THE JOURNAL OF FINANCE • VOL. LVII, NO. 1 • FEB. 2002

Economic Distress, Financial Distress, and Dynamic Liquidation

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ABSTRACT

Many firms emerging from a debt restructuring remain highly leveraged, continue to invest little, perform poorly, and often reenter financial distress. The existing literature interprets these findings as inefficiencies arising from coordination problems among many creditors or an inefficient design of bankruptcy law. In contrast, this paper emphasizes that creditors lack the information that is needed to make quick and correct liquidation decisions. It can explain the long-term nature of financial distress solely as the result of dynamic learning strategies of creditors and suggests that it may be an unavoidable byproduct of an efficient resolution of financial distress.

FINANCIAL DISTRESS IS OFTEN a long-term process and has an impact on the capital structure, investment policies, and performance of many firms even *after* they emerge from debt restructurings. James (1995) finds that many firms increase their investment expenditures only by very little in the first two years after a debt restructuring. Hotchkiss (1995) shows that in each of the first five years after emerging from bankruptcy, between 35 percent and 41 percent of all firms have negative operating income. According to Gilson (1997), more than 75 percent of firms that complete debt restructurings emerge with a leverage ratio that is higher than industry median and most are still significantly more highly leveraged than before the onset of financial distress. Furthermore, between one quarter and one third of all distressed firms

* The Anderson School at UCLA. This is a substantially revised version of the first chapter of my dissertation at the University of Pennsylvania. The paper was previously entitled "Dynamic Liquidation, Adjustment of Capital Structure, and the Costs of Financial Distress." I am greatly indebted to my advisors, Gary Gorton and George Mailath, for their constant guidance and support and many helpful discussions. The paper has also benefited very much from comments by two anonymous referees and René Stulz (the editor). I would like to thank Franklin Allen, David Brown, Mike Burkart, Bhagwan Chowdhry, Julian Franks, Amit Goyal, Bruce Grundy, Lutz Hendricks, Stephen Morris, Peter Norman, Richard Rosen, Raj Singh, Avanidhar Subrahmanyam, Walter Torous, Masako Ueda, S. Viswanathan, and seminar participants at Boston University, Chicago, Cornell, Dartmouth, Duke, Florida, Indiana, INSEAD, LBS, LSE, Minnesota, Northwestern, Princeton, Stanford, Texas-Austin, UCLA, Wharton, and Wisconsin, and conference participants at the 1998 meetings of the Western Finance Association and the 1996 meetings of the European Economics Association, European Finance Association, and European Econometric Society for many valuable suggestions. All errors and shortcomings are solely my responsibility.

reenter financial distress within a few years after completing a debt restructuring (Hotchkiss (1995) and Gilson (1997)).[1]

The existing literature has difficulties in explaining these observations and interprets them as inefficiencies arising from coordination problems among multiple creditors (Aggarwal (1995)) or an inefficient design of U.S. bankruptcy law (Hotchkiss (1995)). In this paper, we argue that the long-term nature of financial distress is difficult to explain without appealing to substantial inefficiencies only if one assumes, as most of the existing literature does, that creditors have perfect information about the economic viability of distressed firms.[2] However, a simple explanation for all these findings arises if one recognizes that creditors are uncertain about the viability of distressed firms. We suggest that the long-term nature of financial distress may be an unavoidable byproduct of an efficient resolution of financial distress. A key element of our explanation is that financial distress is an imperfect indicator of economic viability. If a firm enters financial distress, an important problem facing its creditors is to distinguish between economically viable firms and firms that should be liquidated. If there is sufficient uncertainty about the firm's viability, it may be optimal for the creditors to postpone the liquidation decision and wait for more information about the firm's viability. In particular, creditors may want to keep their debt claims, leaving leverage high, and require high short-term payments so that they can liquidate later if the firm does not improve its performance and hence reenters financial distress. A necessary cost of this strategy is to induce a myopic investment policy. This strategy of a "controlled liquidation" offers an alternative explanation for the stylized facts documenting the long-term nature of financial distress. Our dynamic view of financial distress implies that the financial distress process is more efficient than previously thought and, hence, debt is more beneficial because the benefits of financial distress may outweigh its costs.

In the following, a brief summary of the intuition of the model is presented before the implications of the theory developed in this paper are discussed in more detail. The paper considers the following situation. A firm is run by a liquidation-averse manager, who is privately informed about the prospects of the firm but who will never voluntarily liquidate the firm even if this would be efficient. To implement better liquidation decisions, the initial owners may choose to have some debt in the capital structure. After a default, creditors are in control and may liquidate the firm against the will of management. Creditors do not know whether the firm is economically viable or not. The traditional static view of liquidation (Bulow and Shoven (1978)) assumes that creditors have to make immediate liquidation decisions. Once they decide to continue, there is no subsequent liquidation opportunity and, hence, learning about the firm's prospects is irrelevant. In contrast to this view, the interpretation of liquidation as a *dynamic* process recognizes that

[1] High recidivism rates for firms in Chapter 11 have also been reported by Altman (1993) and LoPucki and Whitford (1993).

[2] A notable exception is Harris and Raviv (1990), which is discussed below.

creditors do not have to make immediate, once-and-for-all liquidation decisions. Instead, they may postpone the liquidation decision and wait for more information about the firm's prospects. When creditors receive another liquidation opportunity later, they can make a better informed liquidation decision.

In such a dynamic environment, an efficient resolution of financial distress should have two goals. The first goal is to continue viable firms and liquidate firms that should be liquidated. This may require *learning* about the financially distressed firm's economic viability. The second goal is to help a viable firm to recover as quickly as possible from its financial distress so that it can take advantage of its profitable investment opportunities ("realize its growth opportunities"). We argue that these two goals are in conflict, and this trade-off between learning (which allows better liquidation decisions) and the realization of growth opportunities influences the behavior of creditors and gives rise to a distinction between two strategies creditors can follow.

One strategy allows a quick and full recovery of the viable firm and enables it to realize its growth opportunities. The creditors can achieve this by swapping their debt into equity and, hence, removing the constraints that leverage imposes on the firm's investment policy. However, this also means that the creditors are not able to learn to distinguish between viable firms and firms that should be liquidated in time, and, hence, make less efficient liquidation decisions.[3] Instead of swapping their debt into equity, the creditors may want to keep leverage high. This strategy of a controlled liquidation keeps their intervention opportunities and allows them to intervene early should the firm not recover quickly.

A controlled liquidation can be the optimal strategy for the creditors, and this may explain the long-term nature of financial distress. It is attractive to creditors because it preserves the opportunity to participate in a recovery of the firm and receive more than the liquidation value. At the same time, it preserves the opportunity of limiting the downside risk if assets lose value, since the creditors learn enough to make an informed liquidation decision (in particular, they liquidate before a dramatic loss in asset values) when the firm fails to recover and reenters financial distress. However, while a controlled liquidation leads to more efficient liquidation decisions, it reduces the efficiency of the distressed firm's investment policy. In particular, leaving leverage high creates a debt overhang problem, which prevents the viable firm from undertaking profitable long-run projects. This investment distortion is a necessary byproduct of making better liquidation decisions.

The model assumes that the creditors have all the bargaining power in the debt restructuring. Since the creditors effectively become the firm's residual claimants in the restructuring, they tend to make decisions that—given their information—maximize firm value. They immediately liquidate firms that

[3] The model in the main text assumes that creditors lose their liquidation opportunity after a debt–equity swap. In the Appendix, it is shown that even if they do not lose their liquidation opportunity, they implement worse liquidation decisions after a debt–equity swap.

have very poor recovery prospects. They allow firms with good recovery prospects and potentially very attractive growth opportunities (i.e., growth opportunities that are very attractive if the firm is viable) to quickly recover from financial distress and enable them to realize their growth opportunities. Creditors engage in a controlled liquidation if there is sufficient uncertainty about a firm's recovery prospects and a correct liquidation decision is very important. The latter will be the case if the assets of a firm that should be liquidated can lose dramatically in value if it continues its operations.

Overall, in the framework of this paper, the costs of the intervention process triggered by financial distress (excessive liquidation and investment distortions) are outweighed by its benefits (liquidation of inefficient firms). If such an intervention process is not triggered by poor economic performance alone or is less timely and severe, it is optimal to include some debt in the initial capital structure. Bankruptcy reform would be unable to alleviate the costs of financial distress addressed in this paper. For instance, the cancellation of all debt and an all-equity recapitalization of distressed firms, as advocated by Roe (1983), would not eliminate all costs of financial distress in our model, in contrast to many other models.

The implications of our theory are in sharp contrast to the existing literature, which has interpreted the long-term nature of financial distress as a consequence of inefficiencies in the financial distress process arising from the difficulties that creditors have in implementing the correct liquidation and investment decisions. These difficulties may stem, for instance, from coordination problems among many small creditors and different priority groups of creditors (Bulow and Shoven (1978), Gertner and Scharfstein (1991), and Aggarwal (1995)). Alternatively, Hotchkiss (1995) suggests that poor postbankruptcy performance is a consequence of the U.S. bankruptcy environment (in particular, Chapter 11), which gives liquidation-averse managers too much power to continue inefficient firms against the will of their creditors. This view of the financial distress process implies that financial distress has very limited benefits but potentially high costs and that the financial distress process is inefficient and could be improved substantially through bankruptcy reform. Moreover, it suggests that significant costs of financial distress and very limited benefits justify low debt levels of firms.

In addition to the observations mentioned previously, our theory can explain why firms with substantially reduced debt burden increase their investment expenditures substantially and perform better than firms that emerge from a debt restructuring still highly leveraged. Moreover, it gives a rationale for why banks tend to take equity in firms with substantial growth opportunities as measured by the ratio of market-to-book value of the assets (see James (1995)). Additional empirical implications are presented in Section III.

This paper is related to Harris and Raviv (1990), who analyze the informational role of debt payments, which is also discussed in Jensen (1989a, 1989b). In their model, a default is informative about the viability of a firm in two ways: first, it indicates low current earnings, and second, it triggers an investigation of the firm by its creditors. Harris and Raviv (1990) em-

phasize the implications for capital structure and generate substantially richer implications for capital structure choices than this paper. However, they do not model investment decisions after distress and how they interact with learning about firm quality. This is important for explaining the data discussed above and for the implications concerning the efficiency of the financial distress process.

