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Dynamic Liquidation, Adjustment of Capital Structure, and the Costs of Financial Distress

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Abstract

Many financially distressed firms remain highly levered, invest little, and perform poorly after emerging from a debt restructuring. As a consequence, they often reenter distress shortly after the restructuring. This paper presents a theory of dynamic liquidation that is consistent with these findings. Postponing the liquidation decision allows creditors to learn about the firm's prospects and implement a better liquidation policy. However, there is a trade-off between optimal liquidation and optimal investment because creditors learn more about the firm's prospects if the firm forgoes some profitable long-term projects. When creditors resolve this trade-off in favor of learning, the firm suffers from the consequences of distress even after emerging from the restructuring. The theory has implications for the costs of financial distress and bankruptcy law.

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1. Introduction

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. In particular, James (1995) finds that many firms increase their investment expenditures by only very little in the first two years after a restructuring. Hotchkiss (1995) shows that in each of the first five years after emerging from bankruptcy, roughly 40% of all firms have negative operating profits. According to Gilson (1995), 75% of firms that complete debt restructurings emerge with a leverage ratio that is higher than industry median and most are still significantly more highly levered than before the onset of distress. Most strikingly, between 25% and 33% of all distressed firms reenter financial distress within a few years after completing a restructuring. These findings are puzzling to a theoretical literature that has viewed the liquidation decision as *static* (see for instance Bulow and Shoven (1978) and White (1989)). This paper presents a *dynamic* view of the liquidation process that can explain these observations. In addition to the predictions about post-restructuring investment policies, performance, and capital structure of distressed firms, the dynamic view of liquidation has implications for the costs of financial distress, bankruptcy law, and other issues.

The paper considers the situation after a firm has defaulted on its debt obligations. The firm is run by a manager who is privately informed about the prospects of the firm but will never liquidate the firm voluntarily. Creditors[1] do not know whether the firm is just in financial difficulties but economically viable or whether its financial difficulties indicate that the firm is economically not viable and should be liquidated. In contrast to the static view of liquidation, the interpretation of liquidation as a dynamic process recognizes that creditors do not have to make immediate, once-and-for-all liquidation decisions. Since there can be substantial uncertainty about a financially distressed firm s economic prospects, it may be optimal for the creditors to postpone the liquidation decision and allow a distressed firm to continue its operations in order to *learn* about its prospects and economic viability. Of course, learning about a firm s prospects is without value to creditors if they do not have the opportunity to react to negative news about the firm. One way for creditors to keep an intervention opportunity is to ask for short-term debt repayments. If the firm fails to recover, it will reenter distress and hence creditors receive another opportunity to liquidate the firm.

An efficient resolution of distress should have two goals. The first goal is to continue viable (efficient) firms and liquidate not viable ones. This requires *learning* about the financially distressed

[1] In the model presented here, there is a single creditor. The model abstracts from free-rider problems among many creditors. In practice, free-rider problems are often overcome by coercive exchange offers or are not very important because of the concentration of debt claims in the hands of a small number of banks and vulture funds.

rm s economic viability. The second goal is to help the rm to recover as quickly as possible from its nancial distress so that it can take advantage of its pro table investment opportunities (*realize its growth opportunities*). This paper makes the point that these two goals are in con ict because creditors can learn more about the distressed rm s viability if the rm forgoes some pro table long-term projects. This trade-off between learning and the realization of growth opportunities gives rise to a distinction between two strategies creditors can follow.

One strategy allows a quick and full recovery of the rm and allows it to realize its growth opportunities. However, this also means that creditors are not able to learn to distinguish between viable and not viable rms in time, and hence they make inefficient liquidation decisions. The other strategy allows creditors to learn more and hence make better liquidation decisions but it induces the rm to forgo pro table investment opportunities. This latter strategy I call a *controlled liquidation*. Controlled liquidation can be seen as a compromise between continuation and liquidation: if the rm recovers in the short-term, it will not be liquidated; if the rm reenters distress, it will be liquidated. As will become clear, a rm that is the object of a controlled liquidation has to make high short-term payments, invests little, and is likely to perform poorly and to reenter distress.

Controlled liquidation can be the optimal strategy for the creditors, and this explains the long-term consequences of nancial distress. A controlled liquidation preserves the opportunity for creditors to participate in a recovery of the rm and receive the full face value of their debt claims rather than only the liquidation value. Controlled liquidation also 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, to liquidate before a dramatic loss in asset values) when the rm fails to recover and renters nancial distress. But why is it not always optimal to allow the distressed rm to take advantage of the pro table investment opportunities it has? Why is there a trade-off between optimal investment and optimal liquidation?

A central idea in this paper is that allowing the rm to invest in all pro table long-term projects will reduce the ability of creditors to learn whether the rm is viable or not. Indicators of a rm s prospects are useful for the creditors liquidation decision only if they are received *in the short-run*, i.e. *before* assets may have lost dramatically in value. Hence, creditors may choose to learn about the rm s viability by asking for a *short-term* payment. The rm s inability to make this payment reveals negative news about the rm s viability and may induce creditors to liquidate early enough to prevent a further, more dramatic loss in asset values. While *short-term* results are informative about *long-term* pro tability, *the informativeness of short-term pro ts depends on the strategy followed by the rm s management*. If management focuses on boosting short-term results - by preserving cash and not investing in pro table long-run projects - but the rm is still unable to make the short-term payment, the economic situation of the rm is likely to be very bad and the rm should be liquidated. However, if management does not make an effort to boost short-term

results, the inability to make the short-term payment is not as bad news: poor short-term results may have been caused by investing the rm s resources in pro table long-run projects. Hence, a managerial investment strategy that maximizes long-run pro ts reduces the informativeness of short-term results and thus induces the creditors to make a less informed liquidation decision in the short-run. In particular, this may mean that creditors fail to liquidate the rm before a dramatic loss in asset values because they do not recognize the poor quality of the rm s prospects in time.[2]

In the model, creditors can affect management s ability and incentives to invest in pro table long-term projects by providing new funding, by the choice of managerial compensation and by the level of short-term payments the rm is required to make. For simplicity, the model assumes that the creditors have all the bargaining power in the debt restructuring. Since the creditors effectively become the residual claimants of the rm s pro ts in the restructuring, they make efficient decisions. They immediately liquidate rms that have very poor recovery prospects. They allow rms with potentially very attractive growth opportunities (i.e., growth opportunities that are very attractive if the rm is viable) to quickly recover from distress and enable them to realize their growth opportunities. Creditors engage in a controlled liquidation if there is sufficient uncertainty about a rm s recovery prospects and learning is very important. The latter will be the case if the rm s assets can lose dramatically in value should the rm fail to recover.

The paper relates two widely discussed costs of nancial distress: investment distortions and inefficient liquidation decisions. It suggests that efficient liquidation decisions can be implemented although management is initially better informed about the rm s prospects than the creditors, but not willing to liquidate the rm and still in control of investment decisions. On the other hand, nancial distress will lead to substantial costs in form of inefficient investment decisions or inefficient liquidation decisions even when creditors have the right incentives to make decisions that maximize rm value and there are no other impediments to an efficient resolution of distress than managerial liquidation aversion and creditors uncertainty about the rm s prospects. While bankruptcy law can alleviate costs of nancial distress not analyzed in this paper (such as free-rider problems among many creditors) it is unlikely to substantially reduce the costs of distress addressed in this paper. These costs seem to be a direct consequence of the separation of ownership and control and managerial liquidation aversion. Moreover, the theory of dynamic liquidation provides an explanation for the poor performance of reorganized rms that does not implicate the enhanced

[2]Von Thadden (1995) presents a model in which it may be impossible to nance pro table long-term projects because such projects can lead to low short-term results. In his paper, it is assumed that low short-term results always lead to the rm s liquidation. In contrast to that setting, this paper presents and makes use of the idea that investors should recognize that a rm s investment horizon affects the information content of short-term pro ts and hence it may be optimal for the investors to continue even after low short-term pro ts. The cost of a long-term investment strategy is that it leads to worse (less informed) liquidation decisions in the short-run. On the other hand, in contrast to this paper, von Thadden also explicitly analyzes the role of monitoring.

bargaining power of management under Chapter 11, as Hotchkiss (1995) and other authors suggest. Finally, the theory has implications for the comparison of court-supervised Chapter 11 bankruptcies and private workouts. These implications are discussed in more detail in section 4.

The empirical literature shows that the phenomena interpreted here as consequences of a controlled liquidation - low investment and poor performance after reorganizations and the large number of repeated restructurings - are concentrated among firms that emerge with high leverage from the reorganization (because creditors do not swap their debt claims into equity) while firms emerging with lower debt burden (because creditors accept equity stakes) often dramatically increase their capital expenditures and perform better (see James (1995)). This correlation can be explained in different ways. For simplicity, the model appeals to the fact that a debt claim gives the creditors a limited claim on the firm's profits while an equity claim is unlimited and hence allows them to participate in all profits generated by additional investments.[3]

The correlation between capital structure and investment has interesting implications in the setting of this paper. The paper predicts that because a firm that emerges with debt from the restructuring will never realize its growth opportunities, it will always be liquidated after a default on a short-term debt payment (since the inability to pay reveals that the firm is not viable), and will always have a first-best liquidation policy. In contrast, because a firm that emerges free of debt may realize its growth opportunities, a failure to make a short-term dividend payment may be ignored (since the inability to make a short-term dividend payment may be caused by the long-term investment), and then the firm will suffer from a suboptimal liquidation policy.

