Optimal Resolutions of Financial Distress by Contract

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Abstract

We explore 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 legal protection of investors against fraud, and how efficient is the resulting resolution of financial distress. We find that when legal protection against fraud is strong, issuing a convertible debt security to a large, secured creditor allows the parties to attain the first best. Conversion of debt into equity upon default allows the debtor to collateralize the whole firm to the creditor, not just certain physical assets, thereby inducing the creditor to internalize the upside from efficient reorganization. When instead legal protection against fraud is poor, straight debt with foreclosure is the only feasible contract, even if it induces over-liquidation. The normative implication of our analysis is that an efficient resolution of financial distress is attained under freedom of contracting and strong protection against fraud.

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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 current 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).

To address these issues, academics have advanced several proposals for reform of state-mandated procedures.[1] Underlying these proposals is the common idea that the parties cannot efficiently resolve financial distress by contract, either because of writing costs or because of the unpredictability of financial distress (Hart 1995).

In this paper we explore theoretically the possibilities for the parties to efficiently resolve financial distress by contract as opposed to exclusively rely on state intervention. We thus ask, what are the properties of optimal debt structures that allow the parties to efficiently resolve financial distress by contract, absent legal restrictions to doing so? Under which circumstances are such contracts more likely to be effective?

Our idea is that relatively simple debt contracts allow the parties to efficiently resolve financial distress. For this to be the case, debtors must be able to contractually commit to allowing investors to repossess collateral upon default. There are two aspects of this. The first is the well-understood principle that debtors must be able to pledge physical assets to creditors. If creditors cannot foreclose on the debtor's assets, insolvent and unprofitable firms may not be efficiently liquidated. The second, and often overlooked, aspect is that debtors must be able to pledge the whole business to creditors upon default, not only certain physical assets. The latter aspect is crucial because it allows to design contracts inducing creditors to internalize the upside from efficient reorganization, while at the same time maximizing contractual repayment.

We argue that in practice the debtors' ability to pledge the firm's reorganization value depends on the extent of managerial tunneling (Shleifer and Vishny 1997, Djankov et al. 2005). When those who control a corporation can divert its profits to themselves, creditors may be better off

[1] See for example Aghion, Hart and Moore (1992), Bolton and Rosenthal (2002), Berglof, 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).

by ousting the management and triggering a quick piecemeal liquidation than by going through a lengthy reorganization and increasing the risk of tunneling.

Section 2 presents a simple model of credit where ex ante the parties try to resolve financial distress by contract but face the risk of insiders' tunneling. We parameterize legal protection against tunneling by the share of the firm's reorganization value that debtors can pledge to creditors. We find that under strong protection against tunneling debtors effectively collateralize the whole firm (as opposed to just certain physical assets) and contracts attain the first best. For example, the parties can write a "convertible debt" contract whereby the creditor is given (a large fraction of) the firm's equity upon default. Because of strong protection against tunneling, the creditor is residual claimant to the firm's reorganization value and thus internalizes the benefits of efficient reorganization. This way, not only has the creditor the incentive to efficiently reorganize or liquidate the firm, but may even afford to spend resources (or wait) to find out what the reorganization value is in case it is uncertain. [2]

If legal protection against tunneling is low, then under reorganization the creditor recovers very little of the original claim. For the creditor to internalize the upside from efficient reorganization, the debt contract must thus specify a large debt write-down upon default. In turn, such write-down undermines breakeven. As a result, financing ex ante may require committing to termination ex post, for example via a simple "straight debt" contract allocating 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.

Our model can also rationalize the need for debt contracts to rely on courts' expertise. If protection against tunneling is intermediate, the optimal debt write-down (that inducing the creditor to reorganize efficiently) is positive if and only if the firm's value in reorganization exceeds its value in a piecemeal liquidation. This contract, whose enforcement relies on the courts' assessment of the firm's reorganization value, improves upon convertible debt by reducing the total debt write-down, thereby facilitating financing, and improves upon foreclosure by attaining efficient reorganization, especially if courts make few mistakes. This result confirms the idea that court intervention in financial distress is especially useful if courts' expertise is large (Ayotte and Yun 2006).

Section 4 extends our model to allow for multiple creditors. We find that the optimal debt

[2] Alternatively, and especially if the debtor knows the firm's reorganization value, the first best is attained by allowing the debtor to make a non-cash bid for the reorganized firm. Now the creditor needs to concede a debt write-down to make sure that the debtor prefers not to bid if the reorganization value is low, thereby triggering liquidation.

structure has three ingredients. First, liquidation rights should be concentrated on a single large lender so as to avoid inefficient runs on the firm's assets. Second, a large portion of the equity in the reorganized firm should be pledged to such lender, 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. Thus, we show that two problems usually associated with creditors' multiplicity in financial distress such as inefficient runs on the debtor's assets (Bulow and Shoven 1978, Bolton and Scharfstein 1996) and secured creditors' bias against reorganization (Hart 1995, Manove, Padilla and Pagano 2001) are more likely the result of sub-optimal debt structures rather than intrinsic problems of financial distress.

Our theory makes two contributions. First, we characterize the properties of debt contracts and debt structures triggering an efficient resolution of financial distress. Second, we study how these contracts and their respective efficiency depend on legal protection against fraud. Broadly speaking, we find that when legal protection against fraud is strong, the parties can attain the first best by issuing to a large secured creditor a convertible (debt) security; when legal protection against fraud is poor, straight debt with foreclosure is the only feasible contract, even if it induces over-liquidation. Legal protection against tunneling determines how efficiently financial distress is resolved by determining debtors' ability to collateralize the firm's reorganization value. We thus confirm that more developed countries have a comparative advantage at more sophisticated resolutions of financial distress (Ayotte and Yun 2006).

These results thus beg a natural question, how come such contractual resolutions of financial distress are not observed more frequently in practice if, as we show in this paper, optimal debt structures have the potential of resolving financial distress efficiently? One natural answer is that there are often legal restrictions preventing parties from efficiently contracting about distress. Indeed, most real-world bankruptcy procedures are mandatory and thus disallow parties to contract out of the procedure provided by the state (Hart 2000).

More specifically, bankruptcy codes often forbid or override contractual provisions dealing with the firm's reorganization value. One leading example is convertibility clauses in financial contracts, which are precisely a way to contract on the firm's reorganization value but are often overridden by courts in many countries (Lerner and Schoar 2005, Strömberg and Smith 2005, Claessens and Klapper 2005). Another example is floating charge financing, whereby the whole firm is handed to the creditor in financial distress, which also allows debtors to collateralize the whole business as opposed to just certain physical assets. Floating charge financing is not allowed in many (especially

civil law) countries, despite the fact that when it is allowed, it is used and resolves financial distress efficiently (Djankov, Hart, McLiesh, and Shleifer 2006).[3]

These considerations lead to the normative implications of our analysis, which we discuss in Section 5. Our theory suggests that the two key ingredients of optimal bankruptcy law are freedom of contracting and strong legal protection against fraud. In practice, freedom of contracting amounts to allowing the parties to contractually opt out of state-mandated procedures, much in the spirit of Rasmussen (1992) and Schwartz (1997). We argue that doing so has two key advantages with respect to state intervention in bankruptcy, namely consistency and flexibility. Under freedom of contracting, the resulting resolution of financial distress is obviously consistent with the country's level of legal protection, unlike in many emerging countries where state-mandated procedures are borrowed from more developed economies but result in large inefficiencies (e.g. Franks and Loranth 2006, Lambert-Mogilianski et al. 2006).

Second, in contrast to the relative rigidity of existing state-mandated procedures (e.g. Hart 2000), freedom of contracting fosters flexibility across different firms. For example, high-tech firms with little physical assets but potentially strong future prospects will optimally rely on more flexible contracts so as to fully exploit the potential for efficient reorganizations. The convertibility clauses in venture capital contractsmight thus be viewed as an attempt to contract around state mandated procedures, effectively privatizing bankruptcy.

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 two-period firm that 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

[3] Given legal restrictions to ex ante contracting, one wonders whether parties could achieve efficient outcomes by using ex post workouts. Section 3.2 shows that this is not the case. While unrestricted contracting allows the parties to commit to an ex ante optimal outcome, private workouts only allow the parties to avoid ex post inefficiencies. As a result, private workouts may fail to guarantee ex ante break even, suggesting that legal restrictions to ex ante contracting do in fact hinder the efficient resolution of financial distress.