Von Thadden (1995) presents a model of continuation investment (not financial distress and dynamic liquidation decisions) in which there is a similar trade-off between investment efficiency and information generation in the short run. In contrast to von Thadden (1995), this paper aims to spell out implications for understanding and interpreting stylized facts observed during financial distress and for the debate about the costs and benefits of financial distress and bankruptcy law.

Stulz (1990) and Hart and Moore (1995) model capital structure choices and generate a negative correlation between a firm's leverage ratio and the quality of its investment opportunities, which also emerges in our model after the onset of financial distress. As in their papers, the cost of debt (in this paper, post-restructuring debt) is that it suppresses positive NPV projects. In Stulz (1990) and Hart and Moore (1995), the benefit of debt is suppressing discretionary negative NPV projects. In contrast, the benefit of leaving debt high after the onset of financial distress in this paper is that it allows a better liquidation decision (and prevents excessive continuation). During financial distress, optimal liquidation decisions are of crucial importance for firm value. Hence, the optimality of (post-restructuring) debt, which is the focus of this paper, is not only driven by the NPV of discretionary investment opportunities, but also by factors such as the evolution of liquidation and going concern values and the uncertainty about the firm's viability. These factors play no role in Stulz (1990) and Hart and Moore (1995), because they do not focus on a liquidation decision.

The remainder of the paper is structured as follows. Section I presents the model. Section II analyzes the creditors' decisions in the debt restructuring and the firm's initial capital structure choice. Section III offers some additional empirical implications that may help to test our theory. Section IV concludes.

I. Model

The time line in Figure 1 gives an overview of the model.

A. Overview

At date 0, an entrepreneur hires a manager to implement his business idea. The entrepreneur issues shares or obtains a loan to finance a project. The loan is due at date 1. If the firm obtained a loan and has a low date 1 payoff, it cannot make the debt payment and, hence, is in financial distress. Then, its sole creditor ("the bank") gains control. The bank may immediately liquidate the firm or allow it to continue its operations. If the firm is allowed

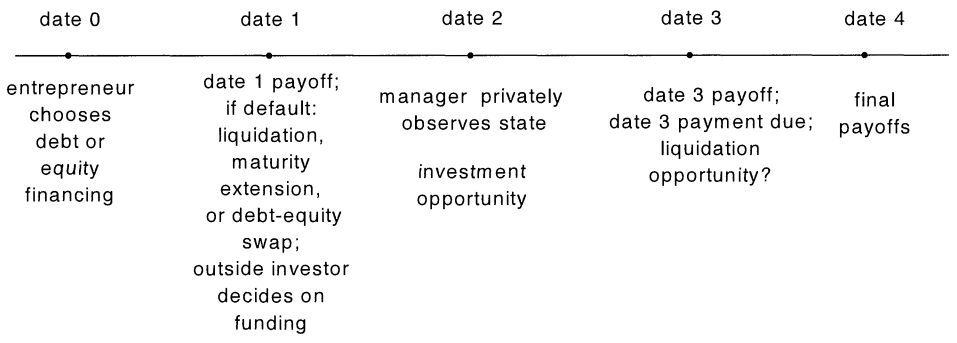

Figure 1. Time line.

to continue, the firm's debt is restructured. The bank has two choices in the debt restructuring: It may extend the debt maturity until dates 3 and 4 or swap its debt into an equity claim. If the bank retains its debt claim, the firm cannot attract financing for discretionary projects due to a debt overhang problem. If the bank swaps its debt claim into equity, the firm can attract new funding for a discretionary project. This project and the viability of the firm determine the payoffs at dates 3 and 4. At date 3, the bank may receive another liquidation opportunity. By then, it may have received new information about the firm's viability by observing its ability to make a date 3 payment. If there is no liquidation, final payoffs are realized at date 4. Table I summarizes the decisions the bank, the manager, the entrepreneur, and the outside investor make at different points of time and indicates what information they possess when they make these decisions. All participants are risk neutral.

B. Detailed Assumptions

B.1. Date 1 Liquidation Decision

This subsection discusses the first basic feature of the model: Financial distress gives the creditor an intervention opportunity but is an imperfect indicator of economic viability. Hence, it is not clear whether a firm entering financial distress should be liquidated or allowed to continue. This is formalized as follows.

At date 0, the entrepreneur raises funds of M by issuing debt with face value F or equity.[4] At date 1, the first payoff arises. It can be either high ($z_H > 0$) or zero. If the firm has no debt, there is no default and hence incumbent management remains in control. However, if the payoff is zero and there is a debt payment due, the firm is in default and the sole creditor

[4] Since the details of the date 0 financing choice are only relevant for Section II.C, their description is postponed until then.

Table I
Decisions

Date	Player	Decision	Information
0	Entrepreneur	Debt or equity	Prior belief about state
1	Bank	Liquidation, maturity extension, or debt–equity swap	Date 1 posterior belief about state
1	Bank	Date 3 payment	Date 1 posterior belief about state
1	Outside investor	Funding	Date 1 posterior belief about state
2	Manager	Project choice	Knows state
3	Bank	Liquidation	Observes whether date 3 payment was made, but not the state

("the bank") gets control over the firm. It may immediately liquidate the firm. Then the bank receives a payoff of L_1 and the equityholders receive nothing. However, it is not clear whether a firm that defaults should be liquidated. The reason is that even economically viable firms can have a low date 1 payoff. This idea is formalized as follows. There are two types of firms in the economy, firms in the high state (viable firms) and firms in the low state (firms that should be liquidated). The prior probability (at date 0) of the high state is λ. Viable firms should be continued because their continuation value is higher than their liquidation value. Their assets in place at date 0 will generate a date 3 payoff of x_H and a date 4 payoff of y_H with $x_H + y_H > L_1$. However, firms in the low state ("inefficient" firms) should be liquidated. Their assets in place at date 0 generate a date 3 payoff of x_L and a date 4 payoff of y_L with $x_L + y_L < L_1$.

While the bank wants to liquidate inefficient firms, it never observes the state of the firm. However, it can learn about the state by observing the firm's ability to make the date 1 debt payment. A firm can make this payment if and only if its date 1 payoff is z_H because it is assumed that $z_H > F > 0$. The bank updates its belief about the quality of a firm that defaults at date 1 using Bayes' Rule. The probability that a viable firm has a high date 1 payoff is assumed to be ϵ_H. This is higher than the probability with which a firm that should be liquidated has a high date 1 payoff, which is assumed to be zero. Hence, the probability that a firm that has a zero date 1 payoff (and, hence, cannot make the date 1 debt payment) is viable is (using Bayes' Rule)

$$\pi = \frac{\lambda(1 - \epsilon_H)}{\lambda(1 - \epsilon_H) + 1 - \lambda}. \tag{1}$$

If the posterior belief about the firm's viability after a default at date 1, π, is sufficiently optimistic, the bank may not want to liquidate the firm. In-

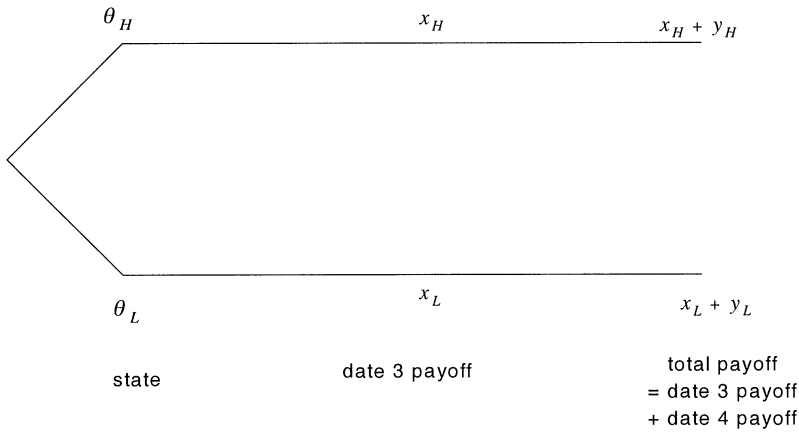

Figure 2. Firm's payoffs after a maturity extension.

stead, it may agree to a debt restructuring and allow the firm to continue its operations.

B.2. The Bank's First Alternative in the Date 1 Debt Restructuring: Maturity Extension

If the bank allows the firm to continue despite a default at date 1, the firm's debt must be restructured. This subsection discusses the second basic model feature: One option for the bank in the debt restructuring is to retain its debt claim but extend its maturity and hence leave leverage high. In this case, the bank asks for a date 3 (short-term) payment of D_I and a date 4 (long-term) payment of $D_F = F - D_I$ (recall that F denotes the debt due at date 1). If the bank extends the maturity of its debt, there is a debt overhang problem (see Myers (1977)).[5] Because the outstanding debt is senior to any new financing, the outside investor is unwilling to finance the new project and the manager cannot invest in a discretionary project.[6] In this case, the only payoffs are the payoffs from the assets in place at date 0 already described above: x_H at date 3 and y_H at date 4 in the high state θ_H and x_L at date 3 and y_L at date 4 in the low state θ_L. These payoffs are illustrated in Figure 2, which assumes that the firm is continued until date 4. Date 3 payoffs are

[5] The exact condition is given in Section B.4 because it is more easily understood after describing the firm's investment opportunities.

[6] If a firm is operating under Chapter 11, it may, subject to court approval, obtain new debtor-in-possession (DIP) financing that becomes senior to existing debt. This possibility is ignored here. While firms may obtain funds to finance ongoing operations during Chapter 11 in this way, DIP financing is not available after emerging from bankruptcy (and never available in out-of-court restructurings). Even allowing for DIP financing, it seems unlikely that many firms can obtain funding for substantial discretionary long-term projects that will be carried out after emerging from bankruptcy unless they reduce their debt burden substantially.

reinvested in a zero NPV project that has its payoff at date 4. We also assume, for simplicity, that $F > x_H + y_H$, so that the bank receives all the payoffs from a maturity extension.

B.3. Second Liquidation Opportunity at Date 3

The third basic model feature is that the bank can receive a second liquidation opportunity. Moreover, it may be valuable to postpone the liquidation decision in order to wait for more accurate information about the firm's viability. This is formalized as follows: If the firm cannot make the date 3 debt payment and, hence, defaults a second time (because the firm has a short-term payoff of x_L and the date 3 debt payment D_I satisfies $D_I > x_L$), the bank receives another liquidation opportunity at date 3. The liquidation value at date 3 consists of the date 3 payoff (in the case of default: x_L) and L_3. If the bank still decides to allow the firm to continue at date 3, it takes all the firm's equity: all payoffs accrue to the bank and none to the old equityholders.

