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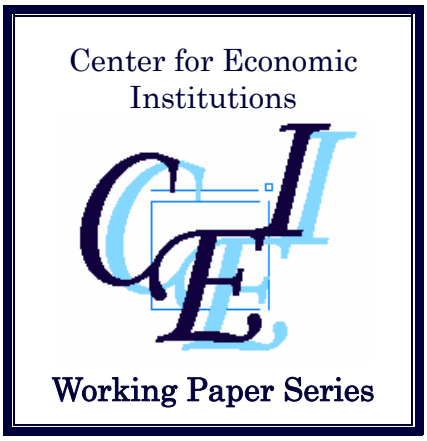

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Optimal Resolutions of Financial Distress by Contract

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Abstract

We study theoretically the possibility for the parties to efficiently resolve financial distress by contract as opposed to exclusively rely on state intervention. We characterize which financial contracts are optimal depending on investor protection against fraud, and how efficient is the resulting resolution of financial distress. We find that when investor protection is strong, issuing a convertible debt security to a large, secured creditor who has the exclusive right to reorganize or liquidate the firm yields the first best. Conversion of debt into equity upon default allows contracts to collateralize the whole firm to that creditor, not just certain physical assets, thereby inducing him to internalize the upside from efficient reorganization. Concentration of liquidation rights on such creditor avoids costly inter-creditor conflicts. When instead investor protection is weak, the only feasible debt structure has standard foreclosure rights, even if it induces over-liquidation. The normative implications are that lifting legal restrictions on floating charge financing, convertibles and concentration of liquidation rights, and increasing investor protection against fraud should improve the efficiency of resolutions of financial distress.

JEL classification: G33, K22.

Keywords: Corporate Bankruptcy, Creditor Protection, Financial Contracting.

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1 Introduction

The efficient resolution of financial distress calls for liquidating unprofitable firms and reorganizing those firms that are only temporarily insolvent, while at the same time ensuring that creditors are repaid. In the real world financial distress is often resolved under state-mandated procedures and court supervision. Yet both practitioners and academics are dissatisfied with existing procedures, which are regarded as favoring the piecemeal liquidation of healthy firms, the lengthy reorganization of unprofitable ones, and the reduction of contractual repayment to creditors (e.g. Hart 1995, Franks, Nyborg and Torous 1996). Accordingly, academics have advanced several proposals to reform existing state-mandated bankruptcy procedures.[1]

Of course, it is not immediately obvious why an efficient resolution of financial distress should rely on state-mandated procedures to begin with, instead of just leaving everything to contracts. Indeed, some law and economics scholars have argued in favor of a contractual resolution of financial distress (e.g. Schwartz 1997, Rasmussen 1992). According to this view, optimal debt contracts would include provisions for resolving financial distress efficiently, allowing the parties to do away with state intervention. The typical counter-argument is that such optimal contracts are too complex or costly for the parties to devise, especially when ex post conflicts among multiple creditors need to be taken care of (Hart 1995, 2000).

In practice, the full extent of the parties' inability to write contracts about financial distress is hard to gauge. The reason is that in the real world such contracts are often just legally forbidden or overruled by bankruptcy courts. Thus, the parties' reluctance to contract about financial distress may just reflect such legal restrictions to private contracting rather than the parties' inability to contract in the first place. What would happen if those legal restrictions were lifted?

This paper presents a model where the parties are both able and legally free to contract about financial distress. This theoretical experiment allows us to ask, which contracts help to efficiently resolve financial distress? Under which conditions are these contracts more efficient? Answering these questions can shed light on exactly which contractual provisions the parties need to be able to write, providing a testing ground for the possibility of a contractual resolution of financial distress.

Our idea is that relatively simple debt contracts may allow the parties to efficiently resolve financial distress. In particular, contracts should collateralize the firm's reorganization value to the

[1] See for example Aghion, Hart and Moore (1992), Berglöf, Roland and von Thadden (2003), Cornelli and Felli (1997), Povel (1999), Berkovitch and Israel (1999), Bernhardt and Nosal (2004), Giammarino and Nosal (1994), Chen and Sundaresan (2003), Ayotte and Yun (2006), and most recently Eraslan and Yilmaz (2007).

creditors, not just certain physical assets. This way, contracts can allow creditors to fully internalize the upside from efficient reorganization, while at the same time maximizing contractual repayment.

In practice, we argue that even in the absence of legal restrictions the ability of contracts to collateralize the firm's reorganization value depends on the extent of managerial tunneling (Shleifer and Vishny 1997). When those who control a corporation can divert its profits to themselves, very few of the reorganization proceeds can be collateralized to the creditors.

Section 2 presents a simple model of credit where one creditor and one entrepreneur try to resolve financial distress by way of an ex ante contract but face the risk of insiders' tunneling. We parameterize legal protection against tunneling by the share of the firm's reorganization value that contracts can pledge to creditors. We find that under strong protection against tunneling the firm's reorganization value can be collateralized by using a "convertible debt" contract. Under such contract the creditor is pledged both physical collateral and an equity stake in the reorganized firm. The creditor has also the exclusive right to decide whether to liquidate or reorganize the firm upon default. The equity stake in the reorganized firm makes the creditor residual claimant to the firm's reorganization value; physical collateral makes him claimant to the firm's liquidation value. As a result, when investor protection against tunneling is strong, our "convertible debt" contract allows the investor to internalize both the social benefits and costs of reorganization, allowing the parties to attain a first best efficient resolution of distress.[2]

If legal protection against tunneling is low, then the creditor is better off by ousting the management and triggering a quick piecemeal liquidation than by going through a lengthy reorganization that only increases the risk of tunneling. In this case financing ex ante requires committing to liquidation ex post, for example via a "straight debt" contract giving only standard foreclosure rights to the creditor. The piecemeal liquidation of healthy firms is thus the price to pay to ensure financing when legal protection against tunneling is low.[3]

These results already show that – provided legal protection against tunneling is strong enough

[2] This mechanism may remind the reader of bankruptcy reform proposals (e.g. Aghion, Hart and Moore 1992) relying on conversion of debt into equity upon default. However, our "convertible debt" differs from the Aghion, Hart and Moore (1992) proposal in one vital respect. In our optimal contract, debt is converted into equity only *after* (not before) the investor has decided to reorganize the firm. If the firm is liquidated, the investor obtains the value of his physical collateral. As we shall see, giving the investor an equity stake *in addition* to physical collateral crucially fosters the ability of contracts to give the investor the incentive to efficiently resolve financial distress. It is also important to stress that Aghion, Hart and Moore only focus on ex post efficiency: they do not study ex ante issues and do not study what mechanisms are optimal at low levels of investor protection. Section 5.3 compares our results with the Aghion, Hart and Moore (1992) proposal in greater detail.

[3] Our model also rationalizes the need for debt contracts to rely on courts' expertise when legal protection against tunneling is intermediate. In addition, Section 3 shows that a similar convertible security to the one just described also ensures the first best when only the debtor knows the firm's reorganization value.

– a simple convertible security has the potential for resolving financial distress efficiently. To fully test such potential we need to study the case with multiple creditors, as a major argument for state intervention in bankruptcy is the concern that under contractual freedom conflicts among creditors would lead to the liquidation of viable firms (e.g. Jackson 1986).

Section 4 studies the case of multiple creditors. We consider the three leading inter-creditor conflicts stressed by bankruptcy scholars: the conflict among secured creditors leading to inefficient runs on the firm's assets and thus to over-liquidation (Bolton and Scharfstein 1996), the conflict between secured and unsecured creditors also leading to over-liquidation (Hart 1995), and the conflict between existing and new creditors, leading to under- and over-investment in financial distress (Myers 1977, Jensen and Meckling 1976, Gertner and Scharfstein 1991).

We find that the optimal debt structure has two main ingredients. First, liquidation rights should be concentrated on a single large lender. Even if many creditors can have the right to cash some liquidation proceeds, only the large lender can command that the firms' assets be partially or totally liquidated, regardless of the other creditors' ex post preferences. Second, an equity stake in the reorganized firm should be pledged under a convertible debt contract to such large lender (whose debt claim should in turn be under-secured), so as to induce him to internalize the upside from efficient reorganization. The rest of the lending should then be dispersed among many creditors.

Intuitively, concentration of liquidation rights on the large lender avoids inefficient runs on the firm's assets. Thus, inter-creditor conflicts do not necessarily follow from freedom of contracting, despite common intuition to the contrary (e.g. Jackson 1986). At the same time, convertible debt gives such lender the incentive to implement the efficient reorganization policy upon default. Importantly, these incentives also prevent him from abusing his power by threatening other parties that he will inefficiently reorganize or liquidate the firm to force an opportunistic restructuring. Finally, dispersion of the rest of the lending prevents the formation of coalitions of creditors that might sometimes bribe the holder of liquidation rights into inefficient liquidation.

Little changes if new creditors need to join the firm's debt structure in financial distress, for example to finance a new investment opportunity. In this case, the large creditor is given the additional, exclusive right to decide whether to allow any supra-priority financing. However, the reorganization proceeds accruing to such large creditor should be reduced by a fixed proportion of any new, supra-priority financing. This way, not only does conversion of debt into equity allow the creditor to internalize the upside of re-financing, but also its downside, thereby triggering re-financing if and only if the investment opportunity has a positive NPV. As a result, we show that

the problems usually associated with the multiplicity of creditors in financial distress are more likely the result of sub-optimal debt structures rather than intrinsic problems of financial distress.

Much in the spirit of the single creditor case, we find that the optimal debt structure just discussed is feasible only when legal protection against tunneling is strong. When legal protection against tunneling is weak the only feasible debt structures give standard foreclosure rights to the creditors, thereby triggering ex post inefficient liquidations and under-investment.

These results rationalize the evidence that more developed countries have a comparative advantage at using more flexible financial contracts (Lerner and Schoar 2005, Qian and Strahan 2006) and more flexible resolutions of financial distress (Djankov et al. 2006).

Remarkably, our results indicate that a quite simple debt structure can attain an efficient resolution of financial distress. Interestingly, many of the features of our optimal debt structure are indeed observed in some common law countries such as the U.K., where the parties are allowed to finance under a floating charge. Much in the spirit of our convertible contract, upon default the floating charge holder becomes the residual claimant to the whole firm (not just to the value of its physical assets). Consistent with our model the floating charge holder has the exclusive contractual right to liquidate the firm and the rest of the lending is dispersed (Franks and Sussman 2005). To the best of our knowledge, our paper is the first to rationalize floating charge financing in an optimal contracting setup.

These considerations lead to the normative implications of our analysis, discussed in Section 5. First, our analysis suggests that there might be significant benefits in increasing contractual freedom as opposed to exclusively rely on state intervention to resolve financial distress. Concretely, legal reform should focus on allowing floating charge, convertibles and concentration of liquidation rights. These recommendations stand in sharp contrast with current practice in many countries where bankruptcy codes impose ex post unanimity or supra-majority voting rules, overrule convertibles (Smith and Strömberg 2003) and, most important, forbid the floating charge (e.g. Djankov et al. 2006) despite evidence that when it is used it works pretty well (Djankov et al. 2006, Franks and Sussman 2005)[4].

Second, to maximize the gains from private contracting, reforms enhancing freedom of contract should be combined with reforms enhancing investor protection against fraud in general anti

[4]There is a concern that the U.K. system may favor inefficient liquidations. In light of our model, this is consistent with the fact that U.K. courts sometimes allow several creditors to unilaterally repossess collateral upon default (e.g. Franks and Nyborg 1996), thereby countering the concentration of liquidation rights in the hands of the floating charge holder.

self-dealing provisions in company law (Djankov et al. 2005) and more specifically in fraudulent conveyance law in bankruptcy codes (e.g. Baird 2006). Section 5 stresses the advantages of our proposals with respect to leading academic proposals for bankruptcy reform (Aghion, Hart and Moore 1992, Bolton and Rosenthal 2002, Jensen 1989).

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). A two-period firm requires an initial outlay of $K > 0$ for the purchase of a physical asset. The firm is run by a penniless entrepreneur whose human capital is indispensable. In period 1, with probability π 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 μ 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 $\mu = 1/2$.

Figure 1. States of Nature

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

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, as opposed to the value $y_2(\omega)$ generated by a reorganization. In state U, the reorganization value of the firm $y_2(U) = \overline{y}_2$ can be interpreted both as the value under E, and as the value under an alternative management team generating $y_{ALT} = \overline{y}_2$.[5] Both investment and liquidation are

[5] This setup helps us to illustrate our findings in the most intuitive manner, but Appendix A2.1 shows that our

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 Contracting Frictions

We stress two contracting frictions. The first 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 α. Our model nests the Hart and Moore (1998) case of unverifiable cash flows as a special case when $\alpha = 0$. We thus allow for non-dissipative private benefits (Aghion and Bolton 1992), but the size of such private benefits depends on the extent of investor protection α, using a formulation introduced in a different context by Shleifer and Wolfenzon (2002) and Johnson et al. (2000). This formulation allows us to ask one key question of our paper, namely how do contractual resolutions of financial distress vary with investor protection.

Such contracting friction introduces two differences with respect to Hart and Moore (1998). First, in our model the first period liquidation proceeds pledgeable to I are not just equal to L but to $L + \alpha y_1(\omega)$, that is equal 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. Second, and 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 zero in the Hart and Moore (1998) model. Notice that E can fully pledge physical collateral L as

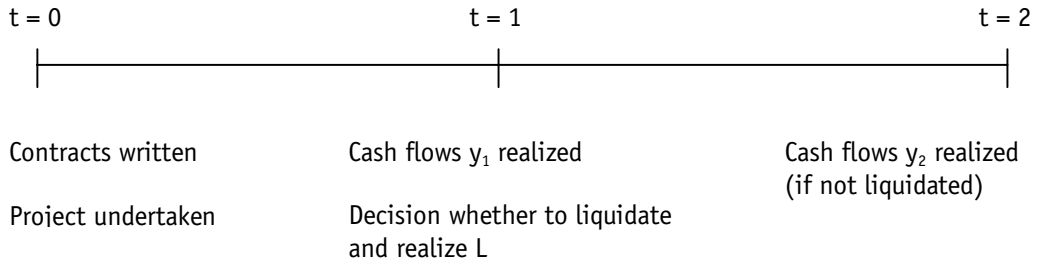
basic results generalize to a setting where first and second period profits as well as liquidation values are stochastic and take on a continuum of values.

in Hart and Moore (1998) but can only pledge other less tangible property up to the extent of investor protection α. We could allow investor protection to increase the pledgeability of physical collateral, too. All of our results still go through as long as investor protection makes it relatively easier to pledge cash flows than physical assets.