The literature often *assumes* that equityholders cannot liquidate (see Jensen (1986) and Stulz (1990)) or are less inclined to liquidate even if they have the opportunity to liquidate (see, among many other papers, Dewatripont and Tirole (1994)). While the assumption that shareholders cannot liquidate is appropriate in contexts in which free-rider problems among many shareholders are prevalent, it seems less attractive in the context of a typical debt restructuring. In particular, Gilson (1990) finds that banks that take equity stakes in financially distressed firms often become large blockholders who are actively involved in corporate governance. The assumption about the stronger inclination of debtholders to liquidate implicitly assumes that creditors cannot take equity in a debt restructuring. However, creditors do quite frequently take equity stakes in distressed firms (James (1995)). This paper does *not* assume that creditors cannot liquidate or are necessarily less inclined to liquidate when they become equityholders in the initial restructuring than when they remain debtholders. Still, *in equilibrium*, creditors *always* liquidate after a default on a short-

[3] The same results are obtained if one appeals to a debt overhang argument. However, this would complicate the model without further insight. The important part of the section on post-restructuring capital structure is not to give a new explanation for the correlation between capital structure and investment but to explore its consequences for liquidation policies and the informational role of debt and dividend payments.

term debt payment when they have remained debtholders while they may ignore the omission of a dividend (of the same size as the short-term debt payment) when they have taken equity stakes in the rm.

The paper is related to Harris and Raviv (1990) who analyze the informational role of debt payments. In contrast to their paper, in this paper dividend payments can *in principle* replicate the informational role of debt. But *in equilibrium*, the default on a debt payment may be *worse news* than the omission of a dividend of the same size. This phenomenon arises because the investment strategies in rms with and without debt may differ.

The remainder of the paper is structured as follows: In Section 2, the model is presented. In Section 3, I analyze the interaction between managerial investment decisions and the bank s liquidation policy for a given choice of capital structure, short-term payment, managerial compensation, and new nancing. Sections 4 and 5 endogenize the bank s decisions in the debt restructuring and contain the main results. Section 6 concludes.

2. The Model

The following time line gives an overview of the model. All notation is summarized in the table at the end of the model section.

2.1. Debt Renegotiation

This paper considers a rm that, for some reason outside the model, cannot pay its debt at date 0. Thus, its sole creditor (the bank) gains control. The bank may immediately liquidate the rm or allow it to continue its operations. Immediate liquidation yields a payoff of L_0 for the bank. If the bank runs the rm itself, the rm s value is also L_0. If the bank remains a debtholder, the debt

maturity is extended. In particular, a debt payment D_I is due at date 2 and a payment of D_F[4] is due at date 3. The total face value of debt, $D_I + D_F$, is discussed in section 2.5. The bank may also forgive all the debt and in exchange receive all the rm s equity (while old equity is wiped out; implicitly it is assumed that the bank has all the bargaining power in renegotiation). As the owner of the all-equity rm the bank requires a dividend payment of D_I at date 2. The optimal choice of D_I (either a dividend or a debt payment) is discussed in section 3.

2.2. States, Investment Opportunities, and Payoffs

This subsection describes the payoff structure which is also illustrated by the graph at the end of this subsection. The state of the rm is realized at date 1. A high state (θ_H) means that the rm will produce high returns as explained below. A low state (θ_L) means that the rm is economically not viable and will produce low payoffs. There are two kinds of payoffs: interim (short-term) payoffs that accrue at date 2 and nal payoffs that are realized at date 3. These payoffs are generated from two sources: (not explicitly modeled) assets in place at date 0 and - potentially - an investment in a project.

(A0) With probability $\gamma > 0$, the manager in the *high* state receives the opportunity to invest in a positive net present value project at date 1, after he has observed the state of the rm. The project costs I. The manager in the low state has no nontrivial investment opportunity available. He invests any new funds at a zero interest rate; hence, neither interim nor nal payoffs in the low state are affected by new nancing.[5]

In this model, the low state serves just one purpose: it formalizes the idea that low short-term payoffs can be bad news about the rm s viability. I also assume

(A1) The rm has no cash; hence, the manager cannot invest in the project unless he obtains new funding. The only source of new funding is the bank.[6]

To simplify the analysis, I assume that the manager invests if he is indifferent between investing and not investing. One can interpret the investment opportunity in the high state (I refer to the investment in the high state as *the project*) as a costly restructuring of the rm s operations that consumes resources in the short-run but pays off in the long-run by improving the rm s competitive

[4] The subscript I stands for interim while the subscript F stands for nal .

[5] This paper is not concerned with the possibility that providing new funding can reduce the value of the rm simply because the funds may be invested in negative net present value projects. Hence, I allow only for this trivial investment in the low state. However, as will be seen below, continuation in the low state is already a negative net present value project.

[6] Outside funding sources are not modeled to keep the analysis simple. Existing creditors usually have an important impact on the willingness of outside investors to provide new funding. If they refuse to scale down their debt claims, the rm may not be able to receive outside funding because of a debt overhang problem (see Myers (1977)).

situation and business opportunities. I assume

(A2) Assets in place at date 0 generate an interim (short-term) payoff at date 2 of x_H in the high state and of x_L in the low state with $x_H > x_L > 0$.

(A3) If the project was undertaken at date 1, it generates an interim payoff at date 2 in addition to the one created by the assets in place at date 0. With probability δ, this interim payoff is I; with probability $1 - \delta$ it is zero.

It is important that $x_H - I \leq x_L$; for simplicity, I assume

(A4) $I = x_H - x_L$.

Thus, with probability $1 - \delta$ the investment causes the interim payoff to be x_L even in the high state.[7]

(A5) In the high state, the final payoff is y_H if the project was not undertaken and $y_H + y_P$ if the project was undertaken, with $y_P > x_H - x_L = I$ (so that the project has always a positive net present value) and $x_H + y_H > L_0$. In the low state, the final payoff is y_L with $x_L + y_L < L_0$.

Because of (A5), continuation is value maximizing in the high state (regardless of whether the firm invests or not) while liquidation is value maximizing in the low state. The parameters γ and y_P determine the firm's upside profit potential (growth opportunities).

[7] The model allows without loss of generality for only two values of the interim payoff. It is important that, if the project is undertaken, the interim payoff in the high state may not be higher than in the low state. Furthermore, the interim payoff in the high state without investment must be larger than in the low state.

2.3. Second Liquidation Opportunity

At date 2, there is a second liquidation opportunity. In the all-equity rm, the owner makes the liquidation decision at date 2 *after* observing whether a dividend was paid or not; he can liquidate even if there was no dividend omission. In a rm with debt, the debtholder receives the right to liquidate after a default at date 2. I assume that the bank receives the interim payoff (x_L or x_H) when the rm is liquidated (even if no interim payment was made), and in addition, the liquidation value (which excludes the interim payoff).

(A6) The liquidation value at date 2 is L_I with $L_I + x_H < L_0$.

Since liquidation values deteriorate over time, immediate liquidation can be optimal. To make liquidation an interesting option at date 2, it is assumed that

(A7) $L_I > y_L$.[8]

While by (A7) liquidation at date 2 is value-maximizing in the low state, continuation is value maximizing in the high state because $y_H > L_I$ which follows directly from (A5) and (A6).

2.4. Information

I assume

(A8) Only the manager observes the state.

All other parameters - such as γ, δ, or y_P– are known also to the bank and the old equityholders.[9] The prior probability of the high state is π . Thus, the bank believes at date 0 that the rm recovers with probability π. The bank could learn about the state by observing the interim payoff because the interim payoff is correlated with the state. However, I assume that

(A9) Interim payoffs are observable only by the manager.[10]

The manager may or may not make a debt or dividend payment after observing the interim payoff. To simplify the analysis, I assume that the manager makes the payment if he is indifferent

[8] The interim payoff does not appear in this inequality because the bank receives it both in a liquidation and in case of continuation.

[9] The rm may be in an industry with substantial growth opportunities. This is known to the bank. However, the bank does not know whether the rm is one of the viable rms in the industry (in which case it will be very pro table) or whether it is economically not viable.

[10] An interpretation of this assumption is that the manager can manipulate short-term earnings reports. However, this assumption is *not* crucial to the analysis. Even if short-term results would be observable by the bank, all results continue to hold as long as creditors have the right to intervene after poor short-term performance.

between making and not making the payment.[11] In this model, the manager will make the payment if he can because he cannot steal cash and hence has no reason not to pay. The only way for the bank to learn about the state is by observing the rm s ability to make the veri able date 2 payment. Date 3 payoffs are also veri able. I also assume

(A10) Only the manager in the high state observes whether he invests in the project or not.

In this simple model, observing the investment *and* the ability to make the short-term payment reveals the state. This is because the model allows for an investment project only in the *high* state. In a more general model, just observing investment expenditures would not generate information about the state because the manager could have invested the money in a negative NPV project in the *low* state.

2.5. Debt and Equity

I assume

(A11) The bank can liquidate at date 2 when it is the rm s owner (chose to take the rm s equity at date 0).

As described in the Introduction, this seems reasonable because banks often acquire large fractions of equity in distressed restructurings and become active in corporate governance. I also assume

(A12) If the bank allows the rm to continue after a default at date 2, the bank receives all of the payoffs that do not go to the manager at date 3 while old equity receives nothing.

Implicitly it is assumed that if the bank remains a debtholder at date 0 and it wants to continue after a default at date 2, the bank can and will take all the equity in a second debt renegotiation. (A12) implies that the bank as a debtholder is *not* more inclined to liquidate than as an equityholder just because of the differences in the payoff structures of debt and equity (since it can swap debt into equity after a second default). Hence, the bank s liquidation opportunities (by (A11)) and liquidation incentives (by (A12)) do *not* depend on whether the bank remained a debtholder or took equity in the initial restructuring.

The only important difference between debt and equity in this model is that debt gives the bank a limited claim on the rm s pro ts while equity gives it an unlimited claim. The total face value of debt, D, is

(A13) $x_H + y_H \leq D_I + D_F \equiv D < x_H + y_H + y_P$.

Assumption (A13) will generate a correlation between post-restructuring capital structure and

[11] This is for simplicity and does not affect any important result.

investment.[12] No result would be changed if one would instead explain this correlation by a debt overhang argument: The distressed firm cannot attract outside funding because of the firm's existing debt obligations. To model this, one would have to introduce an outside investor. This would complicate the model without changing the results or generating new insights, and hence it is not done here.[13] Indeed, the modeling undertaken here may be seen as a reduced form for a debt overhang argument. Because of its limited face value and the absence of an explicit advantage of debt, debt appears to be a weakly dominated choice. This again is a consequence of the simplicity of the model. In section 5, I discuss some benefits banks obtain when they remain debtholders in a restructuring. Since, the total face value of debt can be higher than the liquidation value at date 0 (because of (A5) and (A13)), continuing the firm while remaining a debtholder may be profitable.