As at date 1, it is optimal at date 3 to liquidate inefficient firms because it is assumed that the liquidation value at date 3, $x_L + L_3$, is higher than $x_L + y_L$, the continuation value (i.e., it is assumed that $L_3 > y_L$). Delaying liquidation comes at a cost, since liquidation values deteriorate over time: $x_H + L_3 < L_1$. Hence, an immediate liquidation may be optimal. Because continuation is value-maximizing in the high state at date 1 and liquidation values are deteriorating, continuation is value-maximizing in the high state also at date 3. Formally, the previous assumptions ($x_H + y_H > L_1$ and $L_1 > x_H + L_3$) are already sufficient to derive this because they imply $y_H > L_3$.

Though the manager learns the state at date 2, he is not willing to liquidate the firm himself or reveal the information that the firm should be liquidated to a party that can liquidate the firm. The reason is that he derives private benefits of control B from running the firm, which he loses if the firm is liquidated before date 4. It is assumed that the manager's liquidation aversion is so strong that the bank does not find it optimal to induce the manager to liquidate the firm himself or reveal his private information about the firm's viability. Since the manager's reservation utility is normalized to zero and he has limited liability (so that the payment he receives from the firm can never be negative), a sufficient condition for this is $B > L_3 - y_L$.[7] This means that the payment to the manager needed to induce him to liquidate the firm or reveal that the firm should be liquidated is larger than the bank's gain from learning that the firm should be liquidated. The latter is the difference between the liquidation and the continuation value of the inefficient firm, $L_3 - y_L$.

[7] An assumption that the agency conflict cannot be fully eliminated though compensation contracts is typically made in the literature (see, e.g., Harris and Raviv (1990), Stulz (1990), and Hart and Moore (1995)).

While it is assumed that the bank cannot observe the date 3 payoff directly (perhaps due to the possibility of earnings manipulation), the bank can perfectly infer the date 3 payoff from the firm's ability to make an appropriately chosen date 3 debt payment.[8] Due to the manager's reluctance to reveal the state, the bank can learn about the firm's viability only by observing its ability to make a date 3 payment. But note that in the absence of investment, the date 3 payoff of the viable firm is always x_H and, hence, larger than the date 3 payoff of the inefficient firm, x_L. Hence, although it is assumed that the bank cannot observe the state of the firm, the bank can, in the absence of investment, perfectly distinguish between viable firms and firms that should be liquidated by observing their ability to make a date 3 payment that is between x_L and x_H.[9] This captures the idea that postponing the liquidation decision and observing firm performance in the meantime can generate additional information about firm quality. This allows the bank to implement a better liquidation decision at date 3 than at date 1, which makes postponing the liquidation decision potentially attractive.

B.4. The Bank's Second Alternative in the Date 1 Debt Restructuring: Debt–Equity Swap and Post-Restructuring Investment

The fourth basic model feature is that instead of extending the maturity of its debt claims, the bank may convert all its debt into equity in the debt restructuring at date 1.[10] This allows the firm to attract new funding for discretionary investment projects. Since the bank has all the bargaining power, it receives 100 percent of the equity in exchange for forgiving all the firm's debt. Because there is no outstanding debt and all projects are at least zero NPV, the outside investor is willing to finance the new investment of I.[11] He is paid back at date 4 (in the case of a liquidation at date 3, he is paid back

[8] The assumption that date 3 payoffs are not observable does not play a crucial role in the analysis. As argued above, the investors can in any case infer the payoffs perfectly from observing the firm's ability to make the date 3 payment. However, if date 3 payoffs would be observable, one would need to assume a (arbitrarily small) default cost to pin down the optimal debt payment at date 3. Without such a cost, a debt payment above the highest possible date 3 payoff could not be ruled out. Also, it is assumed that the manager cannot steal date 3 payoffs.

[9] The feature that, in the absence of investment, the bank can perfectly discriminate between viable firms and firms that should be liquidated by observing the ability to make the date 3 payment is just a normalization. What is important is that the bank learns more from the inability to make the date 3 payment if the viable firm does not invest than what it knows at date 1.

[10] Even in the United States, a bank is allowed to take equity in a firm if this firm has defaulted on the bank's loan or is likely to do so. Moreover, banks do quite frequently take equity in distressed restructurings and typically hold it for an extended period of time (see James (1995)).

[11] The bank is indifferent between providing the funds for the discretionary project itself and letting the outside investor fund it. While it is assumed that the funds for the project are provided by the outside investor, the results would be identical if the bank were to finance the project. Although the financing comes from the outside investor, the project will be undertaken if and only if the bank wants it to be undertaken. The reason is that the bank determines the outside investor's incentives to finance the project and, hence, whether the project is undertaken by its willingness to swap its debt into equity.

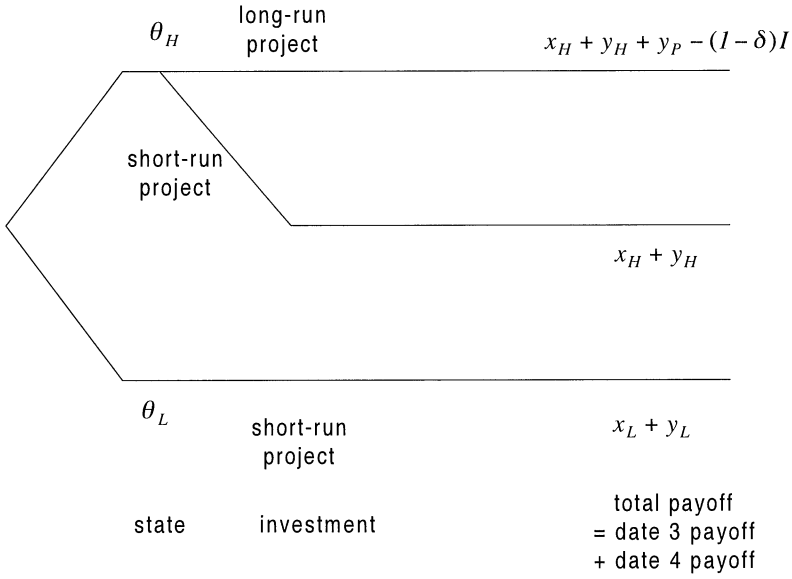

Figure 3. Firm's payoffs after a debt–equity swap.

at date 3). The financing market is competitive. Hence, the outside investor will make zero profits.

If the bank swaps its debt into equity, allowing the firm to attract new outside financing, the firm's date 3 and date 4 payoffs arise from two sources: from its assets in place already at date 0 and from a discretionary investment project. The payoffs from the assets in place at date 0 were already described above. The manager makes the discretionary investment decision. In the low state, the manager can only invest in a zero NPV short-run project.[12] It costs I and returns I at date 3.

In the high state, the manager has two investment projects to choose from: the same zero NPV short-run project that is available in the low state and a positive NPV long-run project. The long-run project costs I and returns $y_p > (1 - \delta)I$ for certain at date 4 (if the firm is continued until date 4). In addition, it generates with probability δ a date 3 payoff of I. With probability $1 - \delta$, the long-run project has a zero payoff at date 3. For now, the only important characteristic of the long-run project is that it has a positive NPV of $y_p - (1 - \delta)I$. It is assumed that the manager invests in the long-run project if he is indifferent between the long-run and the short-run projects. As will become clear below, the manager will always invest in the long-run project after a debt–equity swap. The firm's payoffs after a debt–equity swap (after repaying the outsider at date 4) are illustrated in Figure 3.

[12] The assumption that the short-run project is zero NPV is just a normalization. What is important is the difference between the NPV of the long-run and the short-run project, which is positive.

Since the long-run project is positive NPV, a debt–equity swap may seem to be the bank's dominant choice in the debt restructuring. However, allowing the firm to realize its growth opportunities comes at the cost of inducing less efficient liquidation decisions. For the moment, it is assumed that the bank loses its ability to liquidate the firm at date 3 after it has swapped its debt into equity. This assumption is stronger than what is needed. In Appendix A, this assumption is removed. There it is shown, in a slightly extended model, that even if the bank can liquidate at date 3 after swapping its debt into equity, it will always implement a worse liquidation decision than if it retained its debt claim and hence prevented investment. In particular, it arises as the equilibrium in one parameter region that the bank *chooses* to never liquidate the firm at date 3 as its new owner, regardless of its performance. Since the main results can be stated without deriving the bank's passivity at date 3 as the new owner endogenously, this point is postponed until Appendix A to keep the analysis as simple as possible.

Having described the payoffs arising from discretionary investment, we can now return to state the precise condition under which there is a debt overhang problem when the bank does not swap its debt into equity but just extends maturity (see Section B.2.). The assumption that $F > x_H + y_H + y_P - (1/\pi - \delta)I$ if $F \geq x_L + y_L + I$ and $F > \pi(x_H + y_H + y_P - (1 - \delta)I) + (1 - \pi)(x_L + y_L)$ if $F < x_L + y_L + I$ guarantees that the firm cannot attract new funding if the bank retains its debt claim.

B.5. Discussion of Assumptions

By assuming that there is only one creditor, the model deliberately abstracts from bargaining inefficiencies arising from the presence of multiple creditors, perhaps of differing priority. These issues have been discussed in detail in the existing literature (see Bulow and Shoven (1978) and Gertner and Scharfstein (1991)). It also appears that these bargaining inefficiencies can be alleviated. For instance, the ownership of debt claims tends to become more concentrated shortly before and during financial distress, which should reduce the inefficiencies arising from the presence of many small bondholders. This is often brought about by the acquisition of substantial stakes by investors specializing in distressed securities (Hotchkiss and Mooradian (1997)). In addition, the provisions of Chapter 11 are in part designed to overcome free-rider problems (see Gertner and Scharfstein (1991)). Indeed, there is some empirical evidence suggesting that the bargaining inefficiencies induced by the presence of many creditors are often overcome to an important extent. For instance, Alderson and Betker (1995) find that firms with high liquidation costs emerge from Chapter 11 with relatively low leverage ratios. This could be interpreted as evidence that an adjustment of capital structure is provided when it is needed most. In addition, Andrade and Kaplan (1998) find that more complex debt structures do not increase the costs of financial distress in a sample of highly

levered firms that become financially distressed. However, Section II.D discusses what would change in the presence of multiple creditors and coordination problems among them.