The second contracting friction we consider is the courts' precision in estimating the firm's reorganization value. We assume that courts correctly estimate the continuation value with probability $1-\theta$. As a result, in state B (U) the court mistakenly believes that the entrepreneur is unlucky (bad) and that the firm should be reorganized (liquidated) with probability $\theta \leq 1/2$. Hence, θ captures the (lack of) judicial expertise in estimating the firm's reorganization value.[6] As in Aghion and Bolton (1992) one can view θ as an index of contractual incompleteness, which arises from the parties' impossibility to fully specify ex ante under what circumstances the firm should be liquidated or reorganized, that is whether the state is B or U. We thus allow the parties to contract also on the realization of courts' estimates of the reorganization value. Indeed, if courts can perfectly estimate the firm's reorganization value, then financial distress can be efficiently resolved simply by letting courts decide whether to liquidate or reorganize an insolvent firm.

What about the parties' information structure? We assume that E and I are perfectly informed about the firm's reorganization value, but – as we will discuss – our main results also extend to the case where only E is informed. 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. First period repayments can be contingent on the state of nature. We then allow contracts to allocate to

[6] We mainly interpret θ as reflecting courts' inability to directly verify the firm's reorganization value, but one might also interpret it as stemming from the parties' choice to contract on a fully verifiable signal with imprecision θ.

E, I or the court the decision of whether to liquidate or reorganize the firm after first period profits and repayment. Thus, we further depart from the Hart and Moore (1998) model by allowing parties to write contracts contingent on the state of financial distress. In the spirit of Aghion and Bolton (1992), we allow for contracts specifying I or E control. However, we further depart from Aghion and Bolton (1992) by allowing 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 will see, the parties' ability to provide such incentives (and the resulting efficiency of contracts) will depend on α , that is on E's ability to pledge to I the firm's reorganization value.[7]

3 Contractual Resolutions of Financial Distress

We now study the extent to which the parties can resolve financial distress by appropriately designed debt contracts in the case with one creditor. We first study the case without ex post renegotiation, and summarize the results in Proposition 1. We then turn to the case of renegotiation and summarize the results in Proposition 2. We highlight the key results of our analysis by focusing only on the states U and B where the project is in financial distress. The Appendix studies the optimal contract by taking also state G into account.[8]

3.1 Optimal Contract Terms

In states U and B first period repayment is zero, the firm is in financial distress, and the key decision to be made is whether the firm should be liquidated, which is efficient in B, or reorganized, which is efficient in U. As stressed by Jensen (1991) the decision is complicated by the fact that on the one hand bankruptcy courts often lack the ability to independently assess the firm's reorganization value (i.e. whether the state is U or B), on the other hand the parties lack the incentive to report unbiased estimates of such value.

[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.

[8] Disregarding state G is not important, because contract terms for G are set in isolation. The independence of G from U and B arises 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). As a result, G only affects the optimal resolution of financial distress in states U and B by affecting the ex ante break even constraint. The alternative assumption that courts cannot perfectly tell apart strategic and liquidity defaults would only complicate the analysis without changing our main results. Note that, as in Hart and Moore (1998), although strategic default in state G is a theoretical possibility, it will never arise in equilibrium under optimal contract terms.

It turns out that such conflict can be solved by the parties with an ex ante debt contract, provided that they can effectively write claims on the firm's reorganization value. Suppose that we are in a *contractual freedom* regime, that is there are no legal restrictions in doing so. Then, the parties can implement an ex post optimal reorganization decision by collateralizing to I the whole reorganization proceeds $\alpha\overline{y}_2$ and not just certain physical assets.

Consider for example the case where, in addition to a claim on the firm's reorganization proceeds, I is also given control over the decision of whether to liquidate or reorganize. If $\alpha\overline{y}_2 \geq L$, even if I has foreclosure rights on all of the firm's physical assets, he still finds it optimal to liquidate if and only if the state is B, consistent with ex post optimality. If instead $\alpha\overline{y}_2 < L$, then under the previous contract I has a bias for liquidation and thus liquidates also in state U. An ex ante contract can remove such bias by lowering I's proceeds from liquidation, for example through a debt write-down for an amount S such that:

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

Hence, as long as the parties can contract ex ante on the firm's reorganization value, contracts can allow the investor to internalize the social costs and benefits of the decision to liquidate or reorganize, thereby triggering an ex post efficient outcome. In practice, one simple way to give I such incentives is to use floating charge financing, as in many common law countries (Djankov, et al., 2006). Unlike the fixed charge, which corresponds to collateral over certain specific physical assets, the floating charge is a security that can be extended to cover the whole pool of the company's assets, including intangibles and working capital (i.e. cash, receivables and future cash flows). In the context of our model, a floating charge corresponds to pledging to I the reorganization proceeds $\alpha\overline{y}_2$. One way to implement our optimal contract in practice is to give I: 1) a floating charge, 2) a fixed charge on some of the firm's physical assets (i.e. on $L - S$), and 3) the contractual right to decide whether to seize the company's assets and liquidate them.[9]

The full potential of floating charge financing will be seen in Section 4, where E borrows from multiple creditors. However, the one-creditor case already shows a key property of the floating

[9] Expression (1) already shows one key difference between our optimal contract and the Aghion, Hart and Moore (1992) proposal to convert debt into equity upon default. Under the latter, a debtholder given a fraction x of shares votes for reorganization if and only if $x\alpha\overline{y}_2 \geq xL$. If $\alpha < 1$, some socially profitable reorganizations are passed. By contrast, allowing the floating charge holder to choose between his physical collateral $L - S$ and equity in the reorganized firm allows parties to give him the incentive to efficiently reorganize even at relatively low α.

charge: it allows contracts to pledge the firm's reorganization value to I, who in turn internalizes the upside from efficient reorganization. As a result, with respect to physical collateral, the floating charge induces I to take an efficient reorganization decision and at the same time maximizes contractual repayment. For example, if $\alpha\overline{y}_2 > L$ the floating charge induces efficient reorganization in U and allows I to receive a repayment of $\alpha\overline{y}_2$. Under physical collateral alone instead, not only is the creditor biased towards liquidation but, even if renegotiation takes place, in U the investor obtains strictly less than $\alpha\overline{y}_2$ as long as he does not have all the bargaining power.

Another contract that closely resembles the floating charge is convertible debt. Under convertible debt, the debt contract gives I a large equity stake upon default and reorganization. This way, the contract collateralizes to I the whole reorganized firm as opposed to just certain physical assets.[10] Unlike many standard convertibility clauses, however, our conversion mechanism does not rely on financial markets providing the market value of shares (which is at best noisy in financial distress), but on the parties' reorganization decision. Notwithstanding this key difference, for ease of exposition we call *convertible debt* the above contractual typology.[11]

The contract just considered relies on I being perfectly informed about the firm's reorganization value. Of course, it may sometimes be the case that only E is perfectly informed about the firm's reorganization value. In such case, an ex post efficient outcome is attained under a convertible debt contract where E controls the decision whether to liquidate or reorganize a financially distressed firm. In case of reorganization, the contract commits E to give I an equity stake in the firm. Yet, this is not enough, as E would then always reorganize to get (at least) $(1-\alpha)\,\underline{y}_2 > 0$. To remove E's pro-reorganization bias, some liquidation proceeds must be given to E, for example via a debt write-down S such that:

$$(1-\alpha)\overline{y}_2 \geq S \geq (1-\alpha)\underline{y}_2. \tag{2}$$

Once more, the conflict between the parties is solved by giving E the incentive to implement the ex post efficient policy. In Section 5, we will show that this contract effectively amounts to allowing E to make a non-cash bid for the firm and thus rationalizes some aspects of the Aghion, Hart

[10] While floating charge and convertible debt are formally different (i.e. the floating charge holder does not literally receive equity upon default), they share the same property of making I residual claimant of the firm upon default. In Section 5 we argue that a key difference between these two contracts concerns the extent to which their relative performance depends on creditor vs. shareholder protection against fraud.

[11] Our convertible debt contract has a key difference with the convertible debt contract studied by Aghion and Bolton (1992). Aghion and Bolton (1992) interpret conversion of debt into equity as triggering a shift in control rights from E to I. By contrast, in our optimal contract conversion of debt into equity occurs *after* I has decided to reorganize. Thus, in our model conversion provides I with incentives to take an efficient reorganization decision.

and Moore (1992) proposal for bankruptcy reform and dominates proposals for resolving financial distress by using cash auctions (Jensen 1989).

Although the above convertible securities resolve financial distress in an ex post efficient manner, their ex ante optimality hinges on strong legal protection against tunneling. Indeed, the expected repayment I obtains in financial distress under convertible debt is:

$$(1/2)\left[\alpha\overline{y}_2 + (L - S)\right]. \tag{3}$$

Poor protection against tunneling can undermine break-even via two channels: first, very little of the reorganized firm can be pledged to I ($\alpha\overline{y}_2$ is low); second, when α is low, only a high S induces I to reorganize in U and E to liquidate in B. This second effect indicates that achieving ex post optimality with convertible debt is costly if investor protection is low also because providing the parties with appropriate incentives may undermine ex ante break even.

If α is so low that convertible debt is infeasible, ex ante financing requires E and I to sacrifice ex post efficiency. A simple way to go is thus to write a debt contract whereby I commits to terminating the project in financial distress. This contract is akin to the Hart and Moore (1998) debt contract, whereby foreclosure automatically follows non-repayment. We call this arrangement *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 convertible debt whenever $\alpha\overline{y}_2 < L$. Unfortunately, this ex ante benefit comes at the cost $(\overline{y}_2 - L)/2$ of over liquidating the firm in U. As a result, even if convertible debt is infeasible, can the parties improve ex post efficiency with respect to *straight debt* by using courts' expertise?

Of course, the answer is yes if courts can perfectly estimate the firm's reorganization value ($\theta = 0$). In this case courts become mechanistic executors and the parties trivially dispose of the firm by writing a "complete contract" mandating liquidation only in state B. If instead courts are imperfectly informed, then using their expertise may result in over and under-liquidation. Still, we find that the parties are willing to use judicial expertise in their contract. In particular, it is optimal for E to issue a *convertible debt* contract with a state-contingent debt write-down $S(\omega)$, such that $S(B) = 0$, and $S(U) = L - \alpha\overline{y}_2$. While this contract still gives I control upon default and equity upon reorganization, it specifies a positive debt write-down only when necessary (i.e. in state U, where I should reorganize). To underscore the importance of its state-contingent

convertibility clause, we call such contract *contingent debt*.[12] Under *contingent debt*, the firm is efficiently liquidated in B and over-liquidated with probability $\theta < 1$ in state U. Thus, *contingent debt* outperforms *straight debt* ex post. In addition, irrespective of θ, in financial distress I obtains:

$$(1/2)\left[\alpha\overline{y}_2 + L\right]. \tag{4}$$

By comparing (3) and (4), it is easy to see that if $\alpha\overline{y}_2 < L$, then *contingent debt* outperforms *convertible debt* ex ante. Indeed, the use of judicial expertise reduces, for any level of investor protection α, the share of liquidation proceeds that must accrue to E so as to provide the parties with appropriate incentives to reveal their information about the firm's reorganization value.[13]

To summarize, the above contractual resolutions of financial distress differ as to how they trade off investor break even (ex ante efficiency) with efficient reorganization (ex post efficiency). *Straight debt* maximizes the former at the expense of the latter; *convertible debt* maximizes the latter at the expense of the former; *contingent debt* is between them. Hence, whenever feasible *convertible debt* yields the first best, *contingent debt* the second best and *straight debt* the third best. Are there other contracts that resolve financial distress more efficiently? More importantly, how does investor protection α affect contracting and welfare? We find[14]:

Proposition 1 *Under contractual freedom, there exist $\alpha_{CO} \geq \alpha_C \geq \alpha_S$ such that I breaks even if and only if $\alpha \geq \alpha_S$. For $\alpha \geq \alpha_{CO}$, the parties attain the first best by resolving financial distress with convertible debt. For $\alpha \in [\alpha_C, \alpha_{CO})$, the parties attain the second best by resolving financial distress with contingent debt. In this range, social welfare decreases in θ. For $\alpha \in [\alpha_S, \alpha_C)$, the parties attain the third best by resolving financial distress with straight debt.*

Straight debt, *convertible debt* and *contingent debt* are the most efficient contracts for the parties to resolve financial distress.[15] Crucially, legal protection against tunnelling α shapes their

[12] In fact, unlike in Aghion and Bolton (1992) where contingent control can be optimal, in our model contingent control is always dominated by *contingent debt*, both ex post and ex ante. See the Appendix for details.

[13] If only E knows the firm's reorganization value, then the only possible use of judicial expertise is to let the court directly decide what to do with the firm. In this case, the court's errors induce both over and under-liquidation and also reduce I's repayment which is equal to $L + \alpha\overline{y}_2 - \theta(\overline{y}_2 - \underline{y}_2)$.

[14] To preserve our focus on contracts, Proposition 1 (as well as Proposition 2) only reports which of the above defined contractual typologies is used as a function of α. Detailed Proofs, including the expression for total debt capacity at different levels of α, can be found in Appendix 1.

[15] In principle, in the symmetric information interpretation of our model, the parties might avoid using court's expertise by including in their contract 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 firm is liquidated and the proceeds are paid to charity. This

optimality by shaping the trade off between ex ante and ex post efficiency. If α is low, tunneling of the firm by the controlling shareholders presents a major problem for creditors, creating pressure for a quick piecemeal sale. To attain break even, the parties must commit to always liquidate ex post by using *straight debt*.[16] As a result, in our model the use of automatic foreclosure on the debtor's physical assets endogenously depends on low protection against tunneling α.

