of removing the liquidation bias of the creditor in control. Second, Lemma 2 also implies that – unlike in the single creditor case – with two classes of debt creditor control is always optimal and $E$-control can never improve upon it. Indeed, under $E$-control the debt write-down $S$ must necessarily be paid back to $E$, reducing repayment strictly below (4), with clear ex ante costs. Thus, allowing for multiple debt classes in a model with $N$ creditors generates a natural tendency for the optimal debt structure to allocate control rights upon default to a subset of creditors strictly

[13] The optimal debt structure determines the repayment to the debt class in control in $U$ and $B$ (equal to $\alpha\overline{y}_2$ and $L - S$, respectively) and the repayment to the class not in control in the same states (0 and $S$, respectively). How repayment $(\alpha\overline{y}_1 + \overline{y}_2)$ in $G$ is split among the two classes is indeterminate under the optimal contract.

smaller than $N$.[14]

One objection to Lemma 2 is that ex post collusion among creditors can undermine the benefit of issuing two debt classes. This is because, whenever creditors as a group lose from reorganization (i.e. $\alpha\overline{y}_2 < L$ ), they may collude against $E$ and liquidate the firm in state $U$. Put differently, the creditor(s) without control rights could bribe the creditor(s) holding control rights into inefficient liquidation. To address this and other possible concerns we now study the optimal debt structure under ex post renegotiation among creditors, which allows us to analyse the optimal concentration of creditors (i.e. the number of creditors in each class), so far an irrelevant dimension.

#### 4.1.1 Exogenous Coalition Formation

The bankruptcy literature typically assumes that renegotiation among two or more creditors is impossible (e.g. Berglöf et al. 2007). Since such a stark assumption would immediately prevent any bargaining between the holders of the two classes of debt, we assume more realistically that even with multiple creditors bargaining can take place within a coalition of creditors, as long as such a coalition forms. To do so, we need to specify a process of coalition formation among $N > 1$ creditors. We assume that coalitions form by random assignment. Specifically, if the debt structure consists of a number $N_n$ of creditors without control rights and a number $N_c$ of creditors with control rights, we assume:

**A.3:** With a total of $N = N_n + N_c$ creditors, a coalition of $n$ creditors, where $n = n_c + n_n$ and where $n_c \leq N_c$ are creditors with control rights and $n_n \leq N_n$ are creditors without control rights forms with probability $\Pr(n_c, n_n|n) * \Pr(n|N)$, where $\Pr(n|N) = [N!/(N-n)!n!]/2^N$ and $\Pr(n_c, n_n|n)$ follows a hypergeometric distribution.[15]

Under A.3 coalitions form by random assignment. It is useful to think of the equilibrium coalition as formed in two stages. In the first stage, the total number $n$ of coalition members is determined according to $\Pr(n|N)$, which measures the likelihood of observing a coalition containing exactly $n$ members out of the total number of all possible coalitions of any size that may form from

[14] Taking our model with multiple creditors literally, our parameter $S$ amounts to giving to some creditors the right to cash some liquidation proceeds, but not the control rights to trigger such liquidation. Such redistribution of liquidation proceeds $S$ may be consistent with either of two features of real-world lending. First, consistent with evidence in Franks and Nyborg (1996), there may be several creditors, other than the floating charge holder, that lend under physical collateral. Second, consistent with evidence in Franks and Torous (1994), $S$ may represent the extent of violations of absolute priority in favour of junior creditors (as opposed to equity holders).

[15] The hypergeometric distribution is a discrete probability distribution that describes the number of successes in a sequence of $n$ draws from a finite population *without* replacement (as opposed to the binomial distribution that describes the number of successes for draws *with* replacement).

a population of size $N$. In the second stage, the composition of the coalition in terms of creditors with and without control rights, respectively $n_c$ and $n_n$, is determined by drawing $n = n_c + n_n$ creditors at random without replacement, which is described by the hypergeometric distribution.

A.3 captures two ideas. First, as $N$ becomes large it becomes harder to form a large coalition of creditors (i.e. a coalition with large $n$).[16] Second, the smaller is $N_c/N_n$, the smaller is the number of creditors with control rights $n_c$ that on average end up included in the equilibrium coalition. Assumption A.3 allows us to show in the most intuitive way the determinants of the optimal concentration of creditors, abstracting for the moment from the possibility of endogenous coalitions deliberately comprising the creditors with control rights. In Section 4.1.2 we relax assumption A.3 and allow for endogenous coalition formation via consolidation of claims.

Given a debt structure consisting of a number $N_c$ of secured claims holding control rights under an $I$-control contract and $N_n$ secured claims without control rights, renegotiation works as follows: after a coalition between $n_c \leq N_c$ holders and $n_n \leq N_n$ non-holders of liquidation rights is formed, the members of the coalitions bargain over the liquidation decision; for simplicity, all bargaining power is held by the group of creditors holding liquidation rights. Under A.3, we find:

**Proposition 2** *There exists $\widehat{\alpha}_I \leq \min(\alpha_I, \alpha_E)$ such that, for $\alpha \geq \widehat{\alpha}_I$, the first best can be attained by giving control to one large secured creditor (i.e. $N_c = 1$) who is pledged all reorganization proceeds and distributes an amount $S = L - \alpha \underline{y}_2$ of liquidation proceeds to an infinite number of creditors without control rights (i.e. $N_n = \infty$). If $\alpha_S \leq \alpha < \widehat{\alpha}_I$, $E$ cannot do better than committing to liquidate (at least a fraction of) the firm upon default by issuing straight debt claims with standard foreclosure rights to (any number of) secured creditors. If $\alpha < \alpha_S$, the project is not financed.*

When ex post renegotiation is allowed then, provided investor protection is sufficiently large, the first best is attained by fully concentrating liquidation rights on a large creditor lending under an $I$-control contract, and by fully dispersing the creditor class without liquidation rights. That is, many creditors have the right to collect some liquidation proceeds but only one creditor can unilaterally decide whether to totally or partially liquidate the firm irrespective of the other creditors' ex post preferences. As previously seen, $I$-control allows the investor holding control rights to internalize the social benefits of implementing the first best liquidation policy; the issuance of two classes of

[16] Function $\Pr(n|N)$ also implies that the probability of forming a coalition with $n$ creditors increases in $n$ for $n \leq N/2$ [$n \leq (N+1)/2$ if $N$ is odd] and falls in $n$ otherwise. The key property for our analysis is that $\Pr(n|N)$ falls in $N$ for $n$ close to $N$ [i.e. for $n = N - k$ if $k \leq (N+1)/2$]. This property formally captures the idea that forming an encompassing coalition of creditors becomes more difficult as $N$ increases.

debt reduces the ex ante cost of giving such incentives.

Crucially, the concentration of control rights on a single, large creditor who is the unique claimant to all reorganization proceeds reduces the probability that, for any given coalition of $n_n$ creditors without control rights, the latter are able to bribe the creditor in control into inefficient liquidation. At the same time, the full dispersion of claims without control rights prevents the formation of a coalition of creditors that is sufficiently large to trigger inefficient liquidation, therefore implementing the first best liquidation policy in equilibrium.[17]

If instead investor protection is low (i.e. $\alpha_S \leq \alpha < \widehat{\alpha}_I$), the first best cannot be attained and the optimal debt structure induces some liquidation also in $U$ to foster creditors' break even. The debtor can implement this outcome by issuing only *straight debt* contracts to multiple secured creditors. Although this debt structure paves the way for creditors' runs in financial distress, these runs are not suboptimal in a constrained sense because – given low investor protection – the firm's physical assets should be always liquidated upon default.[18] In this sense, Proposition 2 indicates that creditor runs and other ex post conflicts among creditors may be the by-product of a low level of investor protection, which prevents the possibility for the debtor to issue debt structures triggering an efficient resolution of financial distress. Appendix A.2.1 formally proves that Proposition 2 generalizes to a general setting where reorganization as well as liquidation values are stochastic and take on a continuum of values.

The optimal debt structure prevailing at high levels of investor protection highlights two novel features of our theory with respect to the literature on financial contracting. First, rather than protecting creditors against the debtor's strategic default (Bolton and Scharfstein 1996, Diamond 2004), creditor dispersion in our model protects the debtor against inefficient liquidation. One distinctive empirical implication of this feature is that, while in existing theories creditor dispersion is especially valuable at low levels of investor protection – where strategic default limits ex ante financing – in our model creditor dispersion is valuable at relatively high levels of investor protection, where rescuing profitable firms ex post may be made consistent with ex ante financing.[19]

[17] The optimal debt structure is also immune to other potential problems. For instance, since $I$-control gives the creditor holding control rights the incentive to do the efficient thing, it also prevents him from threatening other creditors that he will inefficiently reorganize or liquidate the firm, so as to force them to accept an opportunistic distressed exchange. The intuition is that these threats are not credible.

[18] In principle, the same debt structure used at $\alpha \geq \widehat{\alpha}_I$ could also be used to induce full liquidation when $\alpha < \widehat{\alpha}_I$ just by giving the creditor in control a small reorganization stake. We prefer to underscore the possibility to implement full liquidation under dispersion of straight debt claims just to stress that at low $\alpha$ phenomena such as creditor runs may be constrained efficient.

[19] It should be noted that while in Bolton and Scharfstein (1996, BS henceforth) dispersed creditors have liquidation rights, in our optimal contract they do not. In this sense, BS can be viewed in our setup as dealing with the case in

Second, our model rationalizes the coexistence of two classes of debt, one fully concentrated on a large creditor who has control rights (e.g. a bank), the other fully dispersed and without control rights (e.g. public debt such as bonds, or trade creditors). Crucially, our model predicts that such coexistence should be observed at relatively high levels of investor protection. Existing work on multiple investors (e.g. Dewatripont and Tirole 1994, Berglöf and von Thadden 1994, Winton 1995, Park 2000) neither studies the role of concentration in different classes of debt, nor the role of investor protection[20]; at the same time, existing work on debt structure (e.g. Diamond 1991, 1993; Rajan 1992; von Thadden 1995) studies the choice between bank and arm's length finance, not their coexistence.

Section 4.3 shows that the features of our optimal debt structure help shed light on how financial distress is resolved in the real world across countries characterized by different levels of creditor protection. Before doing so, however, we deepen our analysis by testing the working of our optimal debt structure when: i) coalitions of creditors form endogenously through consolidation in secondary markets, and ii) new creditors may join the debt structure before financial distress is resolved.