II. Analysis

This section analyzes the bank's decisions in the debt restructuring at date 1. In addition, Subsection C discusses the initial capital structure choice of the entrepreneur at date 0. Subsection D discusses what would happen in the presence of other creditors. In the date 1 debt restructuring, the bank can prevent discretionary investment by refusing to exchange its debt into equity, leaving the firm with a debt overhang that does not allow it to obtain financing from the outsider. Keeping its debt claim allows the bank to have another liquidation opportunity at date 3 and learn enough about the firm's viability to make the optimal liquidation decision then. If the bank instead converts its debt into equity, the manager is able to obtain funds from the outside investor for the discretionary project. The advantage of the debt–equity swap is that the manager can invest in the positive NPV long-run project. He will always do so because he does not have to fear a liquidation. The disadvantage of the debt–equity swap is that the liquidation opportunity at date 3 is lost. Hence, there is excessive continuation because the firm is allowed to continue even if its liquidation value is higher than its continuation value.

A. Immediate Liquidation, Debt–Equity Swap, or Maturity Extension?

Now we consider the bank's choices in the debt restructuring. The bank can follow one of three strategies. It can immediately liquidate the firm. It can allow the firm to realize its growth opportunities by swapping its debt into equity and enabling the viable firm to invest in the long-run project. Or it can allow the firm to continue but focus on generating information about the firm's viability. The bank can achieve this by retaining its debt claim but extending its maturity. This latter strategy is called a controlled liquidation. It is myopic in the sense that the viable firm forgoes the profitable long-run project.

If the bank remains a debtholder, the firm cannot invest, due to the debt overhang problem. The bank will ask for a date 3 debt payment D_I. We can assume without loss of generality that $x_L < D_I \leq x_H$. Such a payment is informative since the ability to make this payment reveals the date 3 payoff. In the absence of investment, it also reveals the state. This is so because the manager in the high state, who has a date 3 payoff of x_H, can make the payment. In contrast, the manager in the low state, who has a date 3 payoff of x_L, cannot make the payment. Hence, the bank will liquidate a firm that cannot make this payment and thus is revealed as inefficient. As a consequence, the bank is able to implement the optimal liquidation policy at date 3. However, this is not the first–best liquidation policy, since the liquidation

of the inefficient firm occurs only at date 3 and not at date 1 and liquidation values deteriorate. If the bank swaps its debt into equity, there is never a liquidation, and hence even firms that should be liquidated are allowed to continue.

The first result describes the conditions under which the bank immediately liquidates the firm or swaps its debt into equity, allowing the firm to realize its long-term growth opportunities.[13]

PROPOSITION 1: *The bank immediately liquidates the firm if and only if the date 1 liquidation value is sufficiently high:*

$$L_1 > \pi(x_H + y_H) + (1 - \pi)(x_L + L_3) \tag{2}$$

and

$$L_1 > \pi(x_H + y_H + y_P - (1 - \delta)I) + (1 - \pi)(x_L + y_L). \tag{3}$$

The bank exchanges its debt into equity and the firm invests in the long-run project in the high state if and only if the long-run project is attractive enough:

$$y_P \geq \frac{L_1 - \pi(x_H + y_H) + \pi(1 - \delta)I - (1 - \pi)(x_L + y_L)}{\pi} \tag{4}$$

and

$$y_P > \frac{(1 - \pi)(L_3 - y_L) + \pi(1 - \delta)I}{\pi}. \tag{5}$$

Proof: See Appendix B.

In this model, the bank has all the bargaining power in the debt restructuring. This effectively makes it the firm's residual claimant and induces it to make decisions that maximize firm value. An immediate liquidation leads to the highest payoff in the low state, L_1, which is higher than the payoff in the low state under a maturity extension ($x_L + L_3$) or a debt–equity swap ($x_L + y_L$). Hence, for each combination of values of the other parameters, one can find a value $\bar{L}_1$ such that the bank liquidates the firm if and only if $L_1 > \bar{L}_1$. The conditions in Proposition 1 illustrate the trade-offs the bank faces when it has to decide on its action after a default at date 1.

[13] It is assumed throughout the paper that the bank breaks an indifference between a debt–equity swap and a maturity extension in favor of a maturity extension. If the bank is indifferent between a maturity extension and an immediate liquidation, it is assumed that the bank chooses a maturity extension. If the bank is indifferent between a debt–equity swap and an immediate liquidation, it is assumed that the bank chooses a debt–equity swap.

First consider the bank's choice between an immediate liquidation and a maturity extension. The bank prefers an immediate liquidation if and only if inequality (2) holds. The advantage of an immediate liquidation is that it liquidates inefficient firms without delay. This is better because liquidation values deteriorate over time ($L_1 > x_L + L_3$). As a consequence, if the recovery probability π is lower or liquidation values lose more in value over time ($x_L + L_3$ is lower), then an immediate liquidation is the preferred choice for a broader range of date 1 liquidation values L_1, that is, is preferred even for relatively small L_1. The advantage of a controlled liquidation (implemented through a maturity extension) over an immediate liquidation is that it leads to a higher value if the firm is viable ($x_H + y_H > L_1$). Hence, an immediate liquidation is preferred for a smaller range of date 1 liquidation values (only for relatively large L_1) if a recovery leads to higher payoffs ($x_H + y_H$ is larger).

Next consider the bank's choice between an immediate liquidation and a debt–equity swap that allows the realization of growth opportunities. The bank prefers an immediate liquidation if and only if inequality (3) holds. The advantage of an immediate liquidation is again that inefficient firms are liquidated without delay. Hence, an immediate liquidation is more attractive for a larger range of date 1 liquidation values (even for relatively small L_1) if π is smaller or the continuation value of an inefficient firm ($x_L + y_L$) is lower. The advantage of the debt–equity swap is that it leads to a higher payoff if the firm is viable, and, in particular, allows the firm to invest in the positive NPV project. As a consequence, an immediate liquidation is preferred for a smaller range of date 1 liquidation values (only for relatively large L_1) if the NPV of the long-run project ($y_P - (1 - \delta)I$) or the continuation value of a viable firm without a discretionary project ($x_H + y_H$) is higher.

When will the bank swap its debt into equity and hence allow the viable firm to realize its growth opportunities? A debt–equity swap leads to the highest payoff among the three possible strategies in the high state: $x_H + y_H + y_P - (1 - \delta)I$, which is higher than the payoff in the high state under a maturity extension ($x_H + y_H$) or an immediate liquidation (L_1). Hence, a debt–equity swap will be optimal if and only if y_P is sufficiently high (i.e., for each combination of the other parameters, there is a critical value $\bar{y}_P$ such that the bank chooses a debt–equity swap if and only if y_P is larger than $\bar{y}_P$). The dependence of the critical value $\bar{y}_P$ on the other parameters of the model illustrates the trade-offs the bank faces. When the bank compares an immediate liquidation with a debt–equity swap, it faces the trade-off already described above. The advantage of an immediate liquidation over the debt–equity swap is that it prevents the potential deterioration of the firm's asset values as a going concern. The cost of an immediate liquidation is that the bank cannot receive more than the liquidation value. Hence, the bank prefers the debt–equity swap for a larger range of y_P (even if y_P is relatively low) if L_1 is lower, $x_L + y_L$ is higher, $x_H + y_H$ is higher, I is lower, or π is higher, as seen in inequality (4).

When the bank compares a debt–equity swap that allows the realization of growth opportunities with a maturity extension that leads to a controlled liquidation, it faces the following trade-off: A controlled liquidation sacrifices the profits generated by the long-run project ($y_P - (1 - \delta)I$). Hence, the bank prefers a debt–equity swap for a larger range of y_P (even if y_P is relatively low) if the probability of the firm being viable (π) is higher or the investment costs less (I is lower) or pays off early with a higher probability (δ is higher). This can be seen from inequality (5). The advantage of a controlled liquidation over a debt–equity swap is that it limits the downside risk. Hence, the bank prefers a debt–equity swap for a smaller range of y_P (only if y_P is relatively high) if L_3 is higher or y_L is lower. This can be seen from inequality (5) as well.

Finally, when does the bank choose a controlled liquidation, that is, when does the bank allow the firm to continue but prevent it from investing by retaining its debt claim while extending its maturity?

PROPOSITION 2: *The bank refuses to exchange its debt into equity and the firm continues its operations but does not invest if and only if the date 3 liquidation value is sufficiently high,*

$$L_3 \geq y_L + \frac{\pi(y_P - (1 - \delta)I)}{1 - \pi}, \tag{6}$$

and the continuation value in the high state in the absence of the long-run project is sufficiently high,

$$x_H + y_H \geq \frac{L_1}{\pi} - \frac{1 - \pi}{\pi}(x_L + L_3). \tag{7}$$

Proof: See Appendix B.

While a debt–equity swap leads to the highest payoff in the high state, it leads to the lowest payoff in the low state. Similarly, while an immediate liquidation leads to the highest payoff in the low state, it leads to the lowest payoff in the high state. A maturity extension leads to the second highest payoff among all three possible strategies in both the high state and the low state. The payoff it induces in the high state ($x_H + y_H$) is lower than the payoff induced by a debt–equity swap ($x_H + y_H + y_P - (1 - \delta)I$), but higher than the payoff induced by an immediate liquidation (L_1). The payoff a maturity extension induces in the low state ($x_L + L_3$) is lower than the payoff induced by an immediate liquidation (L_1), but higher than the payoff induced by a debt–equity swap ($x_L + y_L$). Hence, a maturity extension avoids the lowest payoff in both the high state and the low state and is optimal if L_3 and $x_H + y_H$ are high enough, as can be seen from inequalities (6) and (7).

B. Uncertain Recovery and Controlled Liquidation

The last subsection shows that the bank chooses a controlled liquidation if liquidation decisions have a strong enough impact on firm value. This is the case if the liquidation value of an inefficient firm can be much higher than its continuation value while the continuation value of a viable firm can be much higher than its liquidation value (see Proposition 2). This subsection illustrates that the bank engages in a controlled liquidation if learning matters because there is sufficient uncertainty at the time of the initial debt restructuring about the firm's viability.