As α becomes higher, creditors see the upside of reorganizing a profitable firm. In this case, if they are allowed to write claims on the firm's reorganization value, debt contracts can improve ex post efficiency relative to straight debt. If α is high ($\alpha \geq \alpha_{CO}$), investor break even is easy to attain and the parties reach the first best by using *convertible debt*. The debtor now pledges the whole reorganized firm as collateral, not only specific physical assets, thus providing I with incentives for efficient reorganization. Alternatively, E may be allowed to reorganize by pledging to I an equity stake in the reorganized firm, which would also induce an ex post efficient outcome.

If α is intermediate ($\alpha_C \leq \alpha < \alpha_{CO}$), the cost of endogenous information revelation is so large that *convertible debt* is infeasible and the parties attain the second best under *contingent debt*. This contract still exploits the parties' information, because – for any enforced debt write-down – I must ultimately decide whether to liquidate or reorganize. However, the use of judicial expertise allows I's share of liquidation proceeds to be increased precisely when liquidation is efficient, thereby reducing the ex ante cost of incentives.

An objection to our result is that, even if the parties are allowed to contract about financial distress, they may also be allowed to renegotiate a new contract ex post. What happens to Proposition 1 when the possibility of ex post renegotiation is explicitly considered? We establish:

Proposition 2 *If I has all the bargaining power, then for $\alpha_C \leq \alpha < \alpha_{CO}$ there is a function $\theta_R(\alpha)$ increasing in α such that, for $\theta \leq \theta_R(\alpha)$, I lends $K + \theta(L - \alpha\overline{y}_2)$ and parties attain the first best by resolving financial distress under contingent debt. For every (α, θ) outside this region, contract*

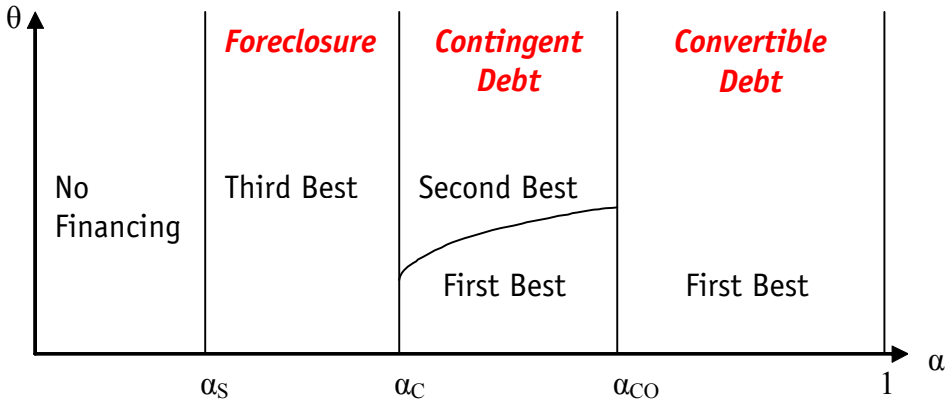
contract induces a truth telling Nash equilibrium implementing the first best with the appropriate assignment of payouts. Unfortunately, however, the players may also coordinate on two other Nash equilibria (always say B or always say U, where the latter equilibrium could be eliminated by fining the investor ex post for having told a lie). As a result, whenever feasible, *convertible debt* dominates this revelation game because it implements the first best as a unique equilibrium. In addition, if there is uncertainty over which equilibrium the parties will coordinate on, the use of judicial expertise would improve over this contract as long as court's imprecision θ is not too high. Finally, there are reasons to believe that the parties will readily renegotiate away the outcome of giving all liquidation proceeds to charity. In this case, it would be highly unlikely for this contract to improve upon *contingent debt*. Once more, the advantage of contingent debt over this revelation game depends on the fact that the conflict among the parties is too intense to be properly resolved with incentives such as giving the liquidation proceeds to charity.

[16] Assumption A.2 matters here: it implies that if *straight debt* guarantees financing, E prefers to sign it rather than doing nothing. Yet, the main features of contract choice remain valid, even if A.2 does not hold.

choice and welfare are the same as in Proposition 1.

Under contractual freedom, ex post bargaining affects the resolution of financial distress very little. The intuition is that the enforcement constraints restricting ex ante contracts also hold ex post when renegotiation occurs. For example, when *straight debt* is optimal it is also renegotiation-proof because E cannot pledge to I enough of the firm's reorganization value to prevent liquidation in U. Renegotiation only matters when *contingent debt* is optimal. Now it is optimal for I to lend E the extra amount $\theta(L - \alpha\overline{y}_2)$, which allows E to bribe I ex post so as to avoid the over liquidation cost of courts' imprecision. Yet, this contract is feasible only if courts are sufficiently precise (i.e. if $\theta \leq \theta_R(\alpha)$), otherwise I should lend so much as to undermine break even.[17] Figure 3 plots contract choice and welfare as a function of (α, θ) as in Proposition 2**:**

Figure 3. Contract Choice



Broadly speaking, Figure 3 above 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 2006) and at more flexible resolutions of financial distress (Djankov et al. 2006). When investor protection is strong, the parties can commit to attaining an efficient resolution of financial distress by writing flexible convertibility clauses that allow the debtor to pledge the firm's reorganization value, not just certain physical assets, as collateral to the creditor which induces him to internalize the upside from efficient reorganization, thereby fostering

[17] Little changes if E has all the bargaining power. The Appendix shows that, with respect to Proposition 2, this change only reduces total repayment in G, thereby increasing the feasibility thresholds for all contracts.

efficiency. When investor protection is low, conversion of debt into equity exposes the creditor to the debtor's massive tunnelling. In such circumstances, the only ex ante feasible solution is for the parties to commit to always liquidate the firm piecemeal by writing more rigid *straight debt* contracts, with standard foreclosure rights.

From a welfare standpoint, our key result is that higher legal protection against tunneling (α) increases the efficiency of contractual resolutions of financial distress. When α is low resolving the conflict between the parties is very costly: debtors always want to reorganize so as to steal as much as they can, which in turn induces creditors to prefer a quick piecemeal sale. As a result, ex post inefficiencies are the price to pay for the creditor to break even. In addition, under *contingent debt* welfare decreases in courts' imprecision. In this respect, we confirm the role of courts' expertise in enabling an efficient resolution of financial distress stressed by Ayotte and Yun (2006), although here the result is derived in a model where contracts can explicitly provide the parties with suitable monetary incentives to reveal their information.

3.2 Private Workouts in the Absence of Contractual Freedom

In the real world the contractual solutions of financial distress described above are often not permitted. For example, bankruptcy courts typically override convertibility clauses, and many bankruptcy codes do not allow the use of floating charge finance (Djankov et al. 2006). More generally, many countries regulate the resolution of financial distress with mandatory bankruptcy procedures that hinder the parties' ability to deal with financial distress by way of ex ante contracts. A natural question is therefore to ask whether these legal constraints are actually binding. Do parties still resolve financial distress optimally despite the unavailability of contractual solutions? For example, ex post private workouts are permitted: the parties can avoid using the state-supplied bankruptcy procedure if they agree on a private workout after financial distress has occurred. The question then arises, even in a world with no contracting freedom, do these private workouts substitute for ex ante contracting?

We address this question by comparing what private workouts can accomplish in a world without contractual freedom to what the parties can attain when they are free to contract ex ante about financial distress. We characterize the absence of contractual freedom by assuming that the bankruptcy code induces a certain liquidation/reorganization decision and a certain division of the resulting proceeds among the parties, that is both "what to do with the firm" and "who gets what" (Hart 2000). We do not model how the specific provisions of the bankruptcy code induce such

outcomes. Our interest here is to take those outcomes as given and then ask, what can the parties attain by renegotiating ex post in a private workout? We find:

Corollary 1 *If at some (α, θ) the state-mandated bankruptcy procedure induces a different liquidation/reorganization outcome than the optimal contract, then ex post workouts deliver lower social welfare and/or lower average repayment to I than the optimal contract.*

This result immediately follows from Proposition 2. The main difference between ex ante contracts and ex post workouts is that while the former allow the parties to commit to an ex ante optimal outcome, the latter only allow the parties to avoid ex post inefficiencies. If the state-mandated procedure sometimes produces a different liquidation/reorganization outcome than the optimal contract, then either the workout fails because E is wealth constrained and the parties are stuck with an inefficient outcome, or the workout succeeds but then I must make some concessions to E (relative to the optimal contract maximizing repayment to I), thereby reducing I's repayment, especially if E has a lot of bargaining power. Intuitively, this is because the optimal ex ante contract maximizes ex post efficiency subject to I breaking even. In contrast, in an ex post workout the parties do not care about break even and only bargain to reach ex post efficiency. Thus, workouts may fail to guarantee I's break even, especially if the state-mandated procedure is biased towards inefficient reorganization.

Corollary 1 implies that, in the absence of contractual freedom, workouts are unlikely to attain the constrained optimal resolutions of distress attained under freedom of contracting. Of course, if for every (α, θ) the state-mandated procedure is identical to the optimal ex ante contract, then there is no welfare loss in abandoning contractual freedom. Unfortunately, this assumption does not square with the way state-mandated procedures work in practice (Djankov et al. 2006). Thus, our results indicate that increasing freedom of contracting as opposed to exclusively relying on state intervention may increase the ex ante efficiency of the resolution of financial distress. In particular, our results indicate that optimal contractual resolutions of financial distress must allow parties to internalize the upside from efficient reorganization. When investor protection is sufficiently high, two simple contracts sharing this key property are floating charge and convertible debt. Because we obtained these results in the case of one creditor it is natural to ask, how would our conclusions change were we to allow for multiple creditors?

4 Multiple Creditors

We now let the entrepreneur borrow from multiple creditors. Our goal is to address the often made point that, absent state intervention in financial distress, conflicts among multiple creditors would necessarily trigger inefficient outcomes. We study the three leading inter-creditor conflicts stressed by bankruptcy scholars: In Section 4.1 we study the two conflicts among pre-existing creditors, namely the conflict among multiple secured creditors leading to inefficient runs on the firm's assets (e.g. Bulow and Shoven 1978, Jackson 1986), and the conflict between secured and unsecured creditors, both leading to over-liquidation (e.g. Hart 1995, Manove, Padilla and Pagano 2001)**;** in Section 4.2 we allow for the arrival of new creditors and thus study the conflict between old and new creditors leading to over- or under-investment in financial distress (e.g. Gertner and Scharfstein 1991). In a regime of contractual freedom we thus ask, can E resolve the above conflicts and induce an efficient resolution of financial distress by suitably designing the firm's debt structure ex ante? How does the optimal debt structure depend on investor protection against fraud?

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 to scale simplifies the algebra but is not crucial for our results.

4.1 Conflicts Among Existing Creditors and the Optimal Debt Structure

We now consider the conflict among secured creditors and the conflict between secured and unsecured creditors. First we present a numerical example to show that in our model under certain ex ante debt structures both of these conflicts lead to over-liquidation. Then, we show that under the optimal ex ante debt structure over-liquidation does not arise.

Example. Suppose that $L = 10$, $y_1 = 100$, $\overline{y}_2 = 38$, $\underline{y}_2 = 6$, $\alpha = 1/2$. 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 $(1/2)*100+38 = 88$. Suppose that creditors as a group are owed 88 and the debt structure does not take financial distress into account. Furthermore, suppose that the multiplicity of creditors prevents them from bargaining ex post. This assumption of no bargaining ex post is commonly invoked to justify state intervention in financial distress. 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 $(1/2) * 38$, each getting 9.5. 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 both creditors have liquidation rights on the same pool of assets.

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 negligible, strictly positive cost. Clearly, the secured creditor has no benefit of acquiring information. Moreover, although reorganization is still efficient on average because it yields creditors $(1/2)\alpha(38 + 6) = 11 > 10$, the uninformed secured creditor liquidates because he only sees the downside of reorganizing, where he expects to get 6.5. 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 played an important role. In the first case, there were too many liquidation rights. In the second case, the repayment schedule of secured debt was too flat across states.

4.1.1 Replicating the One-Creditor Outcome under Multiple Creditors

The above examples raise the question, can E avoid the above inefficiencies by issuing a suitable debt structure ex ante? We then establish:

Proposition 3 *E can replicate the optimal single-creditor outcome under $n > 1$ creditors by concentrating in financial distress all liquidation rights on one secured creditor. At every (α, θ), such creditor is given the same type of debt contract that he would obtain in the single-creditor case.*

The rest of lending is raised from a number of secured and unsecured creditors. It is always possible for E to set repayment schedules sustaining the same resolution of financial distress and total repayment to creditors arising in the single-creditor case.

The one-creditor outcome can be replicated under $n > 1$ creditors by simply concentrating liquidation rights in financial distress on one creditor and by suitably choosing his security and collateral. As in the single-creditor case, if α is high this creditor is given convertible debt so as to obtain (upon default) an equity stake in the reorganized firm;[18] if α is intermediate such creditor is given contingent debt, which still gives him a stake in the reorganized firm but adjusts (through a debt write-down) the face value of his debt depending on courts' assessment of the firm's reorganization value. If instead α is low, the creditor is given straight debt, with standard foreclosure rights.[19] The key feature of the debt structure avoiding inter-creditor conflicts is that only one secured creditor is given the right to decide whether the firm is liquidated or reorganized and it is given, by contract, the incentive to take an optimal decision. To see this, suppose that in the numerical examples A and B above the ex ante debt structure was as follows:

There are two secured creditors, 1 and 2, each entitled to a first period repayment of 10. In financial distress, creditor 1 has the right to decide whether to liquidate or reorganize the firm. In reorganization, debt is converted into equity and creditor 1 is given 1/2 of it, while the rest is given to creditor 2. If creditor 1 liquidates, he gets 6. Notice that now if creditor 1 reorganizes, he gets $(1/2) * (1/2) * 6 = 1.5$ in state B and $(1/2) * (1/2) * 38 = 9.5$ in state U. As a result, if creditor 1 knows the state he implements the efficient reorganization policy. Consistent with Proposition 4, this debt structure efficiently resolves financial distress and maximizes ex ante repayment. There are neither inefficient runs nor lazy creditors. In particular, even if creditor 1 is uninformed and on average loses from reorganization (he gets less than 6), he is willing to spend more than 1.5 to obtain information about the firm's reorganization value – thus, contracts can yield an optimal

[18] In practice, due to their monitoring advantage banks are likely candidates to play the role of the large, secured creditor having control rights in financial distress (e.g. Diamond 1984).