#### 4.1.2 Endogenous Coalition Formation

Trading in secondary markets could allow the large creditor (or any other "vulture" investor) to purchase the claims of those creditors without control rights. This is problematic if the state is $U$, so that reorganization is socially efficient, but investor protection is sufficiently low that creditors as a whole lose from reorganization, i.e. $\alpha\overline{y}_2 < L$. The intuition is that after having been claimant to all liquidation proceeds, the creditor with control rights would choose to liquidate, defying the incentives provided by his $I$-control contract. To see how this possibility works in our model,

which $\alpha$ is very low ($\alpha = 0$ indeed corresponds to the case of fully unverifiable cash flows in BS). As Proposition 2 points out, at $\alpha = 0$ our optimal debt structure may also feature dispersion of control rights, but we abstract from it in our discussion because it is never strictly optimal as it is instead in BS.

[20] There are also other differences between our model and these papers. In Dewatripont and Tirole (1994), the coexistence of debt and equity allows the debt structure to give incentives to the manager to exert effort and to an investor to liquidate the firm after bad performance. In their model, in the absence of a managerial effort choice, a single security would be optimal.
Berglöf and von Thadden (1994) also stress the role of managerial moral hazard by showing that issuing short and long term debt might maximize the debtor's incentive to repay. In our model instead, the issue is not to incentivize the manager but the investor and the presence of a second security allows to do so at zero ex ante cost.
In a costly-state-verification model Winton (1995) derives the optimal mix of secured and unsecured claims as a function of exogenous verification costs. In our model instead the ex ante and ex post costs of different claims are determined endogenously as a function of imperfect enforcement.
In a model where different investors have access to different monitoring technologies, Park (2000) studies the optimal debt structure when the moral hazard problem is particularly severe and finds that it is optimal for the entrepreneur to borrow from two classes of debt. In contrast, we derive the optimal debt structure in a model without monitoring and in our model investors do not differ ex ante.

suppose that $\alpha \geq \widehat{\alpha}_I$, and the debt structure is the one found in Proposition 2. Then, if the price of a claim without control rights in the secondary market is $p$, an individual creditor $i$ chooses how many of these claims $l_i^s$ to sell by solving:

$$\max_{l_i^s} \left(l_i - l_i^s\right) L\lambda + p l_i^s,$$
$$\text{s.t. } l_i^s \in [0, l_i]$$

where $l_i$ is the share of liquidation proceeds allocated to the creditor under the initial debt structure and $\lambda$ is the share of the firm's assets that are liquidated *in equilibrium* by the creditor in control. Of course, as long as the creditor is small and takes the value of $\lambda$ as being independent of his own decision to sell, his supply of claims is equal to:

$$l_i^s = \begin{cases} 0 & for \quad p < L\lambda \\ [0, l_i] & for \quad p = L\lambda \\ l_i & for \quad p > L\lambda \end{cases} \tag{5}$$

Schedule (5) illustrates that if individual creditors do not expect to be pivotal in affecting the creditor in control's decision of whether or not to liquidate the firm (i.e. $\lambda$), they only sell their claim if the price is 'right,' namely if the price is not smaller than the amount of liquidation proceeds that their claim entitles them to obtain. But then of course the creditor in control has no incentive to buy any claims when $p \geq L\lambda$ because his benefit from doing so is zero at best (or strictly negative if there are even negligible transaction costs). Therefore, since in our optimal debt structure creditors without control rights are fully dispersed (so that $l_i$ is negligible $\forall i$), none of them expects to be pivotal. Such dispersion, then, gives rise to a typical holdout problem (Gertner and Scharfstein 1991), whereby no creditor sells his claims. As a result, in our optimal debt structure consolidation never occurs.

This idea can be formally shown as follows. Suppose that the number of creditors without control is $N_n$. Denote by $l_n$ their total claim to liquidation proceeds, so that each such creditor is entitled to get a share $l_i = l_n/N_n$ of liquidation proceeds (as in Proposition 2, the creditor in control is entitled to get a share $l_c = 1 - l_n = \alpha \underline{y}_2/L$ of liquidation proceeds and the whole of the reorganization proceeds). Then, since $\alpha\overline{y}_2 < L$, if all the $N_n$ bondholders sell their claims then the creditor in control will liquidate, setting $\lambda = 1$. If however only $N_n - 1$ creditors sell their claims, the creditor not selling is pivotal provided:

$$0 = \arg\max_{\lambda} \left( l_n \frac{N_n - 1}{N_n} + 1 - l_n \right) L\lambda + \alpha \overline{y}_2 (1 - \lambda), \tag{6}$$

that is, provided the creditor in control reorganizes unless also such creditor sells. If (6) is met, this creditor obtains 0 by holding out and $pl_n/N$ by selling, which implies that he prefers to sell at any price $p > 0$. Conditional on all other creditors selling, a pivotal creditor sells at a very low price because if he does not sell then the firm is reorganized and the value of his claims is zero. In this case, then, secondary markets will consolidate claims in the hands of the creditor in control (who can obtain all existing claims by offering a negligible price).

Crucially, however, expression (6) directly implies that each creditor is pivotal if and only if:

$$N_n \leq \frac{L - \alpha \underline{y}_2}{L - \alpha \overline{y}_2}, \tag{7}$$

which is readily obtained by replacing in (6) the optimal allocation of liquidation proceeds to the creditor in control, $(1 - l_n) = \alpha \underline{y}_2 / L$. Obviously, condition (7) is not fulfilled as $N_n \to \infty$, implying that consolidation never occurs in the optimal debt structure of Proposition 2.[21] Note that in our ex ante optimal debt structure holdouts of dispersed creditors are not necessarily harmful as commonly assumed (e.g. Gertner and Scharfstein 1991), as they may allow the debtor to beneficially separate control and cash flow rights among different classes of investors.[22]

### 4.2 Optimal Debt Structure with Arrival of New Creditors

Sequential arrival of creditors is a common occurency, arising whenever the firm needs to raise external financing from new investors, for example to finance new investment opportunities. It is well known that the ensuing conflict between existing and new claimholders may result in under- as well as over-investment (e.g. Myers 1977, Jensen and Meckling 1976, Gertner and Scharfstein 1991). To see how creditor control can deal with these conflicts, suppose for concreteness that in

[21] Consolidation and inefficient liquidation could also not occur in a mixed strategy equilibrium where bondholders randomize between selling and not selling because in this equilibrium atomistic bondholders would only sell if the price compensates them for the expected value of their claims as in equation (5).

[22] So far we have abstracted from the potential costs arising from creditors' dispersion. For example, Bris and Welch (2005) note that creditors' dispersion may make them vulnerable to the debtor, eventually undermining break even. In a previous version we have formally studied this possibility and showed that in that case the debtor faces a trade-off between the ex post benefit of dispersing claims and its ex ante cost, reducing repayment. The results are available upon request.

financial distress – before observing whether liquidation or reorganization is efficient – the firm has the opportunity to improve an existing line of business by investing $F > 0$.[23] If the investment is undertaken, continuation cash flows increase to $y_2(\omega) + r$, while liquidation cash flows are instead constant at $L$. The return $r$ is observable but not verifiable at the time of re-investment $t = 1$, and is uncertain at $t = 0$ and distributed in the interval $[0, r_{\max}]$ according to the c.d.f. $R(r)$. As contracts cannot be directly contingent on $r$, the debt structure must specify a mechanism for taking the investment decision. We assume:

**A.4:** $r_{\max} < \min\left[L - \underline{y}_2, 2F/\alpha\right]$.

In words, $r$ is sufficiently small that reinvestment does not affect the efficiency of reorganization versus liquidation [e.g. in state $B$ liquidation is still efficient, that is $\underline{y}_2 + r_{\max} < L$], but not so large that existing creditors gain for sure by undertaking it (i.e. $\alpha r_{\max}/2 < F$). The first condition is imposed for simplicity, the second to keep the analysis interesting. If the investment opportunity increases the resources available to existing creditors, there would be no conflict at all.

Because investment only pays off in $U$, it is socially optimal to invest if and only if $r/2 \geq F$. In principle, under-investment can obtain if existing creditors do not see the upside of a positive NPV, and over-investment can obtain if $E$ does not bear the downside of a negative NPV. To induce efficient re-investment an optimal debt structure must solve both of these problems (as well as attaining the previous goals of efficient reorganization and ex ante break even). We find:

**Proposition 3** *There exists a threshold $\alpha_I^* \geq \widehat{\alpha}_I$ such that, for $\alpha \geq \alpha_I^*$ the first best is attained by giving all liquidation and refinancing rights to one large creditor. If such creditor allows refinancing for an amount $D$, his claim falls by $\alpha D$. Such creditor is also pledged all reorganization proceeds and must distribute an amount $S = L - \alpha\left(\underline{y}_2 + r_{\max} - F\right)$ of liquidation proceeds to an infinite number of creditors without liquidation or refinancing rights. If $\alpha \in [\widehat{\alpha}_I, \alpha_I^*)$, only a second best can be implemented whereby some (or all) positive re-investment opportunities are passed. This outcome can be attained by increasing the debt write-down to the large creditor to $\alpha g(\alpha) D$, where $g(\alpha) \geq 1$ is a decreasing function. For $\alpha < \widehat{\alpha}_I$ the optimal debt structure is identical to the one of Proposition 2.*

Provided investor protection is sufficiently large (i.e. for $\alpha \geq \alpha_I^*$), the first best is attained under a debt structure that is equivalent to the one of Proposition 2 with the only difference

[23] We focus on investment opportunities arising in financial distress because in such state the conflict between existing and new creditors is likely to be more intense, but our analysis easily extends to all states of nature.

that now the large secured creditor is also given the right to allow supra-priority financing, on top of the control rights over the liquidation decision. By making the large creditor claimant to reorganization proceeds, the optimal debt structure induces him to internalize the NPV of the new investment, which avoids both under- and over-investment. Importantly, poor investor protection creates a tension also between efficient reinvestment and ex ante break even. If investor protection is intermediate ($\widehat{\alpha}_I \leq \alpha < \alpha_I^*$) the creditor in control implements an efficient reorganization policy but must pass up some positive $NPV$ investment opportunities ex post, the more so the lower is $\alpha$. If instead investor protection is low, reinvestment never takes place and the debt structure is the same as the one of Proposition 2.