A controlled liquidation can be seen as a postponement of the initial liquidation decision. If the bank believes that it is very likely that the firm should be liquidated (is in the low state), an immediate liquidation is more attractive than a controlled liquidation. The advantage of a controlled liquidation over an immediate liquidation lies in the value of preserving the opportunity to receive more than the liquidation value in case the firm is viable. However, the value of this opportunity is very small if the firm is highly unlikely to be viable. The advantage of an immediate liquidation—avoiding a substantial loss in liquidation values if there will be no recovery—dominates. Put differently, an immediate liquidation is optimal if the low state is very likely because it generates the highest payoff in the low state.

If it is highly likely that the firm is viable, exchanging debt into equity and, hence, allowing the realization of growth opportunities is more attractive than a controlled liquidation. The advantage of a controlled liquidation over a debt–equity swap is that the bank learns enough about the firm's prospects to make an optimal liquidation decision at date 3. In particular, it liquidates the firm before a more dramatic loss in asset values when the firm cannot make the short-term payment. However, the value of this opportunity is very small if the firm is viable with very high probability. The advantage of a debt–equity swap—higher upside payoffs—dominates. Put differently, if the high state is very likely, a debt–equity swap is optimal because it generates the highest payoff in the high state.

However, if there is enough uncertainty about the state of the firm, a controlled liquidation (implemented through a maturity extension) can be optimal. Such a strategy guarantees the firm to avoid the lowest payoff in both the high and the low states. If the second-highest payoff in both states is sufficiently higher than the lowest payoff and sufficiently close to the highest payoff, a controlled liquidation will be the bank's preferred strategy.

As a consequence of the arguments in the previous paragraphs, a controlled liquidation is optimal for the bank if and only if π, the posterior belief about firm quality after a default at date 1, is not too high and not too low, that is, the bank is uncertain enough about the firm's state and thus its recovery prospects. The preceding discussion is summarized in Proposition 3.

PROPOSITION 3: *The bank refuses to exchange its debt into equity and the firm continues its operations but does not invest if and only if there is sufficient*

uncertainty about the firm's viability. This is the case if and only if π *is neither too high nor too low, that is,* $\pi \in [\pi_L, \pi_H]$ *where*

$$\pi_L = \frac{L_1 - L_3 - x_L}{x_H + y_H - x_L - L_3} \tag{8}$$

and

$$\pi_H = \frac{L_3 - y_L}{y_P - (1 - \delta)I - y_L + L_3}. \tag{9}$$

If $\pi_L < \pi_H$*, the bank immediately liquidates the firm if and only if it is sufficiently unlikely that the firm is viable* ($\pi < \pi_L$)*. The bank exchanges its debt into equity and the firm invests in the long-run project in the high state if and only if it is sufficiently likely that the firm is viable* ($\pi > \pi_H$)*.*

Proof: See Appendix B.

As can be seen from equation (1), whether there is substantial uncertainty depends in an apparent way on λ and ϵ_H. Clearly, the upper and the lower bound on π that determine when a controlled liquidation is optimal depend on the other parameters of the model. If liquidation values deteriorate substantially (so that the difference between L_1 and $x_L + L_3$ is large), the bank's belief about the high state must be relatively high (the bank must be relatively optimistic about the firm's prospects) for a controlled liquidation to be more profitable than an immediate liquidation. Similarly, if the long-run project is very attractive or the going concern value does not deteriorate substantially even if the firm fails to recover, the bank must be relatively pessimistic about the firm's recovery prospects to prefer a controlled liquidation to a debt–equity swap. This can be easily seen from the bounds on π in the above proposition. Of course, if $\pi_L > \pi_H$, a maturity extension is never optimal.[14]

Another way of describing the bank's choice is to use an option analogy. A liquidation opportunity corresponds to a put option on the value of the firm, with the strike price equal to the liquidation value of the firm. An immediate liquidation corresponds to immediately exercising the put option with a strike price of L_1, the date 1 liquidation value. A controlled liquidation corresponds to keeping the put option alive and perhaps exercising it at date 3. The strike price is then the date 3 liquidation value of $x_L + L_3$, which is smaller than the date 1 liquidation value of L_1. A debt–equity swap means that the bank forgoes any opportunity to liquidate the firm. This means that

[14] Then the bank chooses an immediate liquidation if and only if $\pi < (L_1 - x_L - y_L)/(x_H + y_H + y_P - (1 - \delta)I - x_L - y_L)$. Otherwise, it chooses a debt–equity swap.

it does not have the put option. However, the cost of keeping the put option alive is an investment distortion due to the debt overhang problem. Hence, it can be optimal to forgo receiving the option to liquidate altogether.

The value of keeping alive the put option (the option to liquidate) increases if the date 3 strike price (the liquidation value at date 3, $x_L + L_3$) is higher or the volatility of the underlying asset is higher. The latter is shown in the following result.

PROPOSITION 4: *A maturity extension is more attractive relative to an immediate liquidation and a debt–equity swap if the variance of date 4 payoffs is higher.*

Proof: See Appendix B.

The intuition behind this result is the same as the intuition behind a positive relationship between the volatility of the underlying asset and option prices. If there is a mean-preserving spread of the date 4 payoff and hence a reduction in y_L, the payoff from a maturity extension in the low state is not affected. The reason is that the bank exercises the option to liquidate at date 3 and receives a payoff of $x_L + L_3$ in any case after a second default at date 3. However, the bank's payoff in the high state, in which it does not exercise the option to liquidate, is higher due to the increase in y_H. Thus, a maturity extension becomes more attractive if the variance of the date 4 payoff increases and, hence, will be chosen under more circumstances.

The option analogy also offers an alternative way to explain why the bank chooses a maturity extension if and only if there is enough uncertainty about the state of the firm. The probability of the low state $(1 - \pi)$ is also the probability that the strike price $(x_L + L_3)$ is higher than the value of the underlying asset (the continuation value). Hence, the option to liquidate is exercised at date 3 with probability $1 - \pi$. If the high state is very likely (π is very high), the option to liquidate at date 3 is almost never exercised and, hence, not very valuable. Then, due to the loss of the profitable investment opportunity, a controlled liquidation is less attractive than a debt–equity swap. If the low state is very likely (π is very low), the option to liquidate at date 3 is exercised with very high probability. But then it is better to exercise the option immediately, since liquidation values deteriorate.

C. The Initial Capital Structure Choice by the Entrepreneur

To address the initial capital structure choice by the entrepreneur, assume the following setting for the date 0 choice of financing: The entrepreneur has a business idea but lacks the funds and the managerial skills to implement it. He decides whether to obtain a loan or issue shares to outsiders to finance the project. Both the loan market and the market for outside equity are competitive: Loans and outside equity are fairly priced so that banks and outside shareholders make zero expected profits. The face value of a fairly priced loan, F, is due at date 1.

If the firm is all equity financed, there is never an intervention, even after a zero date 1 payoff. In particular, there is never a liquidation. Moreover, the manager will invest in the long-run project since he does not have to fear a liquidation and can always fund the project by attracting new financing. The latter is the case because there is no debt overhang problem and all projects are at least zero NPV. If the firm is debt financed but there is no default at date 1, there again is no intervention. Since all debt is already paid off and all projects have a nonnegative NPV, the manager can attract funding for the discretionary project. He will invest in the long-run project and there will never be a liquidation. The difference between debt and equity financing at date 0 is that debt financing leads to an intervention after a zero payoff at date 1. Proposition 5 characterizes the initial capital structure choice by the entrepreneur. Note that the entrepreneur chooses the funding source that maximizes firm value. The reason is that he is the residual claimant of firm value since outside investors behave competitively and hence break even.

PROPOSITION 5: *If the long-run project is sufficiently attractive so that inequalities (4) and (5) hold, the entrepreneur is indifferent between obtaining a loan and issuing shares. For all other parameter constellations, the entrepreneur strictly prefers to obtain a loan.*

Proof: See Appendix B.

The costs of the intervention process triggered by financial distress lie in the possibility of excessive liquidation and the potential passing up of the positive NPV long-run project. Sometimes a firm is liquidated (at date 1) although it is viable, which would never happen outside of financial distress since then no firm would be liquidated. Alternatively, if the bank engages in a controlled liquidation, the viable firm cannot invest in the positive NPV discretionary project, while in the absence of financial distress all positive NPV projects would be undertaken. The benefit of the intervention process triggered by financial distress lies in the better liquidation decisions implemented by the bank. Overall, the intervention process is beneficial in the environment analyzed in this paper. In the absence of an intervention, the manager would remain in control of liquidation decisions at all times. Hence there would never be a liquidation and the manager of a viable firm would always invest in the long-run project. Such an outcome can also be achieved by the bank during financial distress if it swaps its debt into equity. Indeed, this outcome will be achieved if it maximizes firm value. However, an improved liquidation decision may be more valuable than realizing the firm's growth opportunities, and such an improved liquidation decision can only be implemented by the bank when it intervenes during financial distress.

If there was an arbitrarily small cost of default (e.g., transactions costs of a debt restructuring), then it could be strictly better to have no debt in the capital structure. This would be true in all those instances in which the optimal response for the bank after a default induces the same outcome as would occur in the absence of a default: The firm is allowed to continue and realizes its growth opportunities. This is the case if inequalities (4) and (5) hold.

The role of debt in the initial capital structure is to give outside investors (creditors) an intervention opportunity if firm performance is poor. If the firm has initially no debt, there is never an intervention and hence even inefficient firms are always allowed to continue. The role of debt in the debt restructuring at date 1 is to keep a liquidation opportunity later. In Appendix A, it is shown that even if the bank keeps its liquidation opportunity after swapping its debt into equity (so that debt is not needed for this purpose), debt plays a productive role in the date 1 debt restructuring. Keeping the debt claim depresses post-restructuring investment. While this comes at the expense of the discretionary positive NPV project, this can be desirable because it allows the bank to learn more about the firm's viability in the short run and, hence, implement better liquidation decisions. Thus, debt is initially needed to give investors an opportunity to intervene at all; keeping the debt claim in the debt restructuring allows them to learn more about the firm's viability by constraining the firm's investment policy. This allows more informed liquidation decisions.

D. Multiple Creditors

In this subsection, we discuss how the presence of other creditors may affect the bank's behavior in the debt restructuring. Suppose that in addition to the bank debt, there is other outstanding debt. This debt is held by creditors who do not cooperate in the debt restructuring. They never swap their debt into equity but instead always retain their debt claims. One interpretation of this debt is that it is held by uncooperative banks or trade creditors who refuse to swap their debt into equity. Another interpretation is that it is the face value of public debt held by many small bondholders (more precisely, the face value that remains after a possible exchange offer). Also let us assume that the bank debt is senior to the uncooperative debt.