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 assets after piecemeal liquidation. More generally, L is the maximum value that can be extracted by I from the firm's physical assets as opposed to the value $y_2(\omega)$ generated by reorganizing the firm under existing management. For simplicity we abstract from the possibility that the firm is reorganized under an alternative management team. Both investment and liquidation are zero-one decisions (Section 4 allows for partial liquidation). We assume:

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

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

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

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

2.2 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 project'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. This parameterization, introduced in a different context by Shleifer and Wolfenzon (2002) and Johnson et al. (2000), captures the idea that protection against tunneling reduces non-dissipative private benefits (Aghion and Bolton 1992). Our model nests the Hart and Moore (1998) case of unverifiable cash flows as a special case when $\alpha = 0$.

Such contracting friction introduces two main differences with respect to the Hart and Moore (1998) baseline model. First, in our model the first period liquidation proceeds pledgeable to I are not just equal to L but to $L + \alpha y_1(\omega)$, being equal to the value of the project's physical assets L plus the amount $\alpha y_1(\omega)$ of first period cash flows that E was unable to divert.[4] Second, and more important, there is a potential incentive for I to reorganize: by reorganizing, I can obtain $\alpha y_2(\omega)$ in period 2, as opposed to zero in the baseline Hart and Moore (1998) model.

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's 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. If courts 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.

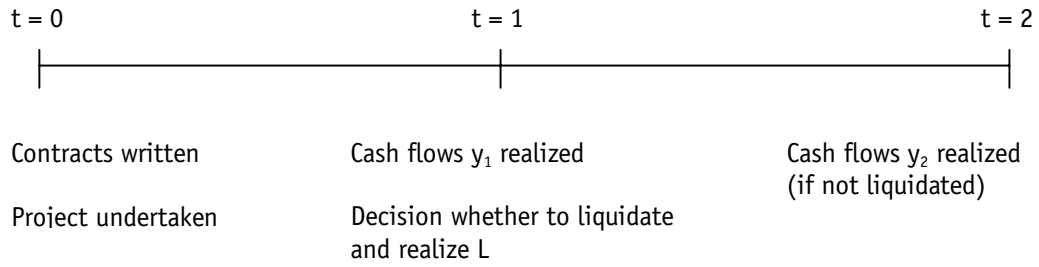
What about the parties' information structure? We assume that E and I are perfectly informed about the firm's reorganization value, but – as we will discuss – our main results also extend to the case where only E is informed. Figure 2 shows the timing of the model.

We consider financial contracts where I lends an amount $D \geq K$ to E in exchange for a repayment schedule. First period repayments can be made contingent on the state of nature. The liquidation decision (as well as the allocation of liquidation proceeds) can be made contingent both on the state of nature and whether E repaid or not in the first period. Crucially, depending on α the parties may also specify a division of the firm's reorganization value. As we shall see, their

[4] In line with Hart and Moore (1998), we assume that physical assets are harder for E to divert than other less tangible property. Yet, even if creditor protection affects L, too, all of our results still go through as long as physical assets are easier to pledge than cash flows.

ability to do so shapes the efficiency of contractual resolutions of financial distress.

Figure 2. Timeline



3 Contractual Resolutions of Financial Distress

We now study how the parties resolve financial distress by appropriately designed debt contracts. We first study the case when the parties do not renegotiate ex post, and summarize the results in Proposition 1. We then turn to the case of renegotiation and summarize the results in Proposition 2. We highlight our key results by focusing on the states U and B when the firm is in financial distress. The Appendix studies the optimal contract by taking also state G into account.[5]

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. This decision is complicated by the fact that bankruptcy courts lack the ability to independently assess the firm's reorganization value (i.e. whether the state is U or B), and parties face a conflict on whether to liquidate or reorganize.

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

[5] Disregarding state G in the following discussion is not an important omission. Because contract terms for G are set in isolation, consistent with Hart and Moore (1998) we find that in this state the parties optimally use the threat of foreclosure to deter E's strategic default and maximize repayment. 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 resolution of financial distress by affecting the ex ante break even constraint. The alternative assumption that courts cannot perfectly tell apart strategic and liquidity default would only complicate the analysis without changing our main results.

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 committing to pledge the whole firm to I in financial distress, not just certain physical assets. In turn, I is given the right to decide whether to liquidate or reorganize. If $\alpha\overline{y}_2 \geq L$, I 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 liquidates also in state U. In other words, I has a preference (bias) towards liquidation. To remove such pro-liquidation bias, the contract should lower I's proceeds from liquidation, for example through a debt write-down (or a severance pay to E) for an amount S such that:

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

As long as the parties can contract ex ante on the firm's reorganization value, they can give the creditor the incentive to efficiently reorganize.

Another solution, especially viable when E has superior information about the firm's reorganization value, is attained by committing to allow E to make a non-cash bid of $\alpha\overline{y}_2$ for the reorganized firm. Yet, this is not enough, as E would then always reorganize to get (at least) $\alpha\underline{y}_2 > 0$. To remove E's pro-reorganization bias, a debt write-down (or a severance pay) S should transfer some liquidation proceeds to E so as to:

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

Once more, the conflict between the parties is solved by giving E the incentive to implement the ex post efficient policy.[6]

In general, the parties can efficiently dispose of the firm by making E or I residual claimant to the social benefit of reorganization. In practice, this goal can be attained by including in the debt contract a convertibility clause that, along the lines described above, gives I a large equity stake into the reorganized firm (i.e. a share α of the firm). This way, E can collateralize to I the whole firm as opposed to just certain physical assets. 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 optimal debt contracts inducing the parties

[6] Thus, notice that in both cases the optimal contract decreases I's liquidation proceeds. However, only if E is the informed party is it crucial that E gets some liquidation proceeds (information rent). If I is informed, such liquidation proceeds could even go to charity.

to internalize the benefit from reorganization by suitably dividing liquidation and reorganization proceeds. Notwithstanding this key difference, for ease of exposition we call *convertible debt* the above contractual typology.

Although convertible debt resolves financial distress in an ex post efficient manner, the ex ante optimality of this contract hinges on good legal protection against tunneling. If α is low, inducing ex post efficiency is costly ex ante. Indeed, the expected repayment I obtains in financial distress under convertible debt is:

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

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 continue and E to liquidate. This second effect indicates that efficiently resolving financial distress with convertible debt is costly 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 for them is to write a debt contract whereby I commits to terminating the project in financial distress. In financial distress, the creditor forecloses on the firm's physical assets and liquidates them. 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 (or severance pay) $S(\omega)$, such that $S(B) = 0$, and $S(U) = L - \alpha\overline{y}_2$. We call *contingent debt* this state-contingent convertibility clause. 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:

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

As a result, if $\alpha\overline{y}_2 < L$, *contingent debt* outperforms *convertible debt* ex ante (compare (3) and (4)). The use of judicial expertise reduces the parties' conflict and thus the cost of providing them with incentives.[7]

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 in between them. Hence, *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 contract enforcement (α, θ) affect contracting and welfare? We find:

Proposition 1 *Under contractual freedom, there exist $\alpha_O \geq \alpha_C \geq \alpha_S$ such that I breaks even if and and only if $\alpha \geq \alpha_S$. For $\alpha \geq \alpha_O$, the parties attain the first best by resolving financial distress with convertible debt. For $\alpha \in [\alpha_C, \alpha_O)$, 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 contract terms for the parties to resolve financial distress.[8] Crucially, legal protection against tunnelling α shapes their

[7] 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 reduce also reduce I's repayment which is equal to $L + \alpha\overline{y}_2 - \theta(\overline{y}_2 - \underline{y}_2)$.

[8] 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 1977) 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 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 over *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.

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. In order to attain break even the parties must commit to always liquidate ex post by using *straight debt*.[9] Thus, 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 profitable firms. 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 ($\alpha \geq \alpha_O$), investor break even is easy to attain and the parties reach the first best by using convertible debt. The debtor now pledges the whole firm as collateral, not only specific assets, thus providing the creditor with incentives for efficient continuation. Alternatively, the debtor may be allowed to buy back the firm from the creditor with a non-cash bid, which would also induce the first best when α is high.

If α is intermediate ($\alpha_C \leq \alpha < \alpha_O$), the cost of incentives is so large that *convertible debt* is infeasible and the parties use *contingent debt*. This contract still relies on the parties' incentives because I must ultimately decide whether to liquidate or reorganize. However, the use of judicial expertise allows to increase I's share of liquidation proceeds precisely when liquidation is efficient, thereby reducing the amount of incentives to be provided.