## 4.3 Discussion of Empirical Implications

Our model offers a rationalization for the use and performance of contractual resolutions of financial distress around the world as a function of investor protection. We illustrate this idea in two steps. First, we show how our model helps rationalize some key features of floating charge financing in the U.K. where investor protection is strong. Second, we discuss the broader link between investor protection and contractual resolutions of financial distress around the world.

### 4.3.1 Floating Charge Financing in the U.K.

Franks and Sussman (2005a) describe the contractual resolution of financial distress carried out in the U.K. with the extensive use of *floating charge financing*. As in our optimal debt structure, upon default a large creditor (typically a bank) is given control rights over the reorganization vs. liquidation decision.[24] This creditor is also given a floating charge, which is a security that covers not only certain specific physical assets, but it can also be extended to cover the whole pool of the company's assets, including intangibles and working capital (i.e. cash, receivables, future cash flows). In the context of our optimal contract, the floating charge effectively represents a claim over the company's reorganization proceeds $\alpha\overline{y}_2$. Crucially, the creditor in control is often given not only a floating charge but also a fixed charge, which allows him to repossess physical collateral in case of liquidation. Since fixed charges are usually senior to the floating charge, the fixed charge allows the creditor in control to be senior in liquidation, ahead of any preferential claims and unsecured

[24] Upon deciding for reorganization, the floating charge holder leaves the management in control. Upon deciding for liquidation, he usually appoints a professional agent, e.g. a receiver. The receiver assumes all the powers of the company's board of directors on behalf of the floating charge holder (e.g. Davies 1997, p. 385).

creditors. In the context of our optimal contract, the fixed charge represents the claim over (some of) the company's liquidation proceeds $L - S$. Finally, and again consistent with our optimal debt structure, the rest of the lending is dispersed among many small creditors.

In our model, these features of floating charge financing are instrumental to providing the controlling creditor with correct incentives to efficiently resolve financial distress. In line with this possibility, Franks and Sussman (2005a) document that in the U.K. floating charge financing works very well, mitigating the problems usually associated with creditor control. In particular, there are no inefficient runs and the controlling creditor's typical response to financial distress is an attempt to rescue the firm rather than to liquidate it automatically.[25] Our model further suggests that the use and the good performance of floating charge financing in the U.K. may be due to the high level of investor protection prevailing there. We discuss this possibility in the next section.

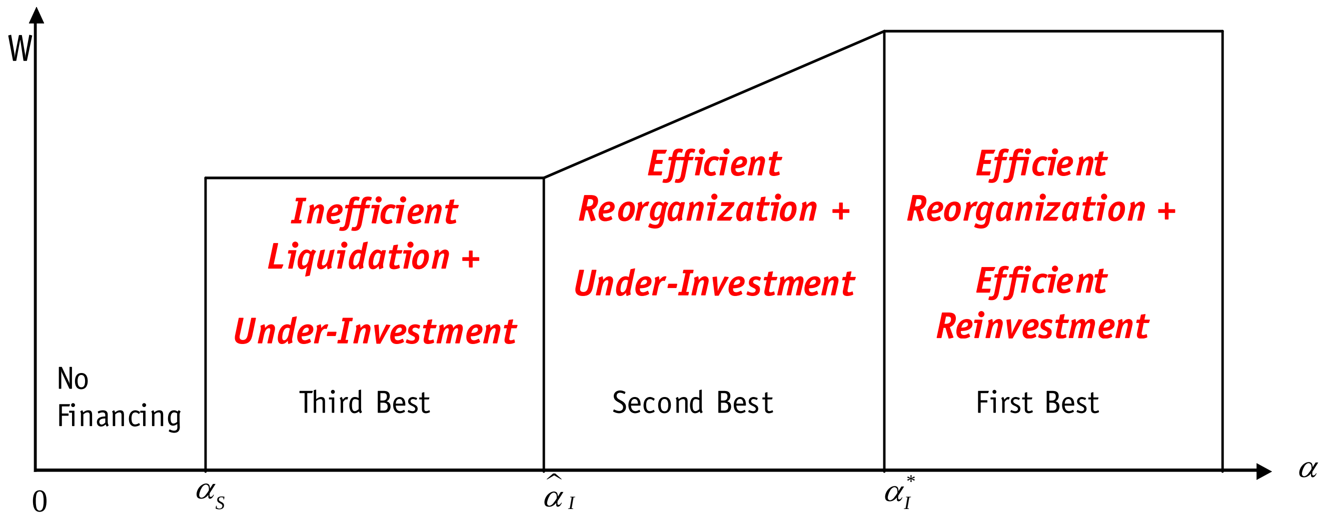
#### 4.3.2 Contractual Resolutions of Distress Around the World

Our model directly implies that contractual resolutions of financial distress should work better in countries with stronger investor protection. Figure 3 below illustrates this prediction.

Higher levels of $\alpha$ improve the resolution of financial distress by allowing the controlling creditor to better internalize the upside of efficient reorganization, thereby removing any liquidation or under-investment bias on his part. By contrast, low levels of investor protection $\alpha$ reduce the ability of contracts to give creditors the incentive to resolve financial distress efficiently, generating a bias towards under-investment and liquidation. In sum, Figure 3 shows that more developed countries (i.e. countries where $\alpha$ is higher) have a comparative advantage at using more flexible debt structures, thus attaining a more efficient resolution of financial distress.

[25] Interestingly, floating charge financing in the U.K. is sometimes held responsible for under-investment in financial distress (e.g. Franks, Nyborg and Torous 1996). Our model suggests two interpretations of these remarks. At one level it could be that, for floating charge financing to work perfectly, investor protection has to be so implausibly high that not even the U.K. level is large enough to allow all profitable reinvestment in financial distress. More subtly, but perhaps more realistically, the U.K. courts' ambiguous stance towards supra-priority financing has raised questions regarding its viability (e.g. Davies 1997). This and other limitations to supra-priority financing may directly trigger under-investment. In this respect, our analysis indicates that one simple reform strategy in the U.K. might be to just allow debt structures to combine floating charge with supra-priority financing, along the lines of our Proposition 3. Of course one may also use a more top down approach, legally reducing the power of the floating charge holder to block reinvestment and restructuring in financial distress. The U.K. Enterprise Act of 2002 is an example of this second type of approach, whose consequences are yet to be fully evaluated.

**Figure 3. Contractual Resolutions of Distress, Investor Protection and Welfare**




At one broad level, this result rationalizes the empirical findings that more developed countries have a comparative advantage at writing more flexible financial contracts (Lerner and Schoar 2005, Qian and Strahan 2007). There is to-date little direct evidence on resolutions of financial distress around the world, but some additional support to our predictions is provided by Djankov et al. (2008a). In their study of debt enforcement around the world, they survey insolvency practitioners in 88 countries on how, based on their experience, a standardized insolvency case can be expected to be resolved in their country. The survey shows that three basic insolvency procedures are used in the world: i) foreclosure by the senior creditor, ii) liquidation, and iii) reorganization. Crucially from our standpoint, while liquidation and reorganization are formal bankruptcy procedures, foreclosure is a purely contractual solution with minimal or no court involvement. Djankov et al. (2008a) then use data on the time, cost and likely outcome (going concern v. piecemeal sale) of the process to construct an efficiency index. The details on these variables are described in Table A3 in the Appendix. Their analysis shows that the efficiency of all three procedures, including foreclosure, increases with per capita income and common law legal origin. To the extent that common law and richer countries also have higher investor protection, this evidence is also consistent with our prediction that a contractual mechanism such as foreclosure should work better when investor protection is higher.

Of course, given the availability of more direct measures of investor protection, at this point the reader might wonder how a more direct association between investor protection and the efficiency of foreclosure looks actually like in the data. If not as a formal test of our hypothesis, this exercise can at least be viewed as an illustration of how the data can be organized so that it can speak more directly to our theory.[26] One interesting angle in this exercise pertains to the fact that the data distinguishes between two versions of foreclosure by the senior creditor, one in which such creditor is pledged as collateral only specific physical assets [in line with Djankov et al. (2008a) we call this version "foreclosure"], and another version in which the senior creditor is pledged the entire firms as collateral by using a floating charge [we call this version "foreclosure plus floating charge"]. Figure 4 below plots the efficiency of these two different forms of creditor control as a function of investor protection, as proxied by the Djankov et al. (2008b)'s anti self dealing[27] index.

Figure 4 shows that contractual resolutions of financial distress appear to work better in countries where investor protection is stronger, consistent with the basic insight of our model.[28] Figure 4 also shows that – for a given level of investor protection – foreclosure plus floating charge works better than foreclosure. Our model offers one possible rationalization of this fact: pledging the entire business as collateral as opposed to specific physical assets improves the controlling creditor's incentives, thereby making creditor control more efficient. Perhaps not surprisingly then, the benefit of floating charges with respect to standard foreclosure rights increases in the level of investor protection because the incentives provided by the former arrangement likely improve with

