The Resolution of Financial Distress

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Most models of financial structure embody an assumption about financial distress that causes debt to be costly to the issuing firm. This approach has been criticized on the grounds that the assumed costs could be avoided by a costless financial reorganization. In this article we show that despite the possibility of costless reorganization, it may be rational for firms to incur significant costs in the resolution of financial distress. The main assumptions that give rise to our results are the existence of asymmetric information and of judicial discretion that allows courts to impose a reorganization on the claimants of a firm.

Most models of financial structure embody an assumption about financial distress that causes debt to be costly to the issuing firm. In some the assumption is that it is costly to have a firm legally declared bankrupt; in others the costs result from suboptimal investment and operating decisions that may be induced by the agency problems associated with financial distress. Both types of model have been criticized on the grounds that the costs that are central to the analysis could be avoided in practice by a relatively costless financial reorganiza-

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1For the purpose of this article, a firm enters financial distress when it is unable to meet a condition of its debt contract. Financial distress ends with either a financial reorganization or with the legal extinction of the firm through the declaration of bankruptcy by a court of law.
zation. It this article we show that despite the possibility of costless reorganization it may be rational for firms to incur significant deadweight costs in the resolution of financial distress.

Despite their central role in models of corporate financing, there is little theoretical justification for the existence of these assumed debt-related costs. In fact there is an apparently compelling argument that they must be insignificant: In well-functioning markets agents who face a conflict of interest will reorganize the capital structure so as to avoid any deadweight costs. Fama and Miller (1972), for instance, argue that the capital structure decision of the firm will not affect the welfare of security holders if agents insist on protective covenants or “me-first” rules ex ante and are allowed to make side payments ex post. In this context, bankruptcy laws can be thought of as me-first rules and a financial reorganization can be thought of as a way of implementing an ex post cost-avoiding side payment. A slightly different argument is found in Stiglitz’ (1974) generalization of the Modigliani-Miller theorem in which an intermediary is assumed to be able to costlessly repackage suboptimal capital structures in order, for example, to avoid costly conflicts of interest.

The most direct attack on the existence of significant costs, however, is made by Haugen and Senbet (1978, 1988). They argue that it would pay debt holders and equity holders to agree to an informal reorganization of the firm before any deadweight costs are incurred. To illustrate, suppose that a firm has defaulted on a debt payment but that it is costly for debt holders to have the equity extinguished by a bankruptcy court. Instead of proceeding with the costly legal action, the debt holders could offer to reduce the debt claim so as to avoid bankruptcy and the associated costs. If the proposed reorganization leaves the equity with a value less than the costs avoided then the debt holders are better off. At the same time the equity holders are also better off. Consequently, both agents should agree to a cost-avoiding reorganization.3

Despite this argument, costly financial distress is a common assumption in financial economics. For instance, many analyses of capital structure rest on the assumption that financial distress generates significant deadweight costs which, in equilibrium, are balanced by the tax advantage of debt.4 Other studies have analyzed the way in which debt-related costs can be used to explain investment and output decisions in an imperfectly com-

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3 Haugen and Senbet (1978) also argue that if the present claimants to the firm did not undertake the appropriate reorganization, then a third party could do so by purchasing all existing claims in the market, eliminating the conflict, and earning a riskless profit in the process. However, Allen (1986) and Haugen and Senbet (1988) recognize that this process is likely to be impeded by the free-rider problem identified by Grossman and Hart (1980). Haugen and Senbet (1988) suggest that the free-rider problem can be circumvented by, among other means, charter amendments which “give the bond trustee the right to accept or reject bids on behalf of all the debt holders.” In our analysis we eliminate the free-rider problem by assuming that there is only one debt holder and one equity holder.
4 For example, Kraus and Litzenberger (1973), Scott (1976), Kim (1978).
petitive product market. Finally, the literature on optimal contracting with costly state verification develops the optimal contract form under the assumption that agents incur deadweight costs in verifying the realized state. While these studies reflect an increasingly elaborate treatment of financial distress, they are all subject to the criticism outlined above.

In this article we take a step toward the development of a positive theory of the cost of financial distress by modeling the resolution of financial distress as a noncooperative game of incomplete information played by a firm and its creditor. Although we assume that debt contracts are complete in that they specify a state-contingent resolution of financial distress, the bargaining problem remains interesting because enforcement of the contract is costly and agents are asymmetrically informed about the state that has obtained. Under certain conditions, we are able to extend the argument of Haugen and Senbet to a world with asymmetric information. However, this is not a general result since we are also able to characterize equilibria in which agents, acting rationally, decide to incur deadweight costs.

An important difference between our analysis and previous work is that we explicitly address the question of whether or not agents will decide to incur costs given the existence of the costless alternative of renegotiation. A second important feature of our analysis is that we allow for strategic interaction between the different claimants to the firm. The combination of these features is not found in earlier contributions. For example, Van Horne (1976) examined the optimal initiation of bankruptcy essentially as a game against nature in which the firm passively accepts the decision made by the creditors. This, by assumption, precludes cost-avoiding reorganizations as well as learning and strategic behavior. Bulow and Shoven (1978) analyze the coalition that might form between the firm and a bank in the process of expropriating wealth from debt holders during financial distress. By assumption, however, debt holders and equity holders are not allowed to renegotiate. Aivazian and Callen (1983) and Brown (1986) look at questions that relate to coalition formation within the context of a cooperative game under symmetric information. Bergman (1986) assumes that me-first rules do not exist and considers the case in which equity holders force a reorganization on the debt holders by threatening to slowly destroy the firm. In a paper which is closest in spirit to ours Webb (1987) considers the question of whether or not agents will incur costs during financial distress. However, Webb assumes that agents act on the basis of their prior information only and therefore there is no learning or strategic behavior involved.


For example, Townsend (1979), Diamond (1984), and Gale and Hellwig (1985).

The bargaining environment that we posit is more closely related to the literature dealing with the economics of out of court settlements. The literature in this area includes contributions by Gould (1973), Shavell (1982), P'ng (1983, 1987), Salant (1984), and Reinganum and Wilde (1986). However, our treatment
In the following section we discuss U.S. bankruptcy law and the way in which it affects the bargaining problem surrounding an informal reorganization of the firm. This is followed by a description of our model in Section 2. The analysis and discussion of resulting equilibria are presented in Section 3. Concluding remarks are found in Section 4. To enhance the readability of the paper, most of the formal results are placed in the Appendix.