From a welfare standpoint, our key result is that legal protection against tunneling (α) affects the parties' ability to resolve financial distress by contract. 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 (Ayotte and Yun 2006).

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

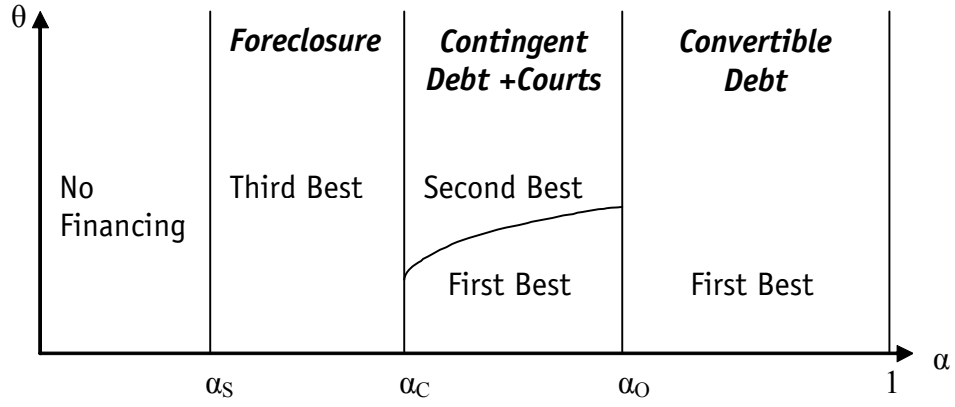
Proposition 2 *If I has all the bargaining power, then for $\alpha_C \leq \alpha < \alpha_O$ there is a function $\theta_R(\alpha)$ increasing in α such that, for $\theta \leq \theta_R(\alpha)$, I lends $K + \theta(L - \alpha\overline{y}_2)$ and parties attain the first best*

[9] 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.

by resolving financial distress under contingent debt. For every (α, θ) outside this region, contract 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 optimal 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 $\theta(L - \alpha\overline{y}_2)$ ex ante, 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.[10] Figure 3 summarizes the pattern of contract choice and welfare emerging from Proposition 2:

Figure 3. Contract Choice



In sum, by writing appropriate convertibility clauses in their debt contract, the parties can commit to attaining an efficient resolution of financial distress. Such clauses allow the debtor to pledge the whole of the firm, not just certain physical assets, as collateral to the creditor. In turn, pledging the whole firm as collateral helps remove the pro-liquidation bias of the creditor, thereby fostering efficiency. Crucially, the parties' ability to use such contractual instruments relies on good legal protection against tunneling. When such protection is low, conversion of debt into equity exposes

[10] Little changes if E has all the bargaining power. The appendix shows that, with respect to Proposition 2, this change only affects the version of *convertible debt* where E is allowed to make a non-cash bid. Now, E may strategically attempt to reduce the bid ex post, thereby lowering the threshold above which *convertible debt* is feasible. Yet, the main thrust of Proposition 1 is preserved.

the creditor to the debtors' massive tunnelling. In such circumstances, the only ex ante feasible solution is for the parties to commit to always liquidate the firm piecemeal.

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 (e.g. 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. Yet, ex post private solutions are permitted. In particular, the parties can avoid using the state-supplied bankruptcy procedure if they agree on a private resolution 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 answer 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. In order to do so, we characterize the absence of contractual freedom by assuming that the bankruptcy code decides whether to liquidate/reorganize a financially distressed firm and the division of the resulting proceeds among the parties. This is what state-mandated bankruptcy procedures do in theory and in practice: they specify "what to do with the firm" and "who gets what" (Hart, 2000).

As in the case of contracts, we allow state-mandated procedures to include a procedure for taking the decision whether to reorganize or liquidate a firm that relies on the parties' decisions or on judicial expertise, or both. We then ask: for a given state-mandated liquidation/reorganization procedure and for a given distribution of the resulting proceeds, what can the parties attain by renegotiating ex post in a private workout? We find:

Proposition 3 *Suppose that I has all the bargaining power. Then, 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.*

The main difference between contracts and private workouts is that while the former allow the parties to commit to an ex ante optimal outcome, the latter only allows the parties to avoid ex-

post inefficiencies. If in some state of nature the state-mandated procedure produces a different liquidation/reorganization outcome than the optimal contract, then either the workout fails and the parties are stuck with an inefficient outcome, or the workout succeeds but then I must make some concessions to E, which reduces the repayment I is able to obtain. This is because the optimal contract seeks to maximize ex post efficiency subject to I breaking even. In contrast, in an ex post workout the parties do not care about ex ante break even and only bargain to reach ex post efficiency. As a result, workouts may fail to guarantee I's break even, especially if the state-mandated procedure is biased towards inefficient reorganization.

Proposition 4 therefore implies that, in the absence of contractual freedom, one cannot expect workouts 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. Unfortnately, this assumption does not square with the way state-mandated procedures work in practice (Djankov et al. 2006). As a result, contractual freedom appears to be a crucial pre-condition for the parties to commit to an ex ante optimal resolution of financial distress.

4 Multiple Creditors

We now extend our model to the case where the entrepreneur borrows from multiple creditors. We ask whether E can induce an efficient resolution of financial distress by suitably designing the firm's debt structure ex ante. Our goal here is to address the often made point that the role of state-mandated bankruptcy procedures is to regulate conflicts among multiple creditors that could lead to inefficient runs on the assets of the company (e.g. Bulow and Shoven 1978 and Jackson 1986). 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.

A main difference between the single and the multiple-creditors case is that now E can always finance part of the project by issuing unsecured debt, namely debt which yields no liquidation rights nor liquidation proceeds to its holder. Because repayment of unsecured debt hinges on E's ability to pledge the project's cash flows, in the single creditor case unsecured debt supports financing only for very high α.

4.1 Debt Structure and Coordination Among Creditors

Two major sources of conflict among creditors have been analyzed in the literature. The first is the conflict between multiple secured creditors, which may lead to inefficient runs on the firm's assets.[11] The second is the conflict between secured and unsecured creditors, which may also lead to inefficient liquidations. We now present a numerical example to show that, under sub-optimal debt structures both of these conflicts may arise in our model.

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 the debt structure is set sub-optimally without taking financial distress into account. Furthermore, suppose that creditors' multiplicity prevents them from bargaining ex post. This assumption of non ex-post bargaining is commonly invoked to justify state intervention in financial distress. Consider the following two outcomes that may arise in financial distress given that creditors as a group are owed 88.

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 firms' 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 disappointing outcome arises because the two 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 repyment of 10. All other creditors are unsecured. This debt structure leads to efficient liquidation in B. Consider now state U. Now, irrespective of the

[11] In the banking literature, a run is often interpreted as the contemporaneous withdrawal by individual investors of bank deposit contracts (e.g. Diamond and Dybvig 1983). Such investors are secured to the extent that no suspension of convertibility is in place. In the real world, some bankruptcy codes allow unsecured creditors to file petitions for liquidation, but there is little evidence that it is the unsecured creditors filing these petitions that actually initiate bankruptcy as opposed to foreclosure by secured creditors.

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 but positive cost. Clearly, the secured creditor has no benefit of acquiring information. Moreover, although reorganization is still efficient on average because it yields creditors $(1/2)(19+3) = 11 > 10$, the uninformed secured creditor only sees the downside of reorganizing. This disappointing outcome 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 chosen by E played an important role. In the first case, E issued to many liquidation rights. In the second case, he issued a secured debt claim with a repayment schedule that was too flat across states. The question then arises, can E improve upon these cases by issuing a suitable debt structure ex ante? Suppose that E must borrow from $n > 1$ creditors. We then establish:

Proposition 4 *E can always replicate the optimal single-creditor under $n > 1$ creditors by borrowing from a number of secured and unsecured creditors but by concentrating in financial distress all liquidation rights on one secured creditor. For every (α, θ), such creditor should be given the same type of debt contract that he would obtain in the single-creditor case. Then, it is always possible for E to set contingent repayment schedules sustaining the same resolution of financial distress and total repayment arising in the single-creditor case.*

The one creditor outcome can be simply replicated under $n > 1$ creditors by concentrating liquidation rights in financial distress on one creditor and by suitably choosing his security and collateral. As in the single-creditor case, in financial distress the whole firm should be pledged to this creditor who, if α is high, should be given *convertible debt*; if instead α is intermediate or low, he should be given *contingent debt* (plus court intervention) or *straight debt*, respectively. Centralizing liquidation rights on one creditor avoids runs on the firm's assets. After this creditor has decided whether to continue or liquidate, he should pay out the claims to the other secured and unsecured creditors. In this respect, again in the spirit of the single-creditor case, repayments should be appropriately set by E so that the holder of liquidation rights becomes – at least at the margin – residual claimant to the firm's reorganization value. Providing these incentives to the creditor holding liquidation rights avoids the lazy creditor problem.[12]

[12] Notice that there are many other debt structures, besides the one described in Proposition 3, able to replicating

To see concretely how the above proposition works, consider the numerical examples A and B above and suppose that E issued ex ante the following debt structure:

There are two secured creditors, 1 and 2, each entitled to a first period repayment of 10. In financial distress, the whole firm is pledged to creditor 1, who decides whether to liquidate or reorganize it. In reorganization, debt is converted into equity and the senior creditor is given 1/2 of it. If creditor 1 liquidates, he gets 6. If he 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. Notice that there are no 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. In our example, this debt structure allows to efficiently resolve financial distress and to maximize the firm's debt capacity.