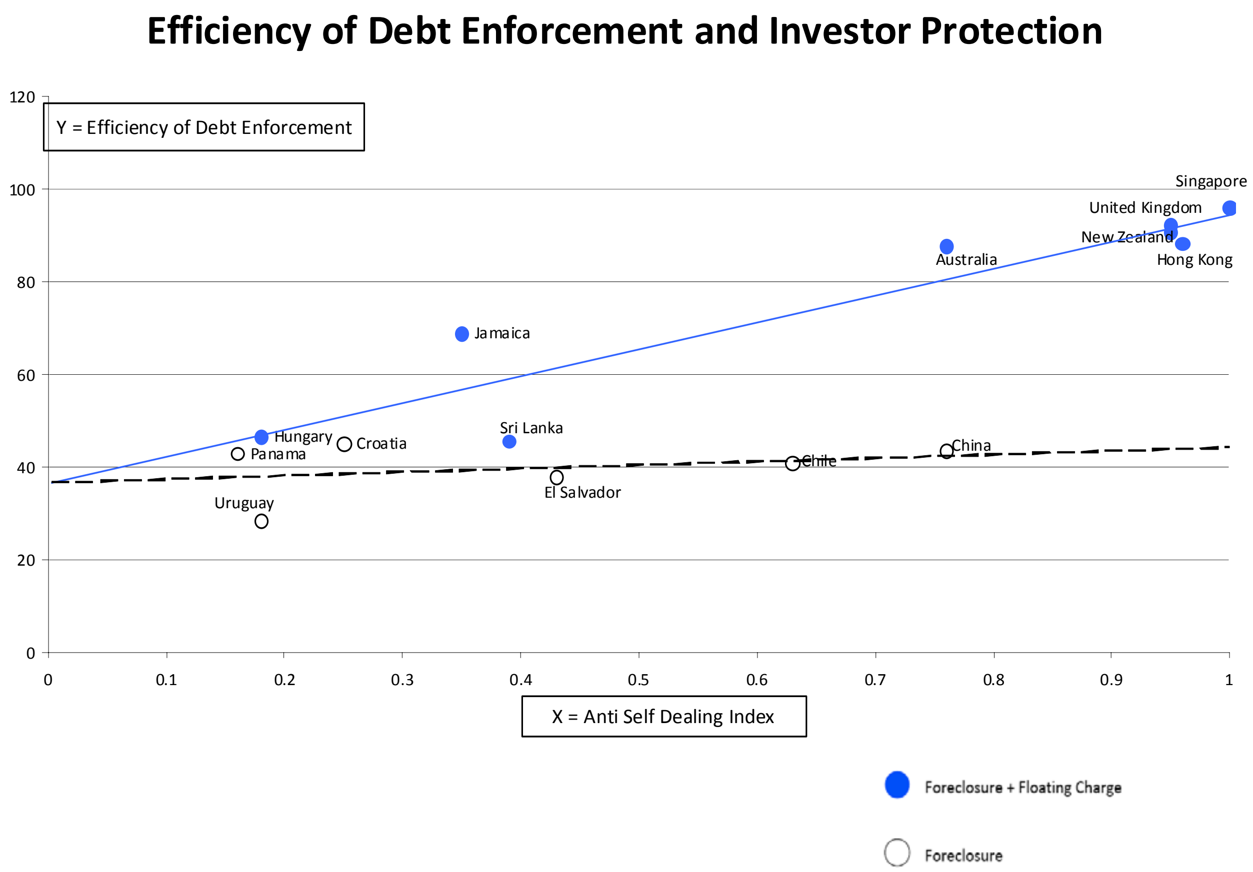
[26] One possible limitation of this exercise is due to the fact that in Djankov et al. (2008a), the case presented to practitioners did not *explicitly* mention the possibility of tunnelling by debtors. Thus, practitioners could have answered by hypothesizing a perfect level of investor protection. On the other hand, one could also expect practitioners operating in tunnelling prone environments to answer the questionnaire by implicitly taking tunnelling risk into account, not least because practitioners were asked to respond to the questionnaire in light of their direct experience with insolvency procedures in their countries.

[27] Figure 4 reports data on the 14 countries that use foreclosure, from Djankov et al. (2008a), *and* for which the anti self dealing index of Djankov et al. (2008b) is available. We choose to proxy investor protection with the anti self dealing index as it is the one that La Porta et al. (2008) indicate as their preferred measure, although similar (if not stronger) results obtain with other proxies, such as for example the revised anti directors index. It should also be noted that in Djankov et al. (2008a) there are 25 countries using foreclosure, and we end up with the 14 in Figure 4 as a result of the match with Djankov et al. (2008b).

[28] The solid blue line and the dashed black line in Figure 4 represent the regression lines of the efficiency of debt enforcement on investor protection, for the two subsamples of countries adopting foreclosure plus floating charge and foreclosure, respectively. Table A1 in the Appendix reports details of these regression results. Column 1 of Table A1 reports a strong positive and significant coefficient of investor protection on efficiency in countries with floating charge (the solid blue line in Figure 4). Column 2 reports a positive but insignificant coefficient of investor protection in countries with standard foreclosure (the dashed black line). In unreported tests, the effect of investor protection on debt enforcement is statistically larger in countries using foreclosure plus floating charge, as compared with countries using foreclosure. Table A2 reports medians and means of efficiency and its components in countries using foreclosure and foreclosure with floating charge, organized by high and low investor protection, and showing similarly that foreclosure with floating charge performs better that standard foreclosure, especially at high investor protection. Interestingly, Panel A of Table A2 shows that one benefit of using the floating charge at high levels of investor protection precisely comes from preserving the going concern value of the firm. This is consistent with the view that the cost of foreclosure is over-liquidation.

debtors' ability to pledge future cash flows to creditors.

**Figure 4**

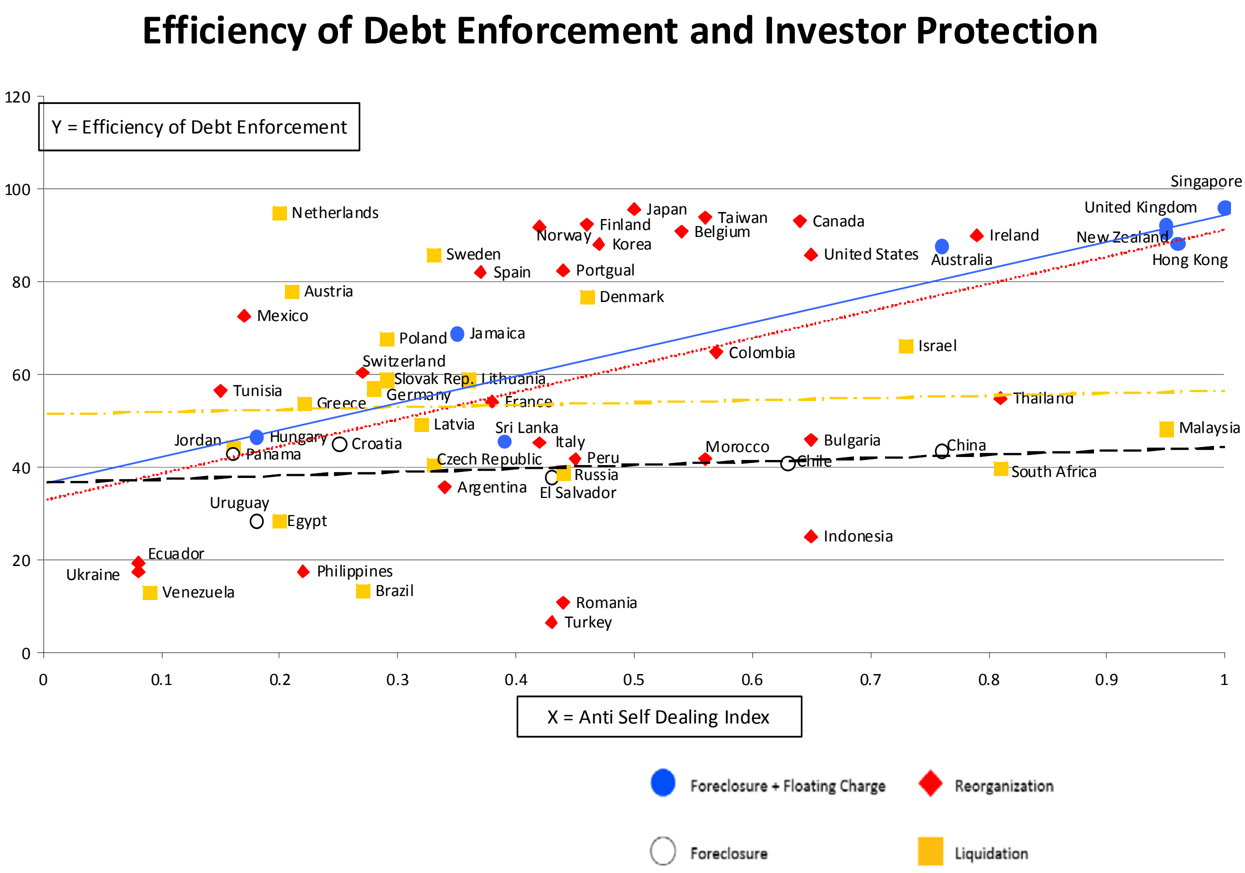



One question then arises, given the benefits of floating charge, why isn't such contract used everywhere in the world? One immediate answer is that in many countries the floating charge is legally forbidden (Djankov et al. 2008a). More subtly, the floating charge may just be very hard to transplant, being as it is the end result of a long process of precedent accumulation that is specific to certain common law systems (Franks and Sussman 2005b). Another possibility is that countries may have opted for formal bankruptcy procedures as alternative mechanisms to mitigate the costs of creditor control under standard foreclosure.[29] We can have a first look at this latter possibility by exploiting the full combined data of Djankov et al. (2008a and 2008b), and plot the efficiency of

[29] A fourth possibility is that other private mechanisms could mimick floating charge financing, even in the shadow of formal bankruptcy procedures. Some evidence along these lines comes from Brunner and Krahnen (2008), who show that in Germany (where the floating charge is not allowed and liquidation is the standard insolvency procedure) the presence of small pools of banks increases the probability of workout success. Also in this case large creditors such as banks successfully coordinate out-of-court restructurings.

contractual resolutions of financial distress with that of liquidation and reorganization at different levels of investor protection in Figure 5 below.

**Figure 5**




In line with the above intuition and with Ayotte and Yun (2009), the red dotted line in Figure 5 does show that in countries using bankruptcy reorganization procedures the efficiency of debt enforcement indeed increases with investor protection.[30] More broadly, Figure 5 hints that flexible procedures[31] to resolve financial distress such as floating charge and reorganization may be preferable to more rigid procedures such as foreclosure or liquidation only at high levels of investor protection. Finally, the performance of foreclosure plus floating charge seems comparable to that of reorganization, in the sense that the coefficients of a regression of efficiency on investor protec-

[30] See Column 4 in Table A1 in the Appendix for details about the regression estimates.

[31] By 'flexible' we mean procedures that aim at keeping the firm as a going concern, if necessary after a complex restructuring, rather than aiming at an automatic, possibly piecemeal sale.

tion in the two sub-samples are statistically indistinguishable from one another. While this is far from a conclusive assessment, the available evidence does suggest that the flexible debt structure of floating charge financing may indeed help remove the pro-liquidation bias associated with creditor control and standard foreclosure, at least when investor protection is high.