2.6. Managerial Compensation

Managerial compensation is chosen at date 0. The manager is paid a fraction $\alpha \geq 0$ of the payoffs equity receives. In an all-equity firm, the owner makes a take-it-or-leave-it offer to the manager. In a firm with debt, the debtholder makes a take-it-or-leave-it offer to the manager. In the Appendix (Lemma 7.1.) I show that the owner of a firm that emerges from the restructuring with debt is willing to grant the debtholder the right to choose compensation. The manager has limited liability so that his compensation must always be nonnegative. His individual rationality level is normalized to zero.

2.7. Objective Functions

The bank is risk-neutral and cares about the sum of its interim and final payoffs net of managerial compensation (it is assumed that the interim payment is invested in a zero net present value project with payoff at date 3). The manager is interested in avoiding liquidation and in his long-run compensation. His utility function is $U = probability(no\ liquidation)\ B + \alpha y^T$, where B is a private benefit the manager receives when the firm is not liquidated and y^T is the payoff to equity (after the payment to debtholders if there is any) which may be a liquidation value or a date 3 payoff. It seems plausible to assume that managerial liquidation aversion is strong since a manager is likely to lose his job in a liquidation. Then, he will lose his firm-specific human capital. Moreover, he may incur reputational costs in the labor market. For instance, Gilson (1989) finds that managers who lose their jobs in financially distressed firms almost never find senior management positions at

[12] A debt claim with a face value of at least $x_H + y_H + y_P$ (in particular, an infinite face value) would correspond to equity. However, typically, debt claims are limited, perhaps because the firm would otherwise have to be declared insolvent immediately.

[13] It should also be noted that the paper does not attempt to provide a capital structure theory applicable for situations outside of financial distress.

any exchange-listed rm for at least three years. I assume that the manager s liquidation aversion is so strong that he cannot be induced by a compensation plan to liquidate the rm himself. A sufficient condition for this is

(A14) $B > L_I + x_L$.[14]

The following table summarizes the notation.

[14] Although in this simple model nal payoffs reveal the state, a punishment for misreporting the state as high while it actually is low is not feasible because of limited liability. A golden parachute will not induce the manager to report the low state either. Such a golden parachute would need to compensate the manager for the private bene ts of control, B. However, the model assumes that $B > L_I + x_L$: The promise of a golden parachute of size B for reporting the low state is not credible since the manager knows that the rm has not enough money to honor it.

3. The Trade-Off Between Optimal Investment And Optimal Liquidation

I solve the game by backwards induction. Thus, in this section, I analyze the managerial investment decision and the bank s liquidation decision for a *given* choice of capital structure, managerial compensation, interim payment, and funding (i.e., we are at date 1). This section will illustrate the con ict between optimal investment and optimal liquidation. In sections 4 and 5, I will endogenize the bank s decisions at date 0.

In this section, the short-term payment can be interpreted either as debt payment or as dividend. A difference between a debt and a dividend payment will arise in section 5. For the interim payment to be informative, it must be chosen such that $x_H \geq D_I > x_L$.[15] I will discuss this case rst. (At the end of the section, it will be analyzed what happens for an uninformative choice of the short-term payment, i.e., $D_I \leq x_L$ or $D_I > x_H$.) Only the manager in the high state may have an investment decision to make. If the manager (in the following, the phrase the manager refers to the manager in the *high* state unless indicated otherwise) receives no funding from the bank, he cannot invest. If the manager receives funding from the bank, his investment decision depends on several factors. If the manager expects that a failure to make the short-term payment will be ignored, he is willing to invest. Then, he does not endanger his job and the private bene ts he derives from it. If the manager expects that a failure to make the short-term payment will lead to a liquidation, he faces a nontrivial trade-off: if he invests, he may increase his long-run compensation if the rm is continued until date 3. But he also risks a liquidation.

The manager s strategy depends on the bank s reaction that he expects if a short-term payment is not made. This reaction depends on two factors: First, what is learned from a failure to pay? Second, given the information learned, will the bank liquidate? If the manager receives no funding or if he receives funding but it is the manager s strategy *not* to undertake the project, a failure to make the payment reveals the low state and hence always leads to the rm s liquidation. If it is the manager s strategy to undertake the project, a failure to pay can be caused either by being in the low state or by being in the high state, investing, and generating the low short-run payoff. I denote by μ the posterior probability of the high state given that the payment was not made and given that the manager s equilibrium strategy is to invest in the project if such an opportunity arises. It can be calculated that $\mu = \frac{\pi\gamma(1-\delta)}{\pi\gamma(1-\delta)+(1-\pi)} = \frac{1}{1+(1-\pi)/\pi\gamma(1-\delta)}$. When the bank believes the manager s strategy is to invest if he receives an opportunity to do so, the bank, both as the owner and as debtholder (recall (A12)), will liquidate after a failure to make the short-term payment if

[15] If the debt due at date 2 was not higher than x_L, there would never be a default and thus short-term debt would not generate valuable information. If this debt level was higher than x_H, default would not be informative because all rms would default. The same is true for the dividend level.

and only if $L_I > \mu(y_H + y_P) + (1-\mu)y_L$, i.e. if and only if $\mu < \frac{L_I - y_L}{y_H + y_P - y_L}$. (I assume that if the bank is indifferent, it does not liquidate). I call the bank liquidation-prone if $\mu < \frac{L_I - y_L}{y_H + y_P - y_L}$. I call it not liquidation-prone otherwise.

Lemma 3.1. *Suppose $x_H \geq D_I > x_L$. The liquidation policy is first-best (i.e. induces liquidation in the low state and continuation in the high state) if and only if the manager does not receive funding or if he receives funding and his strategy is not to undertake the project.*

Proof: Suppose the manager receives funding and his strategy is to invest if he can. If the bank is liquidation-prone, it excessively liquidates after a failure to make the payment: the firm is sometimes liquidated even in the high state (the bank always liquidates after a failure to make the payment, i.e. if the interim payoff is x_L, which happens with probability $1-\delta$). If the bank is not liquidation-prone, there is not enough liquidation: a failure to make the payment is ignored, and hence the firm is continued even in the low state. However, the liquidation policy is first-best if the manager does not receive funding and hence cannot invest or his strategy is *not* to invest in the project. Then, a failure to pay reveals that the firm is in the low state: The interim payoff is high and hence the payment is made if and only if the firm is in the high state. ■

The reason behind this result is that the investment destroys the one-to-one relationship between the state and the ability to make the short-term payment. Thus, it is impossible to simultaneously realize growth opportunities and have a first-best liquidation policy. This reflects the idea that there is a real conflict between realizing growth opportunities and generating information about the firm's viability. The bank learns less about the firm's viability by observing its *short-term results* (here: its ability to make a short-term payment) if the firm is following a *long-term strategy*. This idea can also be illustrated as follows: Suppose an economically viable firm can produce good short-term or good long-term results while a not viable firm will always generate poor short-term and poor long-term results. The viable firm may concentrate on generating good long-term results and in doing so sacrifice good short-term results (for instance, it may incur high investment outlays in the short-run). But then, short-term results do not distinguish well between the viable and the not viable firm.

Managerial compensation may be chosen so that the manager will invest in the project even if there is some chance that the firm will be liquidated.[16] Call α_H (α_H^D)[17] the smallest share of

[16] While compensation can never induce the manager to liquidate the firm himself (by (A14)), compensation may induce him to overcome his liquidation aversion before he makes his investment decision. It can be easily checked that B can fulfill (A14) but still be low enough such that $\alpha_H < 1$. This is true because the investment decision is made *before* the state is realized but the manager would have to make the liquidation decision *after* the *low* state has been realized.

[17] We will see in section 5 that high managerial compensation will never be paid in a firm with debt. For this

payoffs to equity the manager must be promised at date 0 in an all-equity rm (in a rm with debt) to induce him to invest in the high state even if he expects a liquidation after a dividend omission (default). I will call compensation low if $\alpha < \alpha_H(\alpha_H^D)$. I will call compensation high if $\alpha \geq \alpha_H(\alpha_H^D)$. It can be calculated that $\alpha_H = \frac{B(1-\delta)}{y_P\delta+(1-\delta)(x_L+L_I)-(x_H+y_H)(1-\delta)}$.[18] In the following, I assume that the exogenous parameters are such that $\alpha_H \in (0,1)$.[19] α_H increases in B: to overcome a stronger resistance towards liquidation, the manager must be granted a higher share of the payoffs equity receives. The share that must be promised to the manager decreases in the parameters that make the investment in the project more attractive to the manager for a *given* share of equity payoffs, in particular y_P and δ.

The following Proposition characterizes all the perfect Bayesian equilibria in the subgames induced by a particular capital structure, compensation, and funding choice and an *informative* interim payment.

Proposition 3.2. *Suppose $x_H \geq D_I > x_L$. Suppose the manager receives funding for the investment. If $\mu < \frac{L_I-y_L}{y_H+y_P-y_L}$, the perfect Bayesian equilibria are, regardless of whether the bank took equity or remained a debtholder in the initial restructuring:*

(i) if compensation is low ($\alpha < \alpha_H$ (α_H^D) in the rm without (with) debt): the manager does not invest even if he can; the bank liquidates if the short-term payment is not made;

(ii) if compensation is high ($\alpha \geq \alpha_H$ (α_H^D) in the rm without (with) debt): the manager invests if he can; the bank liquidates if the short-term payment is not made.

If $\mu \geq \frac{L_I-y_L}{y_H+y_P-y_L}$, the perfect Bayesian equilibria are:

(i) if compensation is low: One equilibrium is for the manager to invest if he can and the bank never to liquidate. Another equilibrium is for the manager not to invest even if he can and the bank to liquidate if the short-term payment is not made;

(ii) if compensation is high: The manager invests if he can; the bank never liquidates.

Suppose the manager receives no funding. Then the unique perfect Bayesian equilibrium is: the manager does not invest; the bank liquidates if the short-term payment is not made.

Proof: See the Appendix. ■

reason, I do not calculate α_H^D.