In such a setting, the bank will not always make the decision in the debt restructuring that maximizes firm value. First of all, the presence of uncooperative debt reduces the bank's payoffs from a debt–equity swap. This arises because in a debt–equity swap, the bank unilaterally reduces its seniority, which amounts to a wealth transfer to the uncooperative debtholders. This distortion will be more severe if the wealth transfer to uncooperative debtholders is larger. This will be the case if there is more uncooperative debt. If the face value of the bank's debt claim is high enough (in particular, higher than the high payoff in the absence of the long-run project, $x_H + y_H$), this is the only distortion in the bank's decision. The reason is that the bank still gets all of the payoffs from the other two strategies, an immediate liquidation and a maturity extension. Hence, in this situation, the bank sometimes forgoes a debt–equity swap, although this would maximize firm value. However, the bank chooses an immediate liquidation or a maturity extension if these strategies maximize firm value. If the face value of the bank's debt claim is lower than $x_H + y_H$, there may be other distortions in the bank's decision during the debt restructuring. The reason is that now the bank does not receive all of the payoffs from a maturity extension (and per-

haps from an immediate liquidation), since it has to share the payoffs with the uncooperative debtholders. This reduces the attractiveness of these strategies to the bank.

The distortions in the bank's decision in the debt restructuring arising from the presence of uncooperative creditors have implications for the initial capital structure choice by the entrepreneur. If the response to financial distress that maximizes firm value is a debt–equity swap, the bank may fail to implement it because of the wealth transfer to uncooperative debtholders. Since in the absence of debt, there would be no intervention and, hence, the long-run project would be chosen and the firm always continued, having debt reduces firm value in this parameter region. Hence, the entrepreneur will prefer equity to debt financing. However, even in the presence of potential coordination problems among creditors, the intervention process triggered by financial distress may increase firm value. This will be the case in all parameter regions in which the bank implements a maturity extension or an immediate liquidation after a default and these strategies lead to a higher firm value than a debt–equity swap. Then, the entrepreneur strictly prefers debt to equity financing.

III. Further Empirical Implications

The theory presented in this paper is consistent with the stylized facts described in the introduction. There are several additional predictions that are new to this theory and perhaps can serve to discriminate between our explanation of the long-term nature of financial distress and other explanations. The key innovation in our theory is to focus on the role of uncertainty about a firm's prospects, which gives creditors an incentive to postpone liquidation decisions in order to learn more about a financially distressed firm's viability. This implies that liquidation decisions, post-restructuring leverage ratios, and investment decisions are affected by the degree of uncertainty about a firm's prospects. We expect a positive correlation between the uncertainty about a firm's prospects and post-restructuring leverage ratios. Since the dispersion in analysts' forecasts captures the extent of uncertainty about a firm's prospects, we expect firms with higher variance in their analysts' forecasts to emerge with higher leverage from a debt restructuring. Another way to proxy for uncertainty is to take into consideration the variability of a firm's past performance or the industry's performance. The higher the variance in the past performance, the more uncertainty there may be about the firm's future performance, and, hence, the higher the leverage ratio with which it emerges from a debt restructuring.

According to our theory, financial distress is a dynamic process during which uncertainty about a firm's viability is resolved. The uncertainty and its resolution over time affect capital structure, investment, and liquidation decisions. Hence, restructuring outcomes depend on the stage in the dynamic process of financial distress at which the restructuring occurs. In particular, in a first debt restructuring after the onset of financial distress, there is typically more uncertainty about the viability of the firm than in a

subsequent restructuring. As a consequence, we expect more liquidation when a firm reenters financial distress than when it first enters financial distress. In the stylized model presented above, reentering financial distress revealed the firm's lack of viability and led to a liquidation of the firm. In a more general model, there would be a higher degree of liquidation (more asset sales) in a subsequent restructuring than in a first debt restructuring. Moreover, because reentering financial distress is bad news, a debt–equity swap should be less likely at this point.

The discussion in the previous paragraphs suggests more generally a positive correlation between the time a firm has spent in financial distress and the extent of asset sales or liquidation. This arises because uncertainty about a distressed firm's viability is resolved over time. Hence, the longer a firm has been in financial distress, the more likely should be substantial asset sales. We also expect a positive correlation between the degree of uncertainty about a firm's viability at the onset of financial distress and the time it takes for leverage ratios to decline substantially.

The degree of uncertainty about a firm's viability is also affected by its pre-distress debt level and leverage ratio. For simplicity, our stylized model did not allow for different inferences from a default due to different pre-distress debt levels. However, we can offer some conjectures about this case. If a firm has a high pre-distress leverage ratio (perhaps taking on a lot of debt in a leveraged recapitalization or a leveraged buy-out), it can enter financial distress when its cash flows are still relatively high (but not high enough to make the very high debt payments). Moreover, if there is a fairly continuous deterioration in cash flows, such a firm enters financial distress substantially earlier than a firm with low pre-distress leverage but with the same evolution of cash flows. A much shorter time of poor performance will trigger its default or a debt restructuring to avoid the default. This point was already made by Jensen (1989a, 1989b). Financial distress is less bad news for a firm with higher pre-distress leverage, since there is still more uncertainty about the firm's viability than if the firm had a very long history of poor performance. Our model would predict that there are then fewer immediate asset sales. Moreover, a debt–equity swap should be more likely in this situation.

On the other hand, Section II.D suggests that in the presence of uncooperative junior creditors (who always refuse to exchange their debt into equity), a higher leverage ratio at the onset of financial distress may make it less attractive for cooperative creditors (who are, in principle, willing to participate in the debt restructuring) to swap their debt into equity. If there is more debt held by both cooperative and uncooperative creditors, a debt–equity swap becomes less attractive to cooperative creditors. One reason is that the wealth transfer to the uncooperative debt holders is larger if there is more uncooperative debt. Moreover, the higher face value of the cooperative creditors' debt claims may increase their expected payoffs from a maturity extension and an immediate liquidation, because they now receive a larger fraction of the payoffs from these two strategies. Both arguments imply that a higher pre-restructuring debt level may make a debt–equity swap less likely and hence lead to a higher post-restructuring debt level.

This effect of pre-distress leverage on post-restructuring leverage tends to offset the effect based on Jensen's (1989a, 1989b) analysis that was described previously. The net effect is difficult to predict and, hence, it is not clear how pre-distress leverage would affect post-restructuring leverage. However, we conjecture that the effect of the pre-distress leverage ratio on what is learned about a firm's viability at the onset of financial distress is less pronounced if a sudden deterioration in cash flows causes financial distress. In this case, a firm with high pre-distress leverage will enter financial distress not much earlier than a firm with low pre-distress leverage. The dramatic deterioration in the firm's cash flows will force it soon into financial distress in any case, even if its interest payments, due to low pre-distress leverage, are relatively low. The leverage stickiness effect arising in the presence of uncooperative debtholders is then relatively more important and, hence, higher pre-restructuring leverage is more likely to lead to higher post-restructuring leverage.

The evidence on the relationship between pre- and post-restructuring leverage is as mixed as the theoretical predictions. Gilson (1997) finds a positive relationship between pre- and post-restructuring leverage ratios for out-of-court restructurings (however, in Chapter 11 restructurings, he does not find a significant relationship between pre- and post-restructuring leverage ratios). On the other hand, James (1995) finds that banks take equity in firms with higher pre-restructuring leverage ratios, suggesting a negative relationship between pre- and post-restructuring leverage ratios.

While uncertainty about a firm's viability may make learning valuable and, hence, a maturity extension attractive, the payoff to learning is also affected by the expected evolution of going concern and liquidation values. If the going concern value of a firm can deteriorate faster, a debt–equity swap is less attractive. If its liquidation value can deteriorate faster, a maturity extension is less attractive. The evolution of liquidation values is affected by the liquidity of the market for the financially distressed firm's assets. Shleifer and Vishny (1992) argue that in industry recessions, liquidity is lower and, hence, liquidation values are lower because the highest value buyers (firms in the same industry) are also financially constrained. If liquidity is expected to improve, a maturity extension is more attractive; if it is expected to deteriorate, immediate asset sales are more attractive. Moreover, the attractiveness of both an immediate liquidation and a maturity extension relative to a debt–equity swap is also affected by asset market liquidity. If asset markets are not very liquid and expected to remain so, liquidation values are lower and a debt–equity swap becomes more attractive.

As a consequence of the previous arguments, we expect more firms to emerge from debt restructurings with high leverage ratios and fewer immediate asset sales if the asset market is depressed but expected to improve. This could be the case at the end of an industry recession. On the other hand, we expect more immediate asset sales and fewer firms emerging from their debt restructurings with high leverage ratios if the asset market is liquid but expected to deteriorate. This could be the case at the end of an industry boom or when there are first signs of a possible industry recession.

In this scenario, learning about the firm's viability is of relatively low value because creditors expect a substantial deterioration in liquidation values.

There are also some empirical implications that are shared with other theories. Any theory that incorporates a debt overhang element (e.g., James (1995), who models the effect of the presence of public debt on banks' incentives to make concessions in a debt restructuring) would predict a negative correlation between post-restructuring leverage and investment levels. This seems to be the case in the data. In particular, James (1995, p. 1231) contrasts firms in which banks take equity in a debt restructuring and other firms. He finds, for firms in which banks take equity, that "by the end of the second year following the restructuring, capital expenditures for these firms have increased over 100 percent relative to their prerestructuring levels. In contrast, the average growth in capital expenditures for firms in which banks do not take equity is less than two percent . . . ." Because the majority of debt in the sample by James (1995) is bank debt, it is very likely that firms in which banks take equity emerge with lower leverage from the debt restructuring, which could explain the finding. We also predict that firms with lower leverage perform better after the restructuring. They can take advantage of their profitable investment opportunities. Moreover, creditors are more likely to take equity in a firm if it has more profitable investment opportunities (or "better growth opportunities") and better recovery prospects. Indeed, banks tend to take equity in firms with substantial growth opportunities as measured by the ratio of market-to-book value of the assets (see Brown, James, and Mooradian (1993) and James (1995)). Moreover, firms in which banks take equity perform better after the debt restructuring than firms in which banks do not take equity (James (1995)). These implications are also consistent with other theories such as James (1995).