# 5 Conclusions

We study the economics of the optimal resolution of financial distress in an ex ante model of contracting. We find that if investor protection is strong the first best can be implemented under a debt structure consisting of two debt classes: one fully concentrated class of secured debt where a large creditor is given the exclusive control right to reorganize or liquidate the firm upon default and the contractual incentives to do so efficiently, and a second, fully dispersed class of secured debt without control rights. If instead investor protection is low, the second best can be implemented with a debt structure dispersing control rights among creditors lending under standard "straight debt" contracts. Our results rationalize in an optimal contracting setup the optimality of floating charge financing and its efficiency at high levels of investor protection.

From the standpoint of bankruptcy reform, one immediate implication of our analysis is that in countries where there is dissatisfaction with the working of formal bankruptcy procedures, it may be desirable to include a mechanism similar to the floating charge in the bankruptcy code and freely allow the parties to opt for it. Indeed, our analysis, as well as a cursory look at the two leading academic proposals for bankruptcy reform – the use of cash auctions (Baird 1986, Jensen 1989) and the use of options (Bebchuk 1988; AHM 1992) – suggests that floating charge financing may have advantages relative to both proposals. With respect to cash auctions, which rely on financial markets' ability to price a bankrupt firm, floating charge financing gives insiders such as large investors (or even entrepreneurs) the right incentives to reveal their own information truthfully, which may allow a better estimation of firms' reorganization values than the information possessed by market participants.[32] With respect to the use of options, which actually resembles our $E$-control contract, floating charge financing appears to be less biased towards inefficient liquidation. The reason is

[32] The formal intuition is that financial markets, being uninformed, will lend an amount that reflects only the expected not the actual value of the reorganized firm. Thus, insiders will decide to raise money from financial markets and bid if and only if the expected value of the reorganized firm to outsiders exceeds its liquidation value, i.e. iff $\frac{1}{2}\alpha\left(\overline{y}_2+\underline{y}_2\right)\geq L$. If insiders successfully post the bid, then the firm is reorganized even if liquidation is efficient (unless there is ex post renegotiation with creditors). If instead creditor protection is low and insiders cannot post the bid, then the firm is over-liquidated.

that, unlike the AHM proposal that does not focus on two debt classes with different degrees of control and on the potential collusion among them, the two debt classes that characterize floating charge financing facilitate the provision of incentives for efficient reorganization.[33] Of course, we would expect floating charge financing (but also, and for the same reasons, the other proposals) to provide an efficient resolution of financial distress only when investor protection is sufficiently strong. Indeed, our model shows that these flexible debt structures and bankruptcy procedures that focus on rescuing profitable enterprises are only likely to be feasible in more developed countries where investor protection is strong. In emerging economies instead, the resolution of financial distress may need to focus on maximizing creditor repayment, even if that requires the liquidation of potentially viable firms. In this sense, our analysis formally illustrates how attempts to export the flexible bankruptcy procedures of developed economies to countries plagued by poor legal infrastructure may result in both ex ante and ex post inefficiencies, consistent with the evidence in Franks and Lóránth (2006) and Lambert-Mogilianski et al. (2006).

A more fundamental implication of our results is that the problems usually associated with creditors' multiplicity, rather than being intrinsic problems of financial distress, may be just the by-products of the firms' debt structure. Within the traditional, ex post approach to bankruptcy, our analysis thus raises the question, why don't debt structures around the world always cope with problems of creditors' control and multiplicity? As previously discussed, one reason for the use of inflexible debt structures may just be the presence of legal restrictions to floating charge financing. If that were indeed the case, the best policy prescription would simply be to lift those restrictions and allow parties to freely choose whether to use contracts or formal bankruptcy procedures. Another reason for the use of inflexible debt structures may be due to low investor protection. In such a case, there could be ways for bankruptcy law to improve upon the pure private contracting outcome, for instance by strengthening investor protection in fraudulent conveyance law. A third reason may be that floating charge is costly because of other frictions that we have not explicitly modelled, for instance when the interests of tort creditors and workers need to be taken into account. In this

[33] In particular, the AHM (1992) proposal distributes equity in the bankrupt firm to senior creditors and an option to buy equity to junior creditors or shareholders. After the options have expired, the new shareholders vote on whether to select one of the cash bids or maintain the company as a going concern, either under existing management or under some alternative management team. In the context of our model, this scheme amounts to: 1) giving secured creditors all the equity in the firm and 2) giving unsecured creditors as well as shareholders (or the entrepreneur) the option to post a non-cash bid for the firm. In the aggregate, secured creditors will never accept an offer that is less than $L$, the liquidation value of the firm. As a result, the firm would be inefficiently liquidated when $\alpha \overline{y}_2 < L$. Our model suggests that one way to avoid this problem is to reduce the value of collateral of secured creditor by the debt write down $S$. Then, the amount $S$ should be distributed to a new class of creditors (holding neither equity nor options) in such a way as not to affect the reorganization v. liquidation decision.

latter case our analysis would suggest that while floating charge financing can address the problems of creditors' liquidation bias and multiplicity, an optimal bankruptcy code may usefully complement the working of contracts by curing their possible negative externalities on any third parties.[34] In this sense, and well beyond our specific model, the most general message of our analysis is perhaps that the benchmark against which bankruptcy procedures should be evaluated is not the 'war of all against all' depicted by the traditional approach to bankruptcy, but the much more orderly process implemented by floating charge financing.

[34] These third parties may be not only tort-creditors or workers (e.g. as in Bolton and Rosenthal 2002), but also specialized input suppliers or non-exclusive contractors (e.g. as in Bisin and Rampini 2006). The explicit modelling of these potential failures of floating charge financing is clearly beyond the scope of our paper, and we leave it to future research.

# Appendix 1: Proofs

**Proof of Proposition 1.** Denote by $\omega \in \{U, B, G\}$ the state of nature and by $p \in \{0,1\}$ whether the debtor repays (in which case $p = 1$) or not (in which case $p = 0$). Then, $I$ advances $D \geq K$ to $E$ under a contract specifying a liquidation policy $\lambda(G; p)$ in $G$, first and second period repayments $d_1(\omega; p)$, $d_2(\omega; p)$ and the party $c \in \{E, I\}$ in control of the reorganization decision when first period cash flows are equal to zero. Under a given contract, $E$'s expected profits are:

$$\pi \{y_1 + \lambda(G;1)L - d_1(G,1) + [1 - \lambda(G;1)][\overline{y}_2 - d_2(G,1)]\} + \\ + \frac{(1-\pi)}{2} \left\{ \begin{array}{c} \lambda(U;1)L - d_1(U,1) + [1-\lambda(U;1)][\overline{y}_2 - d_2(U,1)] + \\ +\lambda(B;1)L - d_1(B,1) + [1-\lambda(B;1)]\left[\underline{y}_2 - d_2(B,1)\right] \end{array} \right\}$$

The optimal contract maximizes the above objective function subject to the following constraints. First, feasibility requires $d_1(\omega; p) \leq \alpha y_1(\omega) + \lambda(\omega; p) L$, $d_2(\omega; p) \leq \alpha y_2(\omega)$, $\lambda(\omega) \in \{0, 1\}$. Second, in state $G$, $E$ must prefer to repay ($p = 1$) than to strategically default ($p = 0$). Because to avoid ex post inefficiencies it must be that $\lambda(G; 1) = 0$, then $d_1(G, 1)$ and $d_2(G, 1)$ must satisfy:

$$y_1 - d_1(G,1) + \overline{y}_2 - d_2(G,1) \geq y_1 + \lambda(G;0) L - d_1(G,0) + [1 - \lambda(G;0)][\overline{y}_2 - d_2(G;0)].$$

To maximize repayment, $E$'s payoff following default must be minimized, which requires setting $\lambda(G;0) = 1$, $d_1(G;0) = L + \alpha y_1$. This yields $d_1(G,1) + d_2(G,1) \leq \alpha y_1 + \overline{y}_2$. Thus, in $G$ no strategic default occurs and $I$ can extract at most $d_1(G) = \alpha y_1 + (1-\alpha)\overline{y}_2$, $d_2(G) = \alpha \overline{y}_2$. Notice that the contract terms for the state $G$ can be set irrespective of those for $U$ and $B$.

Third, the problem must fulfill a set of constraints such that for $\omega = U, B$, the equilibrium liquidation policy is chosen by the party in control $c = E, I$ to maximize his own utility. Fourth, $I$ must break even ex ante. We now illustrate how all of these these constrains concur to determine the optimal contract for different values of $\alpha$.

Consider what the second and third set of constraints imply for the optimal contract terms in $B$ and $U$, starting from the case where $I$ controls liquidation/reorganization. In those states initial cash flwos are zero and there cannot be strategic default. As a result, we drop the dependence of $d_1$ and $d_2$ on $p$. Then, $I$ implements ex post efficiency when $d_L \equiv d_1(B) \geq d_2(B)$, $d_2(U) \geq d_L$. The repayment-maximizing, feasible schedule satisfying the last two constraints is $d_2(B) = \alpha \underline{y}_2$, $d_2(U) = \alpha \overline{y}_2$, $d_L = L - \max[L - \alpha \overline{y}_2, 0]$. This contract is ex ante feasible and thus implements the first best provided:

$$\pi\left(\alpha y_1+\overline{y}_2\right)+\frac{1-\pi}{2}\left\{\alpha\overline{y}_2+L-\max\left[L-\alpha\overline{y}_2,0\right]\right\}\geq K. \tag{8}$$

The above condition is certainly satisfied at $\alpha=1$, but the left-hand side falls in $\alpha$. Inequality (8) is satisfied also at $\alpha=0$ provided $\pi\overline{y}_2\geq K$, otherwise is only satisfied for $\alpha$ sufficiently large. As a result, there exists a threshold $\alpha_I\geq 0$ such that $I$-control is feasible and yields the first best if and only if $\alpha\geq\alpha_I$.