In sum, the above results illustrate that – without adding further frictions – inefficient runs or lazy creditors are not an inherent problem of financial distress, but rather an implication of an ill chosen debt structure. Irrespective of the enforcement frictions (α, θ) prevailing, E is able to replicate the single-creditor outcome by simply concentrating liquidation rights on one secured creditor and by giving him a sufficient share of the reorganized firm's equity that he has the incentive to efficiently reorganize.

Proposition 3 does not say, however, whether E can do better than in the single-creditor case by suitably choosing the debt structure. The next section addresses this question.

4.2 The Optimal Debt Structure

In our model not only can E replicate the single-creditor outcome under multiple creditors; having multiple creditors allows E some beneficial extra-flexibility. In particular, the concentration of liquidation rights on one secured creditor allows to separare the provision of incentives from break even, thereby reducing the incentive costs of *convertible debt*.

Suppose that $\alpha\overline{y}_2 < L$. Then, with a single creditor ex post efficiency is attained by paying

the single creditor case. In particular, under the current assumption of constant returns to scale, one could trivially replicate the single-creditor case by simply dividing the firm into n identical pieces, each financed by a single creditor. However, we prefer to stress the more centralized debt structure of the proposition because its optimality does not hinge on the assumption of constant returns to scale. Proposition 4 will give another justification for the concentrated debt structure of Proposition 3.

a positive severance pay $S = L - \alpha\overline{y}_2$ to E in liquidation. 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 can obtain:

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

The comparison of (5) and (3) shows that concentrating liquidation rights on one creditor allows E to reduce the ex ante cost of *convertible debt*. In particular, total debt capacity is unaffected by incentive costs. However, separation of liquidation and repayment rights is troubling under low protection against tunneling. If $\alpha < \alpha^*$, creditors as a group lose from reorganization. Hence, if creditors as a group are entitled to the full liquidation proceeds, then they may collude against E and liquidate the firms in state U.

4.2.1 Renegotiation and the Benefit of Debt Dispersion

Can the debt structure, i.e. the relative number, size and type of secured claims, be designed so as to counter the impact of ex post collusion among creditors? To address this issue, 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 $P(s\,|n) = [n!/(n-s)!s!]\,/2^n$

Thus, coalitions form by random assignment. $A.3$ captures the intuitive notion that if n is larger it becomes harder to form an encompassing coalition of creditors. Renegotiation works as follows: after a coalition is formed, its members bargain over liquidation and all bargaining power is held by creditors not holding liquidation rights (this assumption only simplifies the analysis but is not important for our results). Under $A.3$, we find:

Proposition 5 *If $\alpha \geq \alpha_C$, E attains the first best by giving all liquidation rights to a large secured creditor who is given a large 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 commiting to always liquidate by giving straight debt to the large secured creditor. If $\alpha < \alpha_S$, the project is not financed.*

If $\alpha \geq \alpha^*$, all creditors 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. 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, the secured creditor is given *straight debt* − which is not renegotiated.[13] If $\alpha < \alpha_S$, the project is not financed.

The most interesting case arises if $\alpha^* > \alpha \geq \alpha_C$. Now E can attain the first best by issuing a debt structure similar to the two-creditors structure above, except now there are infinitely many small creditors and the amount of liquidation proceeds paid by the large to the small creditors is $S = L - x\alpha\underline{y}_2$. The above debt structure is optimal for two reasons. First, by granting to the holder of liquidation rights a large equity stake x in the reorganized firms and by transferring a large amount of liquidation proceeds to small creditors, it maximizes large creditor's incentive to efficiently reorganize the firm. Second, by dispersing the remaining debt among infinitely many unsecured creditors it minimizes the probability of any given coalition of them having enough resources to convince the large creditor to liquidate.[14]

Here we abstract from potential costs arising from the dispersion of unsecured creditors. For example, as noted by Bris and Welch (2005) such dispersion may make them vulnerable to the debtor, eventually undermining break even. In the Appendix 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. Even in this case, we find that 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 creditor protection against tunneling is intermediate), giving contingent debt to the large secured creditor may be the optimal way to resolve financial distress.

To summarize, by suitably choosing the debt structure, E can induce an optimal resolution of financial distress. The optimal debt structure consists of three 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, 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

[13] 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.

[14] The same benefit of debt dispersion (and the same optimal debt structure) also arises under the alternative assumption that each unsecured creditor individually decides whether to bribe the option holder or not. In this case, collective bribing fails because of holding out of dispersed creditors (Gertner and Sharfstein 1991).

against the debtor. Interestingly, these ingredients for an optimal contractual resolution of financial distress are broadly consistent with the private resolutions of financial distress practiced in the U.K. as described in Franks and Sussman (2005a).[15]

5 Normative Implications

We discuss the normative implications of our analysis. Section 5.1 presents some suggestions for bankruptcy reform. Section 5.2 discusses the advantages of our suggestions. Section 5.3 relates the contractual resolution of distress we advance to three leading academic proposal for bankruptcy reform.

5.1 Suggestions for Bankruptcy Reform

Broadly speaking, our analysis suggests that freedom of contracting and strong protection against fraud should be at the core of an optimal bankruptcy reform. We examine freedom of contracting in Section 5.1.1 and protection against fraud in Section 5.1.2.

5.1.1 Freedom of Contracting

Our model shows that contracts can effectively resolve financial distress if the parties are allowed: a) to contractually commit to liquidate a distressed project, and b) to write claims on the firm's reorganization value. The former aspect of contractual freedom allows creditors to protect themselves against the debtor's tunneling, especially in developing countries. The latter aspect allows creditors to internalize the upside of efficient reorganizations.

In reality, parties often face strong legal restrictions to their ability to contract about financial distress. Real world bankruptcy codes often restrict the parties' ability to commit to liquidating a distressed project, for example by allowing failed debtors to unilaterally file for state-provided reorganization procedures. Such restrictions are even more severe given that these reorganization

[15] From a theoretical standpoint, these results differ from existing studies on the optimal number of creditors. Bolton and Scharfstein (1996) show that debt dispersion beneficially increases creditors' bargaining power by reducing the debtor's incentives for strategic default. By contrast, debt dispersion here reduces creditors' power. Another 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 ex ante and ex post costs of different claims are determined as a function of creditor protection.

procedures often impose an automatic stay on the debtor's assets that prevent creditors from repossessing collateral or induce a violation of the priority of secured creditors with respect to equity holders. But also state-provided liquidation procedures often consist of an elaborate, court supervised process where ex post conflicts between secured and unsecured creditors may produce substantial delays and impose large administrative costs on the parties. We believe that it would be beneficial to give parties the option to opt out of these procedures and to contractually commit to allowing creditors to simply foreclose on the debtor's assets upon default. This would streamline the resolution of financial distress, increase creditor protection and debt capacity, especially in developing countries.

It is even harder for parties to contract on the firm's reorganization value. As we argued, the parties may write in debt contracts convertibility clauses allowing creditors to obtain an equity stake in the reorganized firm.[16] Unfortunately, convertibility clauses are often overridden by bankruptcy courts and conversions of debt into equity are only attained ex post in private workouts under the threat of formal bankruptcy.

A very similar, and sometimes used, arrangement is floating charge financing. Unlike a fixed charge, which is a security on certain specific physical assets, the floating charge (or floating lien) is a security that may 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). As in our convertible debt contract, upon default the floating charge holder has an exclusive right to decide whether, when and how to seize the company's assets and liquidate them, effectively becoming the unique residual claimant of the firm. If he decides for liquidation, the floating charge holder usually appoints a professional agent (e.g., a receiver). In turn, such professional assumes all the powers of the company's board of directors on behalf of the floating charge holder (e.g. Davies 1997, p. 385). The professional agent has typically discretion only about the mode of liquidation, whether by a going concern sale or a piecemeal liquidation. 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 the preferential claims and the unsecured creditors (e.g.

[16] This mechanism is different from many convertible debt contracts observed in practice, whereby convertible debt-holders can convert their claims into equity pro-rata, and do so when share prices are sufficiently large. The reason is that upon distress share prices are either zero or very low, so that conversions of debt into equity are unlikely to be observed. However, sophisticated investors (for example venture capitalists) can usually design debt contracts that shift control upon non-repayment and make the investor effectively residual claimant (e.g. Kaplan and Stromberg 2001), very much in the spirit of our model.

Franks and Sussman 2005). Unfortunately floating charge is legally forbidden in many countries around the world (Djankov et al. 2006). We believe that the parties should be allowed to use floating charge finance and, more generally, to write claims on the firm's reorganization value that are upheld by bankruptcy courts. These claims would allow debtors to pledge to creditors the whole firm, not only specific physical assets, thereby allowing creditors to internalize the upside of efficient reorganizations, in turn improving both the ex ante and ex post efficiency of financial distress. Consistent with this view, the evidence indicates that floating charge finance facilitates an efficient resolution of financial distress (Djankov et al. 2006).

It is worth pointing out that our analysis does not imply that there is no role for public regulation of bankruptcy or that state-provided procedures should be abolished. Our theory instead implies that these procedures should not be mandatory but allow the parties to opt out of them, in line with Rasmussen (1992) and Schwartz (1997). In particular, bankruptcy reforms should enhance the parties' ability to contractually dispose of the debtors' physical assets as they see fit and, perhaps more importantly, their ability to contract on the firm's reorganization value.

5.2 Legal Protection against Tunneling

In our model strong legal protection against tunneling enhances efficiency in two ways. By increasing debtors' ability to pledge the firm's reorganization value, better legal protection against tunneling allows large and sophisticated creditors to negotiate with the debtors more flexible and efficient contracts to deal with financial distress. At the same time, by reducing debtors' ability to divert the firm's cash flows, better protection of investors against tunneling protects small, dispersed, unsophisticated creditors, thereby increasing their willingness to lend ex ante, and thus debt capacity. As a result, we argue that increasing legal protection against tunneling should be at the core of an optimal bankruptcy reform.

Of course, investor protection against tunneling does not only depend on bankruptcy laws; it more broadly reflects the quality of a country's legal system. As showed by our model, financial distress is better resolved when large and sophisticated creditors are willing to take an equity stake in the reorganized firm. However, tunneling of the reorganized firm by its managers may prevent creditors from taking such stake, creating pressure for a quick piecemeal sale. As a result, our results suggests that – by protecting equity-holders against managerial tunneling – general anti self dealing laws (Djankov et al. 2006) and securities laws (La Porta et al. 2005) are key prerequisites for an efficient resolution of financial distress, thereby confirming that bankruptcy reform should

not be viewed in isolation (Hart, 2000).

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. On the other hand, bankruptcy codes protect small, dispersed and unsophisticated investors – who are unlikely to take advantage of these contractual protections[17] – with specific anti self-dealing provisions known as fraudulent transfer law.

The usual reason for specific fraudulent transfer law is to reach more directly transactions made by firms in the vicinity of financial distress.[18] Put differently, some self dealing transactions can be particularly harmful because they can trigger financial distress and the ultimate winding up of the company. As a result, more legal tools are needed, such as for example a long look-back period to identify such transactions. Interestingly, 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 S. 213 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.

In general, not only anti-self-dealing law but also fraudulent transfer law is a key component of investor protection against fraud.[19] For example, Baird (2006) argues that fraudulent transfer law was the key tool for unraveling many transactions in Enron. As a result, we believe that bankruptcy law should provide an ex post mechanism for detecting, punishing and thus deterring managerial misbehavior, thereby increasing investor protection, especially for small, unsophisticated creditors.

[17] This is especially likely to be the case for involuntary creditors such as tort claimants (Kraakman 2006, Eidenmuller 2006, Wagner 2006).

[18] One form of tunneling that is particularly relevant 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 whole business to creditors.

[19] LLSV (1998) list a number of legal provisions protecting the right of creditors, such as the absence of an automatic stay on the assets, the right for secured creditors to collateral in reorganizations, the need of creditors' consent for filing for reorganization, and management removal pending the resolution of the reorganization procedure. LLSV also consider one remedial creditors' right, namely the existence of a legal reserve requirement forcing firms to maintain a certain level of capital to avoid automatic liquidation. It protects creditors who have few other rights by forcing an automatic liquidation before all capital is stolen by the insiders.

Such a mechanism might include seeking strict avoidance of fraudulent conveyances, placing the burden of proof and personal liability on directors, and maximizing mandated disclosure.

In sum, bankruptcy reforms should foster an efficient resolution of financial distress by focusing on contractual freedom and on strong protection against tunneling. Only under freedom of contracting and strong protection against fraud can debtors collateralize the whole firm, thereby protecting both the large, sophisticated creditors and the small, dispersed, unsophisticated creditors, while at the same time ensuring an efficient disposal of the firm.

5.3 Advantages of a Contractual Resolution of Financial Distress

We now discuss two key advantages of our suggestions for bankruptcy reform. First, they allow a resolution of financial distress that is both flexible (Section 5.2.1) and consistent with the pre-existing legal infrastructure (Section 5.2.2).

5.3.1 Flexibility

One criticism often raised at existing proposals for bankruptcy reform is that they are relatively rigid, in that they apply to all firms in a given economy, regardless of their underlying technology. By contrast, our proposal allows for flexibility, in that one can expect different types of firms to rely on different contractual arrangements to efficiently resolve financial distress.

For example, firms in mature industries such as real estate and utilities where the debtor in possession is unlikely to have a significant advantage in running the reorganized firm, and thus where physical assets represent a large proportion of total assets (i.e. where $\overline{y}_2$ is very close to L), may be expected to rely heavily on the firm's physical assets as collateral. In this case, the parties attain the first best by contractually committing to liquidating a financially distressed project.

Conversely, 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 to resolve financial distress so as to pledge to outside investors the reorganization value of the firm. Such contracts should use convertibility clauses and/or floating charge financing so as to induce the debtor to internalize the (large) upside of reorganizing the firm under existing management. Some of these features are indeed captured by Venture Capital financing.[20]

[20] Strictly speaking, VC contracts use a large variety of securities and not just convertible debt, as in our model; for example, VCs often use convertible preferred stock. Broadly speaking, such VC contracts capture the spirit of our

Of course, for the latter arrangements to work properly legal restrictions to contracting should be low and protection against tunneling should be strong. These observations may help explain the relative under-development of the high-tech sector in Continental Europe as opposed to the U.S.

5.3.2 Consistency

Another criticism that has been raised with respect to state-provided bankruptcy procedures, related to the attempt of exporting them from developed to emerging countries, is that such procedures rely on an effective legal infrastructure (e.g. high quality bankruptcy courts) that may only be available in developed economies (Ayotte and Yun 2006). For example, Franks and Loranth (2006) document that in Hungary, the introduction of a judicially administered reorganization procedure inspired to U.S. Chapter 11 led to significant inefficient reorganizations, consistent with the experience of other transition economies (e.g. Lambert-Moglianski et al. 2006).

By contrast, our proposal is consistent with the country's legal infrastructure because one can expect private parties to rely only on those contracts that such legal infrastructure is effectively able to enforce. For example, in economies plagued by weak investor protection, it would be highly desirable to give parties the freedom to contractually commit to allowing the creditors to simply foreclose on the firm's physical assets upon default. By committing to providing creditors with such contractual protection, marginal projects would be better able to obtain financing.

5.4 Contracts and Academic Proposals for Bankruptcy Reform

We conclude the normative 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 (1991) 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).

model: in VC contracts, board rights, voting rights, and liquidation rights are allocated such that if the firm performs very well, the VCs retain their cash flow rights, but relinquish most of their control and liquidation rights. If the firm is in financial distress instead, the VCs obtain full control (e.g. Kaplan and Stromberg 2001). Consistent with the spirit of our model, Venture Capitalists are thus able to become residual claimants in states of financial distress.

5.4.1 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) converting I's debt into equity, and 2) giving E (i.e. the only shareholder) the option to post a non-cash bid to buy back the firm from I. By exercising the option, E avoids liquidation and continues the project.[21] Notice that this procedure shares many features with our convertible debt contract where in financial distress the whole firm is pledged to I and the debtor is allowed to make a non-cash bid for the firm. As a result, our model rationalizes the optimality of the AHM procedure for sufficiently high legal protection against tunneling.[22]

5.4.2 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

[21] As stressed by Bebchuk and AHM, options serve two roles. First, options are a way to endogenously reveal information of the project's continuation value. Second, options are a 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.

[22] The way the AHM scheme works in practice depends on whether E is given the right to exercise the option by making a cash or a non-cash payment. In the former case, E can raise up to $\alpha\overline{y}_2$ from capital markets in state U. As a result, the AHM scheme yields full efficiency for $\alpha\overline{y}_2 > L$ and over-liquidation otherwise. If instead E is allowed to exercise the option by making a non-cash payment (i.e. by issuing shares), the AHM scheme yields always over-continuation because E will always claim that the state is U and promise to pay out L out of second period cash flows $\overline{y}_2$. By always continuing, E obtains at least $(1-\alpha)\, y_2(\omega) > 0$ as opposed to 0 under liquidation. In line with our findings in Section 3, this discussion suggests that for $\alpha \geq \alpha_O$, the AHM procedure as discussed above is (weakly) dominated by a *convertible debt* contract. In fact, for $\alpha \geq \alpha_O$, unlike AHM, a *convertible debt* contract guarantees the first best. More generally, irrespective of the type of options used, if $\alpha < \alpha_O$, our analysis indicates that the ex ante cost of options is larger than their ex post benefit and options are no longer optimal. In this case, a bankruptcy procedure mandating the distribution of options ex post is costly, either because it leads to ex post inefficiencies or because it undermines break even. Moreover, proposals mandating automatic conversion of debt into equity upon default may undermine break even if creditor protection against self dealing is low.

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 model we do not consider selling the firm to outside bidders or alternative management teams. We just note that 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 exceeds its liquidation value. Then, 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.

5.4.3 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 identify sufficient conditions for optimal bankruptcy law, namely freedom of contracting, and in particular the possibility for parties to write convertibility clauses and floating charge financing that are upheld by courts, together with strong protection against managerial self-dealing and fraudulent conveyances. The intuition is that parties need to maximize the possibility to collateral the whole of the firm's reorganization value, and not just certain physical assets. Consistent with our theory, Djankov, Hart, McLiesh, and Shleifer (2006) find that foreclosure works extremely well when complemented with floating charge, but only poorly without it.

Given that fraudulent conveyance law varies significantly across bankruptcy codes and floating charge financing is permitted in only a few countries, our theory may help shed light on the patterns of debt enforcement around the world (Djankov, Hart, McLiesh, and Shleifer 2006).

7 Proofs

Debt Contracts. We consider the following contracts. I advances $D \geq K$ to E, who agree to a first and second period state contingent repayment $d_1(\omega)$, $d_2(\omega)$, $\omega = G, U, B$ and to a liquidation policy $\lambda(\omega)$. Feasibility requires $d_1(\omega) \leq \alpha y_1(\omega) + \lambda(\omega)L$, $d_2(\omega) \leq \alpha y_2(\omega)$, $\lambda(\omega) \in \{0, 1\}$. First period repayment can also be contingent on liquidation. The contract also specifies a first and second period repayment and liquidation policies $d_1^D(\omega_3)$, $d_2^D(\omega_3)$ $\lambda^D(\omega)$ that are enforced if E defaults. The parties can also delegate the liquidation decision to themselves by writing into the contract a control allocation $i(\omega) \in \{0, 1\}$. If $i = 1$, I decides whether to liquidate; if $i = 0$, E does. By allocating the liquidation/decision to themselves, the parties may improve ex post efficiency by using their superior information, because bankruptcy courts may erroneously enforce a state contingent liquidation policy $\lambda(\omega)$.

Proof of Proposition 1. The general expression for the contracting problem solved by E and I is cumbersome, but its logic is simple. Suppose that I advances $D = K$. Consider state G first. Because courts can perfectly determine if $\omega = G$, $\lambda(G)$ is perfectly enforced. To avoid ex post inefficiencies, the parties set $\lambda(G) = 0$. The incentive compatible repayments $d_1(G), d_2(G)$ satisfy:

$$y_1 - d_1(G) + \overline{y}_2 - d_2(G) \geq y_1 + \lambda^D(G)L - d_1^D(G) + \left[1 - \lambda^D(G)\right]\overline{y}_2 - d_2^D(G).$$

Subject to the feasibility constraints $d_1(G) \leq y_1, d_2(G) \leq \alpha\overline{y}_2$, $d_1^D(G) \leq \alpha y_1 + \lambda^D(G)L$, $d_2^D(G) \leq \left[1 - \lambda^D(G)\right]\alpha\overline{y}_2$. E's income in case of default is minimized at $\lambda^D(G) = 1$, $d_1^D(G) = L + \alpha y_1$. This yields (**??**). Because $\overline{y}_2 > L$, $\lambda(G) = 0$, $\lambda^D(G) = 1$ is optimal at every (α, θ) and maximizes ex ante and ex post efficiency. Looking at G in isolation was indeed correct. What about B and U? As hinted in section 3.1, there is a tradeoff between ex ante and ex post efficiency. We look for optimal contracts as follows. First, at each (α, θ), we find the maximal repayment I can attain under different arrangements on the liquidation/continuation decision. Then, at each (α, θ) the parties choose the most efficient arrangement among those guaranteeing that I breaks even.

1) First consider contracts maximizing ex post efficiency by exploiting the parties' information on $y_2(\omega)$. **1.1**) E sets liquidation ($i(B) = i(U) = 0$). Call d_L the amount of liquidation proceeds going to I. The transfers such that I sets $\lambda(B) = 1$, $\lambda(U) = 0$ satisfy constraints $L - d_L \geq \underline{y}_2 - d_2(B)$ in B and $\overline{y}_2 - d_2(U) \geq L - d_L$ in U, as E must obtain more by liquidating today than he expects to get tomorrow from continuing in B, while the opposite should hold in U. By relabeling $S_{EP} \equiv L - d_L$**,** this contract is equivalent to the E-put as described in section

3.1. 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 debt contract with an E-put (EP henceforth) repays I at most (**??**) where$\widetilde{L} \equiv L - S_{EP}$. **1.2)** I sets liquidation ($i(B) = i(U) = 1$). The transfers such that I sets $\lambda(B) = 1$, $\lambda(U) = 0$ satisfy constraints $d_L \geq d_2(B)$ in B and $d_2(U) \geq d_L$ in U. Call $L - d_L \equiv S_{IC}$. Then, this contract is equivalent to the I-call described in section 3.1 with strike price S_{IC}. I's payoff is maximized at $d_2(B) = \alpha \underline{y}_2$, $d_2(U) = \alpha \overline{y}_2$ and $d_L \equiv L - S_{IC} = L - \max[L - \alpha \overline{y}_2, 0]$. This debt contract with an I-call (IC henceforth) repays I at most (**??**), where $\widetilde{L} \equiv L - S_{IC}$. For $\alpha \geq \alpha^*$, this contract is equivalent to an I-put with strike price $\alpha \overline{y}_2$. **1.3)** Like in 1.1) E sets liquidation ($i(B) = i(U) = 0$), but $d_L(\omega)$ is state contingent, where $d_L(U)$ and $d_L(B)$ are enforced by courts, with error if $\theta > 0$. Contingent liquidation transfers give E the incentive to do different things in different states, otherwise nothing changes with respect to 1.1). It is optimal to set $d_L(B) = L - (1-\alpha)\overline{y}_2$, $d_L(U) = L$ to maximize repayment. Yet, notice that this contract is never optimal, because by setting $d_L(U) = L - (1-\alpha)\overline{y}_2$, one could improve on it both ex post and ex ante. **1.4)** Like in 1.2), I sets liquidation ($i(B) = i(U) = 1$), and the contract specifies $d_L(U)$ and $d_L(B)$. This contract is equivalent to the contingent debt contract described in section 3.1, where $L - d_L(\omega) \equiv S_{IC}(\omega)$. Contingent liquidation transfers must give I the incentive to do different things in different states, otherwise nothing changes with respect to 1.2). It is optimal to set $S_{IC}(B) = 0$, $S_{IC}(\omega) = \max[L - \alpha \overline{y}_2, 0]$ because they maximize repayment. Under *contingent debt* (CD henceforth) I obtains at most (3) and ex post losses yield an over-liquidation cost of $(1-\pi)(1/2)\theta(\overline{y}_2 - L)$. Figure A1 summarizes the properties of options:

Figure A1. Properties of Options

Option	Decision if Option Not Exercised	Strike Price	Repayment	F.B. Liq.?
I-Call	Continue	$\max[0, L - \alpha \overline{y}_2]$	$\alpha \overline{y}_2 + \min[\alpha \overline{y}_2, L]$	Yes
E-Put	Continue	$(1-\alpha)\,\underline{y}_2$	$\alpha \overline{y}_2 + L - (1-\alpha)\,\underline{y}_2$	Yes
E-Call	Liquidate	$\alpha \overline{y}_2$	$\alpha\left(\overline{y}_2 + \underline{y}_2\right)$	No
I-Put	Liquidate	$\alpha \overline{y}_2$	$\underline{y}_2$	No

2) We now study contracts where the bankruptcy court directly takes the liquidation decision ($\lambda(B) = 0, \lambda(U) = 1$). I gets L under liquidation, $\alpha y_2(\omega)$ under continuation. The average ex post

loss under this contract is $(1-\pi)(1/2)\theta(\overline{y}_2 - \underline{y}_2)$ and maximal repayment to I is

$$\pi(\overline{y}_2 + \alpha y_1) + (1/2)(1-\pi)\left[L + \alpha\theta\underline{y}_2 + (1-\theta)\,\alpha\overline{y}_2\right]. \tag{6}$$

To anticipate another result on contract choice, notice that *CD* dominates this contract in terms of ex post and ex ante efficiency. The intuition is that *CD* at least uses some of the investor's superior information, thus avoiding under-liquidation losses. Hence, this contract is never chosen.

3) We now study contracts where the parties mandate a non-contingent liquidation policy. **3.1)** Parties write $\lambda(B) = \lambda(U) = 1$, $d_L = L$. This is *straight debt* (*SD* henceforth) with ex post losses $(1-\pi)(1/2)(\overline{y}_2 - L)$ and maximal repayment (**??**). **3.2)** Parties write $\lambda(B) = \lambda(U) = 0$, $d_2(\omega) = \alpha y_2(\omega)$. Ex post losses are $(1-\pi)(1/2)(L-\underline{y}_2)$ and repayment to I is at most $\pi(\overline{y}_2+\alpha y_1)+(1/2)(1-\pi)(\alpha\underline{y}_2 + \alpha\overline{y}_2)$. To anticipate another result, notice that *EP* dominates this contract in terms of ex post and ex ante efficiency. Hence, this contract is never chosen.

Note: 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. As a result, increasing the size of the loan only undermines break even without bringing any benefit. We will see that ex post renegotiation between I and E gives rise to a benefit of $D > K$.

Optimal Contracts as a Function of (α, θ). The above analysis reveals the following properties of optimal contracts. In terms of ex post efficiency, for $\theta > 0$ the ranking among the contracts not yet ruled out is: *IC*$\sim$*EP* $\succ$ *CD* $\succ$ *SD* $\succ$ *no contract* (if $\theta = 0$ and/or $\alpha \geq \alpha^*$, then *CD* ranks the same as *IC*). In terms of ex ante efficiency, for $\alpha < 1$ there are two regimes: i) if $\alpha \geq \alpha^* = L/\overline{y}_2$ then *IC* $\sim$ *CD* $\succ$ *EP*, *SD* is last if $\alpha \geq \widetilde{\alpha} = (L+\underline{y}_2)/(\overline{y}_2+\underline{y}_2)$ and third otherwise; ii) if $\alpha < \alpha^*$ then *SD* $\succ$ *CD* $\succ$ *IC*, *EP* is last if $\alpha \geq \widehat{\alpha} = (L-\underline{y}_2)/(\overline{y}_2-\underline{y}_2)$ and third otherwise. For $\alpha = 1$, all contracts are feasible and *IC, EP* or *CD* is chosen (but also an *E*-call with $S_{EC} = \overline{y}_2$ may be chosen). In general, there exist α_{IC}, α_{EP}, α_{SD}, α_{CD}**,** which represent the feasibility thresholds for *IC*, *EP*, *SD* and *CD*, respectively. A contract is only feasible whenever α is non smaller than the corresponding threshold. Then, there are two cases: i) $\alpha_{SD} > \alpha^*$ (i.e. at α^* *SD* is infeasible), then define $\alpha_O \equiv \min[\alpha_{IC}, \alpha_{EP}]$, $\alpha_C = \alpha_O$, $\alpha_S = \alpha_O$. In this case, *SD* is never optimal because when it is feasible it is dominated ex post by *IC* and *EP*, which are also feasible; ii) $\alpha_{SD} < \alpha^*$ (i.e. at α^* *SD* is feasible), then define $\alpha_O \equiv \min[\alpha_{IC}, \alpha_{EP}]$, $\alpha_C = \alpha_{CD}$, $\alpha_S = \alpha_{SD}$. In this case, 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 *IC* and *EP* are not feasible (i.e. if $\alpha_C \leq \alpha < \alpha_O$). *IC* and/or

EP are optimal whenever feasible (i.e. if $\alpha_O \leq \alpha$) because they yield the first best. ■

Proof of Proposition 2. With ex post renegotiation, I may benefit from lending $D = K+t$, $t > 0$ to E. Notice that setting $t > 0$ is never optimal under *debt plus option* (i.e. *EP* and *IC*). Because I on average recoups only a fraction of t, setting $t > 0$ only undermines break even (especially if E has all the bargaining power). That is, it is profitable for the parties to set $t > 0$ only if this reduces ex post inefficiencies. Because *EP* and *IC* yield full ex post efficiency, setting $t > 0$ and letting the parties renegotiate can only be optimal under *CD* and *SD*. We study the model under two alternative assumptions on bargaining power, when I (resp. E) has full bargaining power.

I) I has all the bargaining power. In state G, incentive compatibility implies $d_1(G) + d_2(G) \leq \alpha(y_1 + t) + \overline{y}_2$, i.e. $d_1(G) = \alpha(y_1 + t) + (1 - \alpha)\overline{y}_2$, $d_2(G) = \alpha\overline{y}_2$. Notice that in this **case**, ex post renegotiation does not affect *EP* and *IC*. When $t = 0$ repayment in G is the same as in the no-renegotiation case. Moreover, because *EP* and *IC* are designed to maximize I's payoff, they are renegotiation proof also in B and U when I has all the bargaining power. What about *CD* and *SD*? i) *CD*. With probability θ, this contract induces over liquidation in U. The goal here is to find a $t > 0$ allowing E to bribe I in U to continue the project before the court's intervention. When $\alpha < \alpha^*$ (this is the relevant case, otherwise *IC* and/or *EP*, $t = 0$ attain the first best), I's average payoff in U is $\alpha\overline{y}_2 + \theta(L - \alpha\overline{y}_2)$. If $t^* = \theta(L - \alpha\overline{y}_2)$, E can bribe I to continue in U. This contract yields the first best if feasible, i.e. when:

$$t^* \equiv \theta(L - \alpha\overline{y}_2) \leq \left[\pi(\overline{y}_2 + \alpha y_1) + (1/2)(1 - \pi)(L + \alpha\overline{y}_2) - K\right]/(1 - \alpha\pi). \tag{7}$$

The numerator of the right-hand side of (7) is a measure of slackness of I's break even constraint under *CD* if $t = 0$. The denominator says in how many states of nature such slackness should be "spent" to finance the upfront payment t from I to E. The logic of (7) is that only if t^* is sufficiently small can *CD* achieve the first best when (under renegotiation) I advances $K + t^*$ to E. Condition (7) defines a function $\theta_R(\alpha)$ such that break even is attained iff $\theta \leq \theta_R(\alpha)$. For $\theta > \theta_R(\alpha)$, the parties use *CD* with $t = 0$. Notice that it is optimal to set t at the lowest level t^* (which yields no surplus to I despite the fact he has all the bargaining power) because it maximizes the chances of break even. It is also easy to show that in U and B, it is optimal to leave t "in E's hands" without using it to increase contractual repayment because it reduces the amount of resources E needs to bribe I in renegotiation. ii) *SD*. Here we should have $t = L - \alpha\overline{y}_2$ (again the

minimum amount such that E can bribe I). This contract yields the first best if:

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

Hence, I obtains less than under IC and cannot be feasible when IC is not. If SD is optimal, $t = 0$ and over liquidation cannot be renegotiated away. However, for α sufficiently large, SD with $t = L - \alpha\overline{y}_2$ can be as good as *debt plus option.*

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 exists 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. Additionally, for large α (but still $\alpha < \alpha^*$)**,** several contracts can yield the first best (e.g. SD with $t = L - \alpha\overline{y}_2$ or, equivalently, IC with $S_{IC} = 0$ and $t = L - \alpha\overline{y}_2$).

II) E has all the bargaining power. Besides reducing ex post inefficiency, renegotiation may allow 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 $\lambda^D(G) = 1$, $d_1^D(G) = L + \alpha(y_1 + t)$ if $\alpha < \alpha^*$ and at $\lambda^D(G) = 0$, $d_1^D(G) = \alpha(y_1 + t)$, $d_2^D(G) = \alpha\overline{y}_2$ if $\alpha \geq \alpha^*$. Intuitively, this is less than (**??**). Let us now look at B and U, considering different contracts. i) *EP.* In B, incentive compatibility implies $t + L - d_L \geq t + L - d_2(B)$ and thus $d_L = d_2(B) = \alpha\underline{y}_2$. Thus, E can always bribe I in U, which implies $\overline{y}_2 - d_2(U) \geq \overline{y}_2 - d_L$, or $d_2(U) = \alpha\underline{y}_2$. If E has full bargaining power, EP is thus less feasible than before, as I in B and U only gets $\alpha\underline{y}_2$ on average. ii) *IC.* Under this contract I has the right to liquidate/continue the project, so, even if E has full bargaining power, renegotiation does not alter I's incentives. As a result, IC is unaffected by renegotiation. iii) *CD.* The same can be said of CD, where I has still the right to liquidate/continue the project. The only difference now is that by setting $t^* = \theta(L - \alpha\overline{y}_2)$, over liquidation is renegotiated away in U**.** Thus, if $\theta \leq \theta_R(\alpha)$ this contract yields the first best. Notice that the shift in bargaining power from I to E does not alter renegotiation under CD because t is set at the smallest level making renegotiation possible. iv) *SD.* Also under SD nothing changes as $t = L - \alpha\overline{y}_2$ is infeasible when SD is optimal. It is only feasible when IC is also feasible. Optimal Contracts. The only difference between the case where E has full bargaining power with respect to the case where I has full bargaining power is that in the former case renegotiation undermines EP, which is now less feasible at any α. ■

Proof of Proposition 3. With $n > 1$, E offers a menu of n creditors, at $t = 0$. The project has nondecreasing returns, i.e. liquidating share $1/n$ of its assets yields $(1/n)L$ in liquidation and

$y_2(1-1/n)$ in continuation value, where $y_2(1-k/n)-y_2(1-(k-1)/n) \geq y_2(1-(k-1)/n)-y_2(1-(k-2)/n)$, $\forall k \geq 0$, where $y_2(0)=0$. E can replicate the single creditor outcome in G by setting, for each creditor, repayments $d_1(G)=(\alpha y_1+(1-\alpha)\overline{y}_2)/n$, $d_2(G)=\alpha\overline{y}_2/n$ and by granting him $(L+\alpha y_1)/n$ upon default. E defaults on $k \leq n$ creditors if $y_2(1)-y_2(1-k/n) < (k/n)(y_2(1)-y_2(0))$ the assumption of nondecreasing returns implies that this condition is never satisfied. Thus, $k=0$ and the one-creditor outcome is attained in G. The same outcome would also be replicated under decreasing returns by specifying that the project's physical assets should be fully liquidated upon default. What about states U and B? At any α**,** the debt structure of Proposition 3 attains the same outcome of the one-creditor case. In particular, in equilibrium (where no liquidation occurs in U), the incentive properties of options and CD also hold under the new contract. ■

Proof of Proposition 4. For $\alpha < \alpha_S$**,** the project cannot be financed under multiple creditors. The presence of multiple creditors cannot increase total repayment in G above $\alpha y_1+\overline{y}_2$ (the same would be true also in the presence of multiple secured creditors, even if default on a single one of them is punished by fully liquidating the asset). Since $\alpha_S < \alpha^*$, in U and B investors can at most obtain L. Since SD is infeasible for $\alpha < \alpha_S$**,** then financing does not occur under any debt structure. For $\alpha_S \leq \alpha \leq \alpha_C$, only SD ensures feasibility under a single creditor. By analogy, under multiple creditors break even requires that the asset is liquidated in both U and B. Thus, E cannot do better than under a single creditor SD. In U and B**,** the optimal straight debt contracts may allow for liquidation of only fraction $f<1$, where $\pi(\overline{y}_2+\alpha y_1)+(1/2)(1-\pi)\left[fL+(1-f)\alpha(\underline{y}_2+\overline{y}_2)\right]=K$. However, setting $f<1$ is only efficient for E if $L<(\overline{y}_2+\underline{y}_2)/2$, otherwise the gain in welfare in U is more than compensated by the loss in B. Thus, 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. First, it does not induce over continuation in B because the strike price $L-\alpha\underline{y}_2$ implies that the option holder weakly prefers continuation to liquidation in that state. In B**,** there is no renegotiation because all creditors prefer liquidation over continuation. To see what happens in U, suppose there are $n-1$ unsecured creditors. Then, as indicated in the text, a coalition with $\widetilde{m}(n)=n\frac{\alpha(\overline{y}_2-\underline{y}_2)}{L-\alpha\underline{y}_2}=nv \leq n-1$ unsecured bribes the option holder to liquidate. Thus, with n creditors, liquidation in U occurs with probability $\Pr(m \geq \widetilde{m}(n)\,|n-1)=\sum_{s=nv}^{n-1}\left[(n-1)!/(n-1-s)!s!\right]/2^{n-1}$. For $n \to +\infty$, this probability 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. ■

The Cost of Debt Dispersion. We consider the case where creditors' dispersion hinders their litigation strategy by reducing their individual incentives to invest resources in gathering evidence, hiring lawyers, bringing motions to the court to catch, void or rescind managerial divertive activities, thereby reducing α, i.e. the share of cash flows that creditors can seize. Concretely, assume that if creditor i engages in (unverifiable) legal effort x_i, he prevents the debtor from diverting a share x_i/n of each creditor's repayment. This assumption captures the nature of litigation as a public good: a creditor's successful attempt to monitor the debtor restrains the diversive activities of the latter at the benefit of all 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 creditor 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. By inverting (**??**), one can define the function $n(\delta, \alpha)$, which indicates the 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 creditors' multiplicity and affects the optimal debt structure. In line with Proposition 4, if $\delta \leq 1/2\alpha^*$, E can commit to pledge at least a share α^* of cash flows to creditors by issuing *convertibel debt* and by borrowing from $n \leq n(\delta, \alpha^*)$ creditors, attaining the first best. If $\delta > 1/2\alpha_C$, E can only disgorge a share α_C of cash flows and attains the third best by issuing *straight debt* to $n(\delta, \alpha_S)$ creditors at most. For $\delta > 1/2\alpha_S$**,** the project is not financed. ´The novel case now arises for $\delta \in (1/2\alpha^*, 1/2\alpha_C]$ as the project could either be financed by *convertibel debt* or *contingent debt*. As in Proposition 4, if E can set $n = \infty$, *contingent debt* is never optimal. However, for $\delta \in (1/2\alpha^*, 1/2\alpha_C]$ the creditors break even only if E issues at most $n(\delta, \alpha_C) - 1 < \infty$ unsecured claims. As a result, giving *convertibel debt* to a large secured creditor as in Proposition 3 results in over-liquidation in U with probability $\Pr(m \geq \widetilde{m}(n(\delta, \alpha_C)))$, i.e. whenever a sufficiently large coalition of unsecured forms (see (**??**) for reference). As a result,

contingent debt may still be optimal if courts' mistakes are small. ■

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