[19] Other debt structures, besides the one highlighted in Proposition 3, can replicate the single creditor case. In particular, under the current assumption of constant returns to scale, one could trivially replicate the single-creditor case by dividing the firm into n identical pieces, each financed by a single creditor. We stress the centralized debt structure of the proposition because its optimality does not hinge on the assumption of constant returns to scale and because – as we shall see in Proposition 4 – the case for it is strengthened once one allows for renegotiation among creditors. It is however important to stress that, for α sufficiently large, any desirable debt structure uses our optimal convertible debt contract. For instance, automatic conversion of debt into equity upon default does not improve upon the debt structure of Proposition 3 for $\alpha > \alpha^* \equiv L/\overline{y}_2$ and it does strictly worse for $\alpha \in [\alpha^*, \alpha_C]$. Indeed, as already stressed in footnote 9, our convertible debt instrument is more effective than automatic conversion at giving the investor the incentive to efficiently resolve financial distress.

resolution of financial even if, as stressed by Kahl (2002), something new is learned in financial distress.

This result suggests that creditor runs and lazy creditors are more likely the results of a sub-optimal debt structure than intrinsic problems of financial distress. In particular, our analysis yields two key messages. First, inefficient runs on the firm's assets can be simply avoided by concentrating liquidation rights on a single creditor. Such concentration does not imply that there can only be one secured creditor in the debt structure: many other creditors can be secured in the sense of having the right to obtain some liquidation proceeds. However, these other creditors should not be allowed to unilaterally liquidate the firm's physical assets, otherwise runs might occur. It is precisely the concentration on a single creditor of the right to liquidate in part or totally a financially distressed firm that avoids inefficient runs. Thus, ex post unanimity does not necessarily follow from freedom of contracting, contrary to common wisdom (e.g. Jackson 1986).

Our second message is that giving the holder of liquidation rights a convertible security allows him to internalize the social value of reorganization, thereby avoiding the lazy creditor problem and resolving financial distress efficiently. As a result, the desirable properties of the simple convertible securities found in Section 3 in attaining an efficient resolution of financial distress appear to carry over to the case of multiple creditors.

Of course, one objection to our results is that concentrating liquidation rights on one creditor may be costly because such creditor may opportunistically use his power against other creditors ex post.[20] This issue is directly related to the possibility of ex post renegotiation, which was ruled out in Proposition 3. For example, the holder of liquidation rights may threaten to inefficiently reorganize an unprofitable firm, so as to force other creditors to accept an opportunistic distressed exchange. On a different note, while the current analysis suggests that it is possible to replicate the single creditor outcome under multiple creditors, it is silent as to whether under multiple creditors one can improve upon the single creditor outcome. To address these issues in the next section we study the optimal debt structure with multiple creditors when renegotiation can occur.

[20] In principle, the creditor may also use his power against the debtor. For example, in order to obtain a larger repayment, the holder of liquidation rights could threaten the debtor that he will precipitate financial distress and take over the firm. In our model, if the debtor chooses to repay his debt, there is no way in which the creditor can precipitate financial distress. However, even if such a threat was available, it would be easy to avoid it in our model. Indeed, it is always possible to set the size of the equity stake and the repayment under liquidation low enough that the creditor loses from financial distress. As a result, the creditor does not want to precipitate it.

4.1.2 The Optimal Debt Structure

Before studying renegotiation among creditors, it is interesting to notice that in our model there is a benefit of creditor multiplicity, stemming from the possibility of separating the allocation of liquidation rights and the allocation of liquidation proceeds. Such separation allows contracts to divorce the provision of incentives from total repayment, thereby reducing the incentive costs of *convertible debt*. As a result, under the optimal debt structure, the multiplicity of creditors may improve upon the single creditor case.

To see this, suppose that $\alpha\overline{y}_2 < L$. Then, with a single creditor ex post efficiency is attained via a positive debt write-down $S = L - \alpha\overline{y}_2$. This debt write-down reduces the creditor's repayment under liquidation, thereby reducing debt capacity. If instead E borrows from two secured creditors but only one of them holds liquidation rights, S can be paid to the other creditor, and not to E. Thus, in financial distress creditors as a whole obtain:

$$(1/2)(\alpha\overline{y}_2 + L). \tag{5}$$

Comparing (5) and (3) shows that in addition to avoiding creditors' runs the concentration of liquidation rights also reduces the ex ante cost of *convertible debt*. Now debt capacity is unaffected by incentive costs.

However, separation of liquidation and repayment rights is troubling under low protection against tunneling. In particular, this is the case when $\alpha < \alpha^* \equiv L/\overline{y}_2$. In this case $\alpha\overline{y}_2 < L$ and creditors as a group lose from reorganization. Hence, if creditors as a group are entitled to the full liquidation proceeds, they may collude against E and liquidate the firm in state U. This would reintroduce the ex ante cost of incentives. This is another reason for studying renegotiation among creditors: if other creditors can bribe the holder of liquidation rights, it may be harder for contracts to provide him with efficient incentives.

Can the optimal debt structure, i.e. the relative number, size and type of claims, avoid or limit the detrimental impact of ex post renegotiation among creditors? In the bankruptcy literature it is often assumed that the of multiplicity of creditors makes renegotiation impossible or very costly (e.g. Berglöf et al. 2003). We instead want to allow for some inter-creditor bargaining. To do so, we assume that even with multiple creditors bargaining can take place within a coalition of creditors**,** as long as such a coalition forms. Thus, to study such bargaining process we need to specify a process of coalition formation among $n > 1$ creditors. We assume:

A.3: With n creditors, a coalition of $s \leq n$ of them forms with probability $P(s\,|n) = [n!/(n-s)!s!]\,/2^n$.

Under A.3 coalitions form by random assignment and, intuitively, if n is larger it becomes harder to form an encompassing coalition of creditors. In Appendix A2.2 we relax assumption A.3 and allow for endogenous consolidation of claims by any ("vulture") investors. Renegotiation works as follows: after a coalition is formed, its members bargain over liquidation and all bargaining power is held by the creditor holding liquidation rights (this assumption only simplifies the analysis; what matters for our results is that it is more difficult to form a coalition as n increases). Under $A.3$, we find:

Proposition 4 *If $\alpha \geq \alpha_C$, E attains the first best by giving all liquidation rights to a large secured creditor who is given a share x of reorganization proceeds and must distribute an amount $S = L - x\alpha\underline{y}_2$ of liquidation proceeds to infinitely many small creditors. If $\alpha_S \leq \alpha < \alpha_C$, E cannot do better than committing to always liquidate by issuing straight debt contracts with standard foreclosure rights to a number of secured creditors. If $\alpha < \alpha_S$, the project is not financed.*

Under multiple creditors the parties can attain higher surplus than under a single creditor, even if renegotiation is allowed, provided that the creditors without liquidation rights are fully dispersed. Like in the debt structure of Proposition 3, all liquidation rights are given to a large secured creditor lending under a convertible security. Once more, the convertible security induces such creditor to internalize the upside of efficient reorganization, thereby giving him incentives to resolve financial distress efficiently. Importantly, these very same incentives also prevent such creditor 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, because the holder of liquidation rights has the incentive to put a financially distressed firm to its most efficient use, his threats of doing the opposite are not credible.

Concentration of liquidation rights on the holder of convertible debt and dispersion of the other claims improves upon the single creditor outcome by credibly separating liquidation and repayment rights in financial distress. This is best seen for $\alpha \in (\alpha_C, \alpha^*]$. In this range, in the single creditor case the parties attained the second best by using contingent debt. In contrast, under multiple creditors the parties can attain the first best. The intuition is that, even under renegotiation, the parties can implement the same outcome of the two-creditors debt structure above by reducing (relative to the no renegotiation case) the liquidation proceeds paid to the

creditor holding liquidation rights and by dispersing the other claims. Reduction of his liquidation proceeds maximizes the large creditor's incentive to efficiently reorganize the firm. Debt dispersion minimizes the probability of any given coalition of creditors having enough resources to bargain with the holder of liquidation rights and bribe him to inefficiently liquidate. As a result, the optimal debt structure delivers socially efficient reorganization in state U even if creditors as a whole obtain more (L) under liquidation. In Appendix A.2 we show that not only does debt dispersion discourage the formation of large coalitions of creditors, but it also undermines the ability of any creditor to buy out the other creditors' claims in secondary markets. The intuition is that debt dispersion gives rise to a typical holdout problem (Gertner and Scharfstein 1991).[21]

In sum, the optimal debt structure allows to attain the first best and thus to improve upon the one creditor case for $\alpha \in (\alpha_C, \alpha^*]$**.** Now consider the other regions of the parameter space. If $\alpha \geq \alpha^*$, creditors as a whole benefit from continuing the project when it is efficient to do so. Thus, the optimal debt structure is not renegotiated and attains the first best, just like in the single creditor case. If $\alpha < \alpha_C$, not only does every creditor find it optimal to always liquidate but it is also efficient to do so, because it is the only way to ensure break even. As a result, just like a single creditor in this range, multiple creditors are given *straight debt*.[22] Notice that in this case it is not necessary to concentrate liquidation rights on one creditor. Now multiple secured creditors could hold liquidation rights because the firm's physical assets should always be liquidated upon default.[23] If $\alpha < \alpha_S$**,** the project is not financed.

So far we 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 Appendix A2.3 we model this possibility by assuming that debt dispersion makes it harder for creditors as a group to catch in court E's divertive activity.

[21] In the Appendix A2.2 we show that under the optimal debt structure no consolidation can occur in equilibrium, be it via a cash tender offer or a distressed exchange. The intuition is that, to avoid holdout, the price of dispersed claims in a secondary market must be equal to the amount of liquidation proceeds they command. Therefore, a creditor launching a successful tender offer, be it either the secured creditor holding liquidation rights, another secured or unsecured creditor, or any third party will end up with zero surplus. As a result, if there is a negligible but strictly positive cost to launch a tender offer, then no creditor will want to consolidate the dispersed claims.

[22] Under multiple creditors, we have allowed for partial liquidation. Thus, for $\alpha_S \leq \alpha < \alpha_C$**,** break even is also attained by a *straight debt* contract that in U and B liquidates a fraction $f < 1$ of the project. Intuitively, partial liquidation improves upon full liquidation if and only if over-liquidation is more costly than under-liquidation, i.e. if $L < (\overline{y}_2 + \underline{y}_2)/2$. See the Appendix for details.

[23] In a setting with unverifiable cash flows (akin to $\alpha = 0$) Bolton and Scharfstein (1996) argue that debt dispersion deters strategic default and increases debt capacity. We do not explicitly model this effect but we note that, consistent with our model, it would imply that for low α dispersion of liquidation rights is likely to be optimal. For high α instead, deterring strategic default is less important and concentration of liquidation rights on one creditor is likely to be optimal, again consistent with our model.

Even in this case, the optimal debt structure concentrates liquidation rights on a large secured creditor who is given contractual incentives to undertake an efficient reorganization decision. The main novelty with respect to the current analysis is that when creditor dispersion is moderately costly (which occurs when investor protection against tunneling is intermediate), giving contingent debt to the large secured creditor may be the optimal way to resolve financial distress.[24]

Our results confirm the idea that more developed countries have a comparative advantage at more flexible financial contracts and more flexible resolutions of financial distress. More importantly, by using a simple debt structure, E can solve conflicts among existing creditors and attain an efficient resolution of financial distress. The optimal debt structure has two ingredients. First, liquidation rights should be concentrated on a large lender so as to avoid inefficient runs on the firm's assets. Second, a large portion of the firm's reorganization value should be pledged to such lender under a convertible security, so as to maximize his incentives for efficient reorganization. Finally, the rest of the lending should be dispersed among many unsecured creditors, so as to limit the scope of pro-liquidation coalitions against the debtor.

Remarkably, our optimal debt structure closely resembles the resolution of financial distress as carried out in the U.K. with the extensive use of floating charge financing. Upon deciding for reorganization, the floating charge holder leaves the management in control. Upon deciding for liquidation, the floating charge holder usually appoints a professional agent, e.g. a receiver. In turn, 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). Because fixed charges are usually senior to the floating charge, large lenders such as banks often take both a fixed and floating charge. The floating charge gives the bank control rights over the reorganization decision and the fixed charge gives it seniority in liquidation, ahead of any preferential claims and unsecured creditors. The other claims are then dispersed. As a result, Franks and Sussman (2005) note that there is no litigation in court, there are no inefficient runs, and the floating charge holder's typical response to financial distress is an attempt to rescue the firm rather than to liquidate it automatically.

The empirical evidence shows that when it is allowed, the floating charge is widely used and

[24] From a theoretical standpoint, these results differ from existing studies on the optimal financial structure with multiple investors. Typically this literature does not study how the optimal financial structure varies with investor protection. There are also other differences. For example, one strand of the literature focuses on multiple investors holding *different* claims, such as debt vs. equity (Dewatripont and Tirole 1994) and short-term debt vs. long-term debt (Berglof and von Thadden 1994). These papers take financial contracts as given and study how to combine them in an optimal financial structure. Instead, we derive at the same time the optimal contracts and the optimal financial structure. Winton (1995) derives the optimal mix of secured and unsecured claims as a function of exogenous verification costs. In our model, the costs of different claims depend on investor protection.

performs well (Djankov et al. 2006, Franks and Sussman 2005). Still the practical workings of floating charge financing depend on a variety of other institutions and legal restrictions. Even in a country like the U.K. where the floating charge is allowed, the floating charge holder sometimes cannot exercise full control upon default and other secured creditors may hamper his actions.[25] These restrictions may counter the concentration of liquidation rights on the floating charge holder and cause excessive liquidations, thereby limiting the effectiveness of floating charge financing.