Consider now the contract where $E$ controls liquidation/reorganization. $E$ implements ex post efficiency provided $L-d_L\geq \underline{y}_2-d_2(B)$ and $\overline{y}_2-d_2(U)\geq L-d_L$. This implies that $I$'s payoff is maximized at $d_2(B)=\alpha\underline{y}_2$, $d_2(U)=\alpha\overline{y}_2$ and $d_L=L-(1-\alpha)\underline{y}_2$. This contract is ex ante feasible and thus implements the first best provided:

$$\pi\left(\alpha y_1+\overline{y}_2\right)+\frac{1-\pi}{2}\left\{\alpha\overline{y}_2+L-(1-\alpha)\,\underline{y}_2\right\}\geq K. \tag{9}$$

The above condition is certainly satisfied at $\alpha=1$, but the left-hand side falls in $\alpha$. Inequality (9) is satisfied also at $\alpha=0$ provided $\pi\overline{y}_2+\frac{1-\pi}{2}(L-\underline{y}_2)\geq K$, otherwise is only satisfied for $\alpha$ sufficiently large. As a result, there exists a threshold $\alpha_E\geq 0$ such that $E$-control is feasible and yields the first best if and only if $\alpha\geq\alpha_E$.

It is easy to see that, depending on parameter values it can either be $\alpha_E\geq\alpha_I$ or $\alpha_E<\alpha_I$. For $\alpha\geq\max\left(\alpha_E,\alpha_I\right)$ the first best can be implemented under both $I$- or $E$-control. Then, if $\alpha_E<\alpha_I$, for $\alpha\in[\alpha_E,\alpha_I)$ the first best can only be implemented under $E$-control. If instead $\alpha_E>\alpha_I$, for $\alpha\in[\alpha_I,\alpha_E)$ the first best can only be implemented under $I$-control. For $\alpha<\min\left(\alpha_E,\alpha_I\right)$ the first best cannot be implemented.

For $\alpha<\min\left(\alpha_E,\alpha_I\right)$, the investor can only break even by sacrificing ex post efficiency and thus by liquidating both in $U$ and $B$. One way to implement this outcome is to write a contract $\lambda(B)=\lambda(U)=1$ where $I$ automatically forecloses on $E$'s assets upon default. In this case, ex ante break even is attained provided

$$\pi(\alpha y_1+\overline{y}_2)+\frac{1-\pi}{2}L\geq K. \tag{10}$$

There exists an $\alpha_S\geq 0$ such that the above condition is satisfied for $\alpha\geq\alpha_S$.

Consider now the case whith ex post renegotiation. Renegotiation can occur in $G$ after $E$'s strategic default because at that point the contract stipulates liquidation but liquidation is not ex post efficient. Suppose that $E$'s has all the bargaining power. Then, first note that given our assumption $y_1 > \overline{y}_2$, it must always be the case that $y_1 + \alpha\overline{y}_2 \geq L + \alpha y_1$. This implies that if $E$ strategically defaults he has sufficient resources at $t = 1$ to bribe the investor and avoid strategic liquidation. As a result, with renegotiation the entrepreneur cannot commit to repay more than $L + \alpha y_1$ in $G$, so that total repayment to $I$ falls. Note however that the possibility of renegotiation does not affect repayment in $U$ and $B$. For $\alpha \geq \min(\alpha_E, \alpha_I)$ renegotiation does not occur because under $I$-control and $E$-control ex post efficiency is attained. For $\alpha < \min(\alpha_E, \alpha_I)$ renegotiation could only occur in $U$ when the firm is inefficiently liquidated. However, since in this region $\alpha\overline{y}_2 < L$ the entrepreneur cannot bribe $I$ and thus the contract is not renegotiated. ∎

**Proof of Lemmata 1 and 2.** If the debtor borrows from $N > 1$ creditors under $I$-control contracts giving each creditor a share $1/N$ of reorganization proceeds and a share $l^*/N = \alpha\left(\overline{y}_2/L\right)$ of liquidation proceeds, then an ex post resolution of financial distress is attained, in line with Proposition 1. Lemma 2 immediately follows by noting that the debt write down $S$ needs not be distributed to $E$ but to a second class of creditors holding no liquidation rights. ∎

**Proof of Proposition 2.** For $\alpha < \alpha_S$, the project is not financed. The reason is that creditors' multiplicity cannot increase total repayment above $\alpha y_1 + \overline{y}_2$ in state $G$ and above $L$ in states $U$ and $B$, and such repayments are the same as those under *straight debt* (in the case with one creditor), which is not feasible if $\alpha < \alpha_S$. Define $\widehat{\alpha}_I$ as the level of investor protection at which:

$$\pi\left(\widehat{\alpha}_I y_1 + \overline{y}_2\right) + (1-\pi)\left(\widehat{\alpha}_I\overline{y}_2 + L\right)/2 = K.$$

Thus, $\widehat{\alpha}_I$ is the smallest $\alpha$ at which implementing the first best with $I$-control ensures break even. Then, if $\alpha_S \leq \alpha \leq \widehat{\alpha}_I$, only *straight debt* is feasible and break even requires liquidation in both $U$ and $B$, which in the case of multiple creditors $E$ can accomplish through a variety of debt structures (for example even by fully dispersing control rights). Given that fractional liquidation is allowed, the optimal debt structure might even allow for liquidation of only a fraction $f < 1$, where $\pi\left(\overline{y}_2 + \alpha y_1\right) + \frac{1}{2}(1-\pi)\left[fL + (1-f)\,\alpha(\underline{y}_2 + \overline{y}_2)\right] = K$. Yet, setting $f < 1$ is only efficient for $E$ if $L < (\overline{y}_2 + \underline{y}_2)/2$, otherwise the welfare gain in $U$ is more than compensated by the loss in $B$. If $L \geq (\overline{y}_2 + \underline{y}_2)/2$, then $f = 1$ is optimal.

Let us now examine the optimal debt structure for $\alpha \geq \widehat{\alpha}_I$. Consider a debt structure consisting of a number $N_c$ of creditors holding control rights and a number $N_n$ of creditors holding secured claims without control rights (we call them bondholders henceforth), for a total number of $N = N_c + N_n$ creditors. The $N_c$ controlling creditors are pledged as a whole a fraction $x_c$ of reorganization proceeds and a fraction $l_c$ of liquidation proceeds; $l_c \in \left[x_c\alpha(\underline{y}_2/L), x_c\alpha\left(\overline{y}_2/L\right)\right]$, which are equally shared among them. The remaining cash flow is distributed among bondholders, who get as a whole a share $x_n$ of reorganization proceeds and $l_n$ of liquidation proceeds. Thus, $x_c + x_n = 1$ and $l_c + l_n = 1$. If in equilibrium renegotiation does not occur, this arrangement triggers an ex post efficient outcome and ensures repayment (4) to creditors, guaranteeing break even.

To see whether this is the case, suppose that a coalition between $n_c \leq N_c$ holders of control rights and $n_n \leq N_n$ bondholders is formed, for a total number $n \leq N$ of creditors, $n = n_n + n_c$. The $n_c$ creditors with control rights in the coalition claim a share $n_c/N_c$ of the firm's assets. To induce these creditors to liquidate a fraction $\lambda \leq n_c/N_c$ of the firm's assets, the bondholders are willing to pay at most a total bribe of:

$$b(\lambda) = \frac{n_n}{N_n}\left[l_n L\lambda + x_n\alpha\overline{y}_2(1-\lambda)\right],$$

which is equal to the total payoff that the coalition of bondholders obtains from inefficient liquidation. Suppose for simplicity that the creditors in control have full bargaing power. Then, they select $\lambda$ to solve:

$$\max_{\lambda} \frac{n_n}{N_n}\left[l_n L\lambda + x_n\alpha\overline{y}_2(1-\lambda)\right] + \frac{n_c}{N_c}\left[l_c L\lambda + x_c\alpha\overline{y}_2(1-\lambda)\right]$$

The optimal liquidation policy by these creditors is either full liquidation (i.e. $\lambda = \widehat{\lambda} = n_c/N_c$) or full reorganization (i.e. $\lambda = 0$). Bondholders trigger some inefficient liquidation if and only if:

$$\frac{n_n}{N_n}\left[l_n L - x_n\alpha\overline{y}_2\right] + \frac{n_c}{N_c}\left[l_c L - x_c\alpha\overline{y}_2\right] \geq 0,$$

which, by exploiting the fact that $x_n = (1 - x_c)$ and $l_n = (1 - l_c)$, can be rewritten as:

$$n_n \geq n_c \frac{N_n}{N_c} \frac{\left[x_c\alpha\left(\overline{y}_2/L\right) - l_c\right]}{\left[(1-l_c) - (1-x_c)\alpha\left(\overline{y}_2/L\right)\right]}. \tag{11}$$

In the above condition, setting $N_c$ as low as possible makes it harder for a given coalition ($n_n$, $n_c$) of creditors to trigger liquidation. The intuition is that – for a given aggregate stake ($x_c$, $l_c$) of controlling creditors – the concentration of such stake on a small number of creditors increases the size of the bribe that must be paid by any number of bondholders, which discourages liquidation. We therefore note that there is an intuitive benefit in setting $N_c = 1$ and we indeed later show that setting $N_c = 1$ is also optimal.

Additionally, note that when $\alpha\overline{y}_2/L < 1$, the right hand side of the above inequality (11) increases in $x_c$ and decreases in $l_c$. As a result, to minimize the possibilities for inefficient liquidation to occur, it is optimal to set $x_c = 1$ and $l_c = \alpha\underline{y}_2/L$. That is, the creditor(s) holding control rights must be "large" (and have a strong enough incentive to efficiently reorganize) to make it harder for bondholders to trigger liquidation. The reason is that each bondholder obtains zero in reorganization and $l_n = (1 - \alpha\underline{y}_2/L)/N_n$ in liquidation. Note that when $\alpha\overline{y}_2 > L$ this allocation of reorganization and liquidation proceeds always avoids inefficient liquidation and implements the first best, for any coalition $(n_n, n_c)$. At this optimal cash flow allocation, condition (11) becomes $n_n \geq n_c k\,(N_n/N_c)$, where $k \equiv \frac{\alpha[\overline{y}_2 - \underline{y}_2]}{[L - \alpha\underline{y}_2]} < 1$ for $\alpha\overline{y}_2 < L$.