Finally, our theory has implications for the distribution of post-restructuring performance. Since there is substantial uncertainty about the economic viability of firms that emerge from debt restructurings with high leverage, it is not surprising that a large fraction of them continue to perform poorly. However, one should also expect that a substantial fraction recover because these firms would presumably not be allowed to continue if there was only an extremely small chance that they could recover. This argument may explain the empirical findings by Hotchkiss (1995). She finds that in each of the first five years after emerging from bankruptcy, between 35 percent and 41 percent of firms have negative operating income. However, at the same time between 26 percent and 36 percent of the firms in her sample outperform the industry median.

IV. Conclusion

This paper has described financial distress as a dynamic process, emphasizing the incentives for creditors to learn about a financially distressed firm's recovery prospects. Creditors may postpone their liquidation decision to learn more about the distressed firm's viability and base a final liquidation decision on better information. If there is enough uncertainty about the

distressed firm's prospects and making correct liquidation decisions is important, creditors may leave leverage high by refusing to swap their debt claims into equity. Such a controlled liquidation preserves the opportunity to participate in a recovery of the firm while it also preserves the opportunity to liquidate before a more dramatic loss in asset values if the firm fails to recover. This strategy of a controlled liquidation rationalizes the effects of financial distress on many firms' capital structures, investment policies, and performance even after they emerge from debt restructurings. Hence, the theory of dynamic liquidation can explain the long-term nature of financial distress solely as the result of socially valuable dynamic learning strategies of creditors instead of appealing to bargaining inefficiencies among multiple creditors or a suboptimal design of U.S. bankruptcy law. The dynamic view of liquidation has implications for the costs and benefits of financial distress, the efficiency of the financial distress process, firms' capital structure choices, and empirical work.

It would be interesting to discriminate between the theory of dynamic liquidation and other potential explanations for the long-term nature of financial distress. Hotchkiss (1995) suggests that management entrenchment and the design of U.S. bankruptcy law are responsible for the poor post-bankruptcy performance of many firms. Aggarwal (1995) argues that coordination problems among creditors cause leverage ratios to stay high after debt restructurings. It is left to future empirical work to evaluate the relative importance of the different theories in explaining the long-term nature of financial distress.

It would also be interesting to relax the restrictive assumption that poor economic performance alone does not lead to an intervention process as long as the firm has no trouble making debt payments (perhaps because it has no debt). In reality, poor economic performance can lead to pressure by blockholders, management turnover, or takeovers even in the absence of financial distress. It is plausible to assume that the intervention process is much less drastic than in the presence of debt. However, the extent of the difference between the restructuring induced by financial distress and the restructuring triggered by purely economic distress is an empirical issue that could be addressed in future research.

Appendix A: An Extended Model with a Liquidation Opportunity after a Debt–Equity Swap

This part of the Appendix relaxes an assumption made in the analysis in the main text. It was assumed that the bank loses its ability to liquidate at date 3 after it has swapped its debt into equity. This assumption was made to keep the analysis as simple as possible. It is unnecessarily strong.

To address the issue of the bank's liquidation policy as the owner of the firm after a debt–equity swap, one needs to put a little more structure on the model. An additional assumption that is made is that

$$I = x_H - x_L. \tag{A1}$$

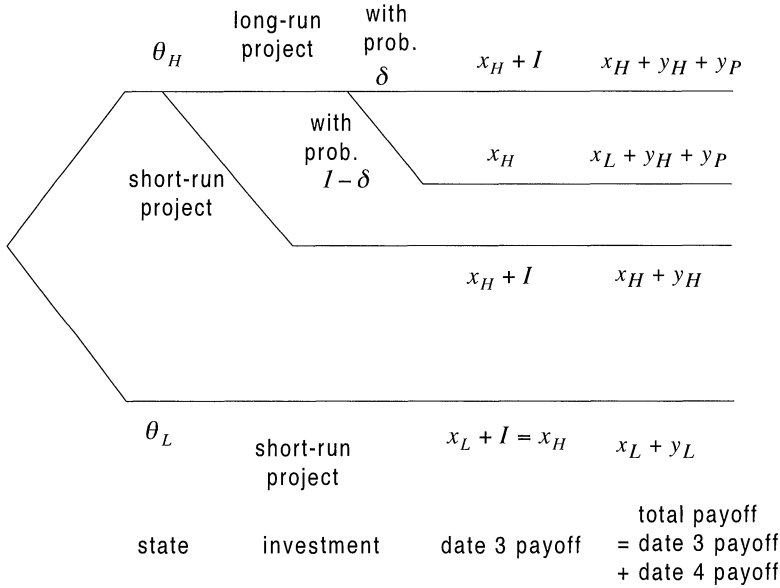

Figure A1. Firm's payoffs after debt–equity swap.

Thus, with probability $1 - \delta$, the long-run investment causes the date 3 payoff to be x_H in the high state, which is the same as the date 3 payoff in the low state after investment in the short-run project, $x_L + I = x_H$.[15] Since payoffs in the high and in the low states can be the same if the viable firm invests in the long-run project, the bank cannot always differentiate between viable firms and firms that should be liquidated at date 3. This will reduce the quality of the bank's liquidation decision at date 3. This basic trade-off between optimal long-run investment and learning in the short run is similar to a trade-off underlying von Thadden's (1995) analysis.

The payoffs after a debt–equity swap are illustrated in Figure A1, which assumes that the firm is continued until date 4. Note that the date 3 payoffs include the funds that the outside investor advanced for the project (I) while the date 4 payoffs do not include them because the outside investor is paid back at date 4. This figure is different from Figure 3 (referred to in Section I.B.4) in two respects: (1) It describes the date 3 payoffs, since they are important for the date 3 liquidation opportunity the bank now has even after a debt–equity swap, and (2) it incorporates the additional assumption (A1).

It is also assumed that if the bank is indifferent between the maturity extension and the debt–equity swap, it chooses the maturity extension. This

[15] This assumption simplifies the analysis considerably but is stronger than needed. For the inference problem to arise, all that is needed is that the date 3 payoffs under the long-run project in the high state and the short-run project in the low state can be the same with positive probability.

may be justified by appealing to an arbitrarily small (not explicitly modeled) transaction cost associated with the debt–equity swap.

Finally, it is assumed that the bank cannot distinguish between the two types of firms by means other than observing their ability to make a short-term payment. In particular, it is assumed that the bank cannot observe managerial project choice. Observing project choice and the ability to make the short-term payment together would allow the bank to always infer the state of the firm correctly at date 3. While typically investors can observe cash flows or infer them from a firm's ability to make payments reasonably well, it is often not clear what causes short-term cash flows to be low. Poor current performance is often excused by appealing to a long-run strategy that will pay off in the future.

After this justification and discussion of the additional model features, the interaction between investment and liquidation policies after a default at date 1 can be analyzed. It was already shown at the beginning of Section II.A that a maturity extension will allow the bank to learn the state of the firm at date 3 without error and, hence, implement the optimal liquidation policy. Here the focus is on the quality of the liquidation policy at date 3 after a debt–equity swap in the date 1 debt restructuring. If the bank swaps its debt into equity, the firm can attract new funding. This is because the debt overhang problem has disappeared. The date 3 payment is now a dividend payment. The firm's ability to make the dividend payment, D_I, reveals its short-term payoff if $x_L + I = x_H < D_I \leq x_H + I$. Such a payment can be made only by the manager in the high state if he invests in the short-run project or he invests in the long-run project and this project pays off already at date 3 (which occurs with probability δ). In both cases the firm has a date 3 payoff of $x_H + I$. The payment can never be made by the manager of the firm in the low state because it always has a date 3 payoff of $x_L + I = x_H < D_I$.

The posterior probability of being in the high state after not making the short-term payment (under the condition that the high state manager invests in the long-run project) is called μ. Using Bayes' Rule, it can be easily calculated that

$$\mu = \frac{\pi(1-\delta)}{\pi(1-\delta)+1-\pi} = \frac{\pi(1-\delta)}{1-\pi\delta}, \tag{A2}$$

where π was the posterior belief about the high state, given that there was a default at date 1 (π was calculated in equation (1)). The bank will liquidate the firm at date 3 if and only if the expected continuation value is lower than the liquidation value, that is, $\mu(y_H + y_P) + (1-\mu)y_L < L_3$ or, equivalently,

$$\mu < \frac{L_3 - y_L}{y_H + y_P - y_L}. \tag{A3}$$

(It is assumed that the bank resolves an indifference between liquidating and not liquidating in favor of not liquidating.)

The following Lemma summarizes the inefficiencies in the date 3 liquidation decision induced by the long-run project.

LEMMA 1: *Suppose the bank asks for a date 3 payment of* D_I *where* $x_L + I = x_H < D_I \leq x_H + I$. *If the manager's strategy in the high state is to invest in the short-run project, the liquidation policy at date 3 is optimal. If the manager's strategy in the high state is to invest in the long-run project, the bank's liquidation policy at date 3 is not optimal. Then, if (A3) does not hold, the bank never liquidates the firm and, hence, there is excessive continuation. If (A3) holds, the bank liquidates the firm if it does not make the date 3 payment and, hence, there is excessive liquidation.*

Proof: See Appendix B.

Because the long-run project is chosen if and only if the bank swaps its debt into equity,[16] the Lemma shows that the disadvantage of a debt–equity swap relative to a maturity extension is a less efficient liquidation decision at date 3. Importantly, if (A3) does not hold, the bank never liquidates after a debt–equity swap. Hence, in this parameter region, all results derived in the main text hold even if one does not assume that the bank cannot liquidate after it has swapped its debt into equity in the date 1 debt restructuring. In contrast, in the parameter region in which (A3) holds, the bank can choose between two possible disadvantages of a debt–equity swap: the excessive liquidation of viable firms or the excessive continuation of firms that should be liquidated. The results in this parameter region are not very different from the ones in the main text and left out in the interest of brevity.