In sum, the simple convertible security found optimal in the case with one creditor also helps to efficiently resolve financial distress under multiple creditors. A simple debt structure concentrating liquidation rights on the holder of such security and dispersing all the other claims is shown to be optimal, provided protection against fraud is strong enough.

4.2 Optimal Debt Structure with Arrival of New Creditors

Another argument often advanced to justify government intervention in bankruptcy pertains to the possibility that the firm acquires new creditors as time passes (e.g. Hart 2000). The argument goes that conflicts between old and new creditors might defy the parties' attempt to contract about financial distress ex ante. Problems related to the sequential arrival of creditors naturally arise when the firm faces new investment opportunities, especially if the firm is already in financial distress and thus needs to raise external financing or to roll over current liabilities.[26] In such circumstances, the conflict between different claimholders can be very intense, potentially resulting in passing up profitable investments opportunities or undertaking unprofitable ones (Myers 1977, Jensen and Meckling 1976, Gertner and Scharfstein 1991). This section studies, in a regime of contractual freedom, the properties of an ex ante optimal debt structure when the arrival of new investment opportunities (and thus of new creditors) is taken into account. This analysis allows us to evaluate how efficient is the resulting resolution of financial distress.

For concreteness, suppose that in financial distress, before observing whether liquidation or reorganization is efficient (i.e. before deciding whether to reorganize or liquidate), the firm has the opportunity to improve an existing line of business by investing $F > 0$. The cash flow from such

[25] Franks and Nyborg (1996) cite the case of the building contractor, G. Dew, where the creditor with a fixed charge over plant and machinery placed a fence around the assets so that they could not be used by the receiver on behalf of the floating charge holder, thereby precipitating liquidation. As we have shown in this Section, unanimity (or supra-majority) provisions in resolving financial distress may lead to over-liquidation by encouraging inefficient runs on the company's assets.

[26] In our model, absent new investment opportunities new creditors need not arrive and the analysis of Sections 4.1 and 4.2 still applies, because borrowing does not serve insurance purposes. See Bisin and Rampini (2006) for a model where borrowing from new creditors serves insurance purposes.

investment is $r \geq 0$. If the investment is undertaken, continuation cash flows increase to $y_2(\omega) + r$, liquidation cash flows are constant at L. We assume that even if investment takes place, in state B liquidation is more efficient than reorganization:

A.4: $\underline{y}_2 + r < L$.

Assumption A.4 simplifies the analysis by positing that the efficiency of reorganization versus liquidation is unaffected by the investment decision. Because the investment only pays off in U, it is socially optimal to invest if and only if $r \geq 2F$. We now present a numerical example showing that, related to the firm's possibility of financing this investment opportunity, the classical over and under-investment problems can arise in our model under sub-optimal debt structures.

Example. Consider the case where $L = 30$, $y_1 = 100$, $\overline{y}_2 = 90$, $\underline{y}_2 = 10$, $\alpha = 1/2$. Suppose that the debt structure specifies a face value of debt of 40, equally distributed across 10 creditors with equal priority. Once more, suppose that the multiplicity of creditors prevents them from bargaining ex post with the debtor. To keep things simple (but without affecting the results), suppose that creditors must decide whether to reorganize or continue the firm: under the chosen parameter values they will have an incentive to take the efficient decision, i.e. to reorganize if and only if it is efficient to do so. The following outcomes may then arise in financial distress:

C (*under-investment*). Suppose that the investment decision requires creditors' unanimity. Suppose that $F = 6$, $r = 20$ and that financing must be provided by a new creditor. Investment is socially efficient, but the new creditor can only break even if his claim has higher priority than existing claims. Consider the preferences of existing creditors. If investment takes place, each of the old creditors obtains 24/10 under liquidation and 40/10 under efficient reorganization, for an expected value of 3.2. If instead investment does not take place, each of the old creditors obtains 30/10 under liquidation and 40/10 under efficient reorganization, for an expected value of 3.5. Since $3.5 > 3.2$, existing creditors unanimously decide not to invest. This is the classic debt overhang problem: because existing creditors do not internalize the upside of profitable investment opportunities, they veto supra-priority financing and thus forego profitable investment opportunities.

D (*over-investment*). Suppose, in contrast with case *C* above, that the debtor has the exclusive power to allow supra-priority financing and suppose that $F = 6$, $r = 1$, so that the new investment is socially inefficient. Consider the preferences of the debtor. If investment takes place, the debtor obtains zero under liquidation and 45.5 under efficient reorganization, for an expected value of 22.75. If instead investment does not take place, the debtor still obtains zero under liquidation but now

obtains only 45 under efficient reorganization, for an expected value of 22.5. Since $22.75 > 22.5$, the debtor decides to invest. This is the classical asset substitution problem: because the debtor only sees the upside and not the downside of the investment opportunity, he tries to allow supra priority financing and thus to invest too often, even if the investment is socially inefficient.

These examples illustrate that the arrival of a new creditor whose claim competes with those of existing ones may create two problems. First, as long as existing creditors cannot fully benefit from the upside of new investment opportunities, they may veto the undertaking of profitable investments. This is the classic under-investment problem (or *debt overhang*, Myers 1977). Second, because equityholders only see the upside of the new investment, they want to invest even if the NPV is negative (Jensen and Meckling 1976). The question then arises, can E improve upon these cases by issuing a suitable debt structure ex ante?

We focus on the case $F \leq L/2$, where under the first best liquidation/reorganization policy the new investment can be financed at every α. If in financial distress debtors cannot pledge enough resources so as to finance the new investment, then new creditors are unwilling to lend and the problems we just discussed do not arise. We also allow for the possibility that the return r of the investment is uncertain at $t = 0$. As a result, the initial debt structure can only specify a mechanism for taking future refinancing decisions. We establish:

Proposition 5 *There exists a α_N and a pair (S, x) such that, if $\alpha \geq \alpha_N$, E attains the first best by giving ex ante all the rights to liquidate and to allow supra priority finance in financial distress to a large secured creditor who is given a share x of the reorganization proceeds. The reorganization proceeds accruing to such creditor are reduced by the amount $2x\alpha D$, where D is the amount of supra priority finance issued in financial distress. All other claims are dispersed. In case of liquidation, such creditor must distribute a total amount S to old and new creditors. For $\alpha < \alpha_N$ supra priority finance is forbidden and the optimal debt structure is the same as that of Proposition 4.*

With little changes, the optimal debt structure of Proposition 4 can attain full efficiency also when a firm needs to acquire new creditors to finance investment opportunities in financial distress. Now the optimal debt structure gives to the large secured creditor also the right to allow supra priority financing (and thus to invest), on top of the right to liquidate the firm. The optimal debt structure avoids under-investment because conversion of debt into equity allows such a creditor to benefit from the upside of new investments. At the same time, lowering the reorganization proceeds obtained by such creditor for an amount proportional to the new debt issued avoids over-investment

by inducing him to internalize the investment cost. The large secured creditor is given discretion to raise new funds but the flexible debt structure makes him residual claimant to the NPV of the new investment, thereby fostering an efficient re-financing decision.

Importantly, just like poor investor protection against fraud creates a tension between efficient reorganization and ex ante break even, so it does with respect to new investment opportunities. When α is low, arrival of new creditors seriously undermines the ability of existing ones to obtain repayment. In such cases, the optimal debt structure should forbid new investments so as to guarantee ex ante break even. As a result, our model yields the novel prediction that under-investment in financial distress should be more severe in countries with poor investor protection.

In an important paper, Gertner and Scharfstein (1991) show that both under- and over-investment problems can arise in financial distress. They argue that a reorganization procedure such as U.S. Chapter 11, putting an automatic stay on the firm's assets, keeping existing management in control and lifting unanimity restrictions on the approval of supra-priority financing will unambiguosly increase investment, thereby reducing or even eliminating the extent of the under-investment problem, but possibly increasing the extent of the over-investment problem.

Our analysis confirms that both creditors' runs on the firm's assets and unanimity rules are likely to create conflicts between old and new creditors, thereby worsening under- or over-investment problems. In addition, we show that these problems are more likely due to an ex ante suboptimal debt structure rather than being an intrinsic problem of financial distress. As long as contracts can freely allocate both liquidation and re-financing rights to a large secured lender, suitably designed convertible debt or floating charge financing contracts yield an efficient resolution of financial distress even in the absence of formal, judicially administered reorganization procedures.

The analysis of the multiple creditor case thus confirms the potential for the parties to efficiently resolve financial distress with simple debt contracts, as opposed to entirely rely on state intervention. Remarkably, for strong investor protection the same convertible security is the pillar of the optimal debt structure, under both a single and multiple creditors. With multiple creditors, the optimal debt structure also features concentration of liquidation, and re-financing rights and debt dispersion.

5 Normative Implications

In most societies the resolution of financial distress is directly regulated by the government with mandatory bankruptcy procedures, rather than being resolved contractually as in our model. These

state-mandated procedures are often an elaborate, court supervised process producing substantial delays and inefficiencies (e.g. Hart 1995, Franks, Nyborg and Torous 1996), and imposing large administrative costs on the parties. Crucially, state-mandated procedures often explicitly prevent parties from contracting about financial distress.[27]

Our theoretical results suggest that there might be substantial benefits of increasing contractual freedom as opposed to exclusively rely on state intervention in resolving financial distress. A bankruptcy reform lifting legal restrictions to floating charge financing, convertibles, concentration of liquidation rights, and at the same time increasing legal protection against tunneling would allow the parties to effectively use our optimal debt structures. Such an increase in freedom of contracting would not undermine public regulation of financial distress in case it is efficient, but it would unleash the potential of private contracts, remedying the deficiencies of inefficient government intervention. Such a "contractual" bankruptcy reform is likely to reduce court involvement, streamline the resolution of financial distress, and thus increase debt capacity and social welfare, especially in developing countries.

Section 5.1 discusses in detail the proposals for bankruptcy reform emerging from our model. Section 5.2 relates the contractual resolution of distress we advance to leading academic proposals for bankruptcy reform.

5.1 Suggestions for Bankruptcy Reform

Sections 5.1.1 and 5.1.2 examine concrete strategies for effectively increasing freedom of contract and investor protection against fraud, respectively.

5.1.1 Freedom of Contracting

At a broad level, our analysis indicates – in the spirit of Rasmussen (1992) and Schwartz (1997) – that allowing entrepreneurs and investors to contractually opt out of state-provided bankruptcy procedures increases the efficiency of resolutions of financial distress. More in detail, our model identifies two specific ingredients for an optimal resolution of financial distress: the use of convertible securities and the concentration of liquidation rights.

In reality, parties face strong legal restrictions to resolve financial distress by using convertibil-

[27] The presence of such legal restrictions to private contracts is often rationalized with political economy conflicts between lenders and borrowers (e.g. Bolton and Rosenthal 2002) or among competitors in an industry (e.g. Feijen and Perotti 2006).

ity clauses and floating charge finance. For example, convertibility clauses are often overridden by bankruptcy courts, especially in civil law countries (e.g. Lerner and Schoar 2005). Most significantly, floating charge financing is simply not allowed in many countries in the world. As Djankov, Hart, McLiesh and Shleifer (2006) show, this is mostly associated with civil law countries, whereby highly formalistic bankruptcy codes require that collateral be only certain physical assets and not the firm's full reorganization value (including bank accounts, intangibles, working capital and future cash flows). As a result, we believe that bankruptcy codes should be reformed toward allowing the parties to use floating charge finance and convertibility clauses. Consistent with this view and with our model, the evidence indicates that, when allowed, floating charge finance is widely used and facilitates an efficient resolution of financial distress (Djankov et al. 2006).[28]

In addition, parties face strong legal restrictions also to concentrating liquidation and refinancing rights on a single large lender. For example, several real world bankruptcy codes allow failed debtors to unilaterally file for state-provided reorganization procedures. In turn, bankrupt debtors enjoy an automatic stay on the secured assets, which prevents any creditor from repossessing collateral upon default. At the other extreme, other bankruptcy codes require ex post unanimity (or supra-majority) of creditors to reorganize a failed firm. Our model suggests that such dispersion of liquidation rights may be responsible for over- and under-liquidation and underinvestment in financial distress. As a result, another key step toward making contracts work would be to reform bankruptcy codes in the direction of allowing the parties to contract out of ex post unanimity and other voting rules.[29]

5.1.2 Legal Protection against Tunneling

Our model also shows that contractual resolutions of financial distress are most efficient when investor protection against fraud is strong. Broadly speaking, this argument confirms that bank-

[28] Notice that whether bankruptcy reform should more urgently focus on allowing floating charge or convertible debt may well depend on the country's legal infrastructure. For example, while floating charge and convertible debt share the need for strong, general legal protection against fraud, they are likely to differ as to the extent to which they rely on different aspects of such legal protection. Specifically, while convertible debt needs to rely on both strong creditor protection and strong shareholder protection, floating charge financing relies more on strong creditor protection. As a result, allowing floating charge financing may be a more effective policy in those countries, like Germany, where creditor protection is much stronger than shareholder protection.

[29] Upholding private contracts also requires respecting the priority of secured creditors. In practice, bankruptcy procedures often violate the priority of secured creditors with respect to both unsecured creditors and equity holders, so the latter get repaid something even if the former are not repaid in full (e.g. Franks and Torous 1989, Weiss 1990). In the context of our model, one might interpret the optimal debt write down as a beneficial violation of the large creditor's absolute priority. However, this interpretation fails to recognize that such debt write down (or forgiveness) is stipulated in the ex ante contract and thus does not constitute a violation of priority.

ruptcy reform should not be viewed in isolation: it may be necessary to combine it with other reforms, such as improvements in corporate governance and the strengthening of investor rights. Indeed, investor protection against tunneling does not only depend on bankruptcy laws; it reflects more broadly the quality of a country's legal system as reflected by general anti self-dealing laws (Djankov et al. 2005) and securities laws (La Porta et al. 2006).

However, bankruptcy codes also play a direct fundamental role in fostering investor protection against tunneling, over and above securities and anti self-dealing laws. On the one hand, bankruptcy codes allow parties to write restrictive covenants or directly forbid dividend payments in financial distress in their debt contracts. These contractual protections are especially useful for large and sophisticated lenders such as banks. On the other hand, by providing specific anti self-dealing provisions known as fraudulent transfer law, bankruptcy codes set a default level of protection that is especially important to protect small, dispersed and unsophisticated investors – precisely those who are least likely to take advantage of contractual protections (e.g. Kraakman 2006).

Fraudulent transfer law is a key component of investor protection against fraud. For example, Baird (2006) argues that fraudulent transfer law was the key tool for unraveling many transactions in Enron. The usual reason for specific fraudulent transfer law is to reach more directly transactions made by firms in the vicinity of financial distress. Put differently, some self-dealing transactions can be particularly harmful because they can trigger financial distress and the ultimate winding up of the company.[30]

Our model then suggests that bankruptcy reform should strengthen, especially in developing countries, fraudulent transfers law so as to increase investor protection, especially for small, unsophisticated creditors. This may call for seeking strict avoidance of fraudulent conveyances, placing the burden of proof and personal liability on directors, and maximizing mandated disclosure. Such reform would maximize the parties' ability to contract about financial distress, thereby fostering

[30] One relevant form of tunneling in financial distress is the strategic acquisition of personal assets by the debtor with the creditors' money. For example, three Enron executives started building million-dollar homes in Texas with Enron money before the Enron bankruptcy filing, because in Texas "the law permits a debtor to fraudulently invest ill-gotten gains in a homestead to beat his or her creditor" (LoPucki 2005, p. 150). Consistent with this example, Berkowitz and White (2004) document that, across U.S. states, greater homestead exemption in bankruptcy is associated with reduced access to credit by small firms. The magnitude of these problems is likely to be much amplified in emerging economies, where underfinanced, incompetent or even corrupt courts cannot be expected to effectively resolve difficult cases of managerial self-dealing, thereby reducing the debtors' ability to pledge their business to creditors. Interestingly, however, even advanced economies are reforming their fraudulent conveyance laws to catch managerial self dealing in financial distress. For example, the 2005 U.S. Bankruptcy Reform Act has raised from one to two years the look-back period for fraudulent conveyances. In addition, in the context of the British Insolvency Act, Davies (2006) argues that fraudulent transfer law allows recovery from the directors by the liquidator on the part of creditors generally, whereas general anti-fraud law provides only for individual recovery, e.g. *Morphitis v. Bernasconi* [2003] 2 BCLC 53.

efficiency, especially in developing countries.

To sum up, our analysis provides some guidance for bankruptcy reform by highlighting which ex ante contracts optimally resolve financial distress at different levels of investor protection. A direct implication of our findings is that there may be significant benefits in lifting existing legal restrictions on the use of floating charge and concentration of liquidation rights. Of course, we are not saying that this is the only reform capable of improving the resolution of financial distress. For example, a bankruptcy reform mimicking our optimal contracts of Figure 3 could substitute for an explicit and broad enactment of freedom of contracting. It should be noted however that such an alternative reform would require the implementation of an entire menu of bankruptcy procedures, each replicating a specific optimal private contract, because the optimal contract typically varies across different firms, even for a common level of investor protection.[31] This suggests that such bankruptcy reform would be de-facto equivalent to lifting legal restrictions by allowing the parties to use a full range of standardized contracts. In addition, such reform should necessarily be complemented by the removal of existing legal restrictions forbidding parties to contract ex ante on which bankruptcy procedure to use, especially if firm characteristics are not fully observable. Thus, one way or another, our findings explicitly call for an increase in contracting freedom (or flexibility) relative to most current state-mandated procedures.[32]

[31] Indeed, Section 3 showed that for $\alpha \geq \alpha^* \equiv L/\overline{y}_2$ convertible debt allows the parties to attain the first best. As a result, firms differing in their potential benefit from efficient reorganization naturally differ, for a given level of α, on their way of optimally resolving financial distress. Ceteris paribus, start-up high-tech firms who cannot rely heavily on physical collateral and where the debtor in possession is likely to have a significant advantage in running the reorganized firm (i.e. where $\overline{y}_2$ is much larger than L), should be expected to use more sophisticated and flexible contractual arrangements such as convertible debt to resolve financial distress. By contrast, firms in mature industries such as real estate and utilities where physical assets represent a large proportion of total assets (i.e. where $\overline{y}_2$ is very close to L), will face relatively larger incentive costs of using sophisticated contractual instrument and thus are more likely to use simpler contracts such as straight debt that approximate the first best by contractually committing to liquidate a financially distressed project.

[32] It is often argued that state-mandated bankruptcy procedures do better than private contracts if anything new (e.g. about a firm's continuation or liquidation value) is learned between the time the contract is signed and the time financial distress arises. We disagree. Our model shows that, as long as the parties are ex ante aware of the possibility of learning something new in the future (a necessary assumption for drawing welfare implications), then the parties can contractually delegate a third party (e.g. a court) to enforce the contract by taking into account the new information. This possibility is obvious in our contingent debt contract, whereby the parties voluntarily surrender to the judge the task of estimating the firm's reorganization value. More generally, it is unclear why the parties cannot allow in their ex ante contract for the same degree of ex post flexibility allowed for by an ex ante bankruptcy law. As an example, consider the case of tort creditors. It is beyond the scope of this paper to exhaustively cover this issue, but one observation helps illustrate the point. If the firm operates in an environment associated with potential tort claims (e.g. asbestos) it might optimally allocate a reserve (or insurance) should the need to settle such claims arise ex post; in fact, tort claims can be seen as negative random shocks to the firm's current and future cash flows. Clearly, the resulting optimal debt structure might end up having fewer (or weaker) security rights than in the case without tort claims, but its welfare properties would be unchanged.

5.2 Contracts and Academic Proposals for Bankruptcy Reform

We conclude this section by discussing how the contractual solution to financial distress we advance is related to existing academic proposals for bankruptcy reform. We consider the Bebchuk (1988) and Aghion, Hart and Moore (1992, AHM henceforth) proposals for using options, Jensen's (1989) proposal for using cash auctions and proposals for using judicial expertise (Bolton and Rosenthal 2002 and Ayotte and Yun 2006). In this respect, we show that our model allows us to evaluate the efficiency of these proposals as a function of contracting frictions (α, θ).

5.2.1 Options

The basic idea goes as follows. First, when a firm goes bankrupt, all the firm's debts are cancelled, and all claims are converted into equity. Then, in line with Bebchuk (1988), former claim-holders are either allocated equity in the new company (in the case of senior creditors) or given an option to buy equity (in the case of junior creditors or shareholders), according to the amount/priority of their claims. Then, cash and non-cash bids are solicited for all or part of the new firm. 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. The firm then exits from bankruptcy.

In the context of our model, this scheme amounts to: 1) giving E (i.e. the only shareholder) the option to post a non-cash bid of $\alpha\overline{y}_2$ to buy back the firm from I − by exercising the option, E avoids liquidation and continues the project[33], 2) giving I a convertible security whereby debt is converted into equity when E exercises the option and reorganizes. This procedure shares some features with our convertible debt contract where in financial distress the debtor is allowed to reorganize by pledging the firm's equity to the investor. As a result, our model can be seen as rationalizing the optimality of some features of the AHM procedure in an ex ante contracting model (which in addition shows the possibility of attaining ex post efficiency with other mechanisms). Notice, however, that our explicit consideration of ex ante efficiency addresses two key issues not addressed by AHM, who only performed an ex post analysis. First, a debt write-down is often needed to provide the parties with appropriate incentives to undertake the efficient reorganization decision (e.g. to prevent E from always reorganizing). Second, sophisticated mechanisms like the

[33] As stressed by Bebchuk and AHM, options serve two roles. First, options are one way to endogenously reveal information of the project's continuation value. Second, options are one way to preserve absolute priority. Because we focus only on the former, to map the AHM proposal into our model it does not matter whether there is only one or many creditors.

one proposed by AHM are only optimal and feasible at high levels of investor protection. At lower levels investor protection, some court intervention or even straight debt are preferable because they facilitate investor break even.

5.2.2 Cash Auctions

Another proposal for bankruptcy reform is to put bankrupt firms on the block, collect cash bids from the public and sell the firm to the highest bidder (Baird 1986; Jensen 1989). The highest bidder then takes control of the firm, and decides whether to keep it as going concern, or liquidate it piecemeal. It is usually believed that such a procedure, known as a "reformed Chapter 7", looks very much like the Swedish Konkurslagen, where bankrupt firms are often sold as going concerns. The most appealing feature of cash auctions is that the bidding aggregates all available information concerning the reorganization value of the firm (in particular relative to estimates of its liquidation value). This way, parties make an efficient liquidation versus continuation decision.

In our simple framework, cash auctions are tantamount to the availability of financial markets pricing for the reorganization value of the firm, so as to let insiders raise money to finance their bids. One could thus wonder how cash auctions compare with private contracts. In our framework, allowing insiders to raise cash from public (stock) markets to finance a cash bid is likely to result either in over-continuation if protection against fraud is high or in over-liquidation otherwise. The 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. This argument shows that a problem of cash auctions is that – unlike options or contracts – they crucially rely on the availability of financial market pricing.

5.2.3 Courts

Bolton and Rosenthal (2002) and Ayotte and Yun (2006) advocate the optimality of third party intervention in resolving financial distress, even if such intervention is imprecise, leading to too many bail outs and reorganizations. Our model provides the intuition for the optimality of judicial interventions as a function of investor protection.

In particular, if protection against tunneling is intermediate, it is optimal for debt contracts to use judicial expertise in resolving financial distress. Although our finding does not pin down how exactly courts should intervene in a bankruptcy procedure, we stress, in line with Bolton and Rosenthal (2002) and Ayotte and Yun (2006) that use of judicial expertise may be optimal. Unlike Bolton and Rosenthal (2002) and Ayotte and Yun (2006) who advocate court intervention on the grounds that it allows to make the resolution of financial distress contingent on ex ante unverifiable information, we rationalize court intervention as a way of avoiding the ex ante cost of incentives.

6 Conclusions

We study the economics of optimal resolution of financial distress in an ex ante model of contracting. We find that convertible debt structures that concentrate liquidation rights on one creditor and induce that same creditor to internalize the upside of efficient reorganization are optimal, especially at high levels of investor protection. At one level, our results rationalize in an optimal contracting setup the optimality of floating charge financing − we are not aware of any theoretical paper doing so. At another level, our results indicate that to increase the efficiency of resolutions of financial distress one bankruptcy reform relatively easy to implement is to foster freedom of contracting, in particular by allowing contracts to use floating charge financing and convertibility clauses, and to concentrate liquidation rights. Because we find that these contractual provisions are most effective when investor protection is strong, such a bankruptcy reform should be optimally combined with improvements in investor protection. These reforms would unleash the potential of private contracts, thereby decreasing the need to exclusively rely on state intervention to resolve financial distress efficiently.

Based on our analysis, one might be tempted to conclude that there are no benefits at all of government intervention in corporate bankruptcy. We wish to warn the reader against jumping too quickly to this conclusion. Our analysis simply suggests that the inefficiencies typically stressed by bankruptcy scholars can be resolved with relatively simple debt contracts and that, as a result, legal restrictions preventing the parties from using such contracts are likely to undermine efficiency. However, there might be other reasons beyond those often advocated in the bankruptcy literature why contracts may fail (Aghion and Hermalin 1990) and some public regulation of financial distress may be needed. For example, as stressed by Bolton and Rosenthal (2002), in economic crises the resolution of financial distress in a given firm may generate large externalities on other firms or

workers. In such circumstances, the possibility of complementing private contracts with government intervention through a soft bankruptcy law may help avoid excessive liquidations, thereby facilitating economic recovery.

Although our main focus is normative, our theory does offer several novel empirical predictions that could be tested in future work. For example, our theory provides the novel implication that, ceteris paribus, the incidence of unsecured debt in the debt structure should increase with investor protection across countries. Because investor protection reduces the relative ability of debtors to steal from cash flows, only when investor protection is strong can creditors with no right to physical collateral expect to be repaid, and are thus willing to lend. Additionally, our theory implies that the extent of the underinvestment problem should decrease with investor protection.

Our model also delivers the implication that the extent of debt dispersion should increase with investor protection across countries. While to the best of our knowledge not explicitly formulated before in the literature, one could however obtain these implications also in the framework of Bris and Welch (2005), were one to interpret their cost of debt collection as "investor protection". This prediction contrasts with the popular view that debt dispersion hardens the debtor's budget constraint and increases debt capacity (Bolton and Scharfstein 1996), the more so in countries with poor investor protection (Diamond 2004). Clearly, the empirical correlation between investor protection and the extent of debt dispersion is an interesting avenue for future research.

Appendix 1: Proofs

Proof of Proposition 1. I advances $D \geq K$ to E under first and second period repayments $d_1(\omega; a)$, $d_2(\omega; a)$, $\omega = G, U, B$ and liquidation policy $\lambda(\omega; a)$; ω is the state, a is the parties' action profile, including E's decision to repay and the decision to liquidate or reorganize. The parties can delegate the latter decision to one of them (possibly in a state contingent manner). For notational simplicity, in the proofs we will often omit to indicate the dependence of the optimal contract terms on a. Feasibility requires $d_1(\omega) \leq \alpha y_1(\omega) + \lambda(\omega)L$, $d_2(\omega) \leq \alpha y_2(\omega)$, $\lambda(\omega) \in \{0, 1\}$.

Suppose that I lends $D = K$. Consider state G first. To avoid ex post inefficiencies, the parties set $\lambda(G) = 0$. The incentive compatible repayments $d_1(G), d_2(G)$ satisfy:

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

NR indicates that E defaulted on $d_1(G)$. E's default payoff is minimized at $\lambda(G; NR) = 1$, $d_1(G; NR) = L + \alpha y_1$. This yields $d_1(G) + d_2(G) \leq \alpha y_1 + \overline{y}_2$. Thus, in G no strategic default occurs and I can extract at most $d_1(G) = \alpha y_1 + (1 - \alpha)\overline{y}_2$, $d_2(G) = \alpha \overline{y}_2$. Consider optimal contract terms for B and U. We must consider the following possibilities. **1)** E controls liquidation/reorganization. Call d_L the liquidation proceeds going to I after 0 first period cash flows. Then, E liquidates in B if $L - d_L \geq \underline{y}_2 - d_2(B)$ and reorganizes in U if $\overline{y}_2 - d_2(U) \geq L - d_L$. Since $d_2(\omega) \leq \alpha y_2(\omega)$ and $d_L \leq L$, 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 effectively gives I the firm's assets upon default. E can get $(1 - \alpha)\underline{y}_2$ and let I liquidate or he can buy back the firm (and reorganize) by making a non-cash bid of $\alpha \overline{y}_2$. **2)** I controls liquidation/reorganization. I decides efficiently provided $d_L \geq d_2(B)$, $d_2(U) \geq d_L$. Subject to ex post efficiency, I's payoff is maximized at $d_2(B) = \alpha \underline{y}_2$, $d_2(U) = \alpha \overline{y}_2$, $d_L = L - \max[L - \alpha \overline{y}_2, 0]$. After zero first period cash flows, this contract effectively stipulates a debt write-down reducing repayment to d_L, pledges to I reorganization proceeds and lets him decide over liquidation/reorganization. Because contracts **2** and **3** give I claims on the firm's reorganization value in financial distress, we call them *convertible debt* (CO henceforth). CO guarantees full ex post efficiency. In terms of ex ante efficiency, repayment to I under CO falls as α goes down. In general, there exists a threshold α_{CO} such that CO is feasible (either in version **1** or in version **2**) iff $\alpha \geq \alpha_{CO}$.

Another set of contracts uses court's ability to estimate the firm's reorganization value. Consider these contracts. **3)** E controls liquidation/reorganization but $d_L(\omega)$ is state-contingent. A

schedule $d_L(B) = L - (1-\alpha)\overline{y}_2$, $d_L(U) = L$ maximizes repayment. This contract is dominated by **1** both ex post and ex ante. **4)** I controls liquidation/reorganization but $d_L(\omega)$ is contingent. The optimal debt write-down is $S(B) = 0$, $S(\omega) = \max[L - \alpha\overline{y}_2, 0]$. To stress the state-contingent debt write-down, we call this contract *contingent debt* (*CD* henceforth). There exists a threshold α_{CD} such that *CD* is feasible iff $\alpha \geq \alpha_{CD}$. Yet, under *CD* there is an ex post over-liquidation cost of $(1-\pi)(1/2)\theta(\overline{y}_2 - L)$. **5)** It is never optimal to give courts the right to control liquidation/reorganization. I gets L under liquidation, $\alpha y_2(\omega)$ under continuation. The average ex post loss under this contract is $(1-\pi)(1/2)\theta(\overline{y}_2 - \underline{y}_2)$, which is larger than the loss under *CD* and repayment to I is smaller.

Consider contracts mandating a non-contingent liquidation/reorganization policy. **6)** The contract stipulates $\lambda(B) = \lambda(U) = 1$, $d_L = L$. This is *straight debt* (*SD* henceforth). There exists a threshold α_S such that *SD* is feasible iff $\alpha \geq \alpha_S$. Ex post losses are now $(1-\pi)(1/2)(\overline{y}_2 - L)$. **7)** Parties write $\lambda(B) = \lambda(U) = 0$, $d_2(\omega) = \alpha y_2(\omega)$. Ex post losses are $(1-\pi)(1/2)(L - \underline{y}_2)$. This contract is dominated both ex ante and ex post by *CD*. Hence, it is never chosen.

Optimal Contracts as a Function of (α, θ). First, notice that the above contracts exhaust the set of optimal contracts. There is no gain for I to lend $D > K$**.** For any extra dollar lent, I gets back at most a fraction $\alpha \leq 1$ of it in G and no more than $D - K$ in any other state: increasing the size of the loan only undermines break even without bringing any benefit. In addition, the above analysis shows: a) in terms of ex post efficiency, for $\theta > 0$ the ranking among the contracts not yet ruled out is: *CO* $\succ$ *CD* $\succ$ *SD* $\succ$ *no contract* (if *CO* and *CD* fare equally well); b) in terms of ex ante efficiency, there are two regimes: i) if $\alpha \geq \alpha^* = L/\overline{y}_2$ then *CO* $\sim$ *CD* $\succ$ *SD*; ii) if $\alpha < \alpha^*$ then *SD* $\succ$ *CD* $\succ$ *CO*. If $\alpha = 1$ all contracts are chosen. There are two cases: i) $\alpha_{SD} \geq \alpha^*$ (i.e. at α^* *SD* is infeasible), then define $\alpha_C = \alpha_{CO}$, $\alpha_S = \alpha_{CO}$. Now *SD* is never optimal because when feasible it is dominated ex post by *CO*, which are also feasible; ii) $\alpha_{SD} < \alpha^*$ (i.e. at α^* *SD* is feasible), then define $\alpha_C = \alpha_{CD}$, $\alpha_S = \alpha_{SD}$. Now if *SD* is feasible, it is also optimal provided other contracts are infeasible (i.e. if $\alpha_S \leq \alpha < \alpha_C$); if *CD* is feasible, it is also optimal provided *CO* is infeasible (i.e. if $\alpha_C \leq \alpha < \alpha_O$). *CO* is optimal whenever feasible (i.e. if $\alpha_O \leq \alpha$) because it yields the first best. This proves Proposition 1. ■

Proof of Proposition 2. With ex post renegotiation, I may benefit from lending $D = K + t$, $t > 0$. Setting $t > 0$ only undermines break even under *CO* because I on average recoups only a fraction of it. $t > 0$ only helps to reduce ex post inefficiencies and may thus be optimal only under *CD* and *SD*. We study the model under two alternative assumptions on bargaining power, when I

(resp. E) has full bargaining power

1) I has the bargaining power. In G, it must be $d_1(G) = \alpha(y_1 + t) + (1-\alpha)\overline{y}_2$, $d_2(G) = \alpha\overline{y}_2$. If $t = 0$ repayment in G is unaffected by renegotiation. Moreover, because CO maximizes I's payoff, it is renegotiation proof also in B and U. What about CD and SD? i) CD. With probability θ, the firm is liquidated in U. Now $t > 0$ may allow E to bribe I in U to reorganize before the court enforces the contract. Since $\alpha < \alpha^*$, I gets $\alpha\overline{y}_2 + \theta(L - \alpha\overline{y}_2)$. If $t^* = \theta(L - \alpha\overline{y}_2)$, E bribes I to continue in U. This contract yields the first best if feasible, i.e. if:

$$t^* \equiv \theta(L - \alpha\overline{y}_2) \leq \left[\pi(\overline{y}_2 + \alpha y_1) + (1/2)(1-\pi)(L + \alpha\overline{y}_2) - K\right]/(1 - \alpha\pi). \tag{6}$$

The logic of (6) is that only if t^* is sufficiently small can CD achieve the first best when I lends $K + t^*$ to E. Condition (6) defines a function $\theta_R(\alpha)$ such that I breaks even iff $\theta \leq \theta_R(\alpha)$. For $\theta > \theta_R(\alpha)$**,** the parties use CD with $t = 0$. Notice that if $t > 0$ it is optimal to set $t = t^*$ because it maximizes the chances of break even. ii) SD. Here, for I to bribe E we need $t = L - \alpha\overline{y}_2$. This is feasible iff $\pi(\overline{y}_2 + \alpha y_1) + (1-\pi)\alpha\overline{y}_2 - (1-\alpha)(L - \alpha\overline{y}_2) \geq K$. But this only holds iff CO is feasible as well. Hence, if SD is optimal, $t = 0$ and over liquidation cannot be renegotiated away. **Optimal Contracts as a function of (α, θ).** The main difference with respect to Proposition 1 is that for $\alpha_S \leq \alpha < \alpha_C$ there is an increasing function $\theta_R(\alpha)$ such that, for $\theta \leq \theta_R(\alpha)$ CD plus $t^* = \theta(L - \alpha\overline{y}_2)$ yields the first best. Otherwise, nothing changes.

2) E has all the bargaining power. Now renegotiation allows E to reduce repayment. In G, incentive compatibility is $d_1(G) + d_2(G) \leq \alpha(y_1 + t) + \max[L, \alpha\overline{y}_2]$, attained with $\lambda(G; NR) = 1$, $d_1(G; NR) = L + \alpha(y_1 + t)$ if $\alpha < \alpha^*$ and at $\lambda(G; NR) = 0$, $d_1(G; NR) = \alpha(y_1 + t)$, $d_2(G; NR) = \alpha\overline{y}_2$ if $\alpha \geq \alpha^*$. This is less than I can obtain under no renegotiation. Let us now look at B and U, considering different contracts. i) CO. Because E or I has the incentive to liquidate in U and reorganize in B, any threat they might use to increase their payoff is not credible. Thus, renegotiation does not affect CO in U and B. iii) CD. I has still the right to liquidate/reorganize the project. The only difference is that $t^* = \theta(L - \alpha\overline{y}_2)$, over liquidation is renegotiated away in U**.** If $\theta \leq \theta_R(\alpha)$ this contract yields the first best. iv) SD. Nothing changes as $t = L - \alpha\overline{y}_2$ is infeasible when SD is optimal. **Optimal Contracts as a function of (α, θ).** The only difference with the case where I has full bargaining power is that, due to lower repayment in G, all thresholds become larger. ■

Proof of Corollary 1. This corollary simply follows from the Proof of Proposition 2. There,

the optimal contract maximizes social welfare for given enforcement constraints (α, θ). Because the same constraints must be satisfied by any state-mandated procedure, unless such procedure is identical to that arising under the optimal contract then an inferior (ex ante and/or ex post) outcome occurs. To see this, assume that the state-mandated procedure produces a different liquidation/reorganization outcome than the optimal contract. Then, either the workout fails because E is wealth constrained and the parties are stuck with an inefficient outcome, or the workout succeeds but then I must make some concessions to E (relative to the optimal contract maximizing repayment to I), which reduces I's repayment, especially if E has a lot of bargaining power. For example, suppose that E has all the bargaining power and the state-mandated procedure always induces reorganization, giving I $\alpha y_2(\omega)$. Then, I always bribes E to liquidate in B and ex post efficiency is always attained. However, average repayment to I in states U and B is only $\frac{1}{2}\alpha\left(\overline{y}_2 + \underline{y}_2\right)$. For any α, such repayment is strictly less than that arising under *convertible debt*. As a result, although in this example private workouts ensure ex post efficiency in spite of an ex post inefficient state-mandated procedure, they cannot improve upon the outcome under the optimal contract. In fact, when *convertible debt* is feasible, it (weakly) dominates workouts from an ex ante standpoint. When *convertible debt* is not feasible, ex ante financing under a state-mandated procedure plus ex post private workout is infeasible, too. As a result, even in this range contractual freedom is superior because it allows the parties to attain the second best with *contingent debt* and the third best with *straight debt*. The same argument can be used for other state-mandated procedures. ■

Proof of Proposition 3. When all liquidation rights are given to one single creditor, the multiple creditors case is very similar to the one creditor case. The main difference with the one creditor case is that the creditor holding liquidation rights does not get the full equity of the reorganized firm nor all liquidation proceeds (net of the write-down). Now liquidation and reorganization proceeds can also go to other creditors. Under *CO* such creditor is given a share x of the reorganized firm and obtains $d_L \in \left[x\alpha\overline{y}_2, x\alpha\underline{y}_2\right]$ in liquidation, thereby having the right incentives. In each state the other creditors are promised the remaining repayment that the single creditor would obtain. The same logic is used to replicate *CD* (where now $d_L(B) > x\overline{y}_2 > d_L(U)$) and *SD*. ■

Proof of Proposition 4. For $\alpha < \alpha_S$**,** the project is not financed. The multiplicity of creditors cannot increase total repayment in G above $\alpha y_1 + \overline{y}_2$ and above L in U and B. But this is what (with one creditor) *SD* pays out, which is infeasible if $\alpha < \alpha_S$**.** If $\alpha_C \geq \alpha \geq \alpha_S$, only *SD* is feasible under a single creditor. By analogy, under multiple creditors break even requires liquidation in both U and B. Thus, E can issue several debt structures faring equally well (he

can even disperse liquidation rights), and the outcome is the same as under a single creditor *SD*. In U and B, the optimal contracts may allow for liquidation of only fraction $f < 1$, where $\pi(\overline{y}_2 + \alpha y_1) + (1/2)(1-\pi)\left[fL + (1-f)\alpha(\underline{y}_2 + \overline{y}_2)\right] = K$. 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 $L \geq (\overline{y}_2 + \underline{y}_2)/2$, $f = 1$ is optimal. For $\alpha \geq \alpha_C$, the debt structure of Proposition 4 yields the first best for the following reasons. Suppose that the creditor holding liquidation rights gets $d_L \in \left[x\alpha\overline{y}_2, x\alpha\underline{y}_2\right]$ in liquidation and an equity stake x on the reorganized firm. Then, not only has he the incentive to undertake the efficient liquidation policy, but also he cannot credibly threaten E or other creditors to do something inefficient so as to extract resources from them. To gauge the role of the creditor's stake and of debt dispersion, consider the possibility of renegotiation in U (there is no renegotiation in B as all creditors prefer liquidation over continuation). If there are $n-1$ identical creditors not having liquidation rights, a coalition of at least $\widetilde{m}(n) = (n-1)\frac{\alpha\overline{y}_2 - d_L}{L - d_L - (1-x)\alpha\overline{y}_2}$ of them is needed to bribe the large creditor to liquidate. Clearly, $\widetilde{m}(n)$ is maximized by setting $d_L = x\alpha\underline{y}_2$, which implies $\widetilde{m}(n) = (n-1)\frac{\alpha(\overline{y}_2 - \underline{y}_2)}{L - \alpha\overline{y}_2 - \alpha(\overline{y}_2 - \underline{y}_2)} = (n-1)v$. Thus, liquidation in U occurs with probability $\Pr(m \geq \widetilde{m}(n)\,|n-1\,) = \sum_{s=(n-1)v}^{n-1}\left[(n-1)!/(n-1-s)!s!\right]/2^{n-1}$. For given n, this probability is minimized by setting x as large as possible (i.e. by giving the creditor holding liquidation rights a large stake in the firm), in particular $\widetilde{m}(n) \geq n-2$ if and only if $x \geq (n-2)(L - \alpha\overline{y}_2)/\alpha(\overline{y}_2 - \underline{y}_2)$. In other words, the creditor holding liquidation rights should have a large stake so as to minimize the probability of being bribed into inefficient liquidation. For $n \to +\infty$, this tends to $\lim_{n\to\infty}\left[(n-1)!/(n-1-nv)!nv!\right]/2^{n-1}$, which is equal, by Stirling's approximation $\ln n! \approx n\ln n - n$, to $\lim_{n\to\infty}\exp\left\{(n-1)\ln(n-1) - (n(1-v)-1)\ln(n(1-v)-1) - nv\ln nv - 1\right\}/2^{n-1}$. The numerator of the limit tends to $\exp(-1)$, the denominator to $+\infty$. As a result, for $n \to +\infty$, $\Pr(m \geq \widetilde{m}(n)\,|n-1\,) \to 0$ and the first best is attained. ■

Proof of Proposition 5. The first best is to invest iff $r > 2F$ and to reorganize iff $\omega = U$. Call C the creditor holding liquidation rights of Proposition 4. Suppose that C is given the right to raise, in financial distress, supra priority finance with respect to dispersed claims and that, if D is raised, repayment to C under reorganization is reduced by θD. At the optimal reorganization policy, C raises new financing (and invests) provided $x\alpha r - \theta D \geq 0$. New financing is raised only if investment takes place. At the same time, C finds it profitable to set $D \leq F$. Then, $\theta = 2x\alpha$ induces C to choose an ex post efficient refinancing (and investment) policy. C efficiently reorganizes iff $x\alpha\overline{y}_2 + x\alpha(r-2F)Z(D=F) \geq L - S$ and $x\alpha\underline{y}_2 + x\alpha(r-2F)Z(D=F) \leq L - S$, where $Z(D=F)$ is an indicator taking value 1 if $D = F$ and 0 otherwise. Because $\underline{y}_2 + r < L$, it is possible to find S

such that both conditions hold. Thus, C can be given the incentive to efficiently resolve financial distress. Since $F < L/2$, x and S can always be set such that F is financed. Yet, this has ex ante costs. Suppose that r is distributed according to a c.d.f. $R(r)$ and $r^* = E(r\,|r > 2I\,)$. Then, total expected payout to initial creditors in financial distress is

$$\alpha\overline{y}_2 + L + [1 - R(2F)]\,(\alpha r^* - F)$$

If $\alpha < F/r^*$, investment reduces the payout to initial creditors. Thus, there is a α_N such that, for $\alpha < \alpha_N$, investment undermines break even. For $\alpha < \alpha_N$ supra-priority finance is forbidden and the debt structure of Proposition 5 is optimal. ■

Appendix 2: Extensions

A2.1: Uncertain Cash Flows and Liquidation Values. We now solve for the optimal contract when first and second period profits as well as liquidation values are all stochastic and take a continuum of values. The timing is the same as before. We focus on the case of multiple creditors. To evaluate the incentive properties of the convertible debt contract previously analysed, it is useful to study the optimal contracting problem faced by the parties if all payoffs are observable by the court but still subject to the constraint that a fraction $(1-\alpha)$ of profits can be seized by managers. In such a case, the contract includes a variable $l\,(y_1, y_2, L)$ stipulating – for each state of nature (y_1, y_2, L) – whether the firm should be liquidated, in which case $l\,(y_1, y_2, L) = 1$, or continued, in which case $l\,(y_1, y_2, L) = 0$. With respect to creditor repayment, if in state (y_1, y_2, L) the project is liquidated then creditors are given L in the second period and cannot earn more than αy_1 in the first period. This is because under liquidation the entrepreneur does not earn rents in the second period and thus has no incentive to repay in the first period as well. If instead in state (y_1, y_2, L) the project is continued, in line with the analysis of state G in Proposition 1, in the two periods creditors either obtain $\alpha y_1 + y_2$ provided $y_1 > y_2$ or $\alpha y_2 + y_1$ provided $y_2 > y_1$. As a result, if courts perfectly observe (y_1, y_2, L), the optimal contract solves:

$$\begin{aligned} &\max_{\lambda(y_1,y_2,L)} E\left\{y_1 + \lambda\,(y_1, y_2, L)\,L + [1 - \lambda\,(y_1, y_2, L)]\,y_2\right\} \qquad (7)\\ &s.t. \qquad E\left\{\lambda\,(y_1, y_2, L)\,(L + \alpha y_1) + [1 - \lambda\,(y_1, y_2, L)]\,[(\alpha y_1 + y_2)I(y_1 > y_2) + (\alpha y_2 + y_1)I(y_1 \leq y_2)]\right\} \geq K \end{aligned}$$

Then, the first order conditions imply that the optimal contract stipulates liquidation in a given

state if and only if:

$$\begin{aligned} (L - y_2) + \omega \left[L - \alpha y_2 - (1 - \alpha) y_1 \right] &> 0 \quad \text{for} \quad y_1 < y_2 \\ (L - y_2)(1 + \omega) &> 0 \quad \text{for} \quad y_1 > y_2 \end{aligned}$$

where ω is the Lagrange multiplier associated with the investors' break even constraint. If the break even constraint is not binding (i.e. $\omega = 0$), then liquidation occurs if and only if $L > y_2$. If instead first period cash flows are low (i.e. $y_1 < y_2$) some socially unprofitable liquidations must be undertaken to attain investor break even. Indeed, the above first order condition implies for $y_1 < y_2$ that the project should be liquidated iff $L > L^* \equiv \left[y_2 + \omega(\alpha y_2 + (1 - \alpha) y_1) \right] / (1 + \omega)$. Clearly, if $\omega > 0$ then $L^* > y_2$, implying that liquidation is sometimes socially inefficient. While a full comparative static analysis of this version of our model is clearly beyond the scope of our paper, it is straightforward to see that under the optimal contract inefficient liquidation (i.e. liquidation in states where $y_1 < y_2$) is more likely the lower is investor protection α. Once more, the intuition is that if α is lower then the break even constraint becomes more binding, increasing the ex ante benefit of inefficient liquidation.

We now show that the first best efficient outcome can be attained under a debt structure akin to the one we found to be optimal in Section 4. Suppose that all liquidation rights are given to one creditor whose credit is collateralized by a fraction $l(y_1, L)$ of physical assets. The physical collateral of this creditor is allowed to vary with y_1 to allow for debt write-downs, as found optimal in Section 4. Courts can enforce $l(y_1, L)$ because they perfectly observe y_1 and also observe L after liquidation proceeds are collected. The creditor holding liquidation rights is also given a claim to a share $x(y_1, y_2) \leq \alpha$ of reorganization cash flows (thus, a floating charge). The rest of the second period proceeds are paid to the other creditors. Once more, courts can perfectly enforce $x(y_1, y_2)$ because they can observe reorganization profits once they are realized. Finally, first period repayment can be arbitrarily divided among the floating charge holder and any other creditor. Indeed, first period repayment does not directly enter our analysis because, for a given liquidation policy, it is equal to the one prevailing in the previous model where the state of nature is perfectly observed by courts. The only aspect that matters in this new context is the possibility for the debt structure just discussed to implement, under an uninformed court, the perfect information outcome attained in (7) above. Put differently, is it possible to write a contract inducing the floating charge holder to implement the optimal, full information liquidation policy and attain the

same amount of investor repayment? It is very easy to find that the answer is yes. In particular, it is sufficient to set $x(y_1, y_2)/l(y_1, L) = 1$ for any $y_1 > y_2$ and $x(y_1, y_2)/l(y_1, L) = L^*(y_1, y_2)$ for any any $y_1 < y_2$ (indeed, multiplier ω is a constant independent from specific realizations of (y_1, y_2, L)). There are many degrees of freedom for choosing specific reorganization and liquidation stakes of creditors that induce the floating charge holder to implement the optimal full information liquidation policy. For example, the debt contract may give the floating charge holder a share of liquidation proceeds just equal to his share of reorganization proceeds, but then implement a reduction in the creditor's physical collateral (i.e. a debt write-down), when the first period cash flow is low (and thus the firms is in financial distress) relative to the second period cash flow[34]. At the same time, it is immediate to see that under the liquidation policy implemented by the floating charge holder total repayment to all creditors is equal to the perfect information one because, for a given liquidation policy, the amount of realized cash flows that can be disgorged to creditors is solely determined by investor protection α. As a result, even in a complex and uncertain environment, the floating charge induces investors to internalize the social costs and benefits of reorganization and thus to implement the constrained optimal resolution of financial distress. ■

A2.2: Holdout in the Secondary Market. Suppose that $\alpha \in [\alpha_C, \alpha^*)$, the state is U and, consistent with Proposition 4, the large secured creditor is owed $x\alpha\overline{y}_2$ in reorganization and $x\alpha\underline{y}_2$ in liquidation. There are N dispersed creditors, each owed $(1-x)\alpha\overline{y}_2/N$ in reorganization and $(L - x\alpha\underline{y}_2)/N$ in liquidation. Because $\alpha < \alpha^*$, the dispersed creditors are owed more under liquidation than under efficient reorganization. A party (e.g. one of the creditors) considers launching a tender offer for dispersed claims in the attempt to bribe the holder of liquidation rights and induce (inefficient) liquidation. Is the offer going to succeed? The answer is yes if the bidder can buy a number M of dispersed claims at a price p such that

$$x\alpha\overline{y}_2 + (M/N)\left[(1-x)\alpha\overline{y}_2 - Np\right] \leq x\alpha\underline{y}_2 + (M/N)\left[L - x\alpha\underline{y}_2 - Np\right]$$

which becomes condition $M \geq M^* \equiv Nx\alpha(\overline{y}_2 - \underline{y}_2)/\left[L - x\alpha\underline{y}_2 - (1-x)\alpha\overline{y}_2\right]$. As a result, the tender offer succeeds if and only if at least M^* dispersed debtholders sell their claim. Does there exist an equilibrium where this happens? The answer is not. To see that, suppose that there is a negligible but positive cost of bidding. Then, if the bidder expects $M < M^*$, his demand for claims

[34] Notice here that the level of second period cash flow is initially truthfully announced by the floating charge holder and then perfectly verified by courts ex post.

$M^d(p)$ in the secondary market is N for $p < (1-x)\alpha\overline{y}_2/N$, and 0 otherwise. If instead the bidder expects $M \geq M^*$, his demand for claims $M^d(p)$ in the secondary market is N for $p < (L - x\alpha\underline{y}_2)/N$ and 0 otherwise. When N is large and each creditor does not expect to be pivotal, the supply of claims depends on the creditors' (rational) expectation about M. If creditors think that $M < M^*$, then supply is 0 for $p < (1-x)\alpha\overline{y}_2/N$, any number in $[0, N]$ for $p = (1-x)\alpha\overline{y}_2/N$ and N otherwise. If creditors think that $M \geq M^*$, then supply is 0 for $p < (L - x\alpha\underline{y}_2)/N$, any number in $[0, N]$ for $p = (L - x\alpha\underline{y}_2)/N$ and N otherwise. It is immediate to see that demand and supply can never be equal at $M \geq M^*$. Indeed, at price $p = (L - x\alpha\underline{y}_2)/N$ the bidder has no incentive to buy any claim. The only equilibrium is one where $p = (1-x)\alpha\overline{y}_2/N$ and $M = 0$. The intuition is that, since for the bidder to have appropriate incentives to buy p must be less than the fundamental value of the claim, each creditor prefers not to sell, hoping that the others will sell. ■

A2.3: The Cost of Debt Dispersion. Creditors' dispersion may be costly as it might hinder their individual incentives to gather evidence, hire lawyers, etc. so as to void or rescind managerial divertive activities, thereby reducing α, i.e. the share of cash flows that creditors can seize. Assume that if creditor i engages in (unverifiable) legal effort x_i, he prevents E from diverting a share x_i/n of each creditor's repayment. Thus, litigation is a public good: a creditor's successful attempt to monitor the debtor also benefits the other creditors. To exert x_i, creditor i spends a share $(1/2)\delta x_i^2$ of his own repayment. Thus, creditors' expenditures are perfect substitutes in increasing the total share of pledgeable cash flows. This assumption is only made for simplicity: it ensures that creditors' incentives do not depend on the value of their claims. Parameter $\delta \geq 0$ characterizes investor protection in this Section. Then, each creditor individually invests $x_i = 1/(\delta n)$, and all creditors obtain the same share $\alpha(n, \delta) = (2n-1)/2\delta n^2$ of their due repayment, which also corresponds to the overall share of cash flows the debtor must disgorge. Intuitively, $\alpha(n, \delta)$ falls in n because the moral-hazard-in-team among creditors gets worse. Expression $\alpha(n, \delta)$ can be integrated into the analysis of Section 4. Now enforcement is described by (δ, θ) and the earlier predictions obtained in the (α, θ) space can be formulated in the (δ, θ) space, with the main difference that our model also yields predictions on the number of creditors n. One can thus define a function $n(\delta, \alpha)$, which indicates the maximum number of creditors from which E can borrow so as to disgorge a fraction α of cash flows under creditor protection δ. The larger is δ, the larger is the cost of creditors' uncoordination as reflected in a smaller α and, in turn, the smaller is the maximum number of creditors consistent with financing. Thus, higher δ reduces the cost of the multiplicity of creditors and affects the optimal debt structure. ■

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