We can now compute expected liquidation under a generic debt structure $(N_n, N_c)$. To do so, note that the process of random coalition formation can be viewed in two steps. In the first step, the total number of coalition members $n \leq N \equiv N_c + N_n$ is determined. The probability with which a coalition of size $n$ forms is equal to:

$$\Pr(n) = \frac{1}{2^N}\frac{N!}{(N-n)!n!}$$

In the second stage, then, the composition of the coalition in terms of creditor types is determined. At this stage, the probability that a coalition of size $n$ has $n_c$ creditors in control and $n - n_c$ bondholders follows a hypergeometric distribution and it is equal to:

$$\Pr(n_c, n - n_c|n) = \frac{\binom{N_c}{n_c}\binom{N_n}{n-n_c}}{\binom{N_n+N_c}{n}}.$$

As a result, and by rewriting (11) as $n \geq n_c[1 + k(N_n/N_c)]$, expected liquidation in $U$ is then equal to:

$$\mathbb{E}(\lambda|N_c, N_n) = \sum_{n_c=1}^{N_c}\sum_{n\geq n_c[1+k(N_n/N_c)]}^{N_c+N_n}\frac{n_c}{N_c} * \Pr(n_c, n-n_c|n) * \Pr(n).$$

When $N_c = 1$ the only possibility for liquidation to occur is when $n_c = 1$, which implies that:

$$\mathbb{E}(\lambda|1, N_n) = \sum_{n\geq 1+kN_n}^{N_n+1}\Pr(1, n-1|n) * \Pr(n) = \sum_{n\geq 1+kN_n}^{N_n+1}\frac{\binom{N_n}{n-1}}{2^{N_n+1}}.$$

So that, using Stirling's approximation $n! \simeq \sqrt{2\pi n}(n/e)^n$ we have that:

$$\mathbb{E}(\lambda|1,N_n) = \sum_{n\geq 1+kN_n}^{N_n+1} \frac{\binom{N_n}{n-1}}{2^{N_n+1}} = \sum_{n\geq 1+kN_n}^{N_n+1} \frac{1}{2^{N_n+1}} \sqrt{\frac{N_n}{2\pi(N_n+1-n)(n-1)}} \frac{N_n^{N_n}}{(N_n+1-n)^{N_n+1-n}(n-1)^{n-1}}$$

As a result:

$$\lim_{N_n\to+\infty} \mathbb{E}(\lambda|1,N_n) = \sum_{n\geq 1+kN_n}^{N_n+1} \lim_{N_n\to+\infty} \frac{\left(\frac{N_n+1-n}{n-1}\right)^{n-1}}{2^{N_n+1}} \sqrt{\frac{N_n}{2\pi(N_n+1-n)(n-1)}} \left(\frac{N_n}{N_n+1-n}\right)^{N_n}$$

For $N_n \to +\infty$, the right hand side of the above expression tends to zero for every $n$, which implies that expected liquidation is zero and thus the first best is attained. Hence, the debt structure $(N_c = 1, N_n = +\infty)$ attains the first best. ■

**Proof of Proposition 3.** Consider a debt structure implementing the first best allocation for every $(r,\omega)$. By previous arguments, such debt structure allocates the large creditor with control rights of Proposition 2 also of the right to issue supra-priority financing. Intuitively, such creditor's equity stake allows him to benefit from re-investment. Suppose that his lending contract of this creditor specifies that if he allows supra-priority financing for amount $D$, his repayment (both in reorganization and in liquidation) falls by $\theta D$. $\theta$ is the extent to which the new creditor's claim compete with $C$'s claim.

At the optimal reorganization policy, new financing (and investment) is allowed provided $x\alpha r/2 - \theta D \geq 0$. New financing is raised if and only if investment takes place. The creditor either optimally sets $D = 0$ or $D = F$, where $D = 0$ stands for the case where new financing is not raised. By setting $\theta = x\alpha$, the creditor efficiently reinvests, namely new financing is raised if and only if $r/2 > F$. We later check whether a debt write-down of $x\alpha F$ is feasible under the optimal debt structure. What about the reorganization decision? The creditor reorganizes if and only if, for every $r$:

$$x\alpha\left[\underline{y}_2 + r - FZ(D=F)\right] \leq L - S \leq x\alpha\left[\overline{y}_2 + r - FZ(D=F)\right] \quad (12)$$

where $Z(D=F)$ is an indicator taking value 1 if $D = F$ and 0 otherwise. Because $\underline{y}_2 + r_{\max} < L$, it is always possible to find $L-S$ such that both conditions hold, e.g. $x\alpha(\underline{y}_2 + r_{\max} - F) = L - S$. Thus, the creditor can be given the incentive to efficiently resolve financial distress. The debt write-down $x\alpha F$ is feasible both in states $B$ and $U$ because $r_{\max} > 2F$.

As in Proposition 2, then, all creditors other than $C$ must be fully dispersed so as to prevent the formation of coalitions against re-investment, and the creditor must be large, i.e.$x = 1$ and $S = L - \alpha\left(\underline{y}_2 + r_{\max} - F\right)$. Then, both the firm and the re-investment are financed and thus the first best is attained provided:

$$\pi\left(\alpha y_1 + \overline{y}_2\right) + (1 - \pi)\left\{L/2 + \alpha(\overline{y}_2 + r^*)/2 - \left[1 - R(2F)\right]F\right\} = K. \tag{13}$$

where $r^* = \int_{2F}^{r_{\max}} r dR(r)$ and $[1 - R(2F)]$ is the probability that supra priority financing is raised in the first best. There is a threshold $\alpha_I^*$ such that the first best can only be attained if $\alpha < \alpha_I^*$. Because A.4 implies that $\alpha r^*/2 < [1 - R(2F)]F$, the left-hand side of (13) is smaller than the left-hand side of (4). Hence, $\alpha_I^* \geq \widehat{\alpha}_I$. For $\alpha \in [\widehat{\alpha}_I, \alpha_I^*]$ refinancing is not allowed (or $\theta$ is set large enough) so there is no re-investment but reorganization is efficient. For $\alpha \in [\widehat{\alpha}_I, \alpha_I^*]$ some (but not all) profitable investment opportunities can be undertaken by setting $\theta = g\alpha$ where $g > 1$ and $g \leq r_{\max}/2F$ (for $g \leq r_{\max}/2F$, $C$ never finds it profitable to refinance). The creditor then reinvests when $r \geq \widehat{r} \equiv gF$ and some profitable investment opportunities are passed – and hence the first best is not attained, – but for sufficiently high $r$ investment takes place. The value of $g$ is set to satify:

$$\pi\left(\alpha y_1 + \overline{y}_2\right) + (1 - \pi)\left\{L/2 + \alpha\left[\overline{y}_2 + r^*(g)\right]/2 - \left[1 - R(gF)\right]F\right\} = K$$

where $r^*(g) = \int_{gF}^{r_{\max}} r dR(r)$. It is immediate to see that, due to assumption A.4., the optimal $g$ falls in $\alpha$. As in Proposition 2, if $\alpha_S \leq \alpha \leq \widehat{\alpha}_I$ the third best is implemented under *straight debt*. For $\alpha < \alpha_S$, the project is not financed. ■

# Appendix 2: Extensions

**A2.1: Uncertain Cash Flows and Liquidation Values.** We now show that floating charges are also optimal if first period cash flows $y_1$, liquidation values $L$, and reorganization values $y_2$ are stochastic, taking on a continuum of values. We do not specify any joint probability distribution for these variables because the proof goes through under a general distribution. We later impose a restiction on the set of distribution, but only to simplify the study of this extension. As a benchmark, consider the optimal contract if courts perfectly verify $(y_1, y_2, L)$ but managers seize a fraction $(1 - \alpha)$ of profits. The optimal contract then sets state-contingent payments $d_1(y_1, y_2, L)$ at $t = 1$, $d_2(y_1, y_2, L)$ at $t = 2$ and liquidation policy $\lambda(y_1, y_2, L)$. If $E$ repays less than $d_1(y_1, y_2, L)$ at $t = 1$, the court fires the manager and implements $\lambda(y_1, y_2, L)$, so that under continuation $[\lambda(y_1, y_2, L) = 0]$ a new management team yielding $y_2$ is hired. To avoid being fired, at $t = 1$ the manager is willing to pay the continuation rent $(1 - \alpha)y_2$, implying that if $t = 1$ cash flows are so high that $y_1 > y_2$, the creditor gets over the two periods a total sum of $(\alpha y_1 + y_2)$ if $\lambda(y_1, y_2, L) = 0$ and $(\alpha y_1 + L)$ otherwise. If $y_1 > y_2$, then, there is not trade-off between ex ante and ex post efficiency so that, on the one hand, the optimal contract sets $\lambda(y_1, y_2, L) = 0$ if and only if $y_2 > L$ and, on the other hand, there is no cost of creditor control. To simplify matters, we assume that if $y_1 > y_2$ reorganization is socially efficient, namely $y_2 > L$. One way to think about this restriction is to view it as imposing a correlation structure whereby $y_2$ is more (positively) correlated with $y_1$ than $L$. The usefulness of this restriction is due to the fact that, whithin the context of our model of Section 2, all states where $y_1 > y_2$ are then analogous to state $G$, in which the firm is not in financial distress and so $\lambda(y_1, y_2, L)$ is mechanically set to be equal to zero. When instead $y_1 < y_2$ the debtor cannot pay at $t = 1$ all of his reorganization rent, implying that a tradeoff between ex post and ex ante efficiency arises. The optimal liquidation policy for states in which $y_1 < y_2$ then solves:

$$\begin{aligned} &\max_{\lambda(y_1,y_2,L) \text{ for } y_1<y_2} \mathbb{E}\left[y_1 + y_2 + \lambda(y_1, y_2, L)(L - y_2) I\right] \\ &s.t. \quad \mathbb{E}\left\{(\alpha y_1 + y_2)(1 - I) + (\alpha y_2 + y_1) I + \lambda(y_1, y_2, L)\left[L - \alpha y_2 - (1 - \alpha) y_1\right] I\right\} \geq K \end{aligned} \tag{14}$$

Where $I = I(y_1 \leq y_2)$ is the indicator function taking value one when $y_1 \leq y_2$. First order conditions with respect to $\lambda(y_1, y_2, L)$ imply that the optimal contract liquidates the firm in states in which $y_1 < y_2$ if and only if:

$$(L - y_2) + \nu\left[L - \alpha y_2 - (1 - \alpha) y_1\right] > 0$$

where $\nu$ is the Lagrange multiplier attached to $I$'s break even constraint. If $\nu = 0$, liquidation occurs iff $L > y_2$. If instead $I$'s break even contraint is binding then liquidation occurs if $L > L^*(y_2, y_1) \equiv \{y_2 + \nu[\alpha y_2 + (1 - \alpha) y_1]\} / (1 + \nu)$, so that ex post inefficient liquidation is implemented whenever $y_2 > L > L^*(y_2, y_1)$. Crucially, note that, by contrast, inefficient ex post reorganization never occurs because $y_2$ can never be lower than $L^*(y_2, y_1)$. Threshold $L^*(y_2, y_1)$ is a linear combination of $y_2$ and $y_1$, which – for future reference – we write as $L^*(y_2, y_1) = \upsilon y_2 + (1 - \upsilon) y_1$, where $\upsilon \in [0, 1]$.