1. Bankruptcy Law and a Statement of the Problem

An informal reorganization of the firm involves a bargaining problem in which the payoffs that will result if bargaining fails (i.e., the conflict point) are determined by the formal procedures and rights set out in bankruptcy law. In this section we briefly outline some of the features of bankruptcy law and discuss ways in which they affect the bargaining problem.\(^8\)

It is often argued that the main purpose of bankruptcy law is, as Jackson (1986) states, “... to ameliorate the common pool problem.” This refers to inefficiencies in the operations of a financially distressed firm brought about by the conflicting claims that are triggered by default on a debt contract. For example, if upon default secured creditors begin procedures to recover their security, it may be that unsecured creditors and/or equity holders who have claim to other assets of the firm suffer significant losses. This may arise from synergies within the firm or transaction-specific investments which become worthless without the secured property.\(^9\)

Bankruptcy law mitigates the common pool problem by imposing an automatic stay on all creditor actions when a bankruptcy petition is filed. Effectively, the stay protects the firm from creditor harassment and allows it full use of all assets, subject only to the supervision of a trustee, until a reorganization plan is formulated and ultimately confirmed by the courts. The bankruptcy petition may be filed by either the debtor firm (voluntary bankruptcy) or by the creditors (involuntary bankruptcy).

While the model which we employ in this study is quite general, it is perhaps most consistent with chapter 11 of the U.S. Bankruptcy Reform Act. Under a chapter 11 filing the debtor is typically allowed to act as the trustee in which case he is referred to as the debtor in possession and retains complete control over the operations of the firm. Furthermore, the debtor alone is entitled to file a reorganization plan during the first 120

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8 For a more detailed account of the bankruptcy process see Newton (1981) or Baird and Jackson (1984).
9 Cases in which court rulings reflect this line of thinking can be found in Baird and Jackson (1984).
days following the filing of a bankruptcy petition and has an additional 60 days to obtain acceptance by the creditors. Only after this time and only if acceptance has not been obtained can other parties file a reorganization plan. Hence, despite having defaulted on a debt contract, a firm can remain in control of its assets for at least six months and possibly longer.\textsuperscript{10}

A reorganization plan offers each class of claimants new securities in exchange for those currently held. If the reorganization is rejected by the creditors the case goes to “cram down” where the court imposes a plan on all claimants. In so doing, however, the court must rule that the reorganization being imposed is “fair and equitable.” This essentially requires that the court be convinced that the reorganization provides claimants to the firm with new securities that are worth as much as the securities surrendered or, if they are not, that no junior security holder receives payment if senior security holders have not received the value of the securities surrendered. Critical to this process is the ability of the court to interpret and verify evidence presented to it regarding the firm’s economic value.

The following hypothetical example illustrates the importance of the court’s valuation and the role which this valuation plays in the prepetition negotiations between debtor and creditor. Consider a firm that has an outstanding liability with a face value of 100 that is currently due in full. Suppose that its only asset is a claim to a future cash flow that will be either 180 or 0, each with equal probability. Assume that all agents are risk-neutral, the discount rate is zero, and therefore that the asset value is 90. Since this is less than the outstanding debt value, the firm is economically insolvent.

Suppose that creditors can have the firm liquidated through bankruptcy but that this will generate costs of 15. Prior to any action being taken, however, the firm and the creditor attempt to settle out of court so as to avoid costs. In bargaining, both agents will anticipate that if the case goes to cram down the court would require that the debt holders receive securities worth at least 75 (the net liquidation value of the firm) before the equity holders are allowed to receive anything. Since this is exactly what the firm will be worth, net of costs, the only reorganization plan which the court would confirm is one which gave full asset value to the debt holders.

The projected outcome of the court resolution provides a basis for the informal reorganization of the firm. In particular, since the value of the firm is reduced by the bankruptcy costs, there exists a new debt contract that, if accepted in an informal reorganization, would leave the debt holders as well off as they would have been if the dispute had been resolved formally. In the example just presented, having the court declare the firm bankrupt would reduce the value of the firm to 75. Alternatively, equity holders can offer to exchange existing debt for new debt with a face value

\textsuperscript{10}The extension will be longer if other delay tactics are successfully employed. In this regard, it is interesting to note that the average time taken to resolve railroad bankruptcy cases in Warner's (1977) study is 13 years!
of 150. The new debt would have an economic value of 75, as much as would be received from the court, while the equity holders would have claims worth 15, an amount equal to the avoided costs.

In a world with symmetrically informed agents, a cost-avoiding reorganization of this type would be expected to emerge. However, an important source of disagreement in chapter 11 negotiations concerns the true value of the firm’s assets, or, more precisely, the court’s view of the true value. To see how this affects negotiations, suppose that the firm argues that it has inside information that can be used to convince the court that the worst possible payoff is 100 instead of 0. If the claim is valid, then, when the case goes to cram down, a reorganization in which debt holders were promised 100 would, since the court sees the debt as riskless, be considered a fair and equitable reorganization. If this outcome is expected by both debt holder and creditor, then, in bargaining to avoid bankruptcy costs, the creditor’s position is weakened in that the minimum acceptable offer is reduced from 150 to 100.

In practice, courts hear evidence on the firm’s prospects in a valuation hearing and adopt a valuation based on their interpretation of the often conflicting information provided. In prepetition bargaining, debtors and creditors must form opinions about the outcome of the court case and in so doing may view the outcome as a random variable, the distribution of which is refined by their own knowledge of the facts and their understanding of the facts available to their opponent.

In the model set out below we assume that the firm is better informed about the likely outcome of a valuation hearing than is the debt holder. This assumption is made because it is likely that managers have better information about the value of the firm than does the debt holder and that the court has the power to evaluate (perhaps imperfectly) claims made by either party.

2. A Model of Financial Distress

Consider a firm in financial distress that has no cash but has outstanding debt with a face value of $B$, currently payable in full. Assume that the firm’s equity is entirely owned by a single risk-neutral individual and that the firm’s debt is held entirely by a single risk-neutral debt holder.\(^{11}\)

We impose the following structure on the problem. We assume that the equity holder has no resources with which to make the required payment and is unable to raise money by selling securities to new investors. As a result, the equity holder must offer a new debt contract to the debt holder.

\(^{11}\) The manager can be thought of as the owner manager of the firm or as the manager of a widely held firm who acts in the best interest of the firm’s shareholders. Similarly, the debt holder can be thought of as a single creditor or as an agent acting on behalf of all creditors. We recognize that this assumption eliminates interesting agency problems but we make it in order to focus on the bargaining problem that remains when such problems have been taken care of.
in exchange for the old debt contract. The debt holder must then either accept the offer or reject it. If the offer is rejected then total costs of $C$ are incurred and the court resolves the issue either by declaring the firm bankrupt (legally extinguishing the equity claim), or by imposing a reorganization under which the firm will continue to operate. In either case the court also rules on the allocation of costs in a manner specified below.

The firm, while having no cash, has assets in place with a state-contingent value of $V(\theta)$, where $\theta \in \{S, I\}$ is the current state of the world. There are only two possible states in our model: the solvent state $S$ in which $V(S) \geq B$, and the insolvent state $I$ in which $V(I) < B$. In keeping with common practice, we will refer to the state of the world as the firm’s type. Hence a solvent firm is one that is experiencing short-run cash flow problems only, whereas an insolvent firm is one with more substantial difficulties.

Given that the firm is in financial distress, the equity holder is required to offer a new debt contract to the debt holder. The offer is characterized by the face value of the new debt contract $F$ which can be drawn from a discrete set of possible values contained in the interval $(0, v)$, $v < \infty$. The economic value of a particular informal reorganization to the debt holder, $D(F, \theta)$, is a nondecreasing concave function of the face value $F$. Conversely, the economic value of the equity claim is $E(F, \theta) \equiv (V(\theta) - D(F, \theta))$, a nonincreasing convex function of $F$.

Once the offer is made, the debt holder must either accept or reject it. Acceptance allows the firm to continue operating with the new debt contract in place. If the offer is rejected we assume that the court, which knows the state, strictly-adheres to the following rules:

- If the firm is insolvent then it is declared bankrupt: The equity holder receives nothing and the debt holder receives $V(I) - C$.
- If the firm is solvent and an offer $F$ has been presented and turned down then:
  - If the value of the offered contract is at least as large as the surrendered contract [i.e., if $D(F, S) \geq B$], the court considers the action to be frivolous and protects the firm from creditor harassment. Thus, the rejected contract is imposed on the litigants and deadweight costs $C$ are recovered from the debt holder who then receives $D(F, S) - C$ while the equity holder receives $E(F, S)$.
  - If the offered contract is worth less than the surrendered contract [i.e., if $D(F, S) < B$], the court imposes $F_s$, where $F_s$ is defined implicitly by

$$D(F_s, S) = B$$

12 The assumption that only debt is allowed in the reorganization is one of convenience. If a straight equity reorganization were involved, then the bargaining would involve the fraction of the firm which must be surrendered instead of the face value of the debt. If both debt and equity are allowed, the analysis would be similar but more complex. In particular, explicit assumptions about the distribution of underlying cash flows would have to be made. This discussed further in Section 4.

13 For convenience, these rules incorporate the assumption that $V(I) \geq C$ and $V(S) \geq B + C$. This implies that the deadweight costs will be paid by the litigants.
Since the court does not consider the legal action launched by the debt holder to be frivolous, costs are recovered from the equity holder. Hence the debt holder receives $D(F_s, S) = B$ while the equity holder receives $E(F_c, S) - C = V(S) - (B + C)$.

We have simplified the problem by assuming that unavoidable costs of $C$ are incurred when an offer is rejected. Clearly, however, the process is more complex than this. For instance, in practice rejection of a reorganization offer might be followed by an attempt by creditors to seize assets which in turn might induce the firm to seek protection under chapter 11. During the time required to formally resolve the dispute, costly litigation will generate direct costs while the distraction of management, the impact on the firm’s reputation, and risk-increasing production changes will generate indirect costs. We ignore these complexities as they would add little insight while obfuscating the main points of our analysis.

In addition, the assumed behavior of the court imposes a special cost allocation mechanism on the negotiation and deserves some explanation. Our treatment of costs in the insolvent state seems quite natural since limited liability implies that equity holders cannot be forced to bear costs. However, a large number of allocation schemes are possible in the solvent state. The mechanism that we have imposed is intended to eliminate the incentive to engage in frivolous legal action. We do this for two reasons. First, even though U.S. bankruptcy courts do not recover costs, there is legal recourse through tort law. Second, we wish to focus on cases in which the only incentives agents have for going to court stem from the financial contracting problems that arise under asymmetric information. Hence, we assume away the potentially significant frivolous suit motives which an imperfect cost collection mechanism would introduce.

Given the assumed structure it is clear that if all agents were symmetrically informed about the firm’s type the resolution of this problem would be simple and efficient. To see this, define $F_I$ as the face value of a debt contract that would have a value to the debt holder exactly equal to the amount that would be received if an insolvent firm were taken to court. That is, $F_I$ satisfies

$$D(F_I, I) = V(I) - C$$

Hence an insolvent firm would offer $F_I$ to the debt holder who would accept the offer and, in so doing, avoid costs. The debt holder receives the value of the firm less costs while the equity holder receives the foregone costs.

On the other hand, if the firm is solvent, the equity holder will offer $F_s$, the minimum that the debt holder would accept. Offering any less would lead to costly court action while offering any more is, from the equity

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14 Although to some extent Canadian and British courts do collect costs.

15 We follow the convention of assuming that, when indifferent, the debt holder will accept the offer since in practice acceptance could be ensured by an offer that is even one cent higher.
holder’s point of view, wasteful. In both cases the resolution is efficient in that it does not involve actions which bring about deadweight costs.

A more interesting and realistic scenario, however, has agents that are asymmetrically informed about the firm’s type. In particular, we assume that the equity holder and the court are both aware of the firm’s type while the debt holder, prior to receiving an offer, is only aware that the firm is solvent with probability \( P_s \) and insolvent with probability \( P_I = 1 - P_s \). Once the offer has been received, however, the debt holder uses the structure of the game and the magnitude of the offer to revise his beliefs about the firm type. The precise nature of this revision is analyzed in the following section.\(^{16}\)

Under this scenario, the equity holder’s optimal offer and the debt holder’s optimal response are no longer as simple to determine. Clearly, the debt holder will reject an offer that is less than \( \min (F_I, F_s) \) since it is less than the minimum acceptable from either a solvent or an insolvent firm. On the other hand, if an offer that at least equals \( \max (F_I, F_s) \) is received, it will be accepted since it is at least as valuable as taking a solvent or insolvent firm to court. Hence, only offers within the interval \( \left[ \min (F_s, F_I), \max (F_s, F_I) \right] \) need be considered in our analysis. When an offer is in this interval, acceptance or rejection depends on the beliefs formed by the equity holder that in turn depend on the strategies being followed by the debt holder. This problem is analyzed in the next section.

3. Analysis

We view the model developed in the previous section as an extensive form game of incomplete information and employ the sequential equilibrium concept of Kreps and Wilson (1982) to identify equilibria. A sequential equilibrium requires that, for each information set, the equilibrium strategies are sequentially rational with respect to beliefs and that beliefs are consistent with the informational structure of the game. An important feature of this approach is that it explicitly deals with off-equilibrium-path information sets and rules out dynamically inconsistent strategies in which the debt holder precommits to arbitrary actions.

The equity holder’s strategy is described by the probability that each feasible offer is made. Let \( \pi_\theta(F) \) denote the probability that a firm of type \( \theta \) will offer \( F \) in exchange for the existing debt contract. On the other hand, the debt holder’s strategy is simply the probability, denoted \( \rho (F) \), with which an offer is rejected. This formulation is quite general in that it allows both mixed- and pure-strategy equilibria. Finally, beliefs, defined as the revised probabilities attached to the possibility that an offer has been

\(^{16}\)An alternative interpretation of this structure is that the agents are asymmetrically informed about the evidence they will present to the court but that the information can be revealed at a cost. In either case, it is not essential that the court be perfectly informed about the value of the firm but only that the manager be better informed about the distribution of the possible outcomes of the valuation hearing.
presented by each type, incorporate expectations about the strategy which the equity holder is following and the prior probability of the firm being of a particular type. We let \( P_s(P_I) \) denote the prior probability that the firm is solvent (insolvent) and denote the revised probabilities by \( \mu(S \mid F) \) for a solvent firm and \( \mu(I \mid F) = 1 - \mu(S \mid F) \) for an insolvent firm.

Our procedure will be to identify strategies which define \( \pi_s(F), \pi_i(F), \) and \( \rho (F) \) for all possible offers and demonstrate that these satisfy the requirements of a sequential equilibrium. Our main interest is to determine whether or not the strategies imply that deadweight costs will be incurred, that is, whether or not offers will be made that, with positive probability, will be turned down.

In deriving the equilibria to this game we make two further assumptions about the behavior of the players. First, we introduce the concept of a dominated action.

**Definition.** An action is dominated if the largest payoff possible from the action does not exceed the smallest payoff possible from another feasible action.\(^{17}\)

Throughout this article we assume that players will not select an action that is dominated and that beliefs reflect this.

Our second assumption concerns the response of debt holders to offers which are “unexpected” in the sense that they are given 0 probability in the equilibrium strategies of both types. Although these offers would not be observed in equilibrium, the construction of equilibrium strategies for the players requires that we specify optimal responses to all conceivable offers. In some cases (for instance, Propositions 1 and 2 below) the refinement afforded by the elimination of dominated strategies is sufficient. In others, however, such a procedure is of little help.\(^ {18}\)

Since our goal is to illustrate why debt holders may insist on a costly reorganization, it suffices to consider a particular set of beliefs under which this will occur. Specifically, we assume that off-equilibrium-path offers are believed to have been presented by the solvent firm if \( F_I < F_s \) and by the insolvent firm if \( F_S < F_I \). However, for each equilibrium we also indicate whether or not the intuitive criterion due to Cho and Kreps (1987) is satisfied. In the context of our model, an equilibrium offer is said to fail this criterion (and hence to be supported by unreasonable beliefs) if we can identify an off-equilibrium-path offer that satisfies the following condition. First, we define a set \( S \) of types who would not prefer to make the off-equilibrium-path offer relative to the equilibrium regardless of the debt

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17 For a more formal discussion of dominance and its role in refining off-equilibrium-path beliefs see McLennan (1985), or Cho and Kreps (1987).

18 The problem of how players react and the types of conjectures they form when confronted with disequilibrium behavior is still an unresolved issue in games with asymmetric information. Discussion of various approaches that one may adopt in dealing with this problem is contained in Banks and Sobel (1987), Cho and Kreps (1987), McLennan (1985), and the references cited therein.
holder’s response. Then we define the set $\tilde{S}$ to be the complement of $S$ in the set of all possible types. The equilibrium is said to fail the intuitive criterion if there is a type in $S$ that would be better off presenting the off-equilibrium-path offer rather than the equilibrium one given that the debt holder believes the firm to be any one of the types contained in the set $\tilde{S}$. Clearly the power of these criteria is in eliminating from consideration types who cannot be made better off by presenting the off-equilibrium-path offer.

Our analysis identifies two main types of equilibria; those which imply that deadweight bankruptcy costs will be avoided despite the fact that agents are asymmetrically informed, and those which imply that costs will not be avoided. It turns out that the actual types of equilibria that exist depend on whether or not $F_I < F_S$. This in turn depends on the relative size of the incentives to take a particular type of firm to court. The incentive to take an insolvent firm to court increases with the size of the debtor’s assets (as these are transferred to the creditor through bankruptcy), but decreases with the costs incurred. Accordingly, the size of the promised payment that would be needed to induce the debt holder to accept if the firm was thought to be insolvent, $F_p$, increases with $V(I)$ but decreases with $C$. On the other hand, the incentive to take a solvent firm to court is increasing in the face value of the unpaid debt contract, $B$, and hence $F_S$ is increasing in $B$.

When $F_S < F_p$, both solvent and insolvent firms would like to convince their creditors that they are solvent and that the inability to meet contractually specified payments reflects a temporary cash flow problem. There are two mutually exclusive equilibria in this case; one in which costs are avoided (Proposition 1) and one in which they are not (Proposition 2). When $F_I < F_S$ both solvent and insolvent firms wish to convince the debt holder that they are @solvent and that the terms of the reorganization should reflect the bankruptcy costs that their proposal would avoid. We find that equilibria exist in which costs are avoided by a reorganization that on average is appropriate from the creditor’s point of view (Proposition 3). However, the same conditions also give rise to equilibria in which expected deadweight costs are positive (Propositions 4 and 5).

3.1 $F_s < F_I$

We will define a solvency claim strategy set as a set in which both solvent and insolvent firms claim to be solvent by offering $F_s$ with probability 1, while the debt holder rejects all offers except $F_S$ and $F_I$.

**Proposition 1.** A solvency claim strategy set forms a sequential equilibrium if and only if $F_S < F_I$ and

$$P_t(D(F_p, I) - D(F_s, I)) \leq P_t C$$

(1)

**Proof.** See the Appendix. ■
The equilibrium may be interpreted as follows. Given that $F_s < F_I$ the solvent firm will not offer more than $F_s$. If the offer is rejected, cram down will lead to the court imposing the contract $F_s$ on the debt holders (see Lemma A1 in the Appendix). Realizing this, the debt holder believes that any other offer that is received is presented by an insolvent firm. Accordingly all offers except $F_s$ and $F_I$ are rejected.

The difficult problem facing the debt holder is in deciding how to respond to an offer of $F_s$. While it is true that a solvent firm will present only this offer, it is also true that an insolvent firm might “bluff” by also presenting $F_s$. The cost of acceptance of $F_s$ is the payoff reduction from not going to court if the firm turns out to be insolvent [i.e., $D(F_p, I) - D(F_s, I)$]. The cost of rejection is the court costs incurred when the firm turns out to be solvent (i.e., $C$).

If condition (1) holds, then even when the insolvent firm bluffs with probability 1, the expected cost of acceptance is less than the cost of rejection. Hence the offer is always accepted. Anticipating acceptance, both firm types present $F_s$ with probability 1. In this case costs are avoided because they exceed the maximum gain available to the debt holder from more stringent enforcement of the debt contract.

The other strategy set of interest when $F_s < F_I$ will be referred to as a "solvent semiseparating" or SSS set and is defined by

1. The solvent firm offers $F_s$ with probability 1.
2. The insolvent firm randomizes between offering $F_s$ and $F_I$ (the probability with which each offer is presented is given in the Appendix).
3. The debt holder accepts an offer of $F_s$ with probability 1 but rejects offers of $F_s$ with positive probability (the exact rejection probability is given in the Appendix).

**Proposition 2.** SSS strategies form a sequential equilibrium if and only if $F_s < F_p$, and

$$P_s(D(F_p, I) - D(F_s, I)) \geq p_s C$$

*Proof.* See the Appendix. ■

Condition (2) ensures that if the insolvent firm bluffs with probability 1 by offering $F_p$, then the cost of rejection is no greater than the cost of acceptance. As a result, a semiseparating equilibrium exists in which the insolvent firm bluffs by offering $F_s$ with a probability that is large enough to make the debt holder indifferent to accepting or rejecting the offer. The debt holder imposes discipline on the insolvent firm by rejecting $F_s$ with positive probability. Hence agents decide to incur deadweight costs because, while the “pie” shrinks by doing so, their expected share of the pie is maximized.

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Both the solvency claim and solvent semiseparating equilibria are supported by the belief that off-equilibrium-path offers are presented only by the insolvent firm. These beliefs satisfy the intuitive criteria for...
3.2 \( F_I < F_s \)

We define a pooling strategy set to be a set that implies that a pooled offer, denoted by \( F^* \), is offered by both solvent and insolvent firms with probability 1, and accepted with probability 1, while all offers except \( F^* \) and \( F_s \) are rejected.

**Proposition 3.** A pooling strategy set forms a sequential equilibrium if and only if \( F_I < F_s \) and the pooled offer \( F^* \) is such that \( \bar{F} \leq F^* \leq F_s \) and \( \bar{F} \) is implicitly defined by

\[
P_f(D(F_s, S) - D(\bar{F}, S)) = P_f(D(\bar{F}, I) - D(F_b, I))
\]

(3)

**Proof.** See the Appendix.\(^{20}\)

In this equilibrium the only offer presented with positive probability by either type is \( F^* \), an offer that, given equilibrium beliefs, provides the debt holder no incentive to reject. Hence deadweight costs are avoided. Under the equilibrium beliefs, the left-hand side of Equation (3) is the expected opportunity cost of not taking a solvent firm to court when \( \bar{F} = \bar{F} \), while the right-hand side is the expected gain from not taking the case to court when the firm is insolvent and \( F^* = \bar{F} \). Since \( \bar{F} \) is the face value at which these two terms offset each other the debt holder is as well off accepting any \( F^* \geq F \).

Proposition 3 establishes that whenever \( F_I < F_s \) there exists an equilibrium in which costs are avoided. Under these conditions, the Haugen-Senbet argument that bankruptcy costs are insignificant can be extended to the case of asymmetric information. However, Propositions 4 and 5, presented below, demonstrate that, under the same conditions, other equilibria exist in which expected costs are positive.

The equilibria described in these propositions are referred to as semi-separating and are characterized by the fact that only two offers are presented with positive probability. One of the offers, referred to as the pooled offer, is presented by both solvent and insolvent firms while the other offer is presented only by one type and hence reveals the firm’s type to the debt holder.

In order to motivate and interpret the equilibria presented in Propositions 4 and 5 we will first set out some preliminary results. Consider two arbitrary offers, denoted \( F_L \) and \( F_H \), that either a solvent or an insolvent firm might present with positive probability. We will adopt the convention that \( F_L < F_H \leq F_s \).

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\(^{20}\)This equilibrium satisfies the intuitive criterion. To see this, note that for both types \( F > F^* \) is dominated by \( F^* \). On the other hand off-equilibrium-path offers \( F < F^* \) would, if accepted, be preferred to the equilibrium by both types so that the set \( S \) contains both solvent and insolvent types. However, the best response of the debt holder based on beliefs that the firm is solvent is to reject the offer. Based on this response, neither type in \( S \) would defect from the equilibrium.
Lemma 1. Strategies in which a separating and a pooled offer are both
presented will form an equilibrium only if the separating offer exceeds the
pooled offer in magnitude.

Proof. Suppose to the contrary that $F_L$ is the separating offer. Since the offer
is separating it will reveal the firm's type. If the firm is solvent then the
offer will be rejected since it is less than $F_s$ and $F_s$ will be imposed by the
courts. Consequently, the solvent firm will prefer to offer $F_s$ rather than $F_L$.
If the separating offer is presented by the insolvent firm it will be optimal
for the debt holder to accept the offer with probability 1. However, based
on this response the solvent firm will also present the offer, thereby destroy-
ing the separating equilibrium. ■

Lemma 2. If $F_I < F_s$ then in equilibrium the only separating offer which
a solvent firm will present is $F_s$.

Proof. A separating offer is one which reveals the firm's type. Hence the
minimum acceptable offer that a solvent firm can present is $F_s$. Since the
outcome from offering $F_s$ is greater than the outcome from offering $F < F_s$
if the offer is rejected with probability 1, the solvent firm will only present
$F_s$ as a separating offer. ■

Lemmas 1 and 2 establish the fact that in equilibrium the magnitude of
the separating offer must exceed that of the pooled offer. In characterizing
the equilibrium we must also examine the question of which type will
present the separating offer and which will present the pooled offer. If we
view the separating offer as a signal, the answer can be seen to depend on
the relative advantage of signaling. This advantage for the solvent firm will
be denoted by $\Delta_s$ and is defined as the payoff from having $F_{H}$ accepted with
probability 1, minus the expected payoff from offering $F_{L}$ and having it
accepted with probability $\rho^*$. Note that in order
for the solvent firm to randomize between $F_{H}$ and $F_{L}$ it is necessary that $\Delta_s
= 0$.

Similarly, we can define $\Delta_I$ by

$$\Delta_s(\rho^*) = [V(S) - D(F_{H}, S)] - ((1 - \rho^*)[V(S) - D(F_{L}, S)]
+ \rho^*[V(S) - (B + C)])
= \rho^*[B + C - D(F_{L}, S)] - [D(F_{H}, S) - D(F_{L}, S)]$$

A solvent firm will prefer $F_{H}$ over $F_{L}$ if $\Delta_s > 0$, will have the opposite
preference if $\Delta_s < 0$, and will be indifferent if $\Delta_s = 0$. Note that in order
for the solvent firm to randomize between $F_{H}$ and $F_{L}$ it is necessary that $\Delta_s
= 0$.

Similarly, we can define $\Delta_I$ by

$$\Delta_I(\rho^*) = \rho^*[V(I) - D(F_{L}, I)] - [D(F_{H}, I) - D(F_{L}, I)]$$

Let $\rho^*_s$ and $\rho^*_l$ be defined such that $\Delta_s(\rho^*_s) = 0$ and $\Delta_I(\rho^*_l) = 0$, respectively. That is,

$$\rho^*_s = \frac{D(F_{H}, S) - D(F_{L}, S)}{B + C - D(F_{L}, S)}$$
Thus if in equilibrium a solvent firm randomizes over \( F_H \) and \( F_L \) then it is necessary that the rejection probability be \( \rho^*_L \). If this is the case then the behavior of the insolvent firm will be determined by the sign of \( \Delta_I(\rho^*_S) \) which in turn can be shown to be given by the sign of \( (\rho_S^* - \rho_I^*) \). Hence, ignoring the knife-edge case in which \( \rho_I^* = \rho_S^* \), if the solvent firm plays a mixed strategy over \( F_H \) and \( F_L \) then the insolvent firm will play a pure strategy of presenting \( F_H \) with probability 1 if \( \rho_S^* > \rho_I^* \), or a pure strategy of presenting \( F_L \) if \( \rho_S^* < \rho_I^* \).

By using a similar argument it can be shown that if an insolvent firm randomizes, implying that the pooled offer is rejected with probability \( \rho^*_S \), the solvent firm will prefer to offer \( F_H \) if \( \rho_I^* > \rho_S^* \) and will prefer to offer \( F_L \) if \( \rho_I^* < \rho_S^* \). These features of a semiseparating equilibrium are summarized in the following lemma:

**Lemma 3.**

1. A semiseparating equilibrium in which the insolvent firm randomizes while the solvent firm pools exists only if \( \rho_I^* < \rho_S^* \).
2. A semiseparating equilibrium in which the solvent firm randomizes while the insolvent firm pools exists only if \( \rho_I^* > \rho_S^* \).

**Proof.** See the Appendix. ■

Proposition 4 refers to a solvent randomization strategy set which is defined by,

1. The insolvent firm only offers the pooled offer \( F_L \).
2. The solvent firm randomizes between offering \( F_L \) and a higher separating offer \( F_S \) (the probability with which each offer is selected is found in the Appendix).
3. The debt holder accepts the separating offer with probability 1 and rejects \( F_L \) with probability \( \rho_S^* \).

**Proposition 4.** The solvent randomization strategy forms a sequential equilibrium if and only if \( F_I < F_S \) and \( \rho_S^* < \rho_I^* \).

**Proof.** See the Appendix. ■

In this equilibrium the solvent firm will either imitate an insolvent firm in demanding the lower reorganization \( F_L \), realizing that the offer will be rejected with positive probability, or it will make an acceptable fully revealing offer \( F_S \). An insolvent firm will always present \( F_L \) even though this will be rejected with positive probability since the expected payoff from doing so is larger than it would be if it imitated a solvent firm [i.e., \( \Delta_I(\rho^*_S) < 0 \)].
Recognizing the incentives that the firm faces, the debt holder is willing to accept a separating offer knowing that it has been presented by the solvent firm, but will reject the pooled offer with positive probability. In this case, rejection is required to impose the appropriate level of discipline on the solvent firm.

Proposition 5 deals with an insolvent randomization strategy set which is defined by

1. The solvent firm offers the pooled offer $F_L$ with probability 1.
2. The insolvent firm randomizes between the pooled offer and the separating offer $F_H$ (the equilibrium probabilities with which each offer is selected are found in the Appendix).
3. The debt holder accepts the separating offer with probability 1, and rejects the pooled offer with probability $\rho^*_I$.

**Proposition 5.** The insolvent randomization strategy set forms a sequential equilibrium if and only if $F_I < F_S$ and $\rho^*_I < \rho^*_S$.

In contrast to the solvent randomization strategies, the insolvent randomization requires that the solvent firm present offer $F_L$ only, while the insolvent firm randomizes by selecting either $F_L$ or separating itself by selecting $F_H$. Again rejection with positive probability is optimal for the debt holder implying that costs are incurred.

It turns out that the equilibrium described in Proposition 4 satisfies the intuitive criterion whereas that dealt with in Proposition 5 does not.21

### 4. Conclusions

The purpose of this study has been to address the question of whether or not financial distress-related costs will, in all cases, be avoided through a costless reorganization. Our conclusion is that costs may not always be avoided: We have identified equilibria in which the debt holder would rather appeal to a costly arbitrator than trust the equity holder to present an appropriate reorganization. Hence, private information interferes in the efficiency of ex post recontracting.

Our results show that the type of equilibrium that results will depend

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21 To see how the criterion eliminates the insolvent randomization strategy of Proposition 5 note that, by construction, the insolvent type is indifferent to presenting $F_H$ which is sure to be accepted and presenting $F_L$ which is rejected with positive probability while the solvent firm strictly prefers to offer $F_L$ even though it will be rejected with positive probability. This implies that there is an offer $\tilde{F}$ where $P_L < \tilde{F} < F_H$ which if accepted with probability 1 would provide the same expected payoff as the solvent firm receives in equilibrium but more than the insolvent firm would. Consider now an off-equilibrium-path offer $F$ that satisfies $\tilde{F} < F < F_H$. If this offer were accepted it would be preferred to the equilibrium by the insolvent firm but not by the solvent firm, so that the set $\tilde{S}$ contains only the insolvent firm. However the best response to the set of types $\tilde{S}$ is to accept the offer. If accepted, then it would induce the insolvent firm to defect. Hence the equilibrium fails the intuitive criteria.

When a similar argument is applied to Proposition 4, the set $\tilde{S}$ contains both types and hence the set of best responses includes rejection, which implies that the types in $\tilde{S}$ would not defect to the equilibrium so that the criterion is satisfied.
upon the setting within which negotiations take place. In our first case, the parameters of the problem are such that both solvent and insolvent firms have an incentive to claim that their economic prospects are favorable and that the inability to meet contractually specified payments reflects temporary cash flow problems. This will come about when the outstanding debt is small relative to the size of the solvent firm or when the enforcement costs are small relative to the size of the insolvent firm. The equilibria in this case (Propositions 1 and 2) survive several of the recently advanced refinements of the sequential equilibrium concept because the only restriction which must be placed on off-equilibrium-path beliefs is that they attach a 0 probability to strategies that are dominated for one of the agents.

The second case involves conditions under which both the solvent and insolvent firms wish to convince the creditor that they are insolvent and that the acceptable reorganization should reflect the costs avoided through the proposed reorganization. This will occur when financial distress costs are relatively large so that \( F_I \) is small or when the outstanding debt is large so that \( F_s \) is large. While a cost-avoiding pooled equilibrium exists under these conditions (Proposition 3), we are also able to show that there exist other equilibria in which costs are incurred (Propositions 4 and 5).

There are several ways in which the analysis could be extended. For instance, intermediaries may specialize in assessing the status of a financially distressed firm in such a way that the informational asymmetry is reduced. Suppose further that the intermediary’s abilities in this respect are type specific and unknown to the firm. This situation could be dealt with as a game of repeated transactions with two-sided informational asymmetry in which the intermediary deals with a number of debtors sequentially. Reputation, which is absent from our analysis, would be an important part of this extension. A second extension would be to allow reorganizations that involve more complex capital structures. For example, suppose that both debt and equity are allowed and an explicit distribution for the underlying cash flows is specified. It is conceivable that, to the extent that the distributions have distinct type-specific features, there could be more scope for signaling than exists in our framework.

The major assumptions upon which our analysis is built are that courts attempt to reorganize the firm in a manner consistent with their assessment of firm value and that agents are asymmetrically informed about the assessment that will be formed. We recognize that the entire problem disappears if there is no judicial discretion to interpret contracts and if agents engage in contracts written solely on observables so that asymmetric information would not be a problem. An example of such a contract would be what Brennan (1986) refers to as a reverting consol bond which automatically becomes equity when the value of the firm falls to a particular point. In practice, however, even when contracts are contingent on observables only, interested parties appeal to a court of law to suspend these terms for various reasons. Judicial discretion, which provides the court the power to rule
on these appeals, is widespread and makes every contract essentially ambiguous. It is this discretion which drives our results.

**Appendix**

In this appendix we derive the results presented in the text.

**Lemma A1.** If \( F_s < F_I \) then offering \( F_s \) with probability 1 dominates all other strategies for a solvent firm.

**Proof.** The assumed protection from frivolous court action implies that the payoff from offering \( F > F_s \) is independent of the response of the debt holder: If the offer is rejected it will be imposed on the debt holder by the court at no cost to the equity holder. However, since the payoff to the equity holder is nonincreasing in the offered face value all offers which exceed \( F_s \) are dominated by \( F_s \). Thus, \( F_s \) dominates all other offers. ■

**Proof of Proposition 1**

**Sufficiency.** Consider first the behavior of the debt holder. If the equilibrium offer is presented, the conditional expected payoff as a function of \( \rho \), denoted \( U(\rho | F_s) \),

\[
U(\rho | F_s) = \rho [\mu(S|F_s)(D(F_s, S) - C) + \mu(I|F_s)(V(I) - C)] \\
+ (1 - \rho)[\mu(S|F_s)D(F_s, S) + \mu(I|F_s)D(F_s, I)] \\
= \mu(S|F_s)D(F_s, S) + \mu(I|F_s)D(F_s, I) \\
+ \rho[\mu(I|F_s)(V(I) - C - D(F_s, I)) - \mu(S|F_s)C]
\]

Equilibrium beliefs can be formed according to Bayes’ rule along the equilibrium path and would, in this case, be \( \mu(I|F_s) = P_I \) and \( \mu(S|F_s) = P_s \), reflecting the fact that the pooled offer is uninformative. Substituting these beliefs into Equation (A1) and using the fact that \( D(F_s, I) = V(I) - C \) we obtain

\[
U(\rho | F_s) = P_sD(F_s, S) + P_ID(F_s, I) + \rho[P_I(D(F_s, I) - D(F_s, I)) - P_sC]
\]

(A1a)

Clearly, \( U(\rho | F_s) \) is decreasing in \( \rho \) if \( P_I(D(F_s, I) - D(F_s, I)) < P_sC \), implying that acceptance is the optimal response to the equilibrium offer. If \( P_I(D(F_s, I) - D(F_s, I)) = P_sC \), then \( U(\rho | F_s) \) is unaffected by \( \rho \) and hence the debt holder has no incentive to defect from the equilibrium strategy.

Beliefs for all off-equilibrium-path offers are based on dominance. Since \( F_s < F \) are dominated by \( F_s \) for a solvent firm (see Lemma A1) but not for the insolvent firm all offers in this range would be treated as if they were presented by an insolvent firm. This means that all offers except \( F \), would be rejected, as is required by the equilibrium strategies.

Next consider the behavior of the equity holder. Lemma A1 establishes that, since \( F_s < F_I \) only the equilibrium strategy is undominated for the
solvent firm. Given the equilibrium response of the debt holder and the fact that the payoff to the equity holder is decreasing in $F$, the insolvent firm would only be worse off by defecting from the equilibrium, regardless of the debt holder’s response.

**Necessity.** If $F_I < F_s$ then both the solvent and insolvent firms would defect from the equilibrium strategies by presenting $F_I$ with probability 1 since $\rho(F) = 0$. If $P_s(D(F_s, I) - D(F_s, I)) > P_3C$, $U(\rho | F_s)$ would be increasing in $\rho$ implying that the debt holder would reject $F_s$. ■

Proposition 2 refers to a solvent semiseparating strategy set (SSS), which is formally defined as follows:

1. $\pi_s(F_s) = 1$, $\pi_s(F_s) = P_sC/(P_s(D(F_s, I) - D(F_s, I)))$, $\pi_I(F_I) = (P_s(D(F_s, I) - D(F_s, I)) - P_sC)/(P_s(D(F_s, I) - D(F_s, I)))$

2. $\rho(F_I) = 0$, $\rho(F_s) = (V(I) - D(F_s, I) - C)/(V(I) - D(F_s, I))$, $\rho(F) = 1 \forall F \neq F_s, F_I$

**Proof of Proposition 2**

**Sufficiency.** Consider first the debt holder’s response to the equilibrium path offers. Since $F_I$ is a separating offer, the debt holder will conclude that the firm is insolvent and therefore will have no incentive to reject. On the other hand, if the offer is $F_s$ then the payoff is given by Equation (A1). Given the equilibrium beliefs, this expression is independent of the value of $\rho$ and may be written as

$$U(\rho | F_s) = \frac{P_s}{P_s + P_3(\pi_s(F_s))} D(F_s, S) + \frac{P_3\pi_s(F_s)}{P_s + P_3\pi_s(F_s)} D(F_s, I) \quad (A1b)$$

Since $U(\rho | F_s)$ is independent of $\rho$, there is no reason for the debt holder to defect from the equilibrium mixed strategy.

As with Proposition 1, off-equilibrium-path beliefs are based on dominance. Hence all off-equilibrium-path offers are treated as having been made by an insolvent firm and are therefore rejected.

We now demonstrate that the firm will not defect from the equilibrium strategies. Lemma A1 establishes this for a solvent firm that will present $F_s$ with probability 1. The equilibrium requires that an insolvent firm randomize between $F_s$ and $F_I$. In order for there to be no incentive for the equity holder to defect from this, it must be the case that the payoff from offering $F_I$ and having it accepted with probability 1 is equal to the expected payoff from presenting $F_s$ and having it rejected with probability $\rho(F_s)$. That is, $\rho(F_s)$ must satisfy

$$V(I) - D(F_s, I) = [1 - \rho(F_s)]\{V(I) - D(F_s, I)\}$$

Since this is satisfied in equilibrium, the insolvent firm has no incentive to prefer $F_s$ over $F_I$. Finally, since all off-equilibrium-path offers are rejected
with probability 1, there is no incentive for agents to defect from the equilibrium offers.

Necessity. If \( F_I < F_s \), then both the solvent and insolvent firms would prefer to present \( F \), with probability 1, thereby destroying the equilibrium. If \( P_s(D(F_s, I) - D(F_s, I)) < P_sC \) then the value of \( \pi_s(F_s) \) specified in the strategy description exceeds one and is therefore not feasible. ■

Note that both Propositions 1 and 2 satisfy the intuitive criteria by virtue of the fact that beliefs are based on dominance.

Proof of Proposition 3

Sufficiency. The debt holder’s payoff given that the equilibrium offer has been presented is

\[
U(\rho | F^*) = [\mu(S)D(F^*, S) + \mu(I)D(F^*, I)] \\
+ \rho[\mu(S)(D(F_s, S) - D(F^*, S)) - \mu(I)(D(F^*, I) - D(F_s, I))]
\]

By substituting in equilibrium beliefs and rearranging terms we obtain

\[
U(\rho | F^*) = P_sD(F^*, S) + P_tD(F^*, I) \\
+ \rho[P_s(D(F_s, S) - D(F^*, S)) - P_t(D(F^*, I) - D(F_s, I))]
\]

(A2)

If \( F^* = \bar{F} \), then by Equation (3) we have that

\[
U(\rho | \bar{F}) = P_sD(\bar{F}, S) + P_tD(\bar{F}, I)
\]

which implies that the debt holder has no incentive to reject the offer. For \( \bar{F} > F^* \), \( U(\rho | F^*) \) is decreasing in \( \rho \) so that acceptance of the offer is optimal.

Neither the solvent nor the insolvent firm has an incentive to offer any more than \( F^* \). Furthermore, since offering any less would lead to rejection, such offers would not be presented.

Necessity. If \( s < F_I \) then the solvent firm would offer \( F_s < F^* \) only (see ■)

Proof of Lemma 3

1. Suppose that an insolvent firm randomizes so that \( F_L \) is rejected with probability \( \rho^*_L \). If \( \rho^*_s < \rho^*_t \) then \( \Delta_s(\rho^*_t) \)
to present \( F \). However, this implies that \( F_L \) is a separating offer and, given Lemma 1, these strategies cannot be a separating equilibrium.

2. The proof of (2) is similar to the proof of (1) and is therefore omitted. ■

Proposition 4 deals with the solvent randomization strategy set which is defined formally as follows:
1. \( \pi_s(F_L) = 1, \pi_s(F_s) = [P_s(D(F_L, I) - D(F_s, I))]/[P_s(D(F_s, S) - D(F_L, S))] \), \( \pi_s(F_s) = 1 - \pi_s(F_L) \)

2. \( \rho(F_s) = 0, \rho(F_L) = \rho^*_s, \rho(F) = 1 \ \forall \ F \neq F_s, F_L \)

where \( F_L \) can be any element from the set of all \( F \) for which \( 0 \leq \pi_s(F_L) < 1 \).

**Proof of Proposition 4**

**Sufficiency.** The assumed c&-equilibrium-path beliefs (i.e., that off-equilibrium-path offers are made by the solvent firm) ensure that all offers except \( F_L \) and \( F_s \) would be rejected. Hence, neither firm type would be willing to present such offers.

Since \( F_s \) is a separating offer, \( \mu(S|F_s) = 1 \) and acceptance is optimal. If \( F_L \) is presented, then the conditional payoff to the debt holder is

\[
U(\rho|F_L) = \frac{P_s\pi_s(F_L)}{P_s + P_s\pi_s(F_L)} D(F_L, S) + \frac{P_i}{P_i + P_s\pi_s(F_L)} D(F_L, I) \\
+ \frac{\rho}{P_i + P_s\pi_s(F_L)} [P_s\pi_s(F_s)(D(F_s, S) - D(F_L, S)) - P_i(D(F_L, I) - D(F_s, I))] \tag{A3}
\]

Equation (A3) reflects beliefs which incorporate the fact that an insolvent firm selects \( F_L \) with probability 1 while the solvent firm makes this selection with probability \( \pi_s(F_L) \). With the equilibrium value of \( \pi_s(F_L) \) substituted in, Equation (A3) becomes

\[
U(\rho|F_L) = \frac{P_s\pi_s(F_L)}{P_s + P_s\pi_s(F_L)} D(F_L, S) + \frac{P_i}{P_i + P_s\pi_s(F_L)} D(F_L, I) \tag{A3a}
\]

Given that the equilibrium strategies followed by the solvent and insolvent firms have neutralized the impact of \( \rho \) on \( U(\rho|F_L) \), the debt holder has no incentive to defect from the equilibrium strategy.

Since \( \rho^*_s \) is defined so that the solvent firm is indifferent between presenting \( F_s \) and \( F_L \) there will be no reason for the solvent firm to defect from the equilibrium mixed strategy. Lemma 3 also establishes that if \( \rho^*_s < \rho^*_i \) then the insolvent firm strictly prefers presenting \( F_L \) rather than \( F_s \). Thus neither firm type has an incentive to defect from the equilibrium strategies. Finally, neither firm type would present an off-equilibrium-path offer since such an offer would be rejected.

**Necessity.** If \( F_s < F_L \) a solvent firm would offer \( F_s \) with probability 1, thereby destroying the equilibrium. If \( \rho^*_s < \rho^*_i \) then, the Insolvent firm would prefer to offer \( F_s \) instead of \( F_L \), thereby destroying the equilibrium. ■

Proposition 5 involves the insolvent randomization strategy set which is defined formally as follows:
The proof of Proposition 5 is similar to that of Proposition 4 and is omitted.

References


Salant, S. W., 1984, “Litigation of Settlement Demands Questioned by Bayesian Defendants,” Social Science Working Paper 516, Division of Humanities and Social Sciences, California Institute of Technology.