[18] If the manager invests and there is a liquidation after a failure to make the payment, his expected utility is: $\alpha\{\pi[(1-\gamma)(x_H+y_H)+\gamma\delta(x_H+y_H+y_P)+\gamma(1-\delta)(x_L+L_I)]+(1-\pi)(x_L+L_I)\}+\pi(1-\gamma+\gamma\delta)B$. If he does not invest, his expected utility is $\alpha\{\pi(x_H+y_H)+(1-\pi)(x_L+L_I)\}+\pi B$. α_H equates these two expressions.

[19] The results generalize to the parameter regions in which this condition is not ful lled. I implicitly assume $\alpha_H < 0.5$ or that the manager receives non-voting shares so that the bank, and not the manager, always has the right to make the liquidation decision when the bank becomes an equityholder.

Thus, there may be multiple equilibria, and this multiplicity is inherent in the economics of the situation. If the bank interprets the failure to make the payment in a negative way, the bank will react with liquidation. Anticipating this, the manager does not invest in the project which means that a default or dividend omission is indeed very bad news: it cannot stem from a short-term cash crunch due to the investment expenditures. But if the bank interprets the failure to make the payment in a less negative way, the bank will ignore it. Anticipating this, the manager invests in the project which justi es that the bank ignores the failure to pay: it can now stem from a cash crunch caused by the investment and does not necessarily indicate that the rm is not viable.

More importantly, nothing in the analysis so far suggests that there is a difference between the manager s behavior and the bank s liquidation policy in a rm that emerges from the restructuring with debt and the rm that emerges without debt. Nor is there a difference between the informational role of debt and dividend payments. This is not surprising because it was assumed that the bank s opportunities and incentives to liquidate do not depend on whether it took equity or remained a debtholder in the initial restructuring. A difference in the liquidation policies of the all-equity rm and the rm with debt will emerge in section 4 when we consider the whole game.

Now let us consider what happens after an *uninformative* choice of the interim payment, i.e., $D_I \leq x_L$ or $D_I > x_H$. Now the bank s liquidation policy is not contingent on the rm s ability to make the short-term payment since the ability to make the payment contains no information. Clearly, the bank s liquidation policy cannot be rst-best. If the bank liquidates at date 2, the rm is liquidated even in the high state; if the bank does not liquidate at date 2, the rm is continued even in the low state. The following Lemma characterizes all perfect Bayesian equilibria after a choice of $D_I \leq x_L$ or $D_I > x_H$.

Lemma 3.3. *Suppose the dividend payment in an all-equity rm is $D_I \leq x_L$ or $D_I > x_H$ or the interim debt payment is $D_I > x_H$. Suppose the manager receives funding for the investment. The perfect Bayesian equilibria in the subgames induced by these choices of D_I are:*

(a) The manager invests if he can and the bank does not liquidate if

$L_I \leq \pi(y_H + \gamma y_P) + (1-\pi)y_L$.

(b) The manager does not invest even if he can and the bank liquidates if $\alpha > 0$ and

$\delta < 1$ and $L_I > \pi y_H + (1-\pi)y_L$.

(c) The manager invests and the bank liquidates if $\alpha = 0$ or $\delta = 1$ and

$L_I > \pi(y_H + \gamma y_P) + (1-\pi)y_L$.

If the bank remains a debtholder and the interim debt payment is $D_I \leq x_L$, the manager invests if he can and the rm is not liquidated.

Suppose the manager does not receive funding for the investment. Then the perfect Bayesian equilibria are:

(d) The manager does not invest and the bank liquidates if $L_I > \pi y_H + (1-\pi)y_L$.

(e) The manager does not invest and the bank does not liquidate if $L_I \leq \pi y_H + (1-\pi)y_L$

If the bank remains a debtholder and the interim payment is $D_I \leq x_L$*, the manager does not invest and the bank does not liquidate at date 2.*

Proof: See the Appendix. ■

4. Controlled Liquidation or Realization of Growth Opportunities?

In this section and the next, I will derive the main results of the paper. I now analyze the whole game, using the results from the analysis of the subgames in section 3. In this section, it will not be analyzed under which circumstances the bank remains a debtholder and under which circumstances it takes equity (this is done in section 5). The reader may assume that the bank takes equity when the manager invests in the project, as is shown in section 5. It will help to establish:

Lemma 4.1. *Whenever the bank chooses* $D_I \leq x_L$ *or* $D_I > x_H$*, it funds the investment, offers zero compensation, the manager invests if he can, and there is no liquidation at date 2.*

Proof: See the Appendix. ■

Asking for an uninformative payment commits the bank to forgo any learning.[20] The bank will then make its liquidation decision according to its prior belief about the rm's state, π. If this prior belief is so pessimistic that the bank will liquidate at date 2, the bank could do better by immediately liquidating since liquidation values deteriorate over time. Thus, asking for an uninformative payment can be optimal only if the bank is optimistic enough about the rm's recovery prospects so that, in the absence of new information, there will be no liquidation at date 2. But then, the bank will want the rm to invest, and hence it funds the investment. If there will be no liquidation, the manager invests if he can. Finally, the only reason to offer a positive share of the equity value to the manager is to induce him to invest. If the manager invests even without participating in the pro ts, there is no need to grant him a share of the equity value.

4.1. When Is There Immediate Liquidation, When Are Growth Opportunities Realized, When Is There A Controlled Liquidation?

The next Proposition shows under which conditions the rm is immediately liquidated and when it realizes its growth opportunities (i.e., the bank induces the rm to invest).

[20] Clearly, the bank can commit to a particular short-term *debt* payment. I assume that the bank can also credibly announce at date 0 which short-term *dividend* payment will be required at date 2.

Proposition 4.2. *The bank immediately liquidates the rm if and only if π is small enough (i.e., for each combination of values for the other parameters, we can nd a value $\underline{\pi}$ such that the bank immediately liquidates the rm if and only if $\pi < \underline{\pi}$). The rm s growth opportunities are realized if and only if y_P is sufficiently large (i.e., for each combination of the values of the other parameters, we can nd a $\overline{y_P}$ such that the bank enables the rm to realize its growth opportunities if and only if $y_P \geq \overline{y_P}$).*

Proof: See the Appendix. ■

In this model, the bank has all the bargaining power in the debt renegotiation. This effectively makes it the residual claimant of the rm s pro ts and induces it to make decisions that maximize rm value.[21] Clearly, if it is almost sure that the rm is in the low state, it does not matter much what would happen in the high state, in particular how attractive the investment opportunities are. Since liquidation values decline over time, it is best to liquidate as early as possible.

In the interest of readability, the exact bounds on π (and also on y_P) are relegated to the proof of the Proposition in the Appendix. However, these bounds are very intuitive. If the initial liquidation value L_0 is higher, then immediate liquidation is the optimal choice for a broader range of recovery probabilities π, i.e. optimal even for relatively large π. If controlled liquidation is more attractive than the realization of growth opportunities and hence is the relevant alternative, immediate liquidation is optimal for a smaller range of recovery probabilities (only for very small π) if liquidation values lose less in value over time ($L_0 - L_I$ is lower) or a recovery leads to higher pro ts ($x_H + y_H - L_0$ is larger). On the other hand, if the realization of growth opportunities is more attractive than controlled liquidation and hence is the relevant alternative, immediate liquidation is optimal for a smaller range of recovery probabilities (only for a very small π) if the pro ts that are generated by the project (y_P) are higher.

When are growth opportunities realized, that is, when does the bank enable the rm to take advantage of its investment opportunities? Clearly, if the investment opportunities are sufficiently attractive, the bank will provide the funds for the investment and give the manager an incentive to invest. The latter may be done by asking for an uninformative short-term payment (for instance, no short-term payment at all). This means that the bank will not liquidate and hence the manager is willing to invest (see Lemma 4.1.). Alternatively, the manager can be offered a compensation package that is sufficiently sensitive to long-run performance ($\alpha \geq \alpha_H$ (α_H^D)) and hence induces the manager to invest despite the chance that the rm may be liquidated if the short-term payoff is

[21] The bank is likely to make less efficient decisions if management or the rm s equityholders have some bargaining power in the debt restructuring. In particular, the bank may allow the rm to realize its growth opportunities less often than is efficient because it has to share the gains from this strategy with the old equityholders.

low.[22] As can be seen from the bounds on y_P (see the proof of the Proposition in the Appendix), the firm invests in the project for a larger range of y_Ps (for instance, even if y_P is not very high) if the recovery prospects are better (π is higher), liquidation values (both L_0 and L_I) are lower, and if profits in case of a recovery but in the absence of the project are lower ($x_H + y_H$ is lower).

Finally, when does the bank choose a controlled liquidation, i.e., when does the bank allow the firm to continue but prevent the investment?

Proposition 4.3. *Suppose* $\mu \geq \frac{L_I - y_L}{y_H + y_P - y_L}$. *Then, the bank chooses a controlled liquidation if (1)* $L_I \geq y_L + \frac{\pi\gamma y_P - \pi\gamma(1-\delta)(x_H - x_L)}{1-\pi}$ *and (2)* $L_I \geq \frac{L_0 - \pi(x_H + y_H) - (1-\pi)x_L}{1-\pi}$ *hold. Suppose* $\mu < \frac{L_I - y_L}{y_H + y_P - y_L}$. *Then, the bank chooses a controlled liquidation if and only if (1), (2), and*
(3) $x_H + y_H \geq \frac{(1-\alpha_H)\pi\gamma\delta y_P + (1-\alpha_H)\pi\gamma(1-\delta)(x_L + L_I) - \alpha_H(1-\pi)(x_L + L_I)}{\pi[1-(1-\alpha_H)(1-\gamma+\gamma\delta)]}$ *hold.*

Proof: See the Appendix. ■

The bank can prevent the investment in the project by not providing the necessary funds. The bank chooses a controlled liquidation[23] (i.e., allows the firm to continue but prevents the investment in the project) if and only if the deterioration in liquidation values is not too strong and the benefits from learning about the firm's prospects outweigh the costs of not realizing the firm's growth opportunities. The latter will be the case if asset values can deteriorate dramatically and hence an optimal liquidation decision is important ($L_I - y_L$ is high) but growth opportunities are not particularly attractive. If the bank is liquidation-prone, learning may be more attractive than the realization of growth opportunities only if both asset values can deteriorate dramatically *and* excessive liquidation is very costly ($x_H + y_H$ is large relative to $L_I + x_L$).[24]

[22] It is less costly for the bank to induce investment by asking for a uninformative short-term payment than by offering high compensation. However, if the bank is liquidation-prone, the bank will offer high compensation if it prefers investment and liquidation after the failure to make an informative short-term payment over investment and no liquidation at date 2 (see the list of all equilibria in the proof of Proposition 4.2. in the Appendix for details).

[23] It might appear that the model suggests that a firm never recovers fully from distress and realizes its growth opportunities if it undergoes a controlled liquidation. However, what is meant is that a firm that undergoes a controlled liquidation forgoes profitable discretionary projects *while the creditors are learning about its prospects*. In a more general model, creditors would be willing to provide substantial new financing or would encourage outside investors to provide the financing by exchanging its debt into equity as soon as they became confident that the firm is viable. At this point of time, the firm would recover from distress and be able to take advantage of its investment opportunities. In the model, this is captured in a reduced form since the firm's profits under a controlled liquidation can be relatively high ($x_H + y_H$ can be high) although there is no investment. For simplicity, the model does not describe the emergence from the controlled liquidation and does not specify the investment projects that allow the continuation payoff ($x_H + y_H$) to be high.

[24] If the bank is liquidation-prone, it can choose between two ways of realizing the firm's growth opportunities. If it offers high compensation and asks for an informative short-term payment, it will induce excessive liquidation (see

4.2. Uncertain Recovery and Controlled Liquidation

The last section has shown that the bank chooses a controlled liquidation if it matters which liquidation decision the bank makes in case the rm fails to make the short-term payment. This subsection will illustrate 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 chances that the rm is in the high state (is viable) and hence will be able to make the short-term payment.

A controlled liquidation (continuation, but no investment) can be seen as a postponement of the initial liquidation decision. If the bank believes it is almost sure that the rm will not recover, 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 rm recovers. However, the value of this opportunity is very small if the rm will most likely not recover. The advantage of immediate liquidation - avoiding a substantial loss in liquidation values if there will be no recovery - dominates.

If it is almost sure that the rm will recover and if the bank is not liquidation-prone[25], providing new nancing and inducing the realization of growth opportunities (for instance, by asking for no short-term payment at all) is more attractive than a controlled liquidation. The advantage of a controlled liquidation over the realization of growth opportunities is that it preserves the opportunity of limiting the downside risk. The bank learns enough about the rm s prospects to induce it to liquidate the rm before a more dramatic loss in asset values when the rm cannot make the short-term payment. However, the value of this opportunity is very small if the rm will recover with a very high probability. The advantage of realizing the growth opportunities - higher upside payoffs - dominates. Hence, if the bank is not liquidation-prone, a controlled liquidation is optimal for the bank if and only if the bank is uncertain enough about the rm s state and thus its recovery prospects.

The preceding discussion is summarized in:

Proposition 4.4. *Assume that* $\mu \geq \frac{L_I - y_L}{y_H + y_P - y_L}$. *The bank chooses a controlled liquidation if and only if* π *is neither too high nor too low, i.e.* $\pi \in [\frac{L_0 - L_I - x_L}{x_H + y_H - x_L - L_I}, \frac{L_I - y_L}{\gamma(1-\delta)(y_P - (x_H - x_L)) + \gamma\delta y_P - y_L + L_I}]$.

section 3). In this case, the cost of realizing the growth opportunities is excessive liquidation. If the bank offers zero compensation and asks for an uninformative short-term payment, it will never (and hence not often enough) liquidate. In this case, the cost of realizing growth opportunities is the possibility of a dramatic loss in asset values if the rm fails to recover.

[25] Even a rm that realizes its growth opportunities may be liquidated after a failure to make the short-term payment. This is the case if the bank is liquidation-prone. Then, the cost of realizing the growth opportunities is still a suboptimal liquidation decision but this time in form of excessive liquidation in the *high* state. Thus, controlled liquidation may be optimal even if it is sure that the rm will recover (i.e., will be in the high state).

Proof: See the Appendix. ■

Clearly, the upper and the lower bound on π that determine when controlled liquidation is optimal depend on the rm s growth opportunities and the potential deterioration in liquidation values. If liquidation values deteriorate substantially (so that $L_0 - L_I$ is high), the bank s prior belief about the high state must be relatively high (the bank must be relatively optimistic about the rm s recovery prospects) for controlled liquidation to be more pro table than immediate liquidation. Similarly, if the investment is very attractive, the bank must be relatively pessimistic about the rm s recovery prospects to prefer controlled liquidation over inducing investment. This can be easily seen from the bounds on π in the above Proposition.

The Proposition has an interesting empirical implication for the *distribution* of postrestructuring performance among rms emerging from a reorganization. It may explain why many rms continue to perform poorly after a debt restructuring. If the ex ante expectations about the recovery prospects for a rm emerging from a restructuring and undergoing a controlled liquidation are to some degree met ex post, one should expect to see that a substantial fraction of such rms do recover. However, one should also expect that a substantial fraction fail. Hotchkiss (1995) nds that in each of the rst ve years after bankruptcy, between 35% and 41% of rms have negative operating income while a substantial number outperform the industry median (between 26% and 33%).[26] Moreover, the idea of controlled liquidation also provides a rationale for the large number of rms that reenter nancial distress within a few years after emerging from a reorganization. Gilson (1995) and Hotchkiss (1995) nd that between a quarter and a third of the rms in their samples reenter nancial distress within a few years after emerging from the rst debt restructuring (the median time in their studies is 2 and 3.8 years, respectively). High recidivism rates for rms in Chapter 11 have also been reported by Altman (1993) and LoPucki and Whitford (1993).

4.3. The Degree of Learning

When the bank chooses a controlled liquidation, it wants to learn about the rm s prospects and hence it asks for an informative short-term payment. Controlled liquidation can only be optimal if the bank s liquidation policy depends in a nontrivial way on the rm s ability to make this payment, i.e. the liquidation decision is different after the rm makes the short-term payment than after it fails to make it. If the bank would liquidate regardless of whether the payment

[26] The model suggests that this prediction about the distribution of postbankruptcy performance should hold for rms that are undergoing a controlled liquidation, and hence in particular for all highly levered rms (section 5 will show that all rms that emerge form the restructuring with debt undergo a controlled liquidation). While Hotchkiss data refer to all rms, they are likely to be not too different from the distribution of postbankruptcy performance for highly levered rms since most rms emerging from a restructuring remain highly levered (see Gilson (1995)).

was made, immediate liquidation would be more pro table than controlled liquidation because liquidation values deteriorate over time. If the bank would never liquidate, inducing investment would be more pro table than controlled liquidation. The more information the ability to make the payment contains about the state of the rm, the more valuable is a strategy of controlled liquidation. In the model, the degree of information contained in the interim payment is measured by the correlation between interim pro ts and the state. A higher correlation enables the bank to improve its liquidation policy: When the bank implements its payment-contingent liquidation policy, it is then less likely to liquidate if the rm would generate high nal payoffs and it is less likely to continue if the rm will generate low nal payoffs. In the model presented in Section 2, the correlation between interim payoffs and the state is perfect for a rm in which the project is not undertaken. In a more general model this would not have to be the case. The next Proposition refers to a model that has a exible correlation between interim payoffs and state in the absence of the investment but that is otherwise identical to the model in section 2 (in particular, liquidation is still optimal in the low state and continuation is optimal in the high state). It summarizes the above argument.

Proposition 4.5. *Suppose that, in the high state and if there is no investment, the interim payoff is x_H with probability prob$(x_H|\theta_H)$; suppose that in the low state, it is x_L with probability prob$(x_L|\theta_L)$. Controlled liquidation (inducing the rm not to invest) can only be optimal if $x_H \geq D_I > x_L$ and if the liquidation decision after the manager makes the interim payment is different from the liquidation decision after the manager fails to make the interim payment. The higher prob$(x_H|\theta_H)$ and the higher prob$(x_L|\theta_L)$, the higher is the difference in the pro ts the bank makes by preventing the investment in the project and the pro ts it makes by inducing the manager to invest, i.e., the more attractive becomes controlled liquidation relative to the realization of growth opportunities.*

Proof: See the Appendix. ■

The Proposition also implies that it is a special feature of the model of section 2 that a controlled liquidation implements the *rst-best* liquidation policy.

4.4. Implications for the Costs of Financial Distress

The paper has ambiguous implications concerning the costs of nancial distress. On the one hand, the paper has a more optimistic view of the liquidation process than is prevalent in the existing literature. Creditors are able to implement efficient liquidation decisions even if liquidation-averse managers are initially better informed about the rm s prospects and still control its investment

decisions. The bank engages in a controlled liquidation only if the bene ts of such a strategy for rm value (an improved liquidation decision) outweigh its costs (suboptimal investment decisions).[27] Hence, if the liquidation decision would have to be made immediately, rm value would be lower under the circumstances that make controlled liquidation optimal.

On the other hand, the analysis implies that some - potentially substantial - costs of nancial distress cannot be avoided. Financial distress will result in inefficient investment decisions after the rm s reorganization or in inefficient liquidation decisions even when creditors have a strong incentive to maximize rm value. This is true even if there are no other impediments to an efficient resolution of distress than creditors lack of information and managerial liquidation aversion. The only situation in which all costs of nancial distress could be avoided is when creditors know whether the defaulting rm is economically viable or when managers implement the efficient liquidation decision themselves. Both scenarios seem unrealistic in a world with separation of ownership and control and liquidation-averse management.

4.5. Implications for Bankruptcy Law

While bankruptcy law can reduce inefficiencies during nancial distress that this paper has not addressed (for instance, free-rider problems among creditors), it is unlikely to have substantial impact on the costs of nancial distress this paper focuses on (it may reduce the costs to some extent by requiring stringent disclosure to creditors). The analysis has another implication for bankruptcy law. It suggests a new interpretation of the poor postbankruptcy performance observed for many rms. This phenomenon is usually interpreted as an indicator that management s enhanced bargaining power under Chapter 11 allows inefficient rms to continue against their creditors will (see Hotchkiss (1995)). This paper implies that poor postbankruptcy performance may simply be a consequence of creditors uncertainty about rms recovery prospects which induces creditors to allow many rms to continue (see Proposition 4.4.). Naturally, a substantial number of these rms will do poorly and perhaps be (partially) liquidated in another incidence of nancial distress.

4.6. Implications for the Debate on Workouts vs. Chapter 11

The view of nancial distress as a dynamic process suggests that out of court debt restructurings, bankruptcies, and subsequent repeated reorganizations of the same rm should not be analyzed in isolation but seen as part of the same, long-term process. In particular, the analysis implies that a distressed rm s situation and prospects are different at different stages of this dynamic process (for instance, the rm is likely to have better prospects in a rst restructuring than when it reenters

[27] However, if creditors would not have all the bargaining power, they might choose a controlled liquidation although the realization of growth opportunities creates a higher rm value.

distress since new negative information has been learned when the rm reenters distress). It seems likely that rms rst attempt an out of court restructuring (in which leverage is typically reduced by less, see Gilson (1995)) before they le for Chapter 11. If a Chapter 11 restructuring comes at a later point in the dynamic distress process, conclusions about the effects of the institutional framework of a Chapter 11 restructuring as compared to an out of court restructuring have to be treated with caution. The different results of the two kinds of restructurings for rms capital structure, investment, and performance may not be generated by the differences in the institutional settings of the two restructurings but by the rm s worse situation when it les for Chapter 11. Potentially misleading conclusions about the efficiency of Chapter 11 could even be obtained if the empirical work controlled for the distressed rm s nancial situation, since, in principle, one should also control for the information learned from the history of the rm s distress. While this seems very difficult to implement, empirical work should at least take into account whether a distressed rm had a previous attempt to restructure its debt. Typically, this is not done; instead, debt restructurings of the same rm that are at least a year apart are analyzed as independent events (see, for instance, Gilson (1995)).

5. Capital Structure Adjustment, Investment, and Liquidation Policies

The empirical literature shows that the phenomena interpreted here as consequences of a controlled liquidation - low investment and poor performance after reorganizations and the large number of repeated restructurings - are concentrated among rms that emerge with high leverage from a reorganization (because creditors do not swap their debt claims into equity) while rms emerging with lower debt burden (because creditors accept equity stakes) often dramatically increase their capital expenditures and perform better. As already mentioned in the Introduction and Model sections, the correlation between post-restructuring capital structure and investment can be explained by a debt overhang argument. The point of this section is *not* to give a new explanation for such a correlation but to *explore its consequences for liquidation policies and the informational role of debt and dividend payments* - regardless of how one explains the correlation.[28]

The following Lemma will help in the analysis:

Lemma 5.1. *The bank will never choose $D_I \leq x_L$ or $D_I > x_H$ when it remains a debtholder.*

Proof: See the Appendix. ■

[28] The appeal to the upside limitation of a debt claim made in this model is the simplest way to generate the correlation because it does not require the modeling of the outside investor. It may be seen as a reduced form for the debt overhang problem.

An uninformative interim payment will induce the manager to invest (see Lemma 4.1.). But choosing equity is more pro table than remaining a debtholder if the manager invests. As a debtholder the bank does not bene t from the project as much as it would as the rm s sole equityholder (by (A13)).

5.1. Post-Restructuring Capital Structure, Investment, and Liquidation Policies

Proposition 5.2. summarizes the results on the interaction of capital structure choice, compensation, and investment and liquidation strategies.

Proposition 5.2. *In all perfect Bayesian equilibria in which the rm emerges from the restructuring with debt the project is not undertaken and there always is a liquidation after a default. The liquidation policy in a rm with debt is always rst-best and managerial compensation is always low ($\alpha < \alpha_H^D$). There are perfect Bayesian equilibria in which the rm emerges from the restructuring as an all-equity rm and the project is undertaken. In an all-equity rm in which the project is undertaken, the liquidation policy is not rst-best, a dividend $D_I > x_L$ is not required or its omission is ignored if the bank is not liquidation-prone, and managerial compensation may be high ($\alpha \geq \alpha_H$).*

Proof: See the Appendix. ■

If the realization of growth opportunities is more valuable than an improved liquidation decision, the bank will induce the manager to invest in the project, as seen in section 4. To bene t the most from the increased upside pro t potential generated by the investment, the bank takes all the equity. However, the bank will prefer a controlled liquidation when learning about the rm s viability is more valuable than realizing its growth opportunities. When the manager does not invest, the rm s pro t potential is limited, and it can be optimal for the bank to retain a limited claim and remain a debtholder (so that the rm emerges with debt from the restructuring). This is because we assumed $D \geq x_H + y_H$. Since the bank remains a debtholder only if the manager does not invest (so that the inability to make the short-term payment reveals the low state), observing the rm s ability to make the debt payment allows the bank to implement the rst-best liquidation policy (see Lemma 3.1.). However, because the bank will take equity when the manager invests, short-term results in an all-equity rm may not be informative enough about the rm s prospects to induce the bank to liquidate after a failure to pay. Then, short-term results will also not be informative enough to enable the bank to make the rst-best liquidation decision (see Lemma 3.1.).

In this model, there are, in some parameter constellations, also perfect Bayesian equilibria in which the manager in a rm that emerges from the restructuring without debt does not invest.

This is a consequence of the bank s indifference between remaining a debtholder and taking all the equity if the project is not undertaken. In a more general model, there are good reasons why the bank would prefer to remain a debtholder in this situation. One such reason is the existence of regulatory costs associated with taking equity stakes in distressed rms. If there are any - even arbitrarily small - regulatory costs to holding equity, the equilibria in which an all-equity rm implements the rst-best liquidation policy disappear. Taking equity stakes may attract regulators attention, and risk-based capital standards require more capital reserves for risky claims such as equity. Furthermore, there are restrictions on the duration banks can hold on to equity stakes in distressed rms (see James (1995)). For simplicity, these regulatory costs are not explicitly modeled. This also means that retaining a debt claims appears to be a weakly dominated strategy (the bank retains in equilibrium a debt claim only when it is indifferent between debt and equity).[29]

Regardless of how one explains the correlation between post-restructuring capital structure and investment, it has, in the context of the model, an interesting implication: The liquidation policies in a rm with and without debt may differ *in equilibrium* although the bank s ability and incentives to liquidate do not in principle depend on whether it remained a debtholder or took equity in the initial restructuring (because of (A11) and (A12)). There are other papers in the literature in which there is a difference in the liquidation policies of owners and debtholders. Among others, Dewatripont and Tirole (1994) use the idea that the concave payoff structure of a debtholder and the convex payoff structure of an equityholder leads to a difference in the reaction of the debtholder and the equityholder to the *same* information generated by some event such as a low interim payoff. In contrast to that argument, in the model presented here the difference in liquidation policies is caused by the fact that a failure to make a short-term payment in a rm with debt may be *worse news* than the failure to make such a payment in a rm without debt. The reason for this is that the investment policies in both types of rms may differ.

5.2. The Informational Role of Debt and Dividends

The short-term payment plays an informational role: the ability to make this payment conveys information about the rm s prospects which is used in the liquidation decision by the bank. In contrast to Harris and Raviv (1990), the model makes the point that dividend payments can *in principle* replicate the informational role of debt payments. However, Proposition 5.2. shows that *in equilibrium* debt payments may contain more information than dividend payments of the same

[29] Introducing arbitrarily small regulatory into the model would mean that the bank may *strictly* prefer to retain its debt claim. Alternatively, one may explain the correlation between post-restructuring capital structure and investment by a debt overhang argument (this is not done in this paper to keep the model simple, see section 2.5.). Then, retaining the debt claim would have the advantage that this may prevent the rm from undertaking the project, which may be optimal as seen in section 4.

size. The default on a short-term debt payment is always very bad news and reveals the low state because the project is never undertaken in a firm with debt. However, the omission of a short-term dividend may not be as bad news as a default. This is so because in a firm without debt, the project may be undertaken, and hence low short-term results do not reveal the low state.

5.3. Empirical Implications

The model is consistent with many empirical findings about financially distressed firms. The strategy of controlled liquidation can explain the long-term effects of financial distress that were described at the beginning of the paper. Proposition 5.2. suggests that firms that emerge highly levered from debt restructurings undergo a controlled liquidation while firms that emerge with lower leverage (because creditors exchanged debt into equity) realize their growth opportunities. Propositions 4.2. and 5.2. together suggest that creditors take equity in firms with substantial growth opportunities. These implications of the model are consistent with the following results of the empirical literature: James (1995) finds that capital expenditures for firms in which banks take equity have increased by the end of the second year of restructuring over 100% relative to their pre-restructuring levels. In contrast, the average growth in capital expenditures for firms in which banks do not take equity is less than two percent. Moreover, firms with substantially reduced debt burden also tend to perform better than firms that emerge still highly levered, and 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) and Brown, James, and Mooradian (1993)).

6. Conclusion

This paper has presented a theory of dynamic liquidation that recognizes creditors incentives to learn about a financially distressed firm's recovery prospects. It was argued that creditors may postpone their liquidation decision to learn more about the distressed firm's prospects and base a final liquidation decision on better information. Creditors can obtain more information about the firm's situation from short-term results if the manager follows a myopic investment strategy, preserving cash and forgoing some profitable long-term projects. Hence, there is a conflict between optimal investment and optimal liquidation decisions. If there is enough uncertainty about a distressed firm's prospects and making the correct liquidation decision is important, creditors may discourage investment in profitable long-term projects by refusing to provide new financing and asking for high short-term payments. Such a controlled liquidation preserves the opportunity to participate in a recovery of the firm while it also preserves the opportunity to learn enough about the firm's prospects to liquidate before a more dramatic loss in asset values if the firm fails to recover. The strategy of controlled liquidation rationalizes the long-term effects of financial distress on many

rms capital structures, investment policies, and performance even after they emerge from debt restructurings. The dynamic view of liquidation has implications for the costs of nancial distress, bankruptcy law, and the comparison of private workouts and Chapter 11 bankruptcies.

The central idea in this paper - controlled liquidation - may also be applicable to start-up rms. In that setting, the investor (perhaps a venture capitalist) faces a similar trade-off between aggressively funding promising but risky long-term projects and a more controlled and conservative approach.[30] The conservative approach would again allow the investor to learn enough about the rm s prospects to implement efficient continuation decisions. In particular, poor short-term results may be informative enough to allow the investor to withhold further funding and liquidate when this is optimal. However, such a conservative strategy would also mean that some pro table investment opportunities would be lost.

The parallel between nancial distress and start-up nancing arises because in both situations there is substantial uncertainty about a rm s prospects and strong incentives for investors to hedge their bets and generate information that allows efficient continuation decisions. However, there are important differences between start-up rms and nancially distressed rms. One difference is the informational role short-term pro ts can play. Arguably, many start-up rms will - due to the nature of their business (inventing and developing new products) - not produce substantial revenues, let alone pro ts, for a long period of time. This makes short-term debt contracts infeasible and may explain the staged nancing contracts typically observed in the venture capital sector (see Sahlman (1988)). These contracts give the investor the right to refuse further funding at several instances of the rm s life cycle, for instance when R&D results become available or when rst prototypes are produced, just as short-term debt contracts grant investors the right to liquidate after poor *nancial* performance. On the other hand, for other, less innovative start-ups (such as retail rms) short-term pro ts could play a similar informational role as for nancially distressed rms. It might be an interesting topic for future research to explore the similarities and differences between start-up rms and distressed rms in more detail. It appears that existing models - including the one presented here - do not adequately capture the differences between the two situations.

Finally, it would be interesting to discriminate between the theory of dynamic liquidation and other potential explanations for the long-term nature of nancial distress. Hotchkiss (1995) suggests that management entrenchment is responsible for the poor post-bankruptcy performance of many rms. While she nds a negative correlation between poor performance and management turnover, another paper (Hotchkiss and Mooradian (1996)) fails to nd such a correlation. Others, most recently Agarwal (1995), argue that free-rider problems among creditors cause leverage ratios to stay high after restructurings. However, free-rider problems can, and apparently are, often overcome by

[30] An investor s refusal to provide funds initially (his participation constraint) corresponds to an immediate liquidation during nancial distress.

means of coercive exchange offers, the voting rights procedures of Chapter 11, and the concentration of debt in the hand of banks and vulture funds. It may be seen as an advantage of the theory of dynamic liquidation that it provides a uni ed explanation for many different indicators of the long-term nature of nancial distress. However, it is left to future empirical work to evaluate the relative importance of the competing theories.

7. Appendix

This Appendix contains all proofs not given in the main text. In addition, it provides a justi cation for the assumption that in a rm with debt the debtholder rather than the equityholder makes a take-it-or-leave-it compensation offer to the manager (Lemma 7.1.). I will start with the proof of Proposition 3.2.

Proof of Proposition 3.2.:

Suppose the rm receives new nancing I. If $\mu < \frac{L_I - y_L}{y_H + y_P - y_L}$, the bank s best response to a failure to make the interim payment is liquidation even if the bank believes that the manager s strategy is to invest in the project. If the manager gets only a low share $\alpha < \alpha_H$ (α_H^D) of the equity value, he is not willing to invest. But if he gets at least α_H (α_H^D), his best response to any liquidation policy is to invest if he can. If $\mu \geq \frac{L_I - y_L}{y_H + y_P - y_L}$, there are two equilibria for $\alpha < \alpha_H$ (α_H^D) : If the bank is expected to ignore a failure to make the payment, investing is the best response. And ignoring the failure to make the payment is the best response if the manager s strategy is to invest. But if the bank is expected to liquidate after a failure to make the payment, not investing is the best response. And the best response to a failure to make the payment if the manager is believed not to invest even if he can is to liquidate. Clearly, if $\alpha \geq \alpha_H$ (α_H^D), the manager invests if he can and a failure to make the payment is ignored. Suppose the rm receives no new nancing. Then, the manager cannot invest, and a failure to make the payment reveals the low state. Hence, the bank liquidates after a failure to make the payment. ■

Proof of Lemma 3.3.:

Suppose the rm receives new nancing I. If there is no liquidation at date 2, the manager s best response is to invest (if the manager receives $\alpha = 0$, he is indifferent between investing and not investing and by assumption invests). If the rm is liquidated at date 2, the manager s best response is not to invest if $\alpha > 0$ and $\delta < 1$ since investment reduces interim pro ts with positive probability but does not increase the liquidation value L_I. If $\delta = 1$, investment never reduces interim pro ts; if $\alpha = 0$, the manager does not care about interim pro ts. In both cases, the manager is indifferent between investing and not investing and by assumption he invests. The bank s best response is to liquidate if the manager s strategy is to invest if he can if and only if $L_I > \pi(y_H + \gamma y_P) + (1 - \pi)y_L$. If the manager s strategy is not to invest, the bank s best response is to liquidate if and only if $L_I > \pi y_H + (1 - \pi)y_L$. (It was assumed that the bank continues if it is indifferent between continuation and liquidation).

It is now easy to see that the strategy combinations under (a), (b), and (c) in the Lemma specify all combinations of best responses for both the manager and the bank. If the bank requires a short-term debt payment $D_I \leq x_L$, the manager always makes the payment and hence the bank

has no right to liquidate at date 2. The owner of a firm with debt will not liquidate because all of the liquidation value and short-term payoff goes to the debtholder. Hence, if $D_I \leq x_L$, the firm is not liquidated at date 2 and hence the manager invests if he has funding and receives the opportunity to invest.

Suppose the firm does not receive new financing. Then the manager cannot invest. The bank's best response is to liquidate at date 2 if and only if $L_I > \pi y_H + (1-\pi)y_L$. It is easy to see that the strategy combinations under (d) and (e) in the Lemma are the only equilibria. Clearly, if the bank remains a debtholder and $D_I \leq x_L$, it cannot liquidate. ■

Proof of Lemma 4.1.:

The bank can always immediately liquidate and receive L_0. Liquidation at date 0 is more profitable than liquidation at date 2 because $L_0 > L_I + \pi x_H + (1-\pi)x_L$ by (A6). Hence, the bank will not ask for an uninformative payment if this strategy means that there will be a liquidation at date 2. Thus, the bank will fund the investment and induce the manager to invest when it asks for an uninformative payment since the project has positive NPV and the quality of the bank's liquidation policy is not affected by the project. The manager will invest because there will be no liquidation. The bank will offer only $\alpha = 0$ because even then the manager will invest. ■

Proof of Proposition 4.2.:

First, I give a more precise statement of the Proposition.

Suppose $\mu < \frac{L_I - y_L}{y_H + y_P - y_L}$. The bank immediately liquidates the firm if and only if $\pi < \min\{\frac{L_0-(x_L+L_I)}{x_H+y_H-(x_L+L_I)}, \frac{L_0-(x_L+L_I)(1-\alpha_H)}{(1-\alpha_H)\{(1-\gamma)(y_H+x_H)+\gamma\delta(y_P+y_H+x_H)+\gamma(1-\delta)(x_L+L_I)-(x_L+L_I)\}}, \frac{L_0-(x_L+y_L)}{(1-\gamma)(y_H+x_H)+\gamma\delta(y_P+y_H+x_H)+\gamma(1-\delta)(x_L+y_P+y_H)-(x_L+y_L)}\}$. The firm's growth opportunities are realized if and only if

$y_P \geq \frac{L_0-(1-\alpha_H)\{\pi[(1-\gamma)(x_H+y_H)+\gamma\delta(x_H+y_H)+\gamma(1-\delta)(x_L+L_I)]+(1-\pi)(x_L+L_I)\}}{(1-\alpha_H)\pi\gamma\delta}$[31] and

$y_P \geq \frac{\pi(x_H+y_H)[\gamma(1-\delta)+\alpha_H(1-\gamma+\gamma\delta)]+\alpha_H(1-\pi)(x_L+L_I)-(1-\alpha_H)\pi\gamma(1-\delta)(x_L+L_I)}{(1-\alpha_H)\pi\gamma\delta}$[32] or

$y_P \geq \frac{L_0-\pi(x_H+y_H)-\pi\gamma(1-\delta)(x_H-x_L)-(1-\pi)(x_L+y_L)}{\pi\gamma}$ and

$y_P \geq \frac{(1-\pi)(L_I-y_L)+\pi\gamma(1-\delta)(x_H-x_L)}{\gamma\pi}$. Suppose $\mu \geq \frac{L_I-y_L}{y_H+y_P-y_L}$. The bank immediately liquidates the firm if and only if

$\pi < \frac{L_0-(x_L+y_L)}{(1-\gamma)(y_H+x_H)+\gamma\delta(y_P+y_H+x_H)+\gamma(1-\delta)(x_L+y_P+y_H)-(x_L+y_L)}$ and $\pi < \frac{L_0-(x_L+L_I)}{x_H+y_H-(x_L+L_I)}$. The firm realizes its growth opportunities if and only if

$y_P \geq \frac{L_0-\pi(x_H+y_H)-\pi\gamma(1-\delta)(x_H-x_L)-(1-\pi)(x_L+y_L)}{\pi\gamma}$ and $y_P \geq \frac{(1-\pi)(L_I-y_L)+\pi\gamma(1-\delta)(x_H-x_L)}{\gamma\pi}$.

[31] As seen above, α_H is a function of y_P. Substituting in for α_H, one can easily obtain the appropriate bound for y_P.

[32] See last footnote.

Proof:

I will calculate all perfect Bayesian equilibria of the game. For completeness, I will also solve for capital structure. While this is not needed for Proposition 4.2., it will be relevant for Proposition 5.2.. The bounds given in Proposition 4.2. can be directly calculated from the list of equilibria.

Let us start out with the following observation (which will also show up in Proposition 5.2.; for expositional reasons, there is a separate section on capital structure in the main text): There is no equilibrium in which the bank remains a debtholder but the manager receives funding and invests if he can. This is a direct consequence of (A13). Taking all the equity allows the bank to receive all the rm s pro ts while this is - if there is investment - not true if the bank remains a debtholder. It is convenient to note that one can restrict attention to a face value of debt of $D = x_H + y_H$. $D > x_H + y_H$ is not optimal if the manager s strategy is to invest because taking all the equity is more pro table. But if the manager s strategy is not to invest or he receives no funding, a face value of $D = x_H + y_H$ generates the same returns for the bank as any higher face value since pro ts will not exceed $x_H + y_H$. We have to consider the option of an uninformative payment only if the manager invests if he can, the bank does not liquidate at date 2, and $\alpha = 0$ (see Lemma 4.1.), in which case the bank will take all the equity by the previous observation: if the manager s strategy is to invest, it is more pro table for the bank to take equity than to remain a debtholder.

Now let us list all equilibria. Suppose $\mu < \frac{L_I - y_L}{y_H + y_P - y_L}$. Immediate liquidation is an equilibrium if and only if

(1) $L_0 > \pi(y_H + x_H) + (1-\pi)(x_L + L_I)$ and at the same time

(2) $L_0 > (1-\alpha_H)\{\pi[(1-\gamma)(y_H + x_H) + \gamma\delta(y_H + x_H + y_P) + \gamma(1-\delta)(x_L + L_I)]$
$+ (1-\pi)(x_L + L_I)\}$ and at the same time

(3) $L_0 > \pi[(1-\gamma)(y_H + x_H) + \gamma\delta(y_P + y_H + x_H) + \gamma(1-\delta)(y_P + y_H + x_L)] + (1-\pi)(x_L + y_L)$ hold.

Choosing (D, α)[33], $\alpha < \alpha_H^D$ with $x_H \geq D_I > x_L$ (with or without funding; i.e., one equilibrium is with funding, another equilibrium is without funding) or $(E, 0)$ with $x_H \geq D_I > x_L$ (with or without funding) is an equilibrium in which the manager does not invest and there is a liquidation after a failure to pay if and only if (1) does *not* hold and at the same time
(4) $\pi(y_H + x_H) + (1-\pi)(x_L + L_I) \geq (1-\alpha_H)\{\pi[(1-\gamma)(y_H + x_H) + \gamma\delta(y_H + x_H + y_P) + \gamma(1-\delta)(x_L + L_I)]$
$+ (1-\pi)(x_L + L_I)\}$ holds and at the same time
(5) $\pi(y_H + x_H) + (1-\pi)(x_L + L_I) \geq \pi[(1-\gamma)(y_H + x_H) + \gamma\delta(y_P + y_H + x_H)$
$+ \gamma(1-\delta)(y_P + y_H + x_L)] + (1-\pi)(x_L + y_L)$ holds.

Choosing $(E, \alpha = \alpha_H)$ with $x_H \geq D_I > x_L$ and with funding is an equilibrium in which the manager invests if he can and there is liquidation after a dividend omission if and only if (2) does *not* hold and at the same time (4) does *not* hold or holds as an equality and

[33] D stands for debt, E for equity. I will often write $(E, 0)$ instead of $(E, \alpha = 0)$.

(6) $(1-\alpha_H)\{\pi[(1-\gamma)(y_H+x_H)+\gamma\delta(y_H+x_H+y_P)+\gamma(1-\delta)(x_L+L_I)]+(1-\pi)(x_L+L_I)\}$
$\geq \pi[(1-\gamma)(y_H+x_H)+\gamma\delta(y_P+y_H+x_H)+\gamma(1-\delta)(y_P+y_H+x_L)]+(1-\pi)(x_L+y_L)$ holds.

Finally, choosing $(E,0)$ with $D_I \leq x_L$ or $D_I > x_H$ and with funding is an equilibrium in which the manager invests if he can and there is no liquidation at date 2 if and only if (3) does *not* hold and at the same time (5) does *not* hold or holds as an equality and at the same time (6) does *not* hold or holds as an equality.

Now suppose $\mu \geq \frac{L_I-y_L}{y_H+y_P-y_L}$. Immediate liquidation is an equilibrium if and only if both (3) and (1) hold.

$(E,0)$ with $x_H \geq D_I > x_L$ and with funding is an equilibrium in which the manager invests if he can and there is no liquidation after a dividend omission if and only if (3) does *not* hold and at the same time (5) does *not* hold or holds with equality.

$(E,0)$ with $D_I \leq x_L$ or $D_I > x_H$ and with funding is an equilibrium in which the manager invests if he can and there is no liquidation at date 2 if and only if (3) does *not* hold and at the same time (5) does *not* hold or holds as equality.

(D,α) with $\alpha < \alpha_H^D$ and $x_H \geq D_I > x_L$ (with or without funding) and $(E,0)$ with $x_H \geq D_I > x_L$ (with or without funding) are equilibria in which the manager does not invest and the rm is liquidated after a default or dividend omission if and only if (1) does *not* hold and at the same time (5) holds.

The conditions under which immediate liquidation and the realization of growth opportunities (inducing investment) are optimal can be easily calculated from this list of all equilibria. ■

Proof of Proposition 4.3.: The conditions under which controlled liquidation is optimal can be easily calculated from the list of all equilibria in the proof of Proposition 4.2.. ■

Proof of Proposition 4.4.:

Controlled liquidation yields an expected payoff of $\pi(y_H+x_H)+(1-\pi)(x_L+L_I)$ and hence is preferred over immediate liquidation if and only if $\pi(y_H+x_H)+(1-\pi)(x_L+L_I) \geq L_0$. Controlled liquidation is more pro table than the realization of growth opportunities (which can be assured by asking for $D_I = 0$) if and only if $\pi(y_H+x_H)+(1-\pi)(x_L+L_I)$
$\geq \pi[(1-\gamma)(x_H+y_H)+\gamma\delta(x_H+y_H+y_P)+\gamma(1-\delta)(x_L+y_H+y_P)]+(1-\pi)(x_L+y_L)$. The relevant range of π can be calculated from the two inequalities. ■

Proof of Proposition 4.5.:

If the bank would liquidate regardless of the interim payoff, immediate liquidation would be more pro table than controlled liquidation because of (A6). If the bank would never liquidate, inducing investment would be more pro table than controlled liquidation. The expected payoff from a controlled liquidation is[34]
$\pi\{prob(x_H|\theta_H)(y_H + x_H) + (1 - prob(x_H|\theta_H))(L_I + x_L)\} + (1 - \pi)\{prob(x_L|\theta_L)(L_I + x_L)$
$+ (1 - prob(x_L|\theta_L))(x_H + y_L)\}$. The expected pro ts from a realization of growth opportunities (inducing the investment) is
$\pi\{(1-\gamma)[prob(x_H|\theta_H)x_H + (1-prob(x_H|\theta_H))x_L + y_H] + \gamma\delta(y_H + x_H + y_P) + \gamma(1-\delta)(y_H + x_L + y_P)\}$
$+ (1 - \pi)\{prob(x_L|\theta_L)x_L + (1 - prob(x_L|\theta_L))x_H + y_L\}$. After some algebraic manipulation, the difference in the expected pro ts from a controlled liquidation and the expected pro ts from the realization of growth opportunities can be calculated as $\pi\{\gamma\delta(x_L - x_H) + L_I - y_H - \gamma y_P\} +$ $\pi prob(x_H|\theta_H)[\gamma(x_H - x_L) + y_H - L_I]\} + (1 - \pi)(prob(x_L|\theta_L)(L_I - y_L))$. This is increasing in both $prob(x_H|\theta_H)$ and $prob((x_L|\theta_L))$. ■

Proof of Lemma 5.1:

The bank will ask for an uninformative payment only if there will be no liquidation at date 2 and there will be investment (see Lemma 4.1.). But then, taking all the equity is more pro table than remaining a debtholder because of (A13). ■

Proof of Proposition 5.2.:

If the manager receives funding and his strategy is to invest, the bank s best response is to take equity. This is more pro table than any debt claim because of (A13). If the manager never invests, the bank is indifferent between equity and a debt claim because of (A13). Hence, a rm that emerges with debt (because the bank retains a debt claim) will never invest. By Lemma 3.1., it will have a rst-best liquidation policy. There will always be liquidation after a default because the default reveals the low state if the manager receives no funding or his strategy is not to invest. Managerial compensation will be low ($\alpha < \alpha_H^D$) - otherwise the manager invests and retaining a debt claim is not a best response. A rm that emerges free of debt (because the bank took all the equity) may invest: taking all the equity is optimal if the manager receives funding and his strategy is to invest. Then, by Lemma 3.1., such a rm s liquidation policy is suboptimal. A dividend omission will not lead to liquidation if $\mu \geq \frac{L_I - y_L}{y_H + y_P - y_L}$: Then, the bank s best response

[34]The bank chooses an informative short-term payment when it engages in a controlled liquidation. Thus, the payment is made if and only if the interim payoff is x_H. I write $prob(x_i|\theta_j)$ instead of $prob(k|\theta_j)$ with $k \in \{$payment, no payment$\}$.

to a dividend omission if the manager s strategy is to invest if he can is to continue (see section 3). The proof of Proposition 4.2. lists all equilibria. From this list it is apparent that there are equilibria in which the rm emerges free of debt and invests and the bank requires an uninformative dividend payment $D_I \leq x_L$ or $D_I > x_H$. It also shows that there are equilibria in which the rm emerges free of debt and $\alpha = \alpha_H$. ■

Lemma 7.1. *The equityholders are willing to let the bank set managerial compensation when the bank remains a debtholder.*

Proof:

In a rm with debt, equityholders always have an incentive to induce the manager to take the project by setting compensation at α_H^D. If the manager undertakes the project, the equityholders receive a strictly positive expected payoff because pro ts may be higher than the face value of the debt (by (A13)); if he does not invest, they receive a payoff of zero for sure (by A13)). But choosing all the equity and offering $\alpha = 0$ is more pro table for the bank than choosing debt in a rm in which the project is undertaken because of (A13). If the bank takes all the equity, then old equity receives a payoff of zero for sure. The old equityholders are not worse off if they grant the bank the right to set managerial compensation if the bank remains a debtholder than if they do not grant the bank this right: in the latter case, the bank takes all the equity, and the old equityholders receive nothing. ■

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