We now show that in financial distress (i.e. if $y_1 < y_2$) a debt structure like the one of Proposition 2 can implement for every $(y_2, y_1, L)$ the constrained optimal outcome in which liquidation occurs iff $L > L^*(y_2, y_1)$, even if courts cannot verify $y_2$ and total repayment to creditors is the same.

As in Section 2, we continue to assume that at $t = 1$ courts determine both $y_1$ and $L$.[35] Suppose then that under the original debt contract the creditor is entitled to a fixed share $g$ of first period repayment (both in the case of full repayment and of default) and a fixed share $l$ of liquidation proceeds. Additionally, suppose that such creditor is also promised a fixed share $x$ of reorganization proceeds. Then, when $y_1 < y_2$ this creditor takes over and liquidates if and only if:

$$x\alpha y_2 + gy_1 < g\alpha y_1 + lL, \tag{15}$$

where the left hand side captures the amount of first and second period repayment under reorganization (whose total amount when $y_1 < y_2$ is equal to $y_1$ at $t = 1$ and $\alpha y_2$ at $t = 2$) accruing to the creditor in control, while the right hand side captures the latter creditor's repayment under liquidation (which is a portion of total repayments $\alpha y_1$ at $t = 1$ and $l$ at $t = 2$). Condition (15) can be rewitten as:

$$L > (x/l)\,\alpha y_2 + (g/l)\,(1-\alpha)\,y_1. \tag{16}$$

It is then immediate to see that, for any $\alpha, \upsilon \in (0,1)$ the constrained optimal reorganization is implemented by giving the creditor in control all reorganization proceeds, (i.e. by setting $x = 1$) and by setting $g$ and $l$ such that:

$$l = \frac{\alpha}{\upsilon} < 1,\; g = \frac{1-\upsilon}{\upsilon}\frac{\alpha}{1-\alpha} < 1 \tag{17}$$

Crucially, the values of $l$ and $g$ in conditions (17) make condition (16) equivalent to condition $L > L^*(y_2, y_1)$, implying that creditor control implements the constrained optimal reorganization policy in financial distress. Obviously, the remaining share of proceeds $1-l$ and $1-g$ are distributed to the second class of creditors, so that the same level of welfare as in problem (14) is attained. The general idea, then, is that by making the creditor in control claimant to reorganization proceeds (and by under-securing him in financial distress, as reflected by $l < 1$) allows to make him internalize

[35] When $y_1 > y_2$, implementing the constrained optimum when courts cannot verify $y_2$ relies on giving the creditor in control the right to replace the existing manager with a new manager upon default. To see this, suppose that such creditor is pledged the same share of $t = 1, 2$ cash flows and liquidation proceeds. Then, such creditor does not interfere with continuation as long as the manager, in addition to continuing the firm, repays $y_1 + (1-\alpha)\,y_2$ to the creditors as a whole. The controlling creditor, given the share $x$ of proceeds he is entitled to obtain, prefers to get $x\,[(1-\alpha)\,y_2 + \alpha y_2] = xy_2$ under continuation than $xL$ under liquidation. Notice that here achieving the efficient outcome does not rely on assuming than when $y_1 > y_2$ continuation is always efficient. In fact, if $L > y_2$ instead, the creditor in control would liquidate the firm because by doing so he increases his repayment, not only ex post efficiency. In sum, when $y_1 > y_2$ an ex post efficient outcome is implemented because the debtor has always sufficient cash to bribe the creditor into efficient reorganization.

the social benefits of efficient reorganization, removing any liquidation bias on his part. Crucially, note that even in this general setting the extent of under-collateralization of the controlling creditor increases as $\alpha$ becomes lower. Indeed, if $\alpha = 1$, then $\upsilon = 1$ and $l = 1$ as well, suggesting that the under-collateralization of the creditor in control is a general feature of optimal debt structures when liquidation proceeds are easier to pledge than cash flows. More broadly, the extent of reorganization in the constrained optimum falls as $\alpha$ falls [as reflected by the fact that $\upsilon$ and thus $L^*(y_2, y_1)$ fall as $\alpha$ falls], precisely capturing the idea that at low investor protection it is ex ante optimal to have inefficient liquidation. ■

**A2.2: $E$ has superior information on $y_2$.** If only $E$ is informed on $y_2$, then the debt structure must induce him to truthfully report it. From the proof of Proposition 1 it is easy to see that in this case $E$ must obtain an amount $(1-\alpha)\underline{y}_2$ of liquidation proceeds. As a result, the initial debt structure provides $E$ with incentives to disclose his superior information by compensating him for the private benefits of control he foresakes. Such thrutful revelation can be combined with investor control by giving the investor the incetive to use the information revealed by $E$ efficiently, much in the spirit of Proposition 2. The only difference is that now creditors can at most obtain:

$$\pi(\overline{y}_2 + \alpha y_1) + (1-\pi)\left[L - (1-\alpha)\underline{y}_2 + \alpha\overline{y}_2\right]/2.$$

The ex ante feasibility of the first best is lower because if $E$ obtains some informational rent then total repayment to the other creditors is lower. If the above expression is greater than $K$, then the debt structure of Proposition 2 yields the first best. Otherwise, *straight debt* must be used and the second best is attained. ■

# Appendix 3: Data

**Table A1 - Regressions Results**[36]

| | $Y$ = Efficiency of Debt Enforcement | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | Foreclosure +Floating Charge | Foreclosure | Liquidation | Reorganization |
| | (Blue solid line) | (Black dashed line) | (Yellow line) | (Red dotted line) |
| Anti Self Dealing Index | 57.86*** | 7.94 | 4.89 | 57.53** |
| | (8.90) | (10.39) | (19.77) | (23.34) |
| Constant | 37.00*** | 36.63*** | 51.62*** | 33.47*** |
| | (8.67) | (6.68) | (10.95) | (11.23) |
| $R^2$ | 0.87 | 0.11 | 0.00 | 0.14 |
| Observations | 8 | 6 | 19 | 28 |

[36] The table presents regressions for 61 countries in 2005. The dependent variable is efficiency of debt enforcement, is described in Table A3 and comes from Djankov et al. (2008a). The anti self dealing index is a discrete variable that equals one if the sovereign is in default in year t-1, zero otherwise. following Djankov et al. (2008b). Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity using the Huber (1967) and White (1980) correction. Column 1 refers to countries adopting foreclosure with floating charge. Column 2 refers to countries adopting foreclosure without floating charge. Column 3 refers to countries adopting a liquidation bankruptcy procedure. Column 4 refers to countries adopting a reorganization bankruptcy procedure. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

**Table A2 - Comparison of Foreclosure and Foreclosure with Floating Charge**[37]

| | Foreclosure | |
|---|---|---|
| | Floating Charge | No Floating Charge |
| | A. High (= above median) Anti Self Dealing Index | |
| Time | 0.60 | 3.45 |
| | 0.60 | 3.45 |
| Cost (%) | 6.00 | 18.25 |
| | 5.50 | 18.25 |
| Going concern | 1.00 | 0.00 |
| | 1.00 | 0.00 |
| Efficiency | 90.70 | 42.25 |
| | 91.04 | 42.25 |
| Observations | 5 | 2 |
| | B. Low (= below median) Anti Self Dealing Index | |
| Time | 1.40 | 1.95 |
| | 1.43 | 2.38 |
| Cost (%) | 18.00 | 11.75 |
| | 16.83 | 12.12 |
| Going concern | 0.00 | 0.00 |
| | 0.33 | 0.00 |
| Efficiency | 46.70 | 40.40 |
| | 53.80 | 38.60 |
| Observations | 3 | 4 |

[37] The table presents the median and median values of time, cost, expectation of keeping Mirage as a going concern, and efficiency of debt enforcement organized by both the anti self-dealing index and the debt enforcement procedure. Debt enforcement procedure is foreclosure with and without floating charge. Panel A reports statistics for countries with above median value of the anti self-dealing index, and Panel B reports statistics for countries with below median value of the anti self-dealing index.

**Table A3 - Description of the Variables Used in the Analysis**

| Variable | Description |
|---|---|
| Anti Self Dealing Index | Ranges from 0 to 1. It is the average of ex ante and ex post private control of self-dealing. In turn, the index of ex ante control of self-dealing transactions is the average of approval by disinterested shareholders and ex ante disclosure; and the index of ex post control of self-dealing transactions is the average of disclosure in periodic filings and ease of proving wrongdoing. Source: Djankov et al. (2008b). |
| Time | Estimated duration, in years, of the time to resolve the insolvency case; measures the duration from the moment of default to the point at which the fate of the firm is determined, i.e., when it is either sold as a going concern, sold piecemeal, or successfully reorganized. Source: Djankov et al. (2008a). |
| Cost (%) | Estimated cost of the debt enforcement proceeding for Mirage, reported as a percentage of the value of the estate, borne by all parties; costs include court/bankruptcy authority costs, attorney fees, bankruptcy administrator fees, accountant fees, notification and publication fees, assessor or inspector fees, asset storage and preservation costs, auctioneer fees, government levies, and other associated insolvency costs. Source: Djankov et al. (2008a). |
| Going concern | Equals 1 if the firm continues operating as a going concern both throughout and upon completion of the insolvency process, 0 otherwise Source: Djankov et al. (2008a). |
| Efficiency of Debt Enforcement | It is computed as $E = \frac{100 \times GC + 70 \times (1 - GC) - 100 \times c}{(1+r)^t}$, where $GC$ is Going Concern, $c$ is Cost, $t$ is Time and $r$ is the nominal lending rate. The variable ranges from 0 (low efficiency) to 100 (high efficiency) and the source is Djankov et al. (2008a). |

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