Appendix B: Proofs

Proof of Proposition 1: The bank can choose between an immediate liquidation, a debt–equity swap allowing the realization of growth opportunities, and a maturity extension leading to a controlled liquidation. The bank ob-

[16] In principle, it could be the case that the manager invests in the short-run project after a debt–equity swap. The reason is that there is a second equilibrium (in addition to the equilibrium in which the manager invests in the long-run project and there is never a liquidation) in the subgame induced by the debt–equity swap in which the manager invests in the short-run project in both the high and the low states and there is a liquidation after a failure to make the date 3 payment. Note that without any transaction cost associated with a debt–equity swap, the bank's expected payoffs from a maturity extension, which prevents investment, and from a debt–equity swap followed by investment in the short-run project are identical. However, it was assumed that, due to an arbitrarily small (not explicitly modeled) transaction cost associated with the debt–equity swap, the bank prefers the maturity extension in this situation. Hence, a profitable deviation for the bank from swapping its debt into equity in a potential equilibrium in which the short-run project is undertaken is to retain its debt claim and prevent investment. As a consequence, investment in the short-run project cannot occur in an equilibrium of the whole game.

tains L_1 in an immediate liquidation. If the bank swaps its debt into equity, the viable firm invests in the long-run project but there will never be a liquidation. Hence, the bank's expected payoff in this case is

$$\pi(x_H + y_H + y_P - (1 - \delta)I) + (1 - \pi)(x_L + y_L). \tag{B1}$$

If the bank does not swap its debt into equity but extends the maturity of its debt instead, the firm cannot invest. Then the bank's expected payoff is

$$\pi(x_H + y_H) + (1 - \pi)(x_L + L_3). \tag{B2}$$

The bank chooses an immediate liquidation if and only if the payoff from an immediate liquidation is the highest of the three payoffs. The conditions for the optimality of an immediate liquidation in the proposition are the relevant two inequalities, which compare the payoff from an immediate liquidation to the payoff from the maturity extension and from the debt–equity swap, respectively. There is a unique cut-off value for L_1 for both comparisons because the payoffs from the debt–equity swap and from the maturity extension are not affected by L_1 while the payoff from an immediate liquidation is strictly increasing in L_1. The conditions for the optimality of the debt–equity swap in the proposition are obtained by solving the relevant two inequalities (payoff from the debt–equity swap versus payoff from an immediate liquidation and payoff from the debt–equity swap versus payoff from the maturity extension, respectively) for y_P. There is a unique cut-off value for y_P for both comparisons because the payoff from the debt–equity swap is strictly increasing in y_P while the payoffs from the maturity extension and an immediate liquidation do not depend on y_P. Q.E.D.

Proof of Proposition 2: The expected payoffs from the three strategies the bank can follow were calculated in the proof of Proposition 1. The conditions for the optimality of the maturity extension in the proposition are obtained as follows. First, solve the first relevant inequality (payoff from the maturity extension versus payoff from the debt–equity swap) for L_3. There is a unique cut-off value for L_3 because the payoff from a maturity extension is strictly increasing in L_3 while the payoff from a debt–equity swap is unaffected by L_3. Second, solve the second relevant inequality (payoff from the maturity extension versus payoff from an immediate liquidation) for $x_H + y_H$. There is a unique cut-off value for $x_H + y_H$ because the payoff from a maturity extension is strictly increasing in $x_H + y_H$ while the payoff from an immediate liquidation is unaffected by $x_H + y_H$. Q.E.D.

Proof of Proposition 3: The maturity extension leading to a controlled liquidation is more profitable for the bank than an immediate liquidation if and only if

$$\pi(x_H + y_H) + (1 - \pi)(x_L + L_3) \geq L_1. \tag{B3}$$

The maturity extension is more profitable for the bank than the debt–equity swap if and only if

$$\pi(x_H + y_H) + (1 - \pi)(x_L + L_3) \geq \pi(x_H + y_H + y_P - (1 - \delta)I) + (1 - \pi)(x_L + y_L). \tag{B4}$$

The range of π for which a maturity extension is optimal can be calculated by solving both inequalities for π. Note that the difference in the bank's expected payoffs from the maturity extension and an immediate liquidation is strictly increasing in π. Note also that the difference in the bank's expected payoffs from the maturity extension and the debt–equity swap is a strictly decreasing function of π. As a consequence, the cut-off values for π are unique. By construction, an immediate liquidation is optimal if $\pi < \pi_L$ and a debt–equity swap is optimal if $\pi > \pi_H$. Q.E.D.

Proof of Proposition 4: Suppose that the date 4 payoff is changed to $y_H + e_H$ in the high state and to $y_L - e_L$ in the low state, with $e_H > 0$ and $e_L > 0$ and $\pi e_H - (1 - \pi)e_L = 0$. The expected payoff from a maturity extension is now

$$\pi(x_H + y_H + e_H) + (1 - \pi)(x_L + L_3). \tag{B5}$$

The payoff from an immediate liquidation is still L_1. The expected payoff from a debt–equity swap is

$$\pi(x_H + y_H + y_P - (1 - \delta)I + e_H) + (1 - \pi)(x_L + y_L - e_L). \tag{B6}$$

But this is equal to

$$\pi(x_H + y_H + y_P - (1 - \delta)I) + (1 - \pi)(x_L + y_L), \tag{B7}$$

because $\pi e_H - (1 - \pi)e_L = 0$. Hence, the expected payoff from a maturity extension has increased due to the higher variance of the date 4 payoff but the expected payoffs from the other possible strategies have remained constant. As a consequence, the maturity extension has become more attractive relative to an immediate liquidation and a debt–equity swap due to the increase in the variance of the date 4 payoff. Q.E.D.

Proof of Proposition 5: Suppose the entrepreneur obtains a loan. Because the loan market is competitive, the loan is priced such that the bank breaks even. Hence, the bank's outlay M must equal the value of the payments to the bank generated by the loan, which is determined by its face value F. Thus,

$$M = \sigma F + (1 - \sigma)A, \tag{B8}$$

where $\sigma = \lambda\epsilon_H$ denotes the probability of a high date 1 payoff and A denotes the firm's value after a default when the bank follows its optimal strategy after a default (recall that the bank receives all payoffs after a default). As a consequence,

$$F = \frac{1}{\sigma}\{M - (1-\sigma)A\}. \tag{B9}$$

Hence, the entrepreneur's expected payoff is

$$\sigma(V-F) = \sigma\left(V - \frac{1}{\sigma}\{M-(1-\sigma)A\}\right) = \sigma V + (1-\sigma)A - M, \tag{B10}$$

where V denotes the firm's value if the date 1 payoff is high. Clearly, the entrepreneur's expected payoff is determined by the bank's reaction to a default that determines the value of A.

Now suppose that the entrepreneur obtains outside equity financing. The outside equity is priced such that the outside investors break even because they behave competitively. Hence, the outside equityholders obtain a share ϕ of the firm's value such that

$$M = \phi(\sigma V + (1-\sigma)C), \tag{B11}$$

where C denotes the value of the firm if the date 1 payoff is zero but the firm has no debt. Clearly,

$$\phi = \frac{M}{\sigma V + (1-\sigma)C}. \tag{B12}$$

Hence, the entrepreneur's expected payoff under equity financing is

$$\begin{aligned}(1-\phi)(\sigma V + (1-\sigma)C) &= \left(1 - \frac{M}{\sigma V + (1-\sigma)C}\right)(\sigma V + (1-\sigma)C) \\ &= \sigma V + (1-\sigma)C - M.\end{aligned} \tag{B13}$$

Thus, the entrepreneur prefers (weakly) debt financing if and only if $A \geq C$.

In the absence of debt, the viable firm invests in the long-run project and there is never a liquidation. Hence,

$$C = \pi(x_H + y_H + y_P - (1-\delta)I) + (1-\pi)(x_L + y_L). \tag{B14}$$

What happens after a default has been calculated in Propositions 1 and 2. The bank swaps its debt into equity and, hence, allows the viable firm to invest in the long-run project and there is never a liquidation if this strategy maximizes firm value (since the bank obtains all the firm's payoffs after a

default). This is the case if and only if inequalities (4) and (5) hold. In these parameter regions, $A = C$, and, hence, the entrepreneur is indifferent between issuing shares and obtaining a loan. However, in all other parameter regions, the bank chooses a maturity extension or an immediate liquidation because firm value after a default is then higher than if the bank, by swapping its debt into equity, allows the firm to take advantage of its growth opportunities. Hence, in all these parameter regions, the entrepreneur strictly prefers to obtain a loan. For example, consider the parameter region in which the bank chooses an immediate liquidation (see Proposition 1). In this parameter region, of course, the bank prefers an immediate liquidation to the debt–equity swap, that is, inequality (3) holds. In this parameter region, the expected payoff of the entrepreneur when obtaining a loan minus the expected payoff when issuing shares is (since the bank implements an immediate liquidation after a default at date 1)

$$\{1 - \sigma\}\{\pi(L_1 - (x_H + y_H + y_P - (1 - \delta)I)) + (1 - \pi)(L_1 - (x_L + y_L))\}. \tag{B15}$$

This is strictly positive because inequality (3) holds. Hence, in this case, $A > C$. A similar calculation applies to the parameter region in which the bank chooses the maturity extension. Q.E.D.

Proof of Lemma 1: Suppose that the manager has received funds I to invest and the bank asks for a date 3 payment of $x_L + I = x_H < D_I \leq x_H + I$. If the manager's strategy in the high state is to invest in the short-run project, he will have a date 3 payoff of $x_H + I$ for certain and, hence, can make the date 3 payment. However, the manager in the low state has a date 3 payoff of only $x_L + I = x_H$ and, hence, cannot make the payment. Thus, the bank is able to implement the optimal liquidation policy at date 3.

Now suppose that the manager receives funds I to invest but the manager in the high state follows the strategy of investing in the long-run project. If the bank asks for a date 3 payment of $x_L + I = x_H < D_I \leq x_H + I$, the manager in the high state cannot make the date 3 payment with probability $1 - \delta$ since his date 3 payoff is only x_H with probability $1 - \delta$. This is as low as the date 3 payoff of the firm in the low state, $x_L + I = x_H$. In this case, both firms cannot make the date 3 payment. If the posterior probability of the high state conditional on not making the date 3 dividend payment, μ, is high enough, that is, inequality (A3) does not hold, the expected continuation value is higher than the liquidation value. Hence, the bank allows the firm to continue. But then, even the inefficient firm is continued. If the posterior probability of the high state conditional on not making the date 3 dividend payment, μ, is not high enough, that is, inequality (A3) holds, the expected continuation value is lower than the liquidation value. Hence, the bank liquidates the firm at date 3 after it does not make the dividend payment. But then it also liquidates the firm if it is in the high state but the

long-run project did not pay off at date 3 (which happens with probability $1 - \delta$). Q.E.